POLYMET
MINING

NorthMet Project

Revised Wetland Permit Application

Issue Date: August 19, 2013

Minnesota Local/State/Federal Application Forms for Water/Wetland Projects

USE THIS APPLICATION FOR ANY PROJECT AFFECTING A LAKE, RIVER, STREAM OR WETLAND, INCLUDING:

Local Government Unit Approval Pursuant to Minnesota Wetlands Conservation Act (WCA)
Minnesota Department of Natural Resources (DNR) Permit to Work in Public Waters
Department of the Army Permit (33 CFR 325)

Note: The U.S. Army Corps of Engineers (**COE**) will forward application forms to the Minnesota Pollution Control Agency (**MPCA**) for processing if state water quality certification is required from the MPCA. You **do not** need to send this application to the MPCA.

This application packet includes :

Part I: The **BASIC APPLICATION** and the **COE APPLICATION** to be filled out by all applicants (see Instructions).

PART II: The **REPLACEMENT PLAN SUPPLEMENT** to be completed ***only for*** projects that impact wetlands and require a replacement plan for wetland mitigation. **If you're not sure** whether your project requires a replacement plan, call your Local Government Unit (LGU) or Soil and Water Conservation District (SWCD) office for guidance.

Do not proceed with your project until you have received all required approvals from your LGU, the DNR and the COE. If you wish to confirm the status of your application at any time, contact the agencies directly (see Instructions, page 2). **Proceeding with work before all required authorizations are obtained may result in fines or other penalties, and may include a requirement to restore the project site to original condition.**

If you have questions or need assistance with filling out these forms, contact your local SWCD office, your LGU, your Area DNR Ecological and Water Resources office, or your COE field office (see Instructions, page 2).

If you believe that your project may be subject to watershed district, local zoning, or any other local regulations besides those of your LGU, contact those office(s) directly. **If you are a Federal Farm Program participant** and your project affects a wetland or water body on agricultural land, your eligibility for USDA benefits may be affected. Contact a Natural Resources Conservation Service office for further information.

A QUICK LOOK AT THE PROJECT APPLICATION PROCESS

Electronic files: Forms can be downloaded and filled out using Microsoft Word. Your input will be restricted to fill-in fields where users can enter text or check boxes. These areas appear gray on the screen, but not on the printed document.

Send copies of these completed application forms to your LGU, your Area DNR Ecological and Water Resources office, and your COE regulatory office.

Any of the agencies may make initial contact with you to: a) inform you that it has no jurisdiction over your project; b) request additional information needed; or c) inform you of applicable fees.

When your application is considered complete and appropriate fees have been received (if requested) it will be distributed for appropriate review.

Following agencies' reviews, you will be informed if it has been approved, approved with changes or conditions, withdrawn, or denied.

For information about state laws, rules and regulations that direct this process go to the web site www.revisor.leg.state.mn.us. For information on U.S. Army Corps of Engineers regulations go to the web site www.mvp.usace.army.mil.

Instructions for Part I

HELP 1: Every applicant must fill out Section 1. The applicant is the person, agency, company, corporation, or other organization that owns, leases, or holds other legal rights to the land where the project is located. Indicate names of multiple applicants on a separate sheet.

HELP 1A: Fill out Section 1A only if you have designated an authorized agent. An authorized agent may be an attorney, builder, consultant, contractor, engineer, or any other person or organization designated by the applicant to represent him/her in this process. An agent is not required.

HELP 5: Purpose, description and dimensions of project: State briefly (in a sentence or two) what you propose to do and why it is needed. Also, describe whether your project will involve any of the following:

- Construction of structures, filling, draining, dewatering, removing, excavating or repair.
- Construction of an access path, bridge, culvert, dam, ditch, dock, driveway, riprap, road, sand blanket, shore protection, or tile line.
- Construction of any structures on fill, piles or a float-supported platform. If so, describe.
- Dredging or discharging (placing fill material) into a wetland or other water body (including the temporary placement of material). If so, explain the specific purpose of the placement of the material (such as erosion control) and indicate how it will be done (such as with a backhoe or dragline). If dredged material is to be discharged on an upland site, identify the location of the site.

Include an overhead view drawing showing the work to be undertaken and its relative location on the property. Show items such as property boundaries or lot dimensions; location and extent of shoreline, wetlands and water; location and dimensions and footprint of the proposed project, structure or activity (include length, width, elevation and other measurements as appropriate); points of reference such as existing homes, structures, docks or landscape features; indication of north; and location of spoil and disposal sites (if applicable). Hand drawn, computer generated or professionally prepared drawings are acceptable, as long as they contain all necessary information clearly, accurately, and in adequate detail. Please include specific dimensions whenever possible. You may also include photos, if you wish. Paper copies should be limited to maximum dimensions of 11" by 17". Computer files should be viewable in a PDF format; contact the agency for other usable formats.

HELP 7: For information regarding adjacent landowners, contact the tax assessor where the project is to be developed.

HELP 8: If any part of the work has already been completed, describe the area already developed. Include a description of structures completed; any dredged or fill material already discharged (including type of material and volume in cubic yards); acres or square feet filled (if a wetland or other water body); and whether the work was done under an existing permit (if so identify the authorization, if possible).

HELP 9: Other permits, reviews or approval related to the project may include the following: conditional use permit; plat approval; zoning variance; National Pollutant Discharge Elimination System permit; state disposal system permit (includes dredged material disposal); watershed district/watershed management organization permit (stormwater, erosion, floodplain); environmental assessment worksheet/environmental impact statement; hazardous waste site; feedlot permit; groundwater appropriation permit; or county/township driveway/road permit. Are you aware of any archeological or cultural resource determinations or surveys completed concerning the project or replacement site by the State Historic Preservation Office (SHPO) or others? If yes, please explain on a separate sheet or attach a copy of any determinations or surveys.

Final Checklists (Part I)

☐ **Have you completed all of Part I** (Page 1), plus the Federal application (Page 2)?
☐ **Did you (and your agent, if applicable) sign Section 10** on page 1?
☐ **Have you signed the Application for the Department of the Army Permit** (Page 2) to seek Federal authorization of your project?
☐ **Have you included the necessary attachments for Part I**?

Attachments *must* include:

- ☒ Site Locator Map (Section 3)
- ☒ Type of Project (Section 4) (if additional space was needed)
- ☒ Overhead View of Project (Section 5 and HELP 5)
- ☒ Project Purpose, Description and Dimensions (Section 5) (if additional space was needed)

Attachments *may* also include:

- ☐ Applicant Contact Information (HELP 1) (if additional space was needed)
- ☒ Project Location (Section 3) (if additional space was needed)
- ☒ Project Alternatives (Section 6) (if additional space was needed)
- ☐ Photographs
- ☐ Adjoining Property Owners (Section 7) (if additional space was needed)
- ☒ Work Already Completed Section (Section 8) (if you answered YES)
- ☐ State Historic Preservation Office determination or survey

Submitting Your Application

Make three copies of the entire application and all attachments. Keep the original, and mail **a complete copy of your application to each of the local, state, and Federal entities listed below.** Be sure to include Part I and all attachments with each application.

LOCAL: Send to the appropriate Local Government Unit (LGU). If necessary, contact your county Soil and Water Conservation District (SWCD) office or visit the Board of Water and Soil Resources (BWSR) web site (www.bwsr.state.mn.us) to determine the appropriate LGU.

STATE: Send to your Area DNR Ecological and Water Resources office, attention Area Hydrologist. If necessary, contact your county Soil and Water Conservation District
(SWCD) office or visit the DNR website (www.dnr.state.mn.us) to locate the Area Hydrologist for your location, or contact a Regional DNR office:

NW Region:
2115 Birchmont Beach Road N.E.
Bemidji, MN 56601
Phone: 218-308-2620

NE Region:
1201 East Highway 2
Grand Rapids, MN 55744
Phone: 218-327-4416

Central Region:
1200 Warner Road
St. Paul, MN 55106
Phone: 651-259-5845

Southern Region:
261 Highway 15 South
New Ulm, MN 56073
Phone: 507 359-6053

FEDERAL: Send to the appropriate U.S. Army Corps of Engineers regulatory field office:

Brainerd:
U.S. COE, Regulatory Branch
10867 E. Gull Lake Drive N.W.
Brainerd, MN 56401-9051
Phone: 218-829-8402

St. Paul:
U.S. COE, Regulatory Branch
Army Corps of Engineers Centre
190 5th Street East
St. Paul, MN 55101-9051
Phone: 651-290-5375

La Crescent:
U.S. COE, Regulatory Branch
1114 South Oak Street
La Crescent, MN 55947-1338
Phone: 507-895-8059

Two Harbors:
U.S. COE, Regulatory Branch
1554 Highway 2, Suite 2
Two Harbors, MN 55616
Phone: 218-834-6630

WEB SITES: BWSR: www.bwsr.state.mn.us U.S. ACOE: www.mvp.usace.army.mil DNR: www.dnr.state.mn.us MPCA: www.pca.state.mn.us

NA-026620-03B (V.2.02 for MS WORD) 9/17/2007

Minnesota Local/State/Federal Application Form for Water/Wetland Projects

For Internal Use Only

Application No.	Field Office Code	Date Initial Application Received	Date initial Application Deemed Complete

PART I: BASIC APPLICATION

"See HELP" directs you to important additional information and assistance in Instructions, Page 1.

1. LANDOWNER/APPLICANT CONTACT INFORMATION ***(See Help 1)***

Name: Jennifer Saran Phone: 651-389-4108 E-mail: jsaran@polymetmining.com

Complete mailing address: Poly Met Mining Inc., Suite 2060, 444 Cedar Street, St. Paul, MN 55110

1A. AUTHORIZED AGENT ***(See Help 1A) (Only if applicable; an agent is not required)***

Name: Phone: E-mail:

Complete mailing address:

2. NAME, TYPE AND SIZE OF PUBLIC WATERS or WETLANDS IMPACTED (Attach *Additional Project Area* sheets if needed)

Name or I.D. # of Waters Impacted (if applicable; if known): None

(Check all that apply): ☐ Lake ☐ River ☒ Circular 39 Wetland type: ☐ 1, ☐ 1L, ☒ 2, ☒ 3, ☒ 4, ☐ 5, ☒ 6, ☒ 7, ☒ 8

Wetland plant community type[1]: ☐ shallow open water, ☒ deep marsh, ☒ shallow marsh, ☒ sedge meadow, ☒ fresh meadow, ☐ wet to wet-mesic prairie, ☐ calcareous fen, ☒ open bog or coniferous bog, ☒ shrub-carr/alder thicket, ☒ hardwood swamp or coniferous swamp, ☐ floodplain forest, ☐ seasonally flooded basin

Indicate size of entire lake or wetland (check one): ☐ Less than 10 acres (indicate size:) ☐ 10 to 40 acres ☒ Greater than 40 acres

3. PROJECT LOCATION *(Information can be found on property tax statement, property title or title insurance):*

Project street address: Fire #: City (if applicable):

¼ Section: Section: See Narrative, Section 3.1 Township #: Range #: County: St. Louis

Lot #: Block: Subdivision: Watershed (name or #) See Large Figure 5 UTM location: N E

Attach a simple site locator map. If needed, include on the map written directions to the site from a known location or landmark, and provide distances from known locations. Label the sheet *SITE LOCATOR MAP.* See Figures 1, 2, and 5. See Narrative, Section 3.1.

4. TYPE OF PROJECT: Describe the type of proposed work. Attach *TYPE OF PROJECT* sheet if needed.

See Narrative, Section 4.0

5. PROJECT PURPOSE, DESCRIPTION AND DIMENSIONS: Describe what you plan to do and why it is needed, how you plan to construct the project with dimensions (length, width, depth), area of impact, and when you propose to construct the project. **This is the most important part of your application. See HELP 5 before completing this section; see What To Include on Plans** (Instructions, page 1). Attach *PROJECT DESCRIPTION* sheet.

See Narrative, Section 5.0

Footprint of project: 939.34 acres or square feet drained, filled or excavated.

6. PROJECT ALTERNATIVES: What alternatives to this proposed project have you considered that would avoid or minimize impacts to wetlands or waters? List at least **TWO** additional alternatives to your project in Section 5 that avoid wetlands (one of which may be "no build" or "do nothing"), and explain why you chose to pursue the option described in this application over these alternatives. Attach *PROJECT ALTERNATIVES* sheet if needed.

See Narrative, Section 6.0

7. ADJOINING PROPERTY OWNERS: For projects that impact more than 10,000 square feet of water or wetlands, list the complete mailing addresses of adjacent property owners on an attached separate sheet. (See **HELP 7**) See Large Table 4

8. PORTION OF WORK COMPLETED: Is any portion of the work in wetland or water areas already completed? ☐ Yes ☒No. If yes, describe the completed work on a separate sheet of paper labeled **WORK ALREADY COMPLETED**. (See **HELP 8**)

9. STATUS OF OTHER APPROVALS: List any other permits, reviews or approvals related to this proposed project that are either **pending** or **have already been approved or denied on a separate attached sheet. See HELP 9.** See Narrative, Section 9.0

10. I am applying for state and local authorization to conduct the work described in this application. I am familiar with the information contained in this application. To the best of my knowledge and belief, all information in Part I is true, complete, and accurate. I possess the authority to undertake the work described, or I am acting as the duly authorized agent of the applicant.

8-16-13

Signature of applicant (Landowner) Date *Signature of agent (if applicable)* Date

This block must be signed by the person who desires to undertake the proposed activity and has the necessary property rights to do so. If only the Agent has signed, please attach a separate sheet signed by the landowner, giving necessary authorization to the Agent.

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[1] **See *Wetland Plants and Plant Communities of Minnesota and Wisconsin (Eggers and Reed, 1997)* as modified by the Board of Water and Soil Resources, United States Army Corps of Engineers.**

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT (33 CFR 325) OMB APPROVAL NO. 0710-003 Expires Dec 31, 2004

The public burden for this collection of information is estimated to average 10 hours per response, although the majority of applications should require 5 hours or less. This includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of these addresses. Completed applications must be submitted to the District engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT: Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research and Sanctuaries Act, 33 USC 1413, Section 103. Principal purpose: Information provided on this form will be used in evaluating the application for a permit. Routine uses: This information may be shared with the Department of Justice and other Federal, state, and local government agencies. Submission of requested information is voluntary; however, if information is not provided, the permit application cannot be evaluated nor can a permit be issued.

ITEMS 1 THROUGH 4 TO BE FILLED IN BY THE CORPS

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

YOU *DO NOT* NEED TO COMPLETE ITEMS 6-10 and 12-25 in the SHADED AREAS.

All applicants must complete **non-shaded** items 5 and 26. If an agent is used, **also** complete items 8 and 11. This optional Federal form is valid for use *only* when included as part of this entire state application packet.

5. APPLICANT'S NAME Poly Met Mining Inc.	8. AUTHORIZED AGENT'S NAME AND TITLE (an agent is not required)
6. APPLICANT'S ADDRESS	9. AGENT'S ADDRESS
7. APPLICANT'S PHONE NO.	10. AGENT'S PHONE NO.

11. STATEMENT OF AUTHORIZATION (*if applicable; complete* **only** *if authorizing an agent)*

I hereby authorize to act on my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT"S SIGNATURE: ______________________ DATE: ________

12. PROJECT NAME OR TITLE (see instructions)

13. NAME OF WATERBODY, IF KNOWN (if applicable)

14. PROJECT STREET ADDRESS (if applicable)

15. LOCATION OF PROJECT

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

17. DIRECTIONS TO THE SITE

18. NATURE OF ACTIVITY

19. PROJECT PURPOSE

20. REASON(S) FOR DISCHARGE

21. TYPES OF MATERIAL BEING DISCHARGED AND THE AMOUNT OF EACH TYPE IN CUBIC YARDS

22. SURFACE AREA IN ACRES OF WETLANDS OR OTHER WATERS FILLED

23. IS ANY PORTION OF THE WORK ALREADY COMPLETE? YES ________ NO ___ IF YES, DESCRIBE COMPLETED WORK.

24. ADDRESSES OF ADJOINING PROPERTY OWNERS,

25. LIST OF OTHER CERTIFICATIONS OR APPROVALS/DENIALS RECEIVED FROM OTHER FEDERAL, STATE OR LOCAL AGENCIES FOR WORK DESCRIBED IN THIS APPLICATION.

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

	3-16-13		
Signature of applicant	Date	Signature of agent (if any)	Date

The application must be signed by the person who desires to undertake the proposed activity (applicant), or it may be signed by a duly authorized agent if the statement in Block 11 has been filled out and signed. **18 U.S.C. Section 1001** provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up with any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

ENG FORM 4345, Jul 97 EDITION OF FEB 94 IS OBSOLETE. (Proponent: CECW-OR)

FOR LGU USE ONLY:

Determination for Part 1: ☐ No WCA Jurisdiction
☐ Exempt: No. ____ (per MN Rule 8420.0122)
☐ No Loss: ____ (A,B,. . .G, per MN Rule 8420.0220)
☐ Wetland Boundary or type
☐ Replacement required – applicant must complete Part II

COMPLETE THE SECTION BELOW ONLY IF REPLACEMENT IS NOT REQUIRED:

Application is (check one): ☐ Approved ☐ Approved with conditions (conditions attached) ☐ Denied

Comments/Findings: ____________________

____________________ *LGU official signature* ____________ *Date*

____________________ *Name and Title*

For Agricultural and Drainage exemptions (MN Rule 8420.0122 Subps. 1 and 2B), LGU has received proof of recording of restrictions (per MN Rule 8420.0115):

____________________ *County where recorded* ____________ *Date* ____________________ *Document # assigned by recorder*

____________________ *LGU official signature* ____________ *Date*

Instructions For Part II

Complete those portions of Part II: Replacement Plan Supplement for which information is readily available (such as location, existing land use, size of impact area, etc.) A person certified in wetland delineation must determine items pertaining to specific wetland impacts (wetland type, predominant vegetation, watershed name, etc.) Contact the local soil and water conservation district (SWCD) office for further information on obtaining such items.

What to Include on Plans

Detailed overhead views of replacement site(s) (Part II), as well as profile view(s) of replacement site(s) (Part II), may be either hand drawn, computer generated or professionally prepared, as long as they contain all necessary information clearly, accurately, and in adequate detail. Please include specific dimensions whenever possible. You may also include photos, if you wish.

Overhead views of Part II replacement site(s) should include the following items that pertain to your project:

Property boundaries and/or lot dimensions.
Location and extent of shoreline, wetlands and water.
Location and dimensions of proposed project, structure or activity. Include length, width, elevation and other measurements as appropriate.
Points of reference (such as existing homes, structures, docks or landscape features).
Location of inlet and outlet structures.
Indication of north.
Location of spoil and disposal sites (if applicable).
Areas of wetland and upland plants established.

Profile views (side or cross-sectional views) should include the following items that pertain to your project:

Location and dimensions of proposed project, structure or activity. Include elevation, depth, soil profile, side slope and other measurements as appropriate.
Proposed water level elevation.

Final Checklists
Part II: Replacement Plan Supplement

☐ **Have you completed all of Part II** (pages 3-5)?
☐ **Did you (or your agent) sign Section 19** on page 5?
☐ **Have you included the necessary attachments for Part II?**

Attachments *must* include:
☐ **If the project includes any wetland banking** (complete or partial), include Application for Withdrawal of Wetland Credits Form (Section 14)
☐ **If the project includes any project-specific replacements** (complete or partial), include:
  Description of Replacement Wetland(s) Construction (Section 15)
  Copy of vegetation management plan (Section 15)
  Scale drawing of overhead view or replacement wetland (Section 18)
  Scale drawing of profile view of replacement wetland (Section 18)

Attachments *may* also include:
☐ Additional description of Wetland Impact Charts (Section 11) (if additional space was needed)
☐ Additional Description of Replacement Wetlands charts (Section 17) (if additional space was needed)
☐ Additional soils information for created replacement wetland(s) (Section 18) (if available)

Note: To deposit surplus wetland credits in the State Wetland Bank, submit a Wetland Banking Application directly to your LGU (Section 16).

Preparing Your Application for Mailing

☐ **To apply for both state and Federal authorization, your application must include Part I** (Page 1), **the Federal application** (Page 2), **and attachments** as indicated on *Final Checklist for Part I* (Instructions, Page 2).
☐ **Your application must also include Part II** (Pages 3-5) and additional attachments as indicated on *Final Checklist for Part II* (above).
☐ **Make three copies of the entire application and all attachments.** Keep the original, and mail the three copies to the appropriate local, state, and Federal agencies (see Instructions for Part I for addresses).

PART II: REPLACEMENT PLAN SUPPLEMENT

For assistance in completing Part II, contact your Local Government Unit or a professional consultant

11. DESCRIPTION OF WETLAND IMPACTS: Complete the chart below: 1) Use one row of boxes for each wetland impact; 2) If your project has more than one wetland impact, reference your overhead view (part of Section 5) to this chart by identifying and labeling "first impact" and "second impact" **on your overhead view**; 3) If you are identifying only one wetland type within a given wetland impact area, use the first dotted line and leave the others blank; 4) If you have chosen to identify more than one wetland type within a given wetland impact area, use the extra dotted lines to indicate each wetland type, and identify predominant vegetation and size of impacted area **for each separate wetland type within that impact area;** 5) If you do not have access to some of this information, call your LGU or SWCD office for assistance. *(Photocopy chart for more impacts, if needed.)*

DESCRIPTION OF WETLAND IMPACTS

Wetland impact *(as noted on overhead view)*	**Watershed name or number *(if known)***	**Watershed and Bank Service Area**	**Wetland plant community type[1]**	**Predominant vegetation in impacted wetland area**	**Size of area impacted (in acres or square feet)**	**Existing land use in project area (check all that apply)**
All Impacts (See Large Table 2)	St. Louis River #3 (See Figure 9)	St. Louis River Watershed and Bank Service Area #1	See Large Table 2	See NorthMet Project Data Package V7 and NorthMet Project Baseline Wetland Type Evaluation	939.34 acres See Large Table 2	☐ **Housing** ☐ **Commercial** ☒ **Industrial** ☐ **Parks/recreation areas** ☒ **Highways and associated rights-of-way** ☒ **Forested** ☐ **Farmsteads/agricultural** ☒ **Vacant lands** ☐ **Public and semi-public (schools/gov't facilities)** ☐ **Airports** ☒ **Extractive (gravel pits/quarries)** ☐ **Other:**

[1]If you are identifying only one wetland type within a given wetland impact area, use the first dotted line and leave the others blank. If you have chosen to identify more than one wetland type within a given wetland impact area, use the extra dotted lines to indicate each separate wetland type, and identify predominant vegetation and size of impacted area **for each separate wetland type with that impact area.**

TOTALS **OF AREA(S) IMPACTED FOR EACH WETLAND TYPE ON CHART** (*indicate acres* ☒ *or square feet* ☐)

Wetland plant community type [1]: Shallow open water: **Deep marsh:** 73.66 **Shallow Marsh:** 77.02 **Sedge meadow:** 23.86
Fresh wet meadow: 15.81 **Wet to wet mesic prairie:** **Calcareous fen:** **Open bog or coniferous bog:** 537.62 **Shrub carr or alder thicket:** 114.45
Hardwood swamp or coniferous swamp: 96.92 **Floodplain forest** **Seasonally flooded basin**

12. SPECIAL CONSIDERATIONS: Are you aware of any special considerations that apply to either the impact site(s) or the replacement site(s)? ☒ Yes ☐ No (Examples: the presence of endangered species, special fish and wildlife resources, sensitive surface waters, or waste disposal site.) If YES, list and describe briefly.

See Narrative, Section 12.0

13. SHORELAND IMPACT ZONE: Please identify each wetland impact site noted in Section 15 that is within 1000 feet of a lake or 300 feet of a river.

No wetland impacts within 1000 feet of a lake.
Wetland fill of 0.14 acres within Type 6 Alder Thicket within the Dunka Road/Treated Water Pipeline Project area is within 300 feet of Longnose Creek.
Wetland fill of 0.34 acres within Type 6 Alder Thicket within the Dunka Road/Treated Water Pipeline Project area is within 300 feet of Longnose Creek.
Wetland fill of 0.07 acres within Type 6 Alder Thicket within the Dunka Road/Treated Water Pipeline Project area is within 300 feet of Wyman Creek.

[1] **See *Wetland Plants and Plant Communities of Minnesota and Wisconsin (Eggers and Reed, 1997)* as modified by the Board of Water and Soil Resources, United States Army Corps of Engineers.**

14. **HOW PROPOSED REPLACEMENT WILL BE ACCOMPLISHED**: Indicate how proposed replacement will be accomplished (check only **one** box below and continue as indicated):

☐ A. Wetland banking credits only
Complete *Application for Withdrawal of Wetland Credits Form* and include with your application. Copies of this form are available from your LGU, or download a copy from www.bwsr.state.mn.us

Skip to Section 19, page 6 (You do not need to complete Sections 15-18).

☒ B. Project-specific replacement only
Continue with Section 15 below.

☐ C. A Combination of wetland banking and project-specific replacement. If using project specific replacement that will result in surplus wetland credits that you propose to deposit in the state wetland bank for future use, then you must submit a wetland banking application directly to your LGU before or concurrently with submittal of this form. Also, Complete *Application for Withdrawal of Wetland Credits Form* and include with your application. Copies of this form and the wetland banking application is available from your LGU, or download a copy from www.bwsr.state.mn.us
Continue with Section 15 below.

15. **DESCRIPTION OF REPLACEMENT WETLAND(S) CONSTRUCTION (Complete this section only if you marked Box B or Box C in Section 14 above):**
Describe in detail how replacement wetland(s) will be constructed. If several methods will be used, describe each method. Details should include the following: 1) type of construction (such as excavated in upland, restored by tile break, restored by ditch block or revegetated); 2) type, size and specifications of outlet structures; 3) elevations relative to Mean Sea Level or established benchmarks or key features (such as sill, emergency overflow or structure height); 4) what best management practices will be implemented to prevent erosions or site degradation; 5) proposed timetable for starting and ending the project; and 6) a vegetation management plan. Write this description on a separate sheet of paper labeled *DESCRIPTION OF REPLACEMENT WETLAND CONSTRUCTION.*
See Narrative, Section 15.0

16. **SURPLUS WETLAND CREDITS:** If using project-specific replacement (Box B or Box C in Section 14 above), will the replacement result in any surplus wetland credits that you wish to have deposited in the State Wetland Bank for future use? ☐ Yes ☐ No. If yes, **submit a Wetland Banking Application directly to your LGU** before or concurrently with submittal of this form. Copies are available from your LGU, or download a copy from www.bwsr.state.mn.us

17. **DESCRIPTION OF REPLACEMENT WETLANDS:** Complete the chart below: 1) Use one row of boxes for each wetland replacement site; 2) If your project has more that one wetland replacement site, reference your overhead view (part of Section 5) to this chart by identifying and labeling "first replacement site" and "second replacement site" **on your overhead view;** 3) If you are identifying only one wetland type within a given replacement site, use the first dotted line(s) and leave the others blank; 4) If you have chosen to identify more than one wetland type in a given replacement site, use the extra dotted lines to indicate each separate wetland type, and identify type(s) of replacement credits and "restored or created" **for each separate wetland type with that replacement site;** 5) If you do not have access to some of the information, or if you do not know your replacement ratio, call your LGU or SWCD office for assistance. *Photocopy chart for more wetland replacements, if needed.)*

DESCRIPTION OF REPLACEMENT WETLANDS
See Table 13-1 and Large Table 5.

Wetland plant community type (acres): See Table 13-1 and Large Table 5.

18. ADDITIONAL INFORMATION REQUIRED FOR PROJECT-SPECIFIC REPLACEMENT (Required *only* if you marked Box B or Box C in Section 14): For projects involving at least some project-specific replacement, include the following additional information:

☒ **Two drawings to scale** of the replacement wetland. Include both overhead view and profile (side view or cross-sectional view). See *What to Include on Plans* (Instructions, Page 3) for a detailed description of what should be included in these drawings. Without drawings, **your application will be considered incomplete.** See Attachments C and D.

☐ **For created replacement wetlands,** include additional soils information (if available) that indicates the capability of the site to produce and maintain wetland characteristics.

Note 1: For replacement wetlands located on pipeline easements, you need to receive endorsement of your project from both the easement holder and the Minnesota Department of Public Safety's Office of Pipeline Safety. Before start of construction, the owner of any utilities must be notified. The landowner or contractor is responsible for giving this notice by calling "Gopher State One-Call" at 652–454-0002 (Twin Cities Metro Area) or 1-800-252-1166 (all other locations).

Note 2: For extensive or complex projects supplementary information may be requested at a later dated from one or more of the responding agencies. Such information may include (but not be limited to) the following: topographic map, water table map, soil borings, depth soundings, aerial photographs, environmental assessment and/or engineering reports.

19. SIGNED AFFIRMATION:

FOR PROJECTS INVOLVING REPLACEMENT BY WETLAND BANKING ONLY. To the best of my knowledge and belief, all information in Part II is true, complete and accurate; and I affirm that the wetland losses will be replaced via withdrawal from an account in the State Wetland Bank.

FOR PROJECTS INVOLVING EITHER PROJECT-SPECIFIC REPLACEMENT ONLY OR A COMBINATION OF WETLAND BANKING AND PROJECT-SPECIFIC REPLACEMENT:

Part A: The replacement wetland. I affirm that the replacement wetland was not:
Previously restored or created under a prior approved replacement plan or permit; **AND**
Drained or filled under an exemption during the previous 10 years; **AND**
Restored with financial assistance from public conservation programs; **AND**
Restored using private funds, other than landowner funds, unless the funds are paid back with interest to the individual or organization that funded the restoration; and the individual or organization notifies the local government unit in writing that the restored wetland may be considered for replacement.

Part B: Additional assurances (check **all** that apply):
☒ The wetland will be replaced before or concurrent with the actual draining or filling of a wetland.
☒ An irrevocable bank letter of credit, performance bond, or other acceptable security has been provided to guarantee successful completion of the wetland replacement.
☐ The wetland losses will be replaced via withdrawal from an account in the State Wetland Bank.

Part C. For projects involving any project-specific replacement: Within 30 days of either receiving approval of this application or beginning work on the project, I will record the Declaration of Restrictions and Covenants on the deed for the property on which the replacement wetland(s) will be located; and I will at the same time submit proof of such recording to the LGU.

To the best of my knowledge and belief, all information in Part II is true, complete and accurate; and I affirm all statements in Part A and C, as well as checked assurance(s) in Part B.

Signature or applicant or agent

8-16-13
Date

FOR LGU USE ONLY

Replacement plan is (check one): ☐ Approved ☐ Approved with conditions (conditions attached) ☐ Denied

LGU official signature *Date*

LGU has receive evidence of title and proof of recording of Declaration of Restrictions and Covenants for Replacement Wetland:

County where recorded *Date* *Document # assigned by recorder*

LGU official signature *Date*

Table of Contents

Acronyms, Abbreviations and Units

Acronym, Abbreviation or Unit	Description
BMP	Best Management Practices
BSA	Bank Service Area
BWSR	Board of Water and Soil Resources
CIR	Color Infrared
CPS	Central Pumping Station
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
EAW	Environmental Assessment Worksheet
ECS	Ecological Classification System
EIS	Environmental Impact Statement
ECS	Ecological Classification System
ELT	Ecological Landtype
ELTP	Ecological Landtype Phase
FSA	Farm Services Agency
FTB	Flotation Tailings Basin
GIS	Geographic Information System
GPS	Global Positioning System
HRF	Hydrometallurgical Residue Facility
kV	kilovolt
LEDPA	Least Environmentally Damaging Practicable Alternative
LTVSMC	LTV Steel Mining Company
MDNR	Minnesota Department of Natural Resources
MEPA	Minnesota Environmental Policy Act
MPCA	Minnesota Pollution Control Agency
MSFMF	Mine Site Fueling and Maintenance Facility

Acronym, Abbreviation or Unit	Description
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
OSLA	Overburden Storage and Laydown Area
OSP	Ore Surge Pile
PGEs	Platinum Group Elements
RFSS	Regional Forester Sensitive Species
RTH	Rail Transfer Hopper
SDEIS	Supplemental Draft Environmental Impact Statement
SDS	State Disposal System
SEIS	Supplemental Environmental Impact Statement
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SNF	Superior National Forest
SWPPP	Stormwater Pollution Prevention Plan
TWP	Treated Water Pipeline
USACE	U.S. Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USFS	U.S. Forest Service
USGS	United States Geological Survey
WCA	Wetland Conservation Act
WWTF	Waste Water Treatment Facility
WWTP	Waste Water Treatment Plant

Executive Summary

Poly Met Mining Inc. (PolyMet) is applying for a wetland permit to construct the NorthMet Mine and Ore Processing Facilities Project (Project). The Project, located near Hoyt Lakes Minnesota, will include a Mine Site, a Plant Site, and connecting corridors. PolyMet has leased the mineral rights at the Mine Site, but the U.S. Forest Service (USFS) currently owns surface rights to the majority of the land. PolyMet has purchased or retains options to purchase several privately-held parcels of land within the Superior National Forest (SNF) and proposes to exchange that land with the USFS for land at the Mine Site. The Plant Site is the former LTV Steel Mining Company (LTVSMC) taconite processing facility and Tailings Basin, which PolyMet has acquired from Cliffs Erie. PolyMet has also acquired the necessary easements and rights-of-way for transportation corridors connecting the Mine Site and the Plant Site. The wetland permit application form is found inside the front cover of this report. Additional details on property ownership are presented in Section 1.0.

PolyMet initially submitted its wetland permit application for the Project to the U.S. Army Corps of Engineers (USACE) in July 2004. This permit application initiated an assessment of the potential scope of environmental review under the National Environmental Protection Act (NEPA) and the Minnesota Environmental Protection Act (MEPA). It was determined that a joint state and federal Environmental Impact Statement (EIS) would be conducted under the authority of NEPA (United States Code 1976, title 42, sections 4321 to 4361) and MEPA (Minnesota Rules, chapter 116D). The NEPA/MEPA activities are collectively referred to in this application as the Environmental Review Process. The Environmental Review Process produced a Draft Environmental Impact Statement (DEIS) in 2009. A Supplemental Draft Environmental Impact Statement (SDEIS) is in preparation as of July 2013. The Project has been modified significantly since 2004 and 2009: this wetland permit application supplements the 2004 application to accord with the updated Project plans.

Information in addition to that provided in this application can be found in the environmental impact statement (EIS) (and record thereof) being prepared by the joint state and federal Environmental Impact Statement (EIS) (and record thereof) being prepared by the Minnesota Department of Natural Resources (MDNR), the USACE, and the USFS, in cooperation with the U.S. Environmental Protection Agency Region 5, Bois Forte Band of Chippewa (Bois Forte Band), Grand Portage Band of Chippewa (Grand Portage Band), and the Fond du Lac Band of Lake Superior Chippewa (Fond du Lac Band) under the authority of the National Environmental Policy Act (United States Code 1976, title 42, sections 4321 to 4361) and the Minnesota Environmental Protection Act (Minnesota Rules, chapter 116D) on the Section 404 permit application and the land exchange proposed by the USFS. The EIS is being jointly prepared with the MDNR under the permit to mine under Minnesota Rules, part statute 6132.1100.

Summary of Wetland Impacts

The Project is expected to result in direct and fragment (indirect) impacts to 127 wetlands as identified in the wetland delineation, covering a total of approximately 939 acres

(Large Table 1). The wetlands were described in Reference (1) and the delineation was discussed with the Wetland IAP Workgroup and approved by the co-lead agencies on March 30, 2011. Wetlands are counted as directly impacted if they will be excavated or filled by Project activities or located between the toe of the Tailings Basin and the Flotation Tailings Basin (FTB) Containment System. The majority of wetland impacts will occur at the Mine Site (84%) followed by the Plant Site (16%) (Large Table 2). Road, railroad, and utility corridors account for less than 1% of wetland impacts. The types of wetlands that will be impacted include: coniferous bog (56%), shrub swamp (12%), coniferous swamp (9%), shallow marsh (9%), deep marsh (8%), sedge/wet meadow (4%), hardwood swamp (1%), and open bog (1%). Additional details on direct wetland impacts are presented in Section 11.4.

The Project has the potential for indirect impacts to wetlands. There will be monitoring of wetlands during Project operations

Project Location and Setting

The Project is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of Duluth, 6 miles south of Babbitt. The Project location is shown on Large Figure 1, and the Project areas, including the Mine Site and the Plant Site, are shown on Large Figure 2. The Mine Site is located within the SNF and drains to the Upper Partridge River. A small portion of the Plant Site also falls in the Upper Partridge River watershed, but most of the Plant Site drains to the Embarrass River. The Upper Partridge River and the Embarrass River are tributaries of the St. Louis River. Large Figure 3 shows Project area watersheds.

In the Project areas, a thin veneer of heterogeneous unconsolidated deposits is underlain by bedrock. The depth to groundwater is typically less than 10 feet, and wetlands are common. Large Figure 4 shows wetlands in the Project vicinity. The Mine Site has been extensively logged, and is currently in varying stages of regeneration. The Plant Site is the former LTVSMC taconite processing plant and Tailings Basin. Most surface area at the Plant Site has been previously disturbed by mining activities and is largely devoid of natural vegetation. Additional details on Project location are presented in Section 3.0 and on the general environmental setting are presented in Section 11.1.

Project Purpose

The Project purpose is to develop a mining facility that will extract and process polymetallic ore from the NorthMet ore body, to supply copper, nickel, cobalt, gold and Platinum Group Elements (PGEs), such as platinum and palladium, to the world market. The Project is needed to exercise valid mineral rights and help meet domestic and international demand for these metals which are used in the electrical power, steel, aircraft, automotive, electronics, and medical device industries. The Project will provide substantial economic benefits to the local and state economy, providing an estimated 360 full-time jobs, more than 600 indirect jobs, and tens of millions of dollars annually in taxes. Additional detail on the purpose of the Project is presented in Section 4.0.

Project Description

PolyMet expects to mine a total of 225 million tons of ore and 308 million tons of waste rock over 20 years. Ore will be excavated at the Mine Site and hauled by railroad approximately 6 miles west to the Plant Site for processing. Corridors for roads, railroad, utilities and water pipelines will connect the Mine Site and the Plant Site. Project areas are shown on Large Figure 2.

The Mine Site will occupy approximately 3,015 acres. The Project will develop open mine pits (up to 528 acres), stockpiles (up to 740 acres), and supporting infrastructure (up to 451 acres). The location and dimensions of Mine Site features are shown on Large Figure 5. Mine Site environmental controls will include, among other features, liners and containment systems to collect seepage from stockpiles, a cover to limit infiltration through the permanent stockpile after closure, and a Waste Water Treatment Facility (WWTF) to treat water that comes in contact with mining features. Water collected from pit dewatering will be treated, then pumped to the Plant Site for use in ore processing. During operations, there will be no direct discharge of treated waste water from the mine site to waters of the U.S. or Minnesota public waters.

The Plant Site is a “brownfields” location which occupies approximately 4,417 acres. At the Plant Site, the Project will upgrade existing facilities (Beneficiation Plant, Tailings Basin, Area 1 Shop, Sanitary Treatment Plant, rail connections, access roads) and construct new facilities, including Hydrometallurgical Plant, Hydrometallurgical Residue Facility (HRF), Concentrate Dewatering/Storage Building, and Waste Water Treatment Plant (WWTP) on previously disturbed areas. The Flotation Tailings will be stored atop the existing LTVSMC Tailings Basin by staged construction of new dams. The location and dimensions of Plant Site features are shown on Large Figure 6.

Plant Site environmental controls during mining operations will include: cover systems to limit infiltration of oxygen and water through the Tailings Basin dams and seepage capture systems to collect seepage from the Tailings Basin. During reclamation and long-term closure these environmental controls will continue to operate, and additional cover systems will be added to the Tailings Basin beaches and pond bottom. Most water used in processing will be recycled from the Tailings Basin Pond for use. A reverse osmosis WWTP will be constructed to treat any water that cannot be recycled prior to discharge to the environment. If makeup water is needed for processing, it may be provided via the Colby Lake Water Pipeline Corridor. Additional detail on the Project description is presented in Section 5.0.

Project Alternatives

Project alternatives have been described in detail in the documents prepared during the Environmental Review Process. The No Action Alternative is under evaluation during the Environmental Review. Under the No Action Alternative, PolyMet will be required to reclaim surface disturbances at the Mine Site associated with exploratory and development drilling. At the Plant Site, Cliffs Erie will be required to complete closure and reclamation activities.

PolyMet does not prefer the No Action Alternative as it does not fulfill the purpose of the Project.

The Environmental Review Process has resulted in Project modifications that avoid and minimize impact to aquatic resources and other environmental concerns. The Project, as initially proposed for the scoping Environmental Assessment Worksheet (EAW) in 2005, was estimated to result in 1,257 acres of direct wetland impacts. PolyMet has modified the Project considerably since that time, incorporating multiple alternatives for avoiding and minimizing wetland impacts. The alternatives incorporated into the refined Project include: avoiding wetlands by using brownfield lands at the Plant Site; avoiding water quality impacts by the collection and treatment of contact waters; minimizing the footprint and optimizing the placement of mining features such as the mine pits, stockpiles, and haul roads; increased in-pit stockpiling.

Large Table 3 summarizes the reduced aquatic ecosystem impacts based on the refinements completed during the evaluation of Alternatives. The cumulative effect of Project modifications is that wetland impacts have been reduced from 1,257 acres to 912 acres in the Project. Large Figure 7 and Large Figure 8 illustrate how Project modifications have evolved at the Mine Site and Plant Site, respectively. Additional detail on the Alternatives Analysis is presented in Section 6.0. Ownership of the Project site and adjacent property owners is provided in Large Table 4.

Description of Wetland Impacts

Project direct wetland impacts will occur at the Mine Site (Large Figure 9), the Plant Site (Large Figure 10), and in the connecting corridors (Large Figure 11). Impacts from wetland fragmentation will occur at the Mine Site (Large Figure 9) and the Plant Site (Large Figure 10). The Project will result in impacts to 59 wetlands covering approximately 785 acres at the Mine Site, 43 wetlands covering a total of approximately 148 acres at the Plant Site, and 25 wetlands covering a total of approximately 7 acres in the corridors connecting the Mine Site and Plant Site. Impacts are due to fill (101 acres), excavation (133 acres), both fill and excavation (593 acres), or installation of the Tailings Basin seepage capture system (85 acres). Twenty-three percent of the directly impacted wetlands at the Mine Site and Plant Site also are impacted by wetland fragmentation. Approximately 65% of the directly impacted wetlands are rated high quality, 5% are rated as moderate quality and 30% are rated as poor quality. The inventory of all wetlands in the Project areas is presented in Large Table 1 and direct wetland impacts are detailed in Large Table 2.

The Project may also cause indirect wetland impacts due to potential change in wetland watershed areas, stream flow, groundwater drawdown, wetland fragmentation, or wetland water quality related to dust or rail car spillage. The documents prepared during the Environmental Review Process describe the range of possible indirect impacts and indicate that the Project could potentially indirectly impact up to approximately 7,350 acres of wetlands located within and around the Project area based on the method of wetlands crossing analog impact zones, or potentially indirectly impact up to 6,498 acres of wetlands located within and around the Project area based on the method of wetlands within analog impact zones. Additional detailed descriptions of direct and potential indirect wetland impacts are presented in Sections 11.4 and 11.5.

Special Considerations

PolyMet conducted database searches and field surveys to evaluate the presence of protected wildlife and plant species in the vicinity of the Project, and to identify any locations of cultural resources.

Wildlife species of special interest in the Project area are Northern goshawk, boreal owl, gray wolf, mountain lion, and Canada lynx. During wildlife surveys in 2000 and 2004, gray wolf and mountain lion tracks were observed, and Northern goshawk was heard during calling surveys. Boreal owls and Canada lynx were not observed. In 2006, a Canada lynx field survey was conducted because a portion of the Project is located within the U.S. Fish and Wildlife Service (USFWS) designated critical habitat area. No Canada lynx or sign of Canada lynx were observed within the Project area. However, the survey identified four female Canada lynx within the larger study area. Coordination with the USFWS has been initiated to support the interagency consultation process. Additional details on protected wildlife species are presented in Section 12.1.

Sixteen plant species listed by the State of Minnesota as endangered, threatened, or special concern, or listed by the USFS Region 9 as a Regional Forester Sensitive Species (RFSS) were identified in the Project area during surveys conducted between 1999 and 2011. Additional details on protected plant species are presented in Section 12.1.

PolyMet coordinated studies to identify and document archaeological and historical resources within and adjacent to the Project area. At the Mine Site, a pre-contact Native American site containing lithic materials, referred to as the Pre-Contact Archaeological Site, was identified as potentially eligible for listing in 2005 and a Phase II evaluation was conducted for this site in 2007 by Soils Consulting.

At the Plant Site, historical properties were evaluated for potential eligibility for listing in the National Register of Historic Places (NHRP) including the former LTVSMC Concentration Plant, the Tailings Basin, and the Area 2 Shops. The former LTVSMC Railroad was also evaluated as part of the plant complex that was constructed during 1954 to 1957. The Concentrator Building may be eligible for listing; however, the report indicates that during operation the Project will have little impact on the integrity of the Concentrator Building, as few changes to the interior or exterior are planned. Nevertheless, the Project's reclamation plans include demolishing the Concentrator Building and other buildings. Therefore, the report recommends that historical records of the site buildings (including schematic drawings, photos, and property descriptions) be created and archived at an appropriate location, such as the Minnesota Historical Society or the Iron Range Research Center.

PolyMet also coordinated a study to identify historical properties of traditional spiritual and cultural significance to the Bois Forte Band of Minnesota Chippewa, the Fond du Lac Band of Lake Superior Chippewa, and the Grand Portage Band of Lake Superior Chippewa (Consulting Bands). The USACE is currently coordinating the results and findings of the study with the appropriate state and federal agencies. Ultimately, these matters will be addressed through the Section 106 coordination process. Additional details on archaeological and historical cultural resources are presented in Section 12.2.

Wetland Mitigation

Mitigation wetlands will be developed to compensate for the wetlands directly impacted by the Project. PolyMet will develop 1,624 wetland mitigation credits from off-site mitigation. The on-site wetland mitigation credits will occur later in the Project and therefore are not shown as mitigation credits in Large Table 5 through Large Table 7. Replacement wetlands will be restored and preserved developed at three off-site locations: the Zim, Hinckley, and Aitkin sites. Off-site replacement wetland locations and watersheds are shown in Large Figure 12. Acreages and credits from each of these sites are summarized in Large Table 5 through Large Table 7.

The proposed mitigation is expected to compensate for all of the direct wetland impacts and the potential indirect fragmentation impacts, with the majority of credits from in-kind mitigation and nearly one-third of the credits from within the Project watershed. The value of mitigation credits, relative to the impacts, has been calculated in accordance with the St. Paul District USACE policy and the State Wetland Conservation Act (WCA) replacement standards. The proposed wetland mitigation package described in this application is expected to result in an excess of approximately 194 credits under the USACE policy and 435 credits under the WCA. PolyMet plans to develop all of the proposed off-site wetland mitigation at least one full growing season prior to the occurrence of the wetland impacts for which the mitigation will compensate. Additional details on wetland mitigation are presented in Section 15.0.

Wetland Monitoring Plan

Monitoring at off-site and on-site wetland mitigation sites will assess whether or not the restored and preserved wetlands meet agreed upon performance standards. Monitoring will evaluate each wetland community type at the mitigation sites, and also evaluate one reference wetland near the restoration site which has relatively natural hydrologic conditions similar to that of the proposed target communities. Detailed vegetation surveys will be conducted each year (typically July-August) to evaluate the success of the restoration or preservation for each community type. Hydrology will also be monitored, using shallow water table monitoring wells, to measure the success of hydrologic restoration. If the restored wetland communities do not meet performance standards PolyMet will propose remedial actions to meet the standard. The USACE retains authority, if necessary, to require additional mitigation credits if remedial actions are not successful. Additional details on wetland mitigation monitoring are presented in Section 16.0.

To identify potential indirect impacts to wetlands caused by mining activities, additional wetland monitoring will be conducted in wetlands not directly impacted. To determine if indirect impacts occur, hydrology, vegetation, and boundaries of wetlands in the Project vicinity, within an area or zone established by the USACE and MDNR, will be monitored, documented, and compared with baseline monitoring and reference wetlands. If monitoring indicates that indirect wetland impacts have occurred, PolyMet will work with the agencies to determine appropriate compensation in accordance with the stipulations of the wetland monitoring plan. Additional details on monitoring for potential indirect wetland impacts are presented in Section 17.0.

1.0 Introduction

PolyMet is submitting this supplement to the 2004 wetland permit application (USACE File # 1999-5528-JKA) to fulfill the requirements of Sections 401 and 404 of the Clean Water Act (CWA) and the Wetland Conservation Act of 1991 (WCA). PolyMet proposes to construct an open pit, low grade, polymetallic mineral mine in northern Minnesota. The project, called the NorthMet Mine and Ore Processing Facilities Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of Duluth, and 6 miles south of Babbitt, Minnesota. The Project location is shown on Large Figure 1 and the Project areas are shown on Large Figure 2. This wetland permit application narrative follows the format of the wetland permit application form, found inside the front cover of this report.

The Project will mine and process polymetallic ore from the northwest portion of the Duluth Complex, which is an ore complex that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, cobalt, gold, and Platinum Group Elements (such as platinum and palladium, known collectively as PGEs). PolyMet plans to refurbish and operate the former LTVSMC taconite processing facility near Hoyt Lakes, Minnesota to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and processing.

PolyMet initially submitted its wetland permit application for the Project to the USACE in July 2004. This permit application initiated an assessment of the potential scope of environmental review under the National Environmental Protection Act (NEPA) and the Minnesota Environmental Protection Act (MEPA). It was determined that a joint state and federal Environmental Impact Statement (EIS) would be conducted under the authority of NEPA (United States Code 1976, title 42, sections 4321 to 4361) and MEPA (Minnesota Rules, chapter 116D). The NEPA/MEPA activities are collectively referred to in this application as the Environmental Review Process. The Environmental Review Process produced a Draft Environmental Impact Statement (DEIS) in 2009. A Supplemental Draft Environmental Impact Statement (SDEIS) is in preparation as of July 2013. The Project has been modified significantly since 2004 and 2009: this wetland permit application supplements the 2004 application to accord with the updated Project plans.

A brief history of the Project site is provided here. The NorthMet deposit has been subject to several episodes of exploration and drilling since its discovery in 1969 by U.S. Steel. Fleck Resources Ltd. (a precursor to PolyMet Mining Corporation) undertook exploration of the deposit in 1989. PolyMet (first generation) commissioned a pre-feasibility study in 2001 which did not contemplate reusing the LTVSMC facilities. The Project was restarted in 2003 when PolyMet (2nd generation) secured an option to buy the LTVSMC plant, which it subsequently exercised.

At the Mine Site, PolyMet has leased the mineral rights that are needed for the Project, but the USFS currently owns surface rights to the majority of the land. PolyMet and the USFS disagree on whether PolyMet can exercise the mineral rights. In part to avoid this disagreement, the USFS has initiated a land exchange with PolyMet under which PolyMet would provide surface rights to several privately-held parcels of land within the SNF which the USFS would exchange for land at the Mine Site (Reference (2)).

For the Plant Site, PolyMet has acquired surface ownership of approximately 7,000 acres of real property and portions of the former LTVSMC taconite processing facility and approximately 8,000 additional acres from Cliffs Erie. Some of this land is additional acreage that would serve as buffer beyond the Project boundary. As described in Section 6.3, under the No Action Alternative, current permits with Cliffs Erie as the permittee would remain in effect. PolyMet also acquired the necessary surface licenses, easements and rights-of-way (e.g., roadways, railroad, electrical service, gas pipeline and water facilities) to enable production at the Plant Site.

To connect the Plant Site and the Mine Site, PolyMet has acquired the necessary easements and rights-of-way to use an 8-mile segment of Dunka Road. PolyMet has also acquired ownership or the right to use additional lands and other railroad assets to secure the rail access between the Mine Site and the Plant Site.

2.0 Summary of Wetland Impacts

The Project is expected to result in direct and fragment (indirect) impacts to 127 wetlands, covering a total of approximately 939 acres. Wetlands are directly impacted if they will be excavated or filled by Project activities or located between the toe of the Tailings Basin and the Flotation Tailings Basin (FTB) Containment System. The majority of direct wetland impacts will occur at the Mine Site (83%) followed by the Plant Site (16%). Road, railroad, and utility corridors account for less than 1% of direct wetlands impacts.

Using the Eggers and Reed Wetland Plant Community type (Reference (3)) and the Circular 39 wetland type (Reference (4)), the types of wetlands that will be directly impacted include: coniferous bog (Type 8; 56%), shrub swamp (Type 6; 12%), coniferous swamp (Type 7; 9%), shallow marsh (Type 3; 9%), deep marsh (Type 5; 8%), sedge/wet meadow (Type 2; 4%), hardwood swamp (Type 7; 1%), and open bog (Type 8; 1%).

Direct wetland impacts, the methods used to determine the impacts, and the estimated timing of impacts are detailed in Section 11.4

3.0 Project Location

The Project is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of Duluth, and 6 miles south of Babbitt, Minnesota. The Project location is shown on Large Figure 1, and the Project areas, including the Mine Site and the Plant Site, are shown on Large Figure 2. The NorthMet ore body (Mine Site) is in the SNF near the western end of a belt of copper-nickel deposits on the northwestern contact of the Duluth Complex. The NorthMet ore body is in proximity to a number of existing mines including the Peter Mitchell open pit taconite mine, which is located approximately 2 miles north of the Mine Site. The Plant Site, which is the former LTVSMC taconite plant property, is located approximately 8 miles west of the ore body. The Mine Site and Plant Site are connected by the existing Dunka Road.

Specifically, the Project is located in Sections 1, 2, 3, 4, 9, 10, 11, 12, 16, 17, and 18, Township 59 North, Range 13 West; Sections 3, 4, 5, 6, 8, 9, 10, 13, 14, 15, 16, 17, 20, 23, 24, 29, and 32, Township 59 North, Range 14 West; and Sections 32, 33, and 34, Township 60 North, Range 14 West, in St. Louis County, Minnesota.

The Project is located near the headwaters of the Partridge River and Embarrass River watersheds (Large Figure 3). The Partridge River and the Embarrass River are both tributary to the St. Louis River, which is located within the Lake Superior Basin. The Mine Site, a portion of the Plant Site, Dunka Road and Utility Corridor, Railroad Connection Corridor, and Colby Lake Water Pipeline Corridor are located within the Upper Partridge River Watershed (Large Figure 3). The majority of the Plant Site is located in the Embarrass River Watershed. Additional details on the Project area hydrology and hydrogeology are found in Section 11.1.1.

4.0 Project Purpose and Need

The Project purpose is to develop a mining facility that will extract and process polymetallic ore from the NorthMet ore body, to supply copper, nickel, cobalt, gold and Platinum Group Elements (PGEs), such as platinum and palladium, to the world market. The Project is needed to exercise valid mineral rights and will help meet domestic and international demand for these metals which are vital in the electrical power, steel, aircraft, automotive, electronics and medical device industries. The mining activities will result in long-term jobs for the region. Environmental objectives are also intrinsic to the Project, which has been modified to avoid, minimize and mitigate environmental impacts by reusing previous mining facilities, and constructing state of the art environmental controls.

The Project is needed for many reasons. The U.S. is a major importer of all the metals that PolyMet plans to extract from the NorthMet ore body. According to numbers from the U.S. Department of the Interior's Geological Survey National Minerals Information Center, the U.S. imports approximately 30-40% of its copper (comparable to the percentage of oil imported) – the annual numbers vary because there is an efficient copper recycling business in place. There are currently no operating nickel or cobalt mines in operation in the U.S., although recycled metal represents a significant supply source. The U.S. also imports 75-95% of its PGEs – there is only one PGE mining operation in the U.S. despite the critical need for PGEs in environmental control technologies and other strategic technological applications. The PGEs are regarded as strategic metals because of their specialized applications in the automotive, agriculture, chemical, petroleum, electrical, electronic, dental, medical, and aerospace industries. They also have important uses in environmentally-related technologies, such as catalytic converters and fuel cells.

On an annual basis, PolyMet expects to produce approximately:

- Copper - 36,000 tons of concentrate will be produced. Copper is an extremely good conductor of electricity and heat. Its major use is in power generation and transmission (including renewable energy), and in residential, commercial, industrial and automotive electrical systems.

- Nickel - 7,700 tons of concentrate will be produced. Nickel is used in production of stainless steel, high quality corrosion resistant steel alloys, rechargeable batteries, and in high-tech engineering applications such as aerospace.

- Cobalt - 360 tons of concentrate will be produced. Cobalt is a hardening agent in steel alloys and is used in super alloys, aircraft engines, rechargeable batteries, and common hand tools.

- PGEs - 97,000 troy ounces of concentrate will be produced. The primary use of PGEs is in catalytic converters which clean-up car exhaust emissions. The PGEs are also used in electronics, medical devices, fuel cells, and jewelry.

- Gold – 9,000 troy ounces of concentrate will be produced. Gold is primarily used for jewelry, investment, and electronics.

The Project will provide substantial economic benefits to the local and state economy, providing hundreds of jobs, millions of dollars of indirect economic activity, and tens of millions of dollars in taxes. The construction phase will engage the equivalent of about 500 skilled construction workers over a three-year period (Reference (2)). Over approximately 20 years of planned operations, the Project will create approximately 360 full-time jobs with an estimated annual payroll and benefits of $36 million. In addition to the direct economic benefits, a study by the University of Minnesota-Duluth Labovitz School of Business and Economics (Reference (5)) estimates that more than 600 indirect jobs will be created in St. Louis County alone, generating annual economic benefit of about $515 million including products and services. Furthermore, the Project is expected to generate tens of millions of dollars annually in federal, state, and local taxes.

PolyMet has evaluated and developed the Project using very conservative assumptions about metals prices. The Definitive Feasibility Study completed in 2006 (Reference (6)) and updated in 2008 demonstrated that the Project will be sustainable even during downturns in the global metal markets. These conservative assumptions help buffer the community from potential economic impacts associated with volatility in the metals markets.

Society's continuing need for copper, nickel, cobalt, gold, and PGEs, combined with use of proven mining techniques and processing methods, reuse of previous mining facilities, and installation of extensive environmental controls, make the Project economically feasible and environmentally responsible. The Project is designed to generate sufficient income to cover operating cost (which includes but is not limited to the cost of mining, processing, transportation, and waste management), capital cost (needed to build and sustain facilities), an adequate return to investors, reclamation and closure costs, and taxes. The open pit mining plan applies best engineering practices based on the size, shape, geometry, grade, location, and geotechnical characteristics of the ore body and the site such that the highest degree of operational certainty is achieved. Ore processing and tailings storage will make use of the existing LTVSMC plant and tailings basin, minimizing impacts to previously disturbed land. Extensive environmental controls will be installed at both the Mine Site and the Plant Site, focused on avoiding, minimizing, and mitigating water impacts, including wetlands impacts.

5.0 Project Description

This section describes specific Project features that will potentially result in wetland impacts. Additional Project features that have no potential wetland impacts are listed in this section, but are not described in detail. For a detailed description of all Project features, refer to the Supplemental DEIS, Reference (2).

The Project includes five areas:

- Mine Site
- Plant Site, including the processing facilities area, the Tailings Basin and the Hydrometallurgical Facility (HRF)
- Dunka Road and Utility Corridor
- Railroad Connection Corridor
- Colby Lake Water Pipeline Corridor

These areas are shown on Large Figure 2. For each of these Project areas, specific features that will potentially result in wetland impacts are described.

5.1 Project Schedule

Table 5-1 provides a summary of the Project schedule.

Table 5-1 Summary of Project Schedule

Time period	Description of Activities
Months 16-18 (prior to Mine Year 0)	Pre-production mine development includes: remove overburden from the pit area and other areas on site as necessary for initial foundation construction; construct the RTH; construct initial liners and containment systems for OSP and waste rock stockpiles; construct water management features (WWTF, CPS, TWP, dikes, ditches, ponds); build out of initial haul roads; grade out OSLA; construct substation drop and install power distribution system; construct processing facilities area, FTB Area, and HRF Area
Mine Year 0	Production begins
Mine Years 0-1	Gradual ramp-up of ore output for 6-12 months
Mine Years 0-20	Mining of waste rock and ore

Time period	Description of Activities
Mine Years 1-8	Build out site as necessary: remove additional overburden from the pit areas and other areas on site as necessary for foundation construction; construct extensions to the liners and containment systems for OSP and waste rock stockpiles; construct additional water management features (WWTF, dikes, ditches, ponds); build out additional haul roads; build out FTB dams and HRF
Mine Years 0-2	Mining begins in the East Pit
Mine Years 2-11	Mining begins in the West Pit
Mine Years 0-10	All Mine Site process water will be pumped to the Plant Site FTB Pond for reuse
Mine Year 11	East Pit mining ends; Category 4 stockpile is completely backfilled
Mine Year 11	Some Mine Site process water will be sent to the East Pit to augment flooding as the pit is backfilled
Mine Years 11-16	Mining in the Central Pit and converges into the East Pit, both will eventually be called the East Pit; all excavated Category 2, 3, and 4 waste rock will be placed directly in the East Pit
Mine Years 11-16	Temporarily-stockpiled Category 2/3 and 4 waste rock will be placed in the East Pit
Mine Years 12-19	Category 2/3 stockpile is backfilled
after Mine Year 13	All additional Category 1 waste rock excavated from the pits will be placed in the East Pit; Cover system will incrementally be added the Category 1 Waste Rock Stockpile
Mine Years 16-20	Temporarily-stockpiled Category 2/3 and 4 waste rock will be placed in the Central Pit

5.2 Mine Site

The Project will use open pit mining methods, similar to those used at nearby taconite mines. The location and dimensions of Mine Site features are shown on Large Figure 5. The Project features at the Mine Site will include:

- supporting infrastructure (such as roads, electrical supply, rail connections, fueling facilities, and maintenance facilities)
- an Overburden Storage and Laydown Area (OSLA) to provide space to sort and store overburden used for construction and reclamation
- mine pits

- ore handling facilities, including an Ore Surge Pile (OSP) and a Rail Transfer Hopper (RTH)

- waste rock stockpiles with engineered systems to manage potential water resource impacts (such as liners, covers, and a Groundwater Containment System)

- a Waste Water Treatment Facility (WWTF) and process water collection systems to collect and treat water from the mine pits, the stockpiles, the ore handling facilities, and the haul roads

- a Central Pumping Station (CPS) and Treated Water Pipeline (TWP) to transport water from the Mine Site to the Plant Site

- stormwater management systems

5.2.1 Pre-production Mine Development

Mine Site infrastructure will be constructed during the estimated 12 to 18 months of pre-production mine development. These activities will include:

- infrastructure - upgrading the existing Dunka Road, constructing site access and haul roads, installing railroad connections and spur, and constructing the Mine Site Fueling and Maintenance Facility (MSFMF)

- removing overburden from the pit area and other areas on site, as necessary

- constructing the RTH

- constructing the liners and containment systems for the OSP and waste rock stockpiles

- constructing water management features, including the WWTF, CPS, and TWP, and dikes, ditches, and ponds to manage stormwater

- constructing the substation drop from the 138 kilovolt (kV) transmission line and installation of a 13.8 kV Mine Site power distribution system

Most of the direct wetlands impacts at the Mine Site will occur during pre-production mine development. The pre-production mine development will be followed by a gradual ramp-up of ore output over 6 to 12 months.

5.2.2 Mining Activities

PolyMet expects to mine a total of 533 million tons of waste rock and ore over 20 years, which will include 225 million tons of ore and 308 million tons of waste rock. After the initial ramp up period, the planned maximum annual average ore production rate will be 32,000 tons per day. Ore will be shipped to the Plant Site, as described below, and waste rock will be managed as described in Section 5.2.3.

Mining activities include overburden removal (pre-stripping), open pit mining, pit dewatering, drilling and blasting, excavation and haulage, stockpiling, ore loading for transport to the Process Plant via the RTH, and temporary ore storage in the OSP. Drilling, blasting, excavation, haulage, and ore loading for transport to the Process Plant via the RTH are mining activities that will not result in wetland impacts, and are not discussed further here. Overburden removal, open pit mining, temporary ore storage, and waste rock and overburden stockpiles will result in wetland impacts, and are described further below.

5.2.2.1 Overburden Removal

The marketable timber will be cleared and the overburden removed from the footprints of the mine pits, the OSP, and the waste rock stockpiles, as necessary.

Overburden will be stripped incrementally as needed for mine development in order to minimize the amount of bedrock exposed at any one time. After removal of overburden from the initial mining area, additional overburden stripping could take place concurrently with the mining of ore and waste rock.

The OSLA will be constructed to temporarily store Peat and Unsaturated mineral Overburden while it is screened and sorted prior to being used for construction, wetland restoration, or reclamation. Overburden has been defined for this Project as the material that lies on top of the underlying bedrock.

5.2.2.2 Open Pit Mining

The Project will use open pit mining methods similar to those currently in use at ferrous metallic mining operations on the Iron Range. The mine will consist of three separate open pits known as the East, Central, and West Pits, as shown in Large Figure 5. For approximately the first 10 years of operations, mining will take place in the East and West Pits simultaneously, with the East Pit mining ending in Mine Year 11. The Central Pit mining will occur between Mine Years 11 and 16. During Central Pit mining, the East and Central pits will converge into one pit which will then be referred to as the East Pit.

At maximum size, each pit is projected to have the approximate maximum area and depth as shown in Table 5-2.

Table 5-2 Maximum Pit Dimensions - Approximate

Mine Pit	Area (acres)	Maximum Depth (feet below ground surface)
West	321	696
Central	52	356
East	155	630

5.2.2.3 Ore Surge Pile (OSP)

The OSP will be constructed near the RTH to allow for temporary storage of ore until it could fit into the processing schedule or as needed based on operational delays (Large Figure 5). Use of the OSP would allow for delivery of a steady annual flow of ore and assist in providing a uniform grade of ore to the Plant Site. Ore will flow into and out of this pile during the life of the mine as needed to meet mine and plant operating conditions.

The OSP will be constructed with an engineered foundation system comprised of, from the bottom up, a foundation underdrain system, an impermeable composite liner barrier, and an overliner drainage layer. Drainage from the OSP will be collected on the liner and routed to a sump for pumping to the WWTF. The OSP will be removed at the completion of mining activities.

5.2.3 Waste Rock and Overburden Management

5.2.3.1 Overburden Management

Three types of overburden are present at the site; Unsaturated mineral Overburden, Saturated mineral Overburden, and Peat (organic soil). Each type of overburden will be managed according to its characteristics.

Unsaturated Overburden is the mineral material that was located above the natural water table surface. Waste characterization studies have demonstrated that Unsaturated Overburden has been weathered long enough for geochemical reactions to be relatively complete, so it will be usable for general on-site construction material. Excess Unsaturated Overburden that is not needed for immediate construction and reclamation needs will be stored in unlined overburden stockpiles at the OSLA.

Saturated mineral Overburden is the material that has been located below the natural water table surface. It has not been exposed to air and is therefore not weathered; so it will only be usable for specific on-site construction applications as approved by the MDNR. Saturated Overburden not used for construction will be combined with waste rock in the membrane-lined temporary waste rock stockpiles.

Peat will be used for restoration and reclamation activities at the Mine Site. This may include the development of wetlands in the East Pit and within the reclaimed temporary stockpile footprints. Peat will also be mixed with Unsaturated Overburden to increase the organic content for restoration soil material across the Mine Site, including over the geomembrane cover of the Category 1 Waste Rock Stockpile. Peat that is not needed for immediate construction and reclamation needs will be stored in unlined overburden stockpiles at the OSLA.

5.2.3.2 Waste Rock Management

Waste rock will be managed according to its geochemical properties as determined using a sampling and analysis program approved by the MDNR. PolyMet has categorized waste rock into four categories defined according to the geochemical and associated acid-producing and metals-leaching properties of the waste rock, in ascending order of reactivity. These waste rock categories are summarized in Table 5-3.

Table 5-3 Summary of Waste Rock Properties

Waste Rock Categorization	Sulfur Content (%S)(1)	Approximate % of Waste Rock Mass	Applications(2)
Category 1	%S ≤ 0.12	70%	Construction and East Pit Backfill
Category 2	0.12 < %S ≤ 0.31	24%	East Pit Backfill
Category 3	0.31 < %S ≤ 0.6	3%	East Pit Backfill
Category 4(3)	%S > 0.6	3%	East Pit Backfill

(1) In general, the higher the rock's sulfur content, the higher its potential for generating acid rock drainage (ARD) or leaching heavy metals.
(2) Applications include uses of the material other than stockpile storage
(3) Includes all Virginia formation rock

The Category 1 Waste Rock Stockpile will be the only permanent stockpile for the Project. During Mine Years 1 through 11, Category 2, 3 and 4 waste rock will be placed on the temporary Category 2/3 or Category 4 Waste Rock Stockpiles (Large Figure 5). When at its maximum size, each stockpile is projected to have the approximate area, height, and elevation shown in Table 5-4.

Table 5-4 Maximum Stockpile Dimensions - Approximate

Stockpile	Mine Year of Maximum Footprint	Max Footprint (acres)	Max Height (feet)	Max Elevation (feet above sea level)
Category 1 Waste Rock	6	526	240	1,840
Category 2/3 Waste Rock	6	180	200	1,770
Category 4 Waste Rock	3	57	180	1,790
Ore Surge Pile	N/A(1)	31	120	1,690

(1) The ore surge pile will have ore moving in and out as needed to meet mine and plant conditions.

Starting in Mine Year 11, when mining in the East Pit ends, the temporary Category 2/3 and Category 4 Waste Rock Stockpiles will be relocated to the East Pit, and all future Category 2, 3, and 4 waste rock will be placed in the East Pit or the Central Pit, once mining ceases in the Central Pit after Mine Year 16. By placing Category 2, 3, and 4 waste rock into the East Pit and Central Pit, it will be stored in a subaqueous environment to reduce the environmental impact associated with further oxidation and dissolution of sulfide minerals. Furthermore, this in-pit stockpiling avoids and minimizes wetland impacts. Most of the Category 1 waste rock mined after Mine Year 12 will also be placed in the East Pit. Ultimately, approximately 45% of the total waste rock mined will be backfilled to the East and Central pits.

All waste rock stockpiles will be engineered to manage water resource impacts. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles, which have the potential to generate acid rock drainage, will have liner systems to capture water passing through the stockpile. The permanent Category 1 Waste Rock Stockpile, which does not have the potential to generate acid rock drainage, will be constructed with a Groundwater Containment System to collect stockpile drainage from around the entire stockpile. The containment system will consist of a cutoff wall (a low permeability compacted soil hydraulic barrier) combined with a drainage collection system surrounding the perimeter of the stockpile near the stockpile toe. A cover system will be added incrementally after Mine Year 13 as waste rock is placed into the Category 1 Waste Rock Stockpile.

5.2.4 Mine Site Water Management

Water management at the Mine Site will include pit dewatering, stormwater dikes and ditches, the stockpile liner, stockpile cover, a Groundwater Containment System, and the WWTF. During operations, the WWTF will treat process water from the waste rock stockpiles, haul roads, OSP, and mine pits. For the first approximately 10 years, all WWTF effluent will be pumped to the Plant Site FTB Pond for reuse in the beneficiation process. Reuse of the Mine Site process water at the Plant Site will eliminate the need to discharge any process water to surface waters at the Mine Site during operations. Starting in Mine Year 11, some WWTF effluent will be sent to the

East Pit to augment flooding as the pit is backfilled, with the remainder of the effluent continuing to go to the FTB. The purpose of the WWTF is to maintain the overall water quality in the FTB at or below process water quality targets in order to manage the water quality of groundwater seepage from the FTB

Mine Site water will be managed in accordance with a future Minnesota Pollution Control Agency (MPCA) National Pollutant Discharge Elimination System (NPDES)/ State Disposal System (SDS) permit, which will include a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP will identify and describe Best Management Practices (BMP) for the Mine Site to minimize the discharge of potential pollutants in stormwater runoff. For a detailed discussion of mine site water management, refer to Reference (2).

5.3 Plant Site

The Plant Site was previously used as a taconite processing facility by LTVSMC. The Project will upgrade existing facilities and construct new facilities within the existing brownfield facility. The location and dimensions of Plant Site features are shown on Large Figure 6. Plant Site features are grouped into three areas for the wetlands analysis and permit application, as follows:

- Processing Facilities Area
    - supporting infrastructure (e.g., roads, electrical supply, rail connections, Area 1 Shop, and Area 2 Shop)
    - a Beneficiation Plant which will use existing buildings for crushing and concentration operations and new buildings for flotation and concentrate dewatering
    - a Hydrometallurgical Plant
    - a Waste Water Treatment Plant (WWTP)
- FTB Area
    - the existing former LTVSMC tailings basin (Tailings Basin), with a new FTB constructed atop the east side
    - FTB Seepage Capture Systems
- HRF Area

The FTB and the HRF are located within the LTVSMC Permit to Mine Ultimate Tailings Basin Limit boundary. When LTVSMC ceased production in January 2001, the mining related assets were transferred to Cleveland Cliffs, Inc. which formed Cliffs Erie LLC. The wetlands located within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary are not regulated by state and federal wetland regulations so were not included in this analysis (Reference (7), Attachment A).

5.3.1 Flotation Tailings Basin (FTB)

Flotation Tailings from the flotation process at the Beneficiation Plant will be pumped to the FTB. In this document, the Tailings Basin is the existing former LTVSMC tailings basin, and the FTB refers to the Tailings Basin with NorthMet Flotation Tailings impounded atop it. New FTB dams will be constructed on top of cells 1E and 2E of the existing LTVSMC Tailings Basin (Large Figure 6). Treated water from the WWTP and WWTF will also be pumped to the FTB, enabling the FTB to serve as the primary source of water used at the Plant Site.

The Tailings Basin is unlined and was constructed in stages beginning in the 1950s. The Tailings Basin operations were shut down and have been inactive since January 2001 except for reclamation activities consistent with a MDNR-approved Closure Plan currently managed by Cliffs Erie.

The future FTB perimeter dams will be raised using upstream construction methods. The dams will be constructed using compacted LTVSMC tailings borrowed from the existing Tailings Basin. Once the LTVSMC tailings supply has been completely used for dam construction, offsite borrow from MDNR-approved sources will be utilized. Material from LTVSMC Area 5 will be a likely source, but other sources could also be considered.

Emergency overflow channels will be provided to protect the dams in the unlikely event that freeboard within the FTB is not sufficient to contain all water from an extreme storm event. Analysis indicates that such extreme rainfall events have a low likelihood of occurring during the life of the basin (Reference (2)). Even though there is a low likelihood of overflow, it is standard practice in dam design to accommodate overflows in a manner that protects the integrity of the dams.

5.3.2 Flotation Tailings Basin Seepage Capture Systems

Seepage from the FTB will be collected by the FTB Containment System located around the north and west sides of the Tailings Basin and the FTB South Surface Seepage Management System located south of Tailings Basin Cell 1E; these two systems are collectively referred to as the FTB seepage capture systems. The FTB Containment System is the primary cause of direct wetland impacts at the Plant Site. The FTB Containment System will consist of a cutoff wall (a low permeability compacted soil hydraulic barrier) combined with a seepage collection system. The cutoff wall will minimize the amount of water that the seepage collection system draws into the seepage collection system from adjacent wetlands.

5.3.3 Hydrometallurgical Residue Facility (HRF)

The HRF will be constructed to manage residues generated by the hydrometallurgical process. The HRF will consist of one lined cell located adjacent to the southwest corner of Tailings Basin

Cell 2W, at the site of the Emergency Basin used in the former LTVSMC operations (Large Figure 6).

The HRF will be double-lined to minimize release of water that has contacted the hydrometallurgical residue. The composite liner system will consist of a geomembrane liner above a geosynthetic clay liner with a second geomembrane/geosynthetic clay liner placed above the first, separated by a leakage collection system, this system will substantially remove all hydraulic head from the lower liner; therefore virtually eliminating leakage from the HRF.

The HRF will be filled by pumping the combined hydrometallurgical residue (Residue) as slurry from the Hydrometallurgical Plant. A pond will be maintained within the HRF so that the solids in the slurry will settle out. Most of the liquid will be recovered by a pump system and returned to the plant for reuse.

5.3.4 Plant Site Water Management

Water management at the Plant Site will include the FTB, the HRF, stormwater dikes and ditches, seepage capture systems, the WWTP, and stream augmentation. With the exception of the FTB seepage containment system, all Plant Site water management features will be located on previously disturbed areas.

The WWTP will treat any water collected by the seepage capture systems that cannot be reused as process water. Water will be treated to meet appropriate discharge limits, then discharged along the west, northwest, and north perimeter of the FTB – beyond the FTB Containment System – and to Second Creek at the south end of the FTB to replenish the flow to the surrounding wetlands. This discharge strategy will limit the potential for indirect wetland impacts due to reduced seepage from the Tailings Basin to the wetlands.

Construction of the FTB Containment System will reduce the amount of seepage that is currently leaving the existing Tailings Basin. Consequently, the stream flow in the four tributaries around the Tailings Basin (Unnamed Creek, Second Creek, Trimble Creek, and Mud Lake Creek) will be reduced from existing levels. Augmentation with other sources of water rather than seepage will be used to maintain stream flow. If the WWTP effluent does not provide adequate water to augment stream flow, water will be transferred from Colby Lake to augment the stream flow and meet the target annual average stream flow.

The Plant Site water will be managed in accordance with a future MPCA NPDES/ State Disposal System (SDS) permit, which will include a SWPPP. The SWPPP will identify and describe BMPs at the Plant Site to minimize the discharge of potential pollutants in stormwater runoff. For a detailed discussion of Plant Site water management, refer to Reference (2).

5.4 Road, Utility, Railroad, and Water Pipeline Corridors

The remaining Project components are linear corridor features, including the following:

- Dunka Road and Utility Corridor
- Railroad Connection Corridor
- Colby Lake Water Pipeline Corridor

5.4.1 Dunka Road and Utility Corridor

Dunka Road is an existing, compacted-gravel, private road that extends from near the existing LTVSMC Plant Site to the Mine Site, then continues roughly northeast toward Babbitt, Minnesota. The portion of Dunka Road that connects the Plant Site to the Mine Site will be widened and a pipeline will be constructed parallel and adjacent to the existing Dunka Road. Dunka Road will be utilized to transport mine equipment between the Mine Site and the Area 1 Shop, as well as mine personnel between the Mine Site and the Area 2 Shop (Large Figure 2).

The TWP will be constructed in the Utility Corridor to transport treated water from the Mine Site to the Plant Site. During operations, the effluent from the WWTF and runoff from the OSLA will be pumped from the Mine Site through the TWP to the FTB for use as plant make-up water.

5.4.2 Railroad Connection Corridor

An approximately 1.1 mile length of new railroad will be constructed to connect the existing Cliffs Erie private railroad to the existing PolyMet railroad track that serves the Coarse Crusher Building at the Process Plant (Large Figure 2).

5.4.3 Colby Lake Water Pipeline Corridor

The FTB Pond will supply most of the water needed for the milling and flotation circuits. Any shortfall in process water requirements will be made up by raw water from the Plant Reservoir which is supplied from Colby Lake using an existing pump station and pipeline. The Colby Lake Water Pipeline may also supply additional water needed for stream augmentation. No new construction is necessary for the Colby Lake Water Pipeline Corridor (Large Figure 2).

6.0 Project Alternatives: Avoiding and Minimizing Wetland Impacts

The Section 404 regulations under the CWA and the WCA require that impacts to wetlands be avoided and minimized to the extent practicable. Avoiding and minimizing wetland impacts has been one of the objectives of Project during the Environmental Review Process.

This section analyzes the alternatives considered during the Environmental Review Process that affect the Project's direct wetland impacts. For a comprehensive analysis of the full range of alternatives explored and evaluated during the Environmental Review Process, see Section 3.2 of the 2009 DEIS (Reference (8)) and we understand this will be covered in Section 3.2 of the 2013 SDEIS (Reference (2)).

This section first outlines the sequencing of steps taken by PolyMet to modify the project to avoid adverse impacts, and incorporate measures to minimize adverse impacts. It then discusses how alternatives were developed and evaluated. Finally, it describes the alternatives, including the No Action Alternative, and minimization alternatives at the Mine Site, the Plant Site, and in the transportation and utility corridors.

6.1 Sequencing

This section describes the reasonable and practicable avoidance, minimization and compensatory mitigation practices that have been and will be implemented as part of the project.

The Project was modified through the process described above to have the least impacts practicable to waters of the U.S., as well as to other biological resources (e.g., vegetation, wildlife, threatened and endangered species, etc.). In addition, to assess alternatives and possible additional environmental management and mitigation measures, the co-lead agencies are preparing a supplemental draft environmental impact statement (SEIS) for the project. The SDEIS is scheduled for public release in the third quarter of 2013.

Final regulations and guidelines associated with Section 404 of the CWA require that project proponents eliminate or reduce adverse impacts to waters of the U.S. by taking certain specific steps during the project planning:

- Modify the project to avoid adverse impact
- Incorporate measures to minimize adverse impacts;
- Compensate for unavoidable adverse impacts through restoration, enhancement, creation, or in-lieu fee.

In addition to the off-site mitigation credits that will be develop, PolyMet may develop wetlands on some impacted Project areas in the future. Because the development of these on-site wetland mitigation credits will occur later in the Project, they are not included in the mitigation credits, as discussed in Section 14.0.

6.1.1 Avoidance

The Project is not a water dependent project; however, it is not possible to avoid all waters of the U.S., including wetlands. The project has been modified to avoid wetlands to the extent practicable.

Geology dictates the location and dimension of the mine pits. The polymetallic ore bodies of the NorthMet deposit can be developed only where the mineral resource exists in economically minable quantities. Extensive exploration programs have been conducted to define the resource, which has allowed a refinement of the pit locations. These studies indicate that the ore reserves identified as the East Pit, Central Pit, and West Pit are the areas where polymetallic ore quality and the distribution and amount of waste rock make mining economically feasible. Mining in other areas of the deposit cannot currently be supported based on these studies.

6.1.2 Minimization

Although avoidance of impacts to waters of the U.S. is impossible, the project will employ numerous methods to minimize impacts.

Alternatives to minimize wetland impacts at the Mine Site, Plant Site, and Transportation Corridors are described in Sections 6.4, 6.5, and 6.6 respectively. Minimization alternatives use the following general strategies:

- minimize the footprint and optimize the placement of mining features, mainly at the Mine Site
- maintain a smaller disturbance footprint by re-using existing infrastructure, mainly at the Plant Site brownfield site
- utilize existing facilities and structures, to the extent practicable, to support ongoing activities
- maintain future tailings disposal in a single location and within the existing watershed where the current facility is located
- expand the existing tailings disposal site upward, to the extent geotechnically practicable, thus disturbing less surface area while allowing more material to be placed in the same footprint
- divert runoff upgradient of facilities into undisturbed drainages
- install culverts to facilitate flow across wetland areas

- maintain a SWPPP, using BMPs, to prevent site erosion and subsequent downstream sedimentation
- collect and treat runoff and other contact water
- implement interim, concurrent (as practicable) and permanent reclamation at the site

6.1.3 Reclamation

After Project closure, Project areas will be reclaimed according to the approved reclamation plans (Reference (2)). The Reclamation Plans for the Mine Site include creation of wetlands in areas where some wetlands were directly impacted (Reference (2)). For example, at the Mine Site, wetlands may be developed in the temporary Category 2/3 Waste Rock Stockpile and the OSLA (Section 15.1).

6.1.4 Compensation

Wetland mitigation projects will be completed to compensate for the direct wetland impacts and potential indirect fragmentation impacts, as detailed in Sections 14.0 and 15.0.

6.2 Alternative Development and Evaluation

Alternatives have been developed and evaluated in three stages during the Environmental Review Process; the scoping stage, the DEIS stage, and the SDEIS stage. Aspects of the proposed action that were considered included alternate locations, alternate configurations of Project features and alternate mitigation measures, as detailed in the DEIS (Reference (8) and summarized in Sections 6.4, 6.5, and 6.6. We understand the alternatives will also be covered in the SDEIS (Reference (2)). Some alternatives would have less adverse impacts to waters of the U.S., including wetlands, and some would have greater adverse impacts. Alternatives with smaller and larger areal coverage, as well as alternatives sited in different locations were considered. The Environmental Review Process evaluated the potential environmental impacts of the alternatives, including wetland impacts, during each stage of alternative development.

The practicability of the alternatives, including cost, technical factors, and logistical factors were evaluated. Practicable alternatives and mitigation measures that were identified to offer substantial environmental benefits, and to meet the Project purpose and need, were incorporated into the draft alternative (NorthMet Project Proposed Action).

Alternatives were eliminated if they failed to meet one of the following criteria:

- meet the Project purpose and need
- technical feasibility
- economic feasibility

- availability of resources (e.g., surface rights, mineral rights, technologies)
- significant environmental or socioeconomic benefits compared to other alternatives

The first stage of alternative development and screening took place during project scoping in 2005. The second stage of alternative development and evaluation took place with the 2009 Draft EIS (DEIS) (Reference (8)). Alternatives considered during project scoping and DEIS development are summarized in the 2009 DEIS (Table 3.2-4 of Reference (8)). For each alternative that was eliminated, this table indicates the rationale for why it was eliminated from further consideration.

In June 2010, the co-lead agencies decided that a SDEIS would be completed for the Project in order to build upon the alternatives and issues identified in the 2009 DEIS, to address subsequent public comments, and to incorporate new information.

The third stage of alternative development and evaluation has been completed for the SDEIS (Reference (2)). As an initial step in developing the SDEIS, the co-lead agencies developed and approved a process to identify, analyze and assist PolyMet to develop revisions to its proposal that responded to the concerns raised under the Environmental Review Process. The objective of this process was to have a revised draft alternative that would minimize potential environmental impacts to the extent practicable. An additional goal of the draft alternative development was to support federal and state permitting decision making, including the USACE’s need to identify a Least Environmentally Damaging Practicable Alternative (LEDPA) for the Section 404 Wetland Permit Record of Decision and the Section 7 Endangered Species Consultation with the USFWS.

The process for evaluating the draft alternatives that we understand will be included in the SDEIS involved topic-focused workgroups which discussed key issues that needed to be closely examined. These workgroups included representatives from the co-lead agencies, cooperating agencies, other regulating agencies, and PolyMet. These workgroups participated in the impact assessment planning process, which led to the development of work plans for data packages and management plans. The workgroups discussed evaluation criteria, methodologies for analysis, potential effects, and possible mitigation measures.

A workgroup was also established to discuss issues related to the project modifications, alternatives (predominantly the Mine Site and Tailings Basin Alternatives addressed in the DEIS), the wild rice standard, and various potential mitigation measures identified by the topic-focused workgroups. PolyMet modified the Project in response to workgroup discussions, comments on the DEIS and evolving MPCA water quality guidance (Reference (9)), resulting in the development of a draft Project alternative that the co-lead agencies felt was appropriate for the SDEIS. Throughout 2011, the co-lead agencies sought input from the cooperating agencies, other involved agencies, and PolyMet and its consultants.

Impact analysis was performed for the draft alternative (as the NorthMet Project) in the SDEIS using probabilistic modeling programs, GIS and special data analysis and other impact assessment calculations. We understand these estimated effects will be described in Section 5 of Reference (2).

Alternatives were considered during the development of the SDEIS development. We understand the alternatives will be summarized in Reference (2). For each alternative that was eliminated, this table indicates the rationale for why it was eliminated from further consideration. This alternatives evaluation included both evaluation of new alternatives developed subsequent to the DEIS, and re-evaluation of several alternatives that had been eliminated in the DIES.

Large Table 3 shows a summary of the refinements to the project that occurred based on the alternatives considered, evaluated and incorporated into the draft alternative. For each refinement, the associated reduced environmental impact is noted.

6.3 No Action Alternative

The No Action Alternative is under evaluation during the Environmental Review Process. We understand the SDEIS will address the No Action Alternative and describes the consequences to the applicant and to the public of not implementing the project. Under the No Action Alternative, PolyMet would be required to reclaim surface disturbances at the Mine Site associated with exploratory and development drilling. At the Plant Site, Cliffs Erie would be required to complete closure and reclamation activities. PolyMet does not prefer the No Action Alternative as it does not fulfill the purpose of the Project.

6.4 Mine Site Minimization Alternatives

The Mine Site will be developed at a greenfield site that has previous disturbance from logging and mining exploration activities. Alternatives for avoiding and minimizing wetland impacts at the Mine Site use various strategies to minimize the footprint and optimize the placement of mining features such as the mine pits, waste rock and overburden stockpiles, haul roads, water management systems, and supporting infrastructure.

6.4.1 Mining Method Alternatives

The alternative of conducting underground mining, rather than open pit mining, was considered during the Environmental Review Process for the DEIS and the SDEIS process, as it could have minimized wetland impacts at the Mine Site. As part of the Environmental Review Process, the co-lead agencies eliminated the underground mining alternative, however, finding that it would not be economically viable, and therefore would not meet the Purpose and Need for the Project (Reference (10)). The same information supports the conclusion that underground mining is not a practicable alternative under the Section 404 regulations. Therefore, there are no further practicable or feasible alternatives for avoiding or minimizing the impacts to wetlands that occur within the limits of the economically minable polymetallic ore reserves.

6.4.2 Alternative Mine Site Layouts

Given that underground mining was found not to be a practicable alternative, the Environmental Review Process evaluated numerous alternatives for open pit mining with the objective of avoiding and minimizing wetland impacts. Through the Environmental Review Process, the mine site minimization alternatives have been configured into three alternative Mine Site layouts, which vary in the extent to which they incorporate the minimization strategies described in Sections 6.4.2.1 and 6.4.2.2. Large Figure 7 illustrates the three alternative Mine Site layouts.

- Scoping EAW Mine Site Layout: One large open pit with three permanent stockpiles occupying most of the site surface area east and west of the pit. Another stockpile placed southeast of the pit.

- DEIS Mine Site Layout: Three distinct pit areas. Six smaller, permanent stockpiles, with waste rock segregated by type. Southeast stockpile eliminated. Haul roads planned to connect mine pits and stockpiles were more localized on the Mine Site.

- SDEIS Mine Site Layout: Three pit areas including the East Pit, Central Pit, and West Pit. One permanent stockpile (Category 1 Stockpile). Three temporary stockpiles: Category 4 Stockpile is sited on the area that will become the Central Pit; and Category 2 and Category 3 waste rock are combined in one temporary stockpile that will later be relocated to the mined out Central and East Pits. After Mine Year 13, The Category 1, 2, 3 and 4 materials mined from the West Pit would be directly placed into the Central and East Pits as backfill. With this more compact layout, the haul roads are located within a smaller area so avoid wetland impacts.

Direct wetland impacts at the Mine Site have been reduced in the proposed SDEIS alternative, compared to the EAW and DEIS alternatives, as shown in Table 6-1.

Table 6-1 Summary of Direct Wetland Impacts Throughout Project

Proposed Mine Site Layout	Direct Wetland Impacts at Mine Site (acres)
Scoping EAW Project	1,257
DEIS Project	804
SDEIS Project	758

6.4.2.1 Minimization Strategies for Mine Pits and Supporting Infrastructure

Mining will necessitate construction of new haul roads and ore handling facilities. As Project modifications have progressed since the Scoping EAW, the road and facility layouts have been altered as shown in Large Figure 7 to reduce the direct wetland impacts, as well as the fragmentation and water quality impacts to the wetlands. The water containment system along the haul roads and at the ore handling facilities will capture runoff and transport it to the WWTF. Overall, PolyMet has located Mine Site infrastructure in order to extract the ore efficiently and minimize wetland impacts to the extent possible.

PolyMet will rely on the advantages obtained by operating large-scale mining equipment. Utilizing large-scale mining equipment minimizes costs, but also requires that adequately sized working areas be maintained for loading faces, haul roads, and stockpile sites. In most cases, the operation of large-scale mining equipment makes it necessary to use contiguous tracts of land. By doing so, this reduces the direct wetland impact by consolidating the operations in select areas rather than throughout the Mine Site, as was the case with the EAW Mine Site Project layout as shown in Large Figure 7.

6.4.2.2 Minimization Strategies for Stockpiles

Mining economics dictate that surface overburden, lean ore, and waste rock materials be removed and stockpiled in the proper sequence to allow efficient access to the underlying polymetallic ores. In order to minimize haulage costs and maintain operating efficiencies, surface overburden, lean ore, and waste rock stockpiles must be located in or adjacent to the mining area.

Section 404 of the CWA and the WCA require that impacts to wetlands be avoided and minimized to the extent practicable. In addition, two provisions of the Minnesota Mineland Reclamation rules are also relevant in determining stockpile locations:

1. Existing stockpiles shall be incorporated or extended to the extent possible (Minnesota Rules 6130.2100(A)).
2. Mining shall be conducted to maximize use of past, present and future mining areas so as to minimize the amount of land disturbed by mining and reduce the loss of nonmineral resources (Minnesota Rules, part 6130.1400, subpart 1).

Because previously it has not been economically feasible to make use of the polymetallic ore resource at the NorthMet site, there are no existing stockpiles in the vicinity of the site. Alternatives for stockpiling within the mine pits, stockpiling on disturbed areas, and alternative stockpile designs are addressed in the sections that follow.

6.4.2.2.1 In-Pit Stockpiling

Stockpiling lean ore, waste rock, and possibly surface overburden in mined-out pits has benefits in that it involves short haul distances and minimizes impacts to undeveloped lands and wetlands. This method is also favorable with respect to the requirements of the CWA, the WCA and portions of the MDNR reclamation rules.

The Project in the Scoping EAW did not include in-pit stockpiling. The Project evaluated in the DEIS included in-pit stockpiling, proposing that Category 1 and 2 waste rock generated after

Mine Year 11would be backfilled directly to the East Pit. All other overburden and waste rock was to be placed in three permanent, lined/covered stockpiles as shown in Large Figure 7.

For the SDEIS Project, in-pit stockpiling is considerably expanded from the Project evaluated in the DEIS. All of the Category 2, 3, and 4 waste rock, along with some Category 1 Waste Rock and saturated overburden, will be placed in the East Pit for subaqueous storage. Two temporary stockpiles will be created, however one of them is placed in a location that will subsequently be mined as the Central Pit (Category 4 Waste Rock Stockpile). This alternative in-pit stockpiling plan increases the volume of waste rock placed in mine pits, and reduces direct wetland impacts. It has been identified as a reasonable and practical alternative to the original plan, and is currently incorporated in the Project as shown in Large Figure 7.

Another in-pit stockpiling alternative was evaluated during the Environmental Review Process that called for placing Category 1 waste rock in a temporary stockpile, then relocating it to the West Pit during reclamation. This approach would not have reduced direct wetland impacts, although it would have offered the opportunity to restore wetlands during reclamation. This alternative was eliminated by the co-lead agencies because it would encumber deeper mineral resources in violation of PolyMet's mineral leases.

6.4.2.2.2 Stockpiling on Disturbed Areas

Disturbed areas are favorable for stockpiling activities because impacts to previously undeveloped lands will be minimized, including wetlands; however, existing stockpiles and tailings disposal areas are not present at the Mine Site. Mine development will result in some disturbance to lands outside of the actual mine pit areas for construction of haul roads and other infrastructure as well as stockpiles. The Environmental Review Process evaluated the alternative of using some Saturated Overburden and Category 1 Waste Rock during Mine Site construction, as approved by the MDNR. This alternative minimizes wetland impacts because it reduces the volume of material to be stockpiled on undeveloped areas, and it has been incorporated in the Project.

The Project also developed an alternative location for the Category 4 Waste Rock Stockpile. Originally it was proposed as a permanent stockpile located on an undeveloped area located south of the East Pit (Large Figure 7). An alternative approach was identified, which temporarily stockpiles the Category 4 waste rock in the area that will subsequently be mined as the Central Pit (see Large Figure 2 and Large Figure 5). This alternative eliminates one stockpile from undeveloped areas, and has been incorporated into the project.

6.4.3 Dewatering

It is necessary to dewater the pits during operation to remove groundwater and runoff and maintain safe access to the mine pits and ore. Therefore, no alternatives to the mine pit dewatering were proposed during the Environmental Review Process. Dewatering has been identified as a factor that may potentially indirectly impact wetlands. Wetland hydrology will be monitored to document any potential indirect wetland impacts from dewatering activities.

Water generated by dewatering will be treated at the WWTF and pumped to the Plant Site for use as process water. This alternative, which reuses groundwater that must be extracted to facilitate mining, is environmentally beneficial because it avoids the need to appropriate water from other waters of the state for use as process water.

6.5 Plant Site Minimization Alternatives

The Plant Site will use the existing LTVSMC facility which is located on a brownfield site. There are no wetlands on the processing facilities area of the Plant Site. An alternative processing plant site would not have environmental benefits over the existing plant site. Reuse of an existing plant site and infrastructure reduces environmental impacts. An evaluation of alternative plant sites was not proposed by the USACE and MDNR during the Environmental Review Process.

Plant Site minimization alternatives generally involve balancing direct wetland impacts with indirect wetland impacts and overall impacts on the environment. Minimization alternatives for some Plant Site features slightly increase direct wetland impacts, but they are included in the Project because they were identified to offer substantial overall environmental benefits.

6.5.1 Flotation Tailings Basin (FTB)

Minimization alternatives evaluated for the FTB include options for alternative locations, alternative sources for dam construction materials, and alternative environmental controls.

Two alternative locations were considered for the FTB, a greenfield site to the west of the existing LTVSMC Tailings Basin, and vertical expansion atop the existing LTVSMC tailings basin. The alternative of constructing the FTB on a greenfield site to the west of the existing LTVSMC Tailings Basin was considered during the Environmental Review Process. This alternative was eliminated early in the process because of the additional environmental and wetland impacts associated with it. PolyMet proposes to store the Flotation Tailings atop the existing LTVSMC tailings basin by building the basin vertically as tailings are produced. Use of the existing brownfield site for the FTB significantly reduces the acreage of direct wetland impacts. The development of alternative layouts for the FTB is illustrated in Large Figure 8. Vertical expansion will require an expansion of the active tailings basin footprint for additional buttressing to reinforce the tailings basin dams as required by the MDNR to address dam stability requirements. The slightly expanded footprint of the SDEIS Tailings Basin layout is shown in right panel of Large Figure 8.

One concern about a taller Tailings Basin is that it may generate more fugitive dust because of greater wind erosion across the surface of the basin. However, we understand that Section 5.2.7 of Reference (2) will discuss how the fugitive dust can feasibly be controlled.

Construction material for the FTB dams will be borrowed from the existing Tailings Basin. Buttress material will be sourced from the former LTVSMC waste rock stockpiles. These alternatives avoid procuring construction materials from more distant sources with potentially greater adverse environmental impacts.

Environmental controls proposed for the FTB also affect wetland impacts. The SDEIS alternative plant layout includes the addition of the FTB containment system. The FTB Containment System consists of a cutoff wall and a collection trench. As described in Section 5.3.2, the FTB Containment System offers significant overall environmental benefits. It will reduce surface water impacts and minimize potential indirect impacts to wetlands north of the Plant Site due to seepage from the FTB. This approach was selected during the Environmental Review Process because it has environmental benefits of limiting ground and surface water impacts, however it does result in the expansion of the Tailings Basin footprint into previously undeveloped areas. The combined effects of the FTB Containment System and the expanded buttress footprint result in direct impacts to approximately 140 acres of wetlands (Reference (7); Attachment A).

An alternative containment system design, using groundwater extraction wells instead of the cutoff wall, was eliminated because the well pumping tests indicated the number of wells needed to collect the volume of seepage necessary to limit water quality impacts was infeasible and there was a potential for indirect wetland impacts by drawing down water levels in adjacent wetlands. The proposed FTB Containment System is expected to decrease groundwater flow from the existing Tailings Basin to the adjacent wetlands and streams. To mitigate these potential indirect impacts, PolyMet will supplement wetland water levels and stream flow using treated water from the WWTP, with additional makeup water from Colby Lake as needed. The makeup water will be transported via the Colby Lake Water Pipeline.

6.5.2 Hydrometallurgical Residue Facility (HRF)

Minimization alternatives evaluated for the HRF include options for alternative locations. The originally proposed location of the HRF was atop the existing LTVSMC Tailings basin Cell 2W (see Large Figure 8 for the location of Cell 2W). This alternative of siting the HRF within the existing Tailings Basin was eliminated during the Environmental Review Process due to concerns over constructability and HRF liner issues. An alternative HRF location was identified in the existing emergency basin southwest of Cell 2W (Large Figure 8). A portion of the existing wetland in the alternative HRF area is identified as not subject to this permit application because wetlands located within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary are not regulated by state and federal wetland regulations. Locating the HRF within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary minimizes direct wetland impacts, as well as avoiding additional impacts to undeveloped areas.

6.6 Transportation and Utility Corridors Minimization Alternatives

Two corridors are needed to connect the Mine Site and the Plant Site. The Rail Connection Corridor will permit rail transport of ore to the Plant Site. The Dunka Road and Utility corridor will contain the TWP alongside the existing Dunka Road.

To transport ore from the Mine to the Plant, PolyMet will use the existing Cliffs Erie (former LTVSMC) railroad. Trains will run on a new spur developed on the Mine Site to the existing railroad. There will be a new approximately 5,750-foot connecting track constructed between the Cliffs Erie railroad and existing PolyMet railroad that serves the Process Plant. Reuse of the existing railroad minimizes direct wetland impacts. The configurations for the new spur and the connector track were selected to avoid sensitive wetland areas and while the layout was modified from the DEIS to the SDEIS, the direct wetland impact was similar (0.3 acres and 0.44 acres, respectively). The alternative of ore transport by truck to the Plant Site was evaluated during Project scoping, but eliminated by the co-lead agencies in the Final Scoping Decision (Reference (11)) because it would not likely provide significant environmental benefit over rail transport.

The project will upgrade the existing Dunka Road, and install the TWP alongside it. The layout of the TWP was refined from the DEIS to the SDEIS, which minimized the direct wetland impacts (10.2 acres and 6.76 acres, respectively). This SDEIS alternative reuses previously disturbed areas and minimizes impacts to wetlands while providing access necessary for mining operations.

7.0 Adjoining Property Owners

There are 39 property owners adjacent to the Project. Large Table 4 identifies the complete mailing addresses of all the property owners.

8.0 Portion of Work Completed

Project work has not commenced. Project activities will not be initiated until appropriate approvals and permits have been obtained.

9.0 Status of Other Approvals

Other permits, reviews and approvals related to the Project are currently in progress (Table 9-1). The MDNR, the USACE, and the USFS are completing the SEIS concurrently with the submittal of this wetland permit application. A Permit to Mine application is currently being prepared for submittal to the MDNR, pursuant to the Minnesota Nonferrous Metallic Mineral Mining Rules (MN Rules Chapter 6132.1100). The Permit to Mine must include an approved wetland replacement plan.

The Section 404 of the CWA is administered by the USACE, and Section 401 of the CWA (Water Quality Certification) is administered by the MPCA, and the Permit to Mine and WCA are administered by the MDNR Division of Lands and Minerals. PolyMet's mining plans will also take into account the MDNR Nonferrous Metallic Mineral Mineland Reclamation Rules (MN Rules Chapter 6132) that may require the use of previously disturbed lands.

Table 9-1 Summary of Project Permits and Approvals

Unit of Government	Type of Permit/Approval	Status
Federal		
U.S. Army Corps of Engineers	Section 404 Permit for Wetland Impacts	Current application
	Section 106 Consultation (MN Historic Preservation Office)	Consultation in progress
U.S. Fish and Wildlife Service	Section 7 Endangered Species Act (ESA) Consultation	Consultation in progress
State		
Minnesota Department of Natural Resources	Permit to Mine	To be applied for
	Endangered Species Taking Permit (if required)	To be applied for if needed
	Water appropriations permit for pits and tailings basins, and mine dewatering	To be applied for
	Water appropriations permit for plant makeup water	To be applied for or transferred
	Water appropriations permit for potable water well for mine site administration building	To be applied for if needed
	Dam Safety Permit or Amendment	To be applied for, or existing Cliffs Erie Mining Permit may be transferred
	Permit for work in public waters, possible modifications and diversions of local streams	To be applied for if needed
	Permit for wetlands modifications under Wetland Conservation Act (as part of Wetland Replacement Plan for Permit to Mine)	To be applied for
	Burning Permit (possibly needed for construction or land clearing)	To be applied for if needed

Unit of Government	Type of Permit/Approval	Status
Minnesota Pollution Control Agency	Section 401 Water Quality Certification/Waiver	To be applied for in conjunction the USACE Section 404 Permit Application
	SDS/NPDES permit for site operations (discharge to surface or groundwater), construction stormwater (activity that would disturb one acre or more of land), and industrial stormwater activity	To be applied for
	Solid Waste Permit for construction debris	To be applied for
	Minnesota Air Emissions Permit	To be applied for
	Minnesota Waste Tire Storage Permit	To be applied for
	General Storage Tank Permit (fuel tanks)	To be applied for
Minnesota Department of Health	Radioactive Material Registration (for low-level radioactive materials in measuring instruments)	To be applied for if needed
	Permit for Non-Community Public Water Supply System (serving an average of at least twenty-five individuals daily at least 60 days out of the year) and wellhead protection plan	To be applied for if needed
	Notification of Water Supply Well Construction	To be provided when constructed
	Permit for Public On-site Sewage Disposal System	To be applied for if needed
Local		
St. Louis County	Zoning Permit – to acknowledge Project is an allowable use within the zoned district	To be applied for
City of Hoyt Lakes	Zoning Permit – to acknowledge Project is an allowable use within the zoned Mining District	To be applied for
City of Babbitt	Building Permit - for new construction on Project areas within the incorporated Babbitt City limits.	To be applied for

10.0 Placeholder Corresponding to Signature Block

Section 10 of the Wetland Permit Application form is a signature block. This placeholder section has been inserted to keep the section numbers in this narrative parallel with the application form numbering.

11.0 Description of Wetlands and Wetland Impacts

This Section provides a description of the overall environmental setting, including hydrogeology, vegetation, and soils for the Project. The methods used to delineate, classify and assess the wetlands are documented and wetlands are described for each Project area. Finally, an accounting of the direct and potential indirect wetland impacts is provided for the Project.

11.1 General Environmental Setting

The Project is located at the foot of the Laurentian Divide, within the Nashwauk Uplands and Laurentian Uplands subsections of the Northern Superior Uplands section in the Laurentian Mixed Forest Province, as described in the Ecological Classification System (ECS) developed by the MDNR and USFS (Reference (12)). Landforms in both subsections are characterized by till and outwash plains and moraines, with peatlands also common in the Laurentian Uplands subsection.

Historically, the Nashwauk Uplands subsection consisted of forested communities dominated by red and white pine, balsam fir, white spruce, and aspen and birch. The Laurentian Uplands subsection historically consisted of forests dominated by aspen and birch, jack pine, red pine, and white pine in the uplands, and coniferous bogs and swamps in the lowlands. At present, aspen is the most dominant tree species in both the Laurentian Uplands and Nashwauk Uplands subsections (Reference (12)). Elevations within the Project range from approximately 1,475 feet to 1,850 feet above mean sea level.

11.1.1 Hydrology and Hydrogeology

The Project area is located near the headwaters of the Partridge River and Embarrass River watersheds (Large Figure 3). The Partridge River and the Embarrass Rivers are both tributary to the St. Louis River, which is located within the Lake Superior Basin. The Mine Site, portions of the Plant Site, Dunka Road and Utility Corridor, Railroad Connection Corridor, and Colby Lake Water Pipeline Corridor are located within the Upper Partridge River Watershed. The majority of the Plant Site is located in the Embarrass River watershed (Large Figure 3).

11.1.1.1 Partridge River Watershed

The Partridge River upstream of the St. Louis River flows through Colby Lake and Whitewater Reservoir, both of which are located in the Colby-Whitewater Watershed (Large Figure 3). Watersheds upstream of Colby Lake include the Upper Partridge River and Wyman Creek. Watersheds downstream of Colby Lake include Second Creek and the Lower Partridge River.

The Mine Site is located in the Upper Partridge River watershed approximately 17 miles upstream of Colby Lake. Upstream of the U.S. Geological Survey (USGS) gage 04015475 (located above Colby Lake and Wyman Creek), the Partridge River watershed covers approximately 103 square miles, including portions of the Peter Mitchell pit. Tributaries to the Partridge River upstream of Colby Lake and Wyman Creek include Wetlegs Creek, Colvin

Creek, Longnose Creek, Yelp Creek, Stubble Creek, and the South Branch of the Partridge River (Large Figure 3).

Under existing conditions, runoff from the northernmost area of the Mine Site generally drains north into the One Hundred Mile Swamp and associated wetlands along the Partridge River. These wetlands form the headwaters of the Partridge River, which meanders around the east end of the Mine Site before turning southwest. Runoff from the majority of the Mine Site naturally drains to the south through culverts under Dunka Road and the adjacent rail line, into the Partridge River downstream of the Dunka Road crossing. The Partridge River hydrology is affected by the periodic and variable dewatering of the Peter Mitchell Pits near the headwaters of the Partridge River, upstream of the proposed Mine Site.

The railroad corridor connecting the Mine Site and Plant Site crosses Wetlegs Creek, Longnose Creek, and Wyman Creek. Small portions of the Plant Site are located in the headwaters of Second Creek. Second Creek drains to the Partridge River downstream of Colby Lake, approximately 3 miles upstream of the confluence with the St. Louis River (Large Figure 3).

The hydrogeologic setting of the Partridge River watershed consists of a thin veneer of heterogeneous unconsolidated deposits (glacial till) underlain by fractured bedrock (Duluth Complex in most of the Mine Site area and Virginia Formation in the northern portion of the area). In the Mine Site area, saturated conditions exist within the unconsolidated deposits and bedrock and the depth to groundwater is typically less than 10 feet. The water table is generally a subdued replica of the land surface, with groundwater divides in the area expected to roughly coincide with surface water divides. Wetlands are common, covering approximately 43% of the Mine Site.

The degree of hydraulic connection between the wetland areas and adjacent unconsolidated deposits and bedrock at the Mine Site is expected to be variable, depending on the characteristics of the wetlands and the localized hydraulic conductivity and degree of bedrock fracturing. The hydraulic conductivity of the bedrock and surficial deposits have been estimated at the Mine Site by a variety of methods, including conducting aquifer tests and using grain-size distribution data from soil borings and ranges over several orders of magnitude. Data collected during a 30-day pumping test at the Mine Site showed a small amount of drawdown in the deep wetland piezometer nearest the pumping well, but no detectable drawdown at other water table or deep wetland piezometers, indicating that the connection between the bedrock, unconsolidated deposits, and wetlands may be relatively weak. Virtually all water movement in peat wetlands occurs horizontally in the upper layers of peat. The deeper, more decomposed peat soils limit vertical seepage because of the low hydraulic conductivities (~0.0028 feet/day) and the wetland hydrology is simply perched on the relatively impermeable peat layer. Vertical seepage losses from wetlands without peat soils will only have the potential to occur in isolated areas of contiguous, high hydraulic conductivity bedrock faults and fracture zones located under isolated areas of high hydraulic conductivity glacial till and aligned with wetlands containing high hydraulic conductivity soils.

11.1.1.2 Embarrass River Watershed

The Plant Site is primarily located within the Embarrass River watershed, upstream of the Embarrass River chain of lakes (Large Figure 3). The FTB occupies approximately 4 square miles along the southern side of the watershed. A small portion of the Plant Site, including stormwater from the Process Plant Area, drains south to Second Creek.

The Embarrass River watershed covers approximately 88 square miles upstream of USGS gage 04017000 (Large Figure 3) and approximately 112 square miles upstream of Project monitoring location PM-13 (the downstream extent of the Plant Site water quality monitoring). Tributaries to the Embarrass River, located between the Tailings Basin and the Embarrass River, which may potentially be affected by the Project, include (east to west) Mud Lake Creek, Trimble Creek, and Unnamed Creek. Other tributaries located between the Tailings Basin and the Embarrass River that are not expected to be affected by the Project include (east to west) Spring Mine Creek, which drains LTVSMC’s former Mine Area 5N, an unnamed creek, and Heikilla Creek (Large Figure 3). Bear Creek drains to the Embarrass River from the north, and is not anticipated to be impacted by the Project.

Under existing conditions, groundwater and surface water seepage from the FTB drain towards Mud Lake Creek to the north, Trimble Creek to the northwest, and Unnamed Creek to the west. Runoff from the outer slopes of the FTB is tributary to the surrounding creeks; precipitation falling within the FTB is contained in the basin.

The hydrogeologic setting of the Embarrass River watershed is broadly similar to the Partridge River watershed, although the unconsolidated deposits are generally thicker and more continuous north of the Plant Site area along the Embarrass River valley. The Plant Site is located north of the Laurentian Divide and the area is underlain by granitic rocks of the Giants Range batholith. Although these rocks may be fractured to some extent, they are expected to have significantly lower hydraulic conductivity than the bedrock units at the Mine Site. As is the case at the Mine Site, wetlands are abundant in the Plant Site and saturated conditions generally exist less than 10 feet below the ground surface. As at the Mine Site, the degree of hydraulic connection between the wetland areas and adjacent unconsolidated deposits and bedrock at the Plant Site is expected to be variable, depending on the characteristics of the wetlands and the localized hydraulic conductivity and degree of bedrock fracturing. Given the very low hydraulic conductivity of the underlying bedrock, there is minimal potential for hydraulic connection between bedrock and wetlands.

11.1.2 Vegetation

Vegetation communities in much of the Project area have been altered by previous mining and logging activities. In addition beaver activities have led to the transition of some forested wetlands to open, emergent marshes and wet meadows. Aside from areas disturbed from mining and logging activities, the Project vicinity is currently a mosaic of upland and wetland native vegetation community types, which is typical of northeastern Minnesota.

While the Mine Site is located in an area that has not been directly disturbed by previous mining activities, extensive logging has occurred throughout the area. The USFS owns the surface rights at the Mine Site, and has managed the area for timber production. Logging activities have changed the vegetative character across the Mine Site, with shrublands and/or early and mid-successional forest replacing mature upland forest. These logged areas are currently in varying stages of regeneration and consist mostly of young aspen stands. Aside from logging and associated roads, the Mine Site is largely undeveloped, with a variety of natural vegetation communities present. These communities include coniferous and deciduous forests in the uplands and wetlands such as shrub swamps, marshes, forested swamps, and bogs in the lowlands. The more mature upland forested areas at the Mine Site are dominated by quaking aspen, jack pine, balsam fir, black spruce, and white spruce with lesser amounts of paper birch, red pine, and white pine.

The Plant Site was previously used as a taconite processing facility by LTVSMC and is largely devoid of natural vegetation. In addition, the road and railroad corridors are existing infrastructure and therefore previously disturbed areas.

As part of the Cultural Landscape Study (discussed below in Section 12.2.2 and in Reference (13)), vegetation surveys were conducted across the Project area using the MDNR and USFS ECS (Reference (12)). These vegetation surveys identified seven ECS vegetation communities across the Project area: Fire Dependent, Forested Rich Peatland, Acid Peatland, Mesic Hardwood, Marsh, Wet Forest, and Wet Meadow (Reference (12)). The uplands at the Mine Site are dominated by fire dependent forested communities, while the wetlands are dominated by acid peatlands (bogs).

11.1.3 Soils

The Mine Site is situated on land mapped by both the USFS SNF (94% of the area) and the St. Louis County Natural Resources Conservation Service (NRCS) (6% of the area) (Large Figure 13). The USFS mapped soil types are based on the Ecological Land Classification System, which divides land areas into Ecological Landtypes (ELT). The ELTs are areas of land with a distinct combination of natural, physical, chemical, and biological properties. In the hierarchical framework, ELTs are further broken down into Ecological Landtype Phases (ELTPs); these ELTPs can be correlated to NRCS mapping units (Reference (14)).

Approximately 55% of the Mine Site is mapped as ELT 16 (Upland Shallow Loamy Dry). Within ELT 16, soils are mapped as ELTPs 18A (1% to 6% slopes, well drained) and 18B (6% to 18% slopes, well drained) (Large Figure 13). The second most dominant soil type at the Mine Site is ELT 6 (Lowland Organic Acid to Neutral), which represents approximately 30% of the Mine Site. Within ELT 6, soils are primarily mapped as ELTP 24 (poorly drained) (Large Figure 13). Additional, less dominant soil types are also mapped at the Mine Site, as shown on Large Figure 13 and in Large Table 8. Poorly drained/Hydric and somewhat poorly drained/partially hydric soils make up approximately 43% of the Mine Site (Large Figure 13, Large Table 8).

The Plant Site is primarily situated on land disturbed from previous mining activities. As such, almost 80% of the soils in the Plant Site are mapped by the St. Louis County NRCS soil survey as the two disturbed soils, “Tailings Basin” map unit (1050; hydric status is unknown) and “Udorthents, loamy” map unit (1003B; hydric status is unknown) (Large Figure 13), Large Table 9). Udorthents are areas that have been stripped and are highly disturbed, such as cut-and-fill operations. Only 9% of the soils in the Plant Site are mapped as hydric or partially hydric; the hydric soil status is unknown for approximately 90% of the Plant Site (Large Table 9).

The St. Louis County NRCS mapped two soil types in the Railroad Connection Corridor. The Udorthents, loamy NRCS soil map unit (1003B, hydric status is unknown) represents approximately 79% of the Railroad Connection Corridor and the Pits, iron mine soil map unit (1049, hydric status is unknown) represents the remaining 21% of the Railroad Connection Corridor (Large Figure 13).

Five St. Louis County NRCS soil map units comprise over 70% of the Dunka Road and Utility Corridor, these include the Eaglesnest-Babbitt complex (F12B, partially hydric), Pits, iron mine (1049, hydric status is unknown), Eaglesnest-Wahlsten complex (F2B, hydric status is unknown), Dumps, iron mine (1048, hydric status is unknown), Udorthents, loamy (1003B, hydric status is unknown), and Babbitt boulder-Aquepts rubbly complex (F13A, partially hydric) (Large Table 10, Large Figure 13). Approximately 40% of the soils mapped within the Colby Lake Water Pipeline Corridor are hydric or partially hydric; the hydric soil status is unknown for approximately 54% of the corridor (Large Table 10).

Three main St. Louis County NRCS soil map units comprise over 75% of the Colby Lake Water Pipeline Corridor, these include the Eaglesnest-Babbitt complex (F12B, partially hydric), Udorthents, loamy (1003B, hydric status is unknown), and Tailings Basin (1050, hydric status is unknown) (Large Table 11, Large Figure 13). Additional soils mapped in the Colby Lake Water Pipeline Corridor units were found within this project area (Large Table 11, Large Figure 13). Approximately 40% of the soils mapped within the Colby Lake Water Pipeline Corridor are hydric or partially hydric; the hydric soil status is unknown for approximately 51% of the corridor (Large Table 11).

11.2 Wetland Delineation and Classification Methods

Delineation and functional assessment of wetlands were conducted within each of the following Project areas: the Mine Site, Plant Site, Dunka Road and Utility Corridor, Railroad Connection Corridor, and the Colby Lake Water Pipeline Corridor (Large Figure 4).

Wetlands were delineated across the Project areas between 2004 and 2012; the following references summarize wetland delineations conducted throughout this time period (Reference (15), Reference (16), Reference (17), Reference (18), Reference (19), Reference (20), Reference (21), Reference (22), Reference (23)). Wetland delineations were performed according to the Routine On Site Determination Method specified in the USACE Wetlands

Delineation Manual (1987 Edition) (Reference (24)). The wetlands were described in Reference (1) and the delineation was discussed with the Wetland IAP Workgroup and approved by the co-lead agencies on March 30, 2011.

Prior to conducting the various field delineations, numerous sources of existing information were gathered and reviewed to assist in developing a strategy for evaluating wetlands within the Project areas (References (21), Reference (7); Attachment A). Aerial photographs and other data were compiled for the area, some of which included:

- Farm Services Administration (FSA) true color aerial photographs between 2003 and 2010.
- FSA color infrared aerial photographs (2003 and 2008)
- USFWS National Wetland Inventory (NWI) Maps
- USFS Ecological Landtype soils data (where available)
- NRCS soils data for St. Louis County (where available)
- SNF USFS stand data Geographic Information System (GIS) shapefile (for the Mine Site)
- USGS topographic maps and digital elevation models
- MDNR 2005 Color Infrared (CIR) photography stereo pairs with 60% overlap

Topographic contours and NWI maps were overlaid on true color and CIR FSA aerial photographs along with previously completed off-site preliminary wetland mapping. Attempts were made to field evaluate all areas mapped as wetlands by the NWI or by preliminary off-site mapping. Depressional areas and areas with relatively flat slopes were also evaluated to determine if wetlands were present.

Soil borings were placed in most of the wetlands to a depth of 6 to 18 inches below the ground surface. Representative soil samples from each boring were examined for hydric soil indicators. Soil colors (e.g., 10YR 4/2, etc.) were determined with the aid of a Munsell® soil color chart and noted on the Wetland Data Forms. In addition, vegetation data were collected within each wetland and adjacent upland.

Wetland boundaries were mapped in the field on large-scale (1-inch = 600 feet) FSA true color and CIR aerial photographs. Data points were collected with a Global Positioning System (GPS) where possible to verify wetland delineation locations, particularly in areas where aerial photo signatures were not distinct. The wetland boundaries were later digitized using ArcView© Geographic Information System software.

The delineated wetlands were classified using the Eggers and Reed Plant Community Classification System (Reference (3)), the USFWS Circular 39 Classification System (Reference (25)), and the USFWS Cowardin Classification System (Reference (4)).

11.3 Wetland Descriptions and Functional Assessment

Approximately 1,585 acres of wetland were identified across the Project areas (Large Table 1; Large Figure 4) (Reference (7); Attachment A). The percentage (based on acreage) of Eggers and Reed (Reference (3)) wetland types identified in the Project areas include: coniferous bog (55%); alder thicket (12%); shallow marsh (11%); coniferous swamp (9%); deep marsh (7%); sedge meadow (2%); open bog (1%); wet meadow (1%); hardwood swamp (1%); shallow, open water (less than 1%); and shrub-carr (less than 1%) (Reference (7)).

11.3.1 Mine Site

A total of 87 wetlands covering approximately 1,298 acres have been identified within the Mine Site (Large Table 1; Large Figure 4) (Reference (7); Attachment A). A total of 7 wetlands, each over 50 acres in size within the Project area, comprise approximately 774 acres of wetlands within the Mine Site. There are an additional 5 wetlands, each over 20 acres in size within the Mine Site. Together, these 12 wetlands comprise 72% of the wetland area within the Mine Site.

Approximately 79% of the wetlands in the Mine Site are coniferous swamp/bog and open bog communities. Shrub swamp wetland communities comprise 13%, shallow marshes comprise about 3%, sedge/wet meadow communities make up 3%, and hardwood swamp communities comprise 1% of the wetlands in the Mine Site. Deep marshes comprise less than 1% of the wetland area in the Mine Site.

Approximately 92% of the wetlands in the Mine Site are of high quality and 8% of wetlands are of moderate quality. High quality wetlands have low disturbance levels and high vegetative diversity and integrity. Moderate quality wetlands have impounded open water because of beaver dams and downstream culverts under Dunka Road or the railroad, are located adjacent to USFS roads, the Dunka Road Corridor, or the Railroad Connection Corridor.

11.3.2 Plant Site

Nearly the entire Plant Site has been disturbed by past mining activities. No wetlands are present in the processing facilities area, although there is a Plant Reservoir located east of the concentrator that is not regulated as a wetland (Reference (21)).

11.3.2.1 Flotation Tailings Basin Area

A total of 49 wetlands covering approximately 237 acres were identified within the FTB Area (Large Table 1; Large Figure 4). The wetlands in the FTB Area include deep marsh (45%), shallow marsh (42%), coniferous swamp (6%), shrub swamp (6%), sedge/wet meadow (less than 1%), open water (less than 1%), and hardwood swamp (less than 1%).

There is a 0.03 acre portion of the sedge/wet meadow wetland identified as not subject to this permit application because the wetlands are located within the Cliffs Erie LLC (formerly LTVSMC) Permit To Mine Ultimate Tailings Basin Limit boundary and are not regulated by state and federal wetland regulations (Section 11.3.2).

The wetlands in the FTB Area have been previously impacted by LTVSMC tailings deposition, roads, and impoundment. The majority (92%) of wetlands within the FTB Area are currently rated as low quality with low vegetative diversity/integrity. Approximately 8% of the wetlands are rated as moderate quality.

11.3.2.2 Hydrometallurgical Residue Facility

A total of 2 shallow marsh wetlands, covering 36.07 acres, were identified within the HRF Area (Large Table 1; Large Figure 4). There is a 28.56 acre portion of the shallow marsh wetland identified as not subject to this permit application because wetlands located within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary are not regulated by state and federal wetland regulations (Section 11.3.2).

An unpaved, gravel road is located along the north side of these wetlands along with small buildings and associated facilities used in the former LTVSMC operations.

11.3.3 Railroad Connection Corridor

A total of 4 wetlands covering 0.44 acres have been identified within the Railroad Connection Corridor (Large Table 1; Large Figure 4). A total of 68% of the wetlands are shrub swamp, 16% are coniferous swamp, and 16% are shallow marsh.

All of the wetlands in the Railroad Connection Corridor are high quality. While these wetlands are moderately impacted by either a haul road or an existing railroad, they have high vegetative diversity/integrity.

11.3.4 Dunka Road and Utility Corridor

A total of 21 wetlands, encompassing 6.76 acres, have been identified within the Dunka Road and Utility Corridor (Large Table 1; Large Figure 4). The wetlands in the corridor include shrub swamp (56%), coniferous swamp (23%), coniferous bog (13%), and shallow marsh (8%).

These wetlands are currently located adjacent to Dunka Road and some of the wetlands have been previously logged. Wetlands in the western half of the corridor are located within areas previously disturbed by mining activities in the former LTVSMC operations. All of the wetlands are of high quality.

11.3.5 Colby Lake Water Pipeline Corridor

A total of 14 wetlands covering 6.99 acres were identified within the Colby Lake Water Pipeline Corridor (Large Table 1; Large Figure 4). The wetlands in the corridor include shallow marsh (37%), shrub swamp (30%), wet meadow (19%), and deep marsh (14%).

The wetlands are located adjacent to an unpaved, gravel road and within a previously disturbed corridor. The majority of wetlands in this corridor are rated as low quality (93%), with the remaining wetland rated as moderate quality (7%).

11.4 Wetland Impact Areas

Direct wetland impacts are defined as activities that result in filling or excavation within the boundaries of a wetland. Direct wetland impacts are summarized in this section; additional information is provided in Reference (7) (Attachment A) and (26) (Attachment B).

Features within each Project area have been buffered with various distances; these buffers represent areas of potential additional disturbance within each Project area. The additional disturbance may include additional structures (e.g., access roads) that will be developed during the design phase of the Project. Wetlands that were within the buffers were identified in the total acres of direct impacts for the Project.

Direct impacts are expected to occur in 126 wetlands, covering approximately 912 acres (Large Table 2; Reference (7); Attachment A). The Mine Site will contain the majority of direct wetland impacts (83%), followed by the FTB Area (15%), HRF (less than 1%), Dunka Road and Utility Corridor (less than 1%), and the Railroad Connection Corridor (less than 0.1%). No direct impacts are associated with the processing facilities area or the Colby Lake Water Pipeline Corridor.

The direct wetland impacts will occur in the following Eggers and Reed wetland types (Reference (3)): coniferous bog (56%), shrub swamp (12%), coniferous swamp (9%), shallow marsh (9%), deep marsh (8%), sedge/wet meadow (4%), hardwood swamp (1%), and open bog (1%).

Indirect wetland impacts from wetland fragmentation by Project features (open pits, stockpiles, haulroads, etc.) were determined based on an analysis of the various factors that may contribute to potential fragmentation (Reference (7); Attachment A). Approximately 26.4 acres of wetland fragments were identified in the Mine Site and 0.5 acres of wetland fragments were identified in the FTB area (Large Table 2).

The majority of the wetland fragments in the Mine Site consist of coniferous bog (79%), followed by alder thicket (14%), coniferous swamp (7%), and sedge meadow (less than 1%). (Large Table 2). The majority of wetland fragments in the FTB Area consist of shallow marsh (61%), followed by deep marsh (35%), coniferous swamp (4%), and alder thicket (less than 0.01%).

The Project is expected to result in direct and fragment (indirect) impacts to 127 wetlands, covering approximately 939.3 acres (Large Table 2). The wetland impacts within the Project areas consist of coniferous bog (56%), shrub swamp (12%), coniferous swamp (9%), shallow marsh (9%), deep marsh (8%), sedge/wet meadow (4%), hardwood swamp (1%), and open bog (1%).

11.4.1 Mine Site

The Project features within the Mine Site were buffered up to 100 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 9. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 59 directly impacted or fragmented wetlands located in the Mine Site covering approximately 758 acres (Large Table 2; Large Figure 9). The total directly impacted wetlands include fill (39%), excavation (24%), or both fill and excavation (37%). Thirty-seven percent of the directly impacted wetlands are also impacted by wetland fragmentation. Three wetland types comprise 90% of the proposed wetland impacts in the Mine Site and include 529 acres of coniferous bog (67%), 101 acres of shrub swamp (13%), and 72 acres of coniferous swamp (9%). In addition, 38 acres of sedge/wet meadow (5%), 23 acres of shallow marsh (3%), 13 acres of hardwood swamp (2%), 8 acres of open bog (1%), and 0.1 acre of deep marsh (less than 1%) will also be impacted.

Approximately 99% of the impacted wetlands are rated high quality. Approximately 1% of the impacted wetlands are rated as moderate quality with the disturbances in these wetlands related to impoundment and proximity to roads.

11.4.2 Plant Site

Wetlands at the Plant Site that are located within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary are classified as not subject to this permit application and not regulated by state and federal wetland regulations (Reference (7); Attachment A). Exempt wetlands are not included in the direct wetland impact analysis.

11.4.2.1 Flotation Tailings Basin Area

The Project features within the FTB Area were buffered up to 25 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 10. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

Wetlands located outside of the Cliffs Erie LLC Permit to Mine Ultimate Tailings Basin boundary but within the FTB Area are included in the wetland impact analysis (Large Figure 10). The wetland in the FTB Area that is not subject to state and federal regulations includes 0.03 acres of Wetland ID T8.

There are 41 directly impacted or fragmented wetlands located in the FTB Area covering approximately 140 acres (Large Table 2). The total directly impacted wetlands include fill (35%), excavation (2.5%), excavation and fill (2.5%), and the FTB Containment System (60%). Twenty-five percent of the directly impacted wetlands are also impacted by wetland fragmentation. The wetland types that will be impacted include 74 acres of deep marsh (53%), 45 acres of shallow marsh (32%), 11 acres of coniferous swamp (8%), 9 acres of shrub swamp (6%), and 1 acre of fresh/wet meadow (1%).

Wetlands in this area have been disturbed by previous mining activities in the former LTVSMC operations or by impoundments caused by beaver activity throughout the area. All of the directly impacted wetlands are disturbed by impoundment, fill, or ditches, and are low or moderate quality wetlands.

11.4.2.2 Hydrometallurgical Residue Facility

The Project features within the HRF were buffered up to 50 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown Large Figure 10. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

Wetlands located outside of the Cliffs Erie LLC Permit to Mine Ultimate Tailings Basin boundary but within the HRF Area are included in the direct wetland impact analysis (Large Table 2; Large Figure 10). The wetland in this Project area that is not subject to state and federal regulations includes 28.56 acres of Wetland ID 1155.

There are two directly impacted wetlands located in the HRF covering 7.51 acres (Large Figure 10). The type of direct wetland impact includes fill (100%). The wetland type that will be directly impacted includes shallow marsh (100%) which is currently a low quality wetland.

11.4.3 Railroad Connection Corridor

The proposed area of disturbance for the Railroad Connection Corridor includes the entire area shown in Large Figure 11. The Project features within the Railroad Connection Corridor were buffered up to 10 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown on Large Figure 11. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 4 directly impacted wetlands located in the Railroad Connection Corridor covering 0.44 acres (Large Table 2; Large Figure 11). The type of direct wetland impact is fill (100%). The wetland types that will be directly impacted include shrub swamp (68%), coniferous swamp (16%), and shallow marsh (16%).

All of the wetlands in this area are high quality and have high vegetative diversity/integrity. These wetlands have been moderately impacted by either a haul road or an existing railroad.

11.4.4 Dunka Road and Utility Corridor

The Project features within the Dunka Road and Utility Corridor were buffered up to 10 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 11. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 21 directly impacted wetlands located in the Dunka Road and Utility Corridor covering 6.76 acres (Large Table 2; Large Figure 11). The type of direct wetland impact is fill (100%). The wetland types that will be directly impacted include shrub swamp (56%), coniferous swamp (23%), coniferous bog (13%), and shallow marsh (8%).

Some of the wetlands have been previously logged and wetlands in the western half of the corridor are located within areas previously disturbed by mining activities in the former LTVSMC operations. All of the wetlands are of high quality.

11.5 Potential Indirect Wetland Impacts

Potential indirect wetland impacts are summarized in this section; additional information is provided in Reference (7), Reference (27) (Attachment A), and Reference (26) (Attachment B) and as we understand will be provided in Reference (2). An analysis was conducted to establish an estimate of potential indirect wetland impacts; this analysis was based on the following six factors:

- Changes in wetland watershed areas (during operation and long-term closure)
- Groundwater drawdown resulting from open pit mine dewatering
- Groundwater drawdown resulting from operation of the FTB including groundwater seepage containment
- Changes in stream flow near the Mine Site and FTB and associated impacts to wetlands abutting the streams (during operation and long-term closure)
- Wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.
- Potential change in wetland water quality related to atmospheric deposition of dust and rail car spillage associated with Mine Site and FTB operations

The potential indirect wetland impact analysis was completed for the Mine Site, the Plant Site, the Dunka Road and Utility corridor, Railroad Connection Corridor, the Colby Lake Water

Pipeline Corridor, and Second Creek between the toe of the Tailings Basin and County Road 666. Wetlands that were previously identified as directly impacted were excluded from this analysis. The methods used for the potential indirect wetland impact analysis are described in References (26) (Attachment B), Reference (7), and Reference (27) (Attachment A). The change in wetland hydrology from groundwater drawdown at the Mine Site was assessed using two different methodologies; potential indirect wetland impacts are presented here using both methodologies. The "Attachment A" method is based on wetlands crossing analog impact zones (Attachment B), while the "Alternate" method is based on wetlands within analog impact zones (see Section 5.2.1.2.2 of Reference (7) (Attachment A)).

Each wetland was assessed to determine whether it could potentially be affected by any of the six factors listed above. A wetland could potentially be indirectly impacted by none of the factors, or up to a maximum of six factors. A potential indirect impact rating was developed based on the number of factors that may potentially affect a wetland – from No Impact (0 factors) to 6 (all six factors potentially indirectly impacting the wetland). Using this approach, no wetlands were rated as a 6 in this analysis. Wetlands potentially indirectly impacted by one or more factor are shown on Large Figure 9 through Large Figure 11.

Table 11-1 summarizes the acreages for wetlands potentially indirectly impacted by one or more factor. Depending upon which methodology was used, 53% to 55% of wetlands received a rating of 1, with one factor potentially indirectly impacting the wetland; 41% to 43% of wetlands received a rating of 2, with two factors potentially indirectly impacting the wetland; 3% of wetlands received a rating of 3, with three factors potentially indirectly impacting the wetland; less than 1% of wetlands received a rating of 4, with four factors potentially indirectly impacting the wetland; and less than 0.1% of wetlands received a rating of 5, with five factors potentially indirectly impacting the wetland. Additional information, such as which factors could potentially indirectly impact each particular wetland, is provided in Reference (7) and Reference (27) (Attachment A).

Table 11-1 Rating for Wetlands Potentially Indirectly Impacted in the Project Area

Rating	Attachment A Method		Alternate Method	
	Wetlands (acres)	Wetlands (% of total acres)	Wetlands (acres)	Wetlands (% of total acres)
1	4,046.30	55.0%	3,470.64	53.4%
2	3,042.91	41.4%	2,813.05	43.3%
3	245.31	3.3%	205.97	3.2%
4	15.89	0.2%	8.11	0.1%
5	0.25	<0.1%	0.25	<0.1%
Total acres of wetland	7,350.72		6,498.02	

The acreages identified in Table 11-1 represent the results of the analysis described in Reference (7) and Reference (27) (Attachment A). The analysis was conducted in order to help identify wetlands that would be the focus of monitoring for potential indirect impacts. Therefore, wetlands selected for inclusion in the monitoring plan for the Project (Section 17.0) reflect the results of the potential indirect wetland impact analysis.

12.0 Special Considerations

12.1 Protected Plant and Wildlife Resources

12.1.1 Introduction

PolyMet conducted database searches and field surveys to evaluate the presence of protected wildlife and plant species in the vicinity of the Project. The focus of these studies was to identify species listed: by the USFWS as endangered or threatened; by the State of Minnesota as endangered, threatened or special concern; or by the USFS Region 9 as Regional Forester Sensitive Species (RFSS). Special consideration may be necessary when evaluating Project impacts on individual species and/or their habitats. The database and field wildlife and plant studies conducted for the Project are further described in the following sections.

12.1.2 Federal and State Listed Wildlife Species

12.1.2.1 Wildlife Field Surveys

Wildlife surveys were conducted in the vicinity of the Project. The primary focus of the surveys was protected species listed by the USFWS, the State of Minnesota, or the USFS Region 9. Designated species may involve special consideration or permitting if the Project has a direct impact on individuals or populations of these species. Studies were also conducted to gain an understanding of how the Project may cumulatively affect wildlife, in the context of other past and future developments on the Iron Range.

Wildlife surveys were conducted in winter 2000 with the following objectives: 1) determine general wildlife use of the Project area; 2) determine the presence of wildlife species of concern; and 3) identify important habitats used by wildlife (Reference (28)). Methods included field and aerial wildlife and wildlife habitat assessments and bait and calling station assessments for the following species of interest including: Northern goshawk, (Accipiter gentilis, RFSS), boreal owl (Aegolius funereu, RFSS), gray wolf (Canis lupus, state special concern), mountain lion, Puma concolor, state special concern), and Canada lynx, Lynx canadensis, federally threatened). Assessments were also conducted for dominant prey of these species.

Results of the winter 2000 wildlife surveys indicated the presence of several common mammal and bird tracks throughout the Mine Site; however, no areas were identified with dense concentrations of tracks. For the species of concern, gray wolf and mountain lion tracks were observed, and Northern goshawk was heard during calling surveys. Boreal owls and Canada lynx were not observed.

Wildlife surveys were conducted in June 2004 on the Mine Site, north of Dunka Road to: 1) determine general wildlife use of the Project area; 2) determine the presence of wildlife species of concern; and 3) identify important habitats used by wildlife Reference (29). Methods included transect surveys, calling surveys for Northern goshawk, owls and wolves, and wildlife habitat assessments. During the Northern goshawk calling surveys, no responses were obtained that could positively be identified as a Northern goshawk. Wolf calling surveys determined the presence of several wolves, which were likely located south of the Mine Site.

12.1.2.2 Canada Lynx Field Surveys

A field survey was completed in 2006 for the federally-threatened Canada lynx within a 250 square mile overall study area around the Project area (Reference (30)). A portion of the Project is located within the USFWS designated critical habitat area, shown on Large Figure 14. Large Figure 14 also shows the Canada lynx sightings within the vicinity of the Project area between 2000 and 2006, based on data from the Minnesota Canada Lynx Database. The study gathered baseline information on the abundance, movement, and habitat usage of Canada lynx in the vicinity of Project. The study area was surveyed between January and March 2006.

No Canada lynx or sign of Canada lynx were observed within the Project area. However, the surveys did identify three female Canada lynx within the overall study area and one female Canada lynx adjacent to the study area (Large Figure 14). Habitat for Canada lynx and their primary prey (snowshoe hare) was identified throughout the study area, except where lands had been disturbed by historic or ongoing mining activity. The Project area contains areas of Canada lynx habitat, including mature jack pine forest with dense balsam fir in the understory.

Approval of the Section 404 permit for the Project will require the preparation of a Biological Assessment of the Project's potential impacts on Canada lynx, and consultation with the USFWS on the findings of the Biological Assessment. As part of the Section 404 permit review process, the USACE has initiated Section 7 ESA consultation with the USFWS.

12.1.2.3 Wildlife Corridor Cumulative Effects Analysis

In 2006, Emmons & Olivier Resources (Reference (31)) completed an assessment of the impacts to 13 wildlife habitat and travel corridors from past, present, and reasonably foreseeable projects in the vicinity of ongoing and proposed projects in northeastern Minnesota. In order to conduct this assessment, the study established appropriate spatial and temporal scales and significance thresholds for examining impacts to habitat and travel corridors. Wildlife habitat impacts were evaluated at the scale of the Arrowhead Region. Losses to key habitats for mammalian MDNR Species of Greatest Conservation Need (SGCN) at this scale were deemed to be important. Travel corridor impacts were evaluated at the scale of the Mesabi Iron Range mineral deposit formation. The temporal scale of the analysis encompassed both past and future actions that have impacted habitat or travel corridors.

The impacts to travel corridors and habitats were tabulated based on human footprint data for mining, forestry, and regional development, including the 2004 mine features, tax-incentive job development zones, potential four-lane highway corridors, proposed state forestry harvest scenarios, and proposed mining actions. The analysis of wildlife habitats indicated significant impact to habitats used by mammalian SGCN as a result of proposed future urban development, mining, and forestry. For the entire Arrowhead Region, future losses of wildlife habitat were estimated at 8,727 acres, with 913 acres impacted by mining, 498 acres impacted by economic development, and 7,315 acres impacted by forestry.

This analysis of wildlife travel corridors indicated impacts were projected as a result of proposed future urban development, mining and increased highway traffic. Future activities were estimated to impact 11 of the 13 remaining wildlife corridors. The report concluded that there have been notable losses since pre-settlement of upland forest, especially pine forests, as well as loss of lowland conifer and deciduous forest. A major portion of the study area is currently in some type of developed cover. Analysis of the cumulative impacts of future projects indicates that about three-quarters of those impacts will occur in areas that are developed or in aspen/birch and upland shrub cover. Future habitat losses attributable to mining projects will largely avoid upland and lowland forested habitats.

In 2009, Barr completed a cumulative effects analysis of wildlife habitat and threatened and endangered wildlife species that expanded upon the 2006 Emmons & Olivier Resources analysis (Reference (32)). It determined that this 2006 analysis conservatively estimated the number and size of wildlife travel corridors because it treated all historic mining features as lost habitat and did not take into account the ameliorating effects of human re-vegetation efforts, natural succession, and the size and topography of mining impacts.

The 2009 Barr report identified 18 existing wildlife corridors; four of these corridors will likely become completely impassable within the next 25 to 30 years as a result of planned mining activities. In addition, five wildlife corridors will be significantly degraded by future mining plans but will still retain some functionality. Smaller mammal, amphibian, reptile, and insect species live in, rather than pass through, corridors, or take much longer time to traverse a corridor. Therefore, these species will be most affected by cumulative corridor impacts. With regard to listed species and SGCN species, the cumulative effects of mining and other industrial projects are not expected to negatively impact the regional wolf, Canada lynx, or bald eagle populations.

12.1.3 Federal and State Listed Plants

PolyMet conducted botanical studies in the vicinity of the Project to establish baseline conditions. The primary focus of these studies was the vascular plant species listed by the State of Minnesota as endangered, threatened or special concern, or by the USFS Region 9 as RFSS. Species with these designations may involve special consideration or permitting if the Project should impact their populations and/or habitats. There are no federally-listed vascular plant species known to occur in northeastern Minnesota.

Foth & Van Dyke and Associates, Inc. conducted a rare plant survey in 1999, prior to on-site mineral exploration by PolyMet (Reference (33)). Two populations from the genus Botrychium (moonworts and grape ferns) were documented during this survey. One population was located in the Mine Site and one population was located south of the Mine Site (Sections 11 and 16 of Township 59N and Range 13W). The plants found were not identified to species. In addition, Foth and Van Dyke documented one location of Eleocharis nitida (neat spike rush), a state-threatened species and RFSS species, in in the Mine Site (Township 59N, Range 13W, Section 11).

Professional botanist Cindy Johnson-Groh conducted surveys in July 2004 to assess the presence of Botrychium species in the vicinity of the Project (Reference (34)). A total of 39 Botrychium populations were documented in the Mine Site and six populations of Botrychium were identified outside of the Mine Site. Populations ranged in size from one individual to over 500 individuals, and all populations were found in or adjacent to old disturbance sites. Four rare Botrychium species were identified during this survey and include the following:

- *Botrychium pallidum*[1] (pale moonwort), a state-endangered species and RFSS species, was documented in five locations in the Mine Site (Sections 10 and 11 of Township 59N, Range 13W) and two locations south of the Mine Site (Sections 11 and 16 of Township 59N, Range 13W).

- *Botrychium rugulosum*[2] (St. Lawrence grapefern), a state-threatened and RFSS species, was documented in one location in the Mine Site (Sections 2 and 11 of Township 59N, Range 13W); however, it is not certain that the plants identified at either location are *Botrychium rugulosum*.

- *Botrychium simplex* (least grapefern), a state species of special concern and RFSS species, was documented in 30 locations in the Mine Site (Sections 2, 3, 10, and 11 of Township 59N, Range 13W) and four locations south of the Mine Site (Sections 11 and 16 of Township 59N, Range 13W).

- *Botrychium michiganense* (*Hesperium)* (Michigan moonwort), a RFSS species, was documented in eight locations in the Mine Site (Sections 2, 3, 10, and 11 of Township 59N, Range 13W) and three locations south of the Mine Site (Sections 11 and 16 of Township 59N, Range 13W).

Deborah Pomroy also completed a rare plant survey of the Project area in spring 2004, focusing on the majority of Sections 3, 4, 9, and 10 of Township 59N and Range 13W (Reference (35)). The following state listed and RFSS species were documented as part of Pomroy's survey:

- One population of *Geocaulon lividum* (False Toadflax), a RFSS species, was documented in the Mine Site (Township 59N, Range 13W, Section 3).

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[1] The MDNR is in the process of revising the state endangered and species list and a change in status for *Botrychium pallidum* from endangered to special concern is under consideration.

[2] The MDNR is in the process of revising the state endangered and species list and a change in status for *Botrychium rugulosum* from threatened to special concern is under consideration.

- Four populations of *Sparganium glomeratum* (clustered bur-reed), a state special concern and RFSS species, were documented in the Mine Site (Sections 9 and 10 of Township 59N, Range 13W) and one population was documented south of the Mine Site (Township 59N, Range 13W, Section 16).

- Ten populations of *Scirpus pedicellatus* (pedicellate bulrush), a RFSS species, were documented in the Mine Site (Sections 3, 9, and 10 of Township 59N, Range 13W) and one population was documented south of the Mine Site (Township 59N, Range 13W, Section 16).

Gary Walton also completed a rare plant survey in the vicinity of the Mine Site in 2004 (Reference (36)). This survey documented 9 rare plant species, two of which are state-protected, in several locations in and around the Mine Site.

- *Caltha natans* (floating marsh marigold), a state-endangered species and RFSS species, was documented in five locations in the Mine Site (Sections 1, 10, and 12 of Township 59N, Range 13W) and in eight locations adjacent to the Mine Site (Sections 1, 11, and 12 of Township 59N, Range 13W).

- *Eleocharis nitida* (quill spikerush), a state-threatened species and RFSS species, was documented in 11 locations in the Mine Site (Sections 1 and 11 of Township 59N, Range 13W).

- *Botrychium simplex* (little grapefern), a state species of special concern and RFSS species, was documented in two locations in the Mine Site (Township 59N, Range 13W, Section 1).

- *Geocaulon lividum* (False Toadflax), RFSS species, was documented in 10 locations in the Mine Site (Sections 1, 2, and 11 of Township 59N, Range 13W).

- *Ranunculus lapponicus* (lapland buttercup) a state species of special concern and RFSS species, was documented in six locations in the Mine Site (Sections 1 and 2 of Township 59N, Range 13W) and in one location east of the Mine Site (Township 59N, Range 12W, Section 6).

- *Sparganium glomeratum* (northern bur reed), a state species of special concern and RFSS species, was documented in seven locations in the Mine Site (Sections 1, 2, and 11 of Township 59N, Range 13W) and one location south of the Mine Site (Township 59N, Range 13W, Section 11).

- *Torreyochloa pallid*a (pale manna grass), a state species of special concern and RFSS species, was documented in two locations in the Mine Site (Township 59N, Range 13W, Section 1) and in six locations outside of the Mine Site (Township 59N, Range 12W, Section 6 and Township 59N, Range 13W, Section 11).

- *Ranunculus gmelinii* (small yellow water crowfoot), a RFSS species, was documented in three locations in the Mine Site (Sections 1, 2, and 12 of Township 59N, Range 13W) and in four locations outside of the Mine Site (Sections 1, 11, and 12 of Township 59N, Range 13W).

- *Juncus vaseyi* (Vasey's rush), a RFSS species, was documented in three locations in the Mine Site (Sections 1, 11, and 12 of Township 59N, Range 13W).

Daniel Jones of Barr completed an additional field survey for *Botrychium* species at the PolyMet Mine Site in 2007 (Reference (37)). During this survey, one *Botrychium rugulosum* population (consisting of four individuals) was documented in the Mine Site (Township 59N, Range 13W, Section 1).

Daniel Jones of Barr also conducted a sensitive plant survey in June and July 2008 along segments of Dunka Road and the proposed pipeline alignment from the west end of the Mine Site to the Plant Site (Reference (38)). The survey resulted in identification of six locations with populations (consisting of one to five individuals) of the state-endangered and RFSS species *Botrychium pallidum* (pale moonwort) (Township 59N, Range 14W, Section 13 and Sections 17 and 18 of Township 59N, Range 13W). All of the plants observed during the survey were within 25 feet of Dunka Road and generally grew in the transition zone between forest and roadside vegetation.

Midwest Natural Resources Inc. (MNRI) completed rare plant surveys of the area north of the Mine Site in 2008 (Reference (39)). The MNRI surveys identified four state-special concern and RFSS plant species.

- *Juncus stygius var. americanus* (bog rush), a state species of special concern and RFSS species, was documented in 18 locations outside of the Mine Site (Township 59, Range 13, Section 4).

- *Platanthera clavellata* (club-spur orchid), a state species of special concern and RFSS species, was identified in 15 locations outside of the Mine Site (Township 59, Range 13, Section 4).

- *Pyrola minor* (small shinleaf), a state species of special concern and RFSS species, was identified in one location outside of the Mine Site (Township 59, Range 13, Section 5).

- *Sparganium glomeratum* (clustered bur-reed), a state species of special concern and RFSS species, was identified in four locations, two of which are located in the Mine Site (Sections 3 and 9 of Township 59N, Range 13W) and two of which are located outside of the Mine Site (Township 59, Range 13, Section 4).

In 2011 Barr prepared a memorandum summarizing the results of the 2008 MNRI survey, as well as a sensitive plant species survey completed by ENSR in 1999, but documented only in the

NHIS database (Reference (39)). During the ENSR survey, one population of the state-threatened and RFSS species *Eleocharis nitida* (quill spikerush) was identified (Township 59N, Range 13W, Section 9).

Large Table 12 includes a summary of all state threatened, endangered, and special concern species, as well as RFSS plants species described by the above surveys.

12.2 Archaeological, Historical, and Cultural Resources

PolyMet has coordinated cultural resources studies to identify and document archaeological and historical resources within and adjacent to the Project area. These studies have included literature searches of existing cultural resource databases, field studies following standard cultural resource management protocols, and specialized studies to evaluate culturally-relevant features in the Project area, as detailed below.

12.2.1 Historical and Archaeological Evaluations

The State Historic Preservation Office (SHPO) provided documentation of known archaeological and historical properties within two miles of the Project area. The SHPO database has records for 75 archaeological sites and 39 historical properties and locations in the search area (Large Figure 15). Most of the archaeological sites (48 of 75) are unidentified structures, remnants of structures, or evidence of past human use, such as fire pits and lithic scatters. The remaining archaeological sites (27 of 75) are primarily identifiable remnants of documented logging and mining camps or abandoned homesteads. Out of the 39 recorded historical properties, 28 are structures and other components of Erie Mining Company activities in the area. Eight of the historical properties are spurs and rail segments of the Duluth, Missabe and Iron Range Railroad. The other three historical properties are State or County Highway segments.

PolyMet has also worked with cultural resources professionals to conduct field investigations of cultural resources in the Project area. Foth & Van Dyke and Associates, Inc. conducted a cultural resources investigation in 1999, prior to on-site mineral exploration by PolyMet (Reference (33)). This study identified four previously recorded historical sites within a one- to two-mile distance from the Project. The four sites included three former logging camps (Knot Camp, Far West Dunka Camp, and Lectionary Camp), and an abandoned saw mill (Stubble Creek Mill). None of these sites are within the Project area (Large Figure 15).

In 2004, The 106 Group Ltd. conducted background research and a visual reconnaissance for the Project (Reference (40)). The study evaluated the potential for archaeological resources in the lease area, the Plant Site, the Tailings Basin, and three proposed railroad interconnection alternatives. The study identified low archaeological potential in the Plant Site, Tailings Basin, and proposed railroad spurs. In addition, because the LTVSMC processing facility site has been heavily disturbed, it was considered to have little or no potential for containing intact archaeological resources. Three potential historical properties were identified by the study: the

LTVSMC processing facility and associated mining features, the facility railroad spur, and the Knot Camp (Large Figure 15).

In 2005, Soils Consulting conducted a Phase I archaeological survey within the vicinity of the Mine Site (Reference (41)). The survey sampled the landscape types identified by consulting archaeologists from the SHPO and the USACE as likely to contain archaeological sites. This survey discovered two sites of interest. The first site is a previously unrecorded pre-contact Native American site containing lithic materials, referred to as the Pre-Contact Archaeological Site on Large Figure 15. This site was identified as potentially eligible for listing in the NRHP. Subsequently, a Phase II evaluation was conducted of this site in 2007 by Soils Consulting. This evaluation yielded few artifacts and it was determined that the site does not meet the criteria for listing on the NRHP. The second site of interest was a post-contact logging site, the Knot Camp, which is located east of the Mine Site (Large Figure 15). It was concluded that no adverse impacts to the Knot Camp are expected as a result of the Project.

In 2007, Landscape Research LLC conducted a Phase I architectural history evaluation and historical context study for the Project area (Reference (42)). The objective of the study was to identify any historical properties which could potentially be eligible for listing in the NHRP. The study evaluated potential impacts to architectural history including demolition and new construction as well as impacts to qualities such as setting, feeling, and association in an area including the former LTVSMC Concentration Plant, the Tailings Basin, and the Area 2 Shops. The former LTVSMC Railroad was also evaluated as part of the plant complex that was constructed during 1954 to 1957. The report suggests that most of the properties evaluated are not eligible for NRHP listing as part of the historical mining landscape or historical district. The Concentrator Building (Large Figure 15) may be eligible for listing; however, the report indicates that during operation the Project will have little impact on the integrity of the Concentrator Building, as few changes to the interior or exterior are planned. Nevertheless, the Project's reclamation plans include demolishing the Concentrator Building and other buildings. Therefore, the report recommends that historical records of the site buildings (including schematic drawings, photos, and property descriptions) be created and archived at an appropriate location, such as the Minnesota Historical Society or the Iron Range Research Center.

In 2007, Soils Consulting conducted a follow-up Phase I archaeological survey for two additional areas of impact: an area that will be widened along Dunka Road and an area that will be used for the construction of an electrical substation (Reference (43)). No cultural resources were found along the Dunka Road or within the electrical substation impact area. This report also provides a further evaluation of the pre-contact Native American site identified in 2005 (see above; Large Figure 15). A Phase II evaluation of a previously identified archaeological site at the Mine Site (see previous details in this section) was also conducted at this time.

12.2.2 Cultural Landscape Study

In 2010 the St. Paul District of the USACE requested PolyMet to implement a work plan for the identification of historical properties of traditional spiritual and cultural significance to Bois

Forte Band of Minnesota Chippewa, the Fond du Lac Band of Lake Superior Chippewa, and the Grand Portage Band of Lake Superior Chippewa (Consulting Bands). This work plan was developed through numerous consultation meetings conducted by the USACE as part of the Section 106 review for the Project. The result of implementing the work plan was the 2012 NorthMet Project Cultural Landscape Study (Reference (13)).

The Cultural Landscape Study is a collaborative effort between PolyMet, the USACE, and the consulting Ojibwe Bands. The study includes the following four components: 1) interviews with Ojibwe Band elders and Band members; 2) archival research to develop cultural landscape historical contexts; 3) completion of plant surveys to describe the distribution and abundance of traditionally-utilized plant species; and 4) completion of reconnaissance-level archaeological fieldwork to identify potential cultural resources.

Draft and final versions of the Cultural Landscape Study have been completed, and the final version of the study was submitted to the USACE. The USACE is currently coordinating the results and findings of the study with the appropriate state and federal agencies.

13.0 Shoreline Impact Zones

There are no wetland impacts within 1,000 feet of a lakeshore for the Project. There are three wetlands within the Dunka Road and Utility Corridor located near streams that will be directly impacted. Two alder thicket (Type 6) wetlands are located within 300 feet of Longnose Creek and will have 0.14 acres (Wetland ID 392) and 0.34 acres (Wetland ID 862) of fill. One alder thicket (Type 6) wetland is located within 300 feet of Wyman Creek and will have 0.07 acres (Wetland ID 1124) of fill.

14.0 Wetland Mitigation Plan Overview

Wetland mitigation will be accomplished with compensatory mitigation credits from both off-site and on-site wetland restoration projects. PolyMet plans to develop approximately 1,624.2 wetland mitigation credits at three off-site mitigation sites known as the Zim, Hinckley, and Aitkin sites (Large Figure 12). A description of the mitigation sites is provided in Table 14-1. The on-site wetland mitigation credits will occur later in the Project and therefore are not shown as mitigation credits in Large Table 5 through Large Table 7. PolyMet plans to complete initial phases of restoration on all of the proposed off-site wetland mitigation at least one full growing season prior to the occurrence of the wetland impacts for which the mitigation will compensate.

Table 14-1 Description of Mitigation Sites

Wetland Replacement Site	Watershed Name, Bank Service Area (BSA)	County	Township (T), Range (R), Section (S)	Restored (R), Preserved (P) or Created (C)?
On-Site	St. Louis River #3, BSA #1	St. Louis	T59, R13, S1,2,3,9,10, and 11	C
Zim Site	St. Louis River #3, BSA #1	St. Louis	T55, R18, S2,3,10,11,26,27, and 34	R/P
Hinckley Site	Snake River #36, BSA #6	Pine	T39, R22, S5	R
Aitkin Site	Elk-Nokasippi #10, BSA #5	Aitkin	T47, R27, S1; T47, R26, S6	R

The proposed mitigation is expected to compensate for all of the direct wetland impacts and potential indirect fragmentation impacts, which total 912.5 acres, with the majority of credits for in-kind mitigation and nearly one-half of the credits from within the Project watershed. Out-of-kind credits will be used to mitigate for impacts to 39.9 acres of Type 4 deep marsh communities that cannot be fully mitigated in-kind at the proposed mitigation sites.

Mitigation credits and ratios proposed by PolyMet are shown in Large Table 5, which complies with the St. Paul District USACE policy (Reference (44)) and recent clarifying guidance (Reference (45)). The USACE credits and ratios are shown in Large Table 6. The WCA credits and ratios are shown in Large Table 7. The proposed wetland mitigation package described in this application is expected to result in excess credits according to the St. Paul District USACE Policy and the WCA. Excess credits will be applied toward currently uncalculated potential indirect impacts, if necessary.

14.1 Mitigation Site Selection Process

Compensatory wetland mitigation site selection for the Project began in 2005 with the initial estimates of wetland impacts and a GIS study conducted within BSA #1 (St. Louis River and Lake Superior watersheds) and BSA #4 (Mississippi Headwaters watersheds) to identify potential wetland mitigation sites (Large Figure 12). Over 100 sites were identified within BSA #1 encompassing over 175,000 acres of potential mitigation. Those opportunities were primarily in partially-drained wetlands with some farmed and completely-drained wetlands. The sites with the greatest potential for wetland mitigation credits were further evaluated in the field. Meetings were held in the field with agencies on June 14, 2005 and June 30, 2005, to identify issues associated with restoring partially-drained wetlands and to solicit input on other mitigation opportunities. The participants at the meetings included representatives from the USACE, MDNR, USFWS, St. Louis County, and the Minnesota Board of Water and Soil Resources (BWSR) (Reference (46)). Significant issues were raised by the participating agencies regarding sites with partially-drained wetlands. They recommended a focus on wetland restoration on private lands, which were largely unavailable in the Lake Superior watersheds.

Approximately three-fourths of the potential mitigation sites identified were determined not to meet the federal and state mitigation guidelines based on more detailed evaluations. Detailed GIS evaluations and site investigations were conducted for the remaining 25 potential mitigation sites identified based on input received from the agency representatives. In addition, PolyMet inquired with numerous public agencies and private natural resource entities in search of mitigation opportunities, resulting in no new leads. The majority of the potential mitigation sites identified in 2005 were deemed infeasible for several reasons including the following:

- potential flooding impacts to public roads and upstream properties
- insufficient wetland drainage or other wetland alterations to meet eligibility requirements
- presence of public ditches that could not be abandoned
- likely soil contamination
- unwilling landowners
- permanently encumbering valuable public resources (i.e., timber, peat, gravel)
- presence of public recreation areas

Based on that extensive mitigation site search within BSA #1, two potential mitigation sites were identified for the Project, one agricultural site and one partially-drained wetland site located on a tax-forfeited property. The agricultural site (Zim Sod) contained over 400 acres, was under sod production, and was owned by two separate landowners. No agreement could be reached with the landowners due to complications related to a long-term lease between the parties and a landowner expectation of compensation far exceeding market value. The second potential mitigation site was located near Floodwood, Minnesota on land that was predominantly County-controlled tax forfeit property with some State-owned land. PolyMet developed an agreement with St. Louis County to allow them to study the site and develop wetland mitigation plans along with a structure for allocating monetary and wetland credit compensation to the county upon final execution of the agreement. A preliminary wetland mitigation plan for the Floodwood site was submitted in March 2006 for agency review. Planning, agency review, and public meetings to identify public concerns continued for the Floodwood site through early 2007. Significant public opposition to the wetland restoration plans surfaced in 2006 along with technical concerns over whether or not wetland hydrology could be adequately restored. In April 2007, the District Court nullified PolyMet's agreement with St. Louis County. The site was deemed infeasible due to that legal action, public opposition, agency concerns regarding crediting, technical issues regarding restoration feasibility, and concerns over the ability to restore hydrology and wetland functions.

After PolyMet thoroughly pursued practicable wetland mitigation opportunities within the Project BSA and when their preferred wetland mitigation opportunity was deemed infeasible in early 2007, wetland mitigation opportunities within neighboring BSAs were pursued. One site was secured within the Mississippi River Headwaters watershed (BSA #5), the Aitkin wetland mitigation site (Aitkin), and one site was secured within the Snake River watershed (BSA #6), the Hinckley wetland mitigation site (Hinckley) (Large Figure 12). The mitigation site plans for the Aitkin and Hinckley sites were submitted in August 2007, the plans went through agency review, and plan revisions were completed in January 2008 (Reference (47); Attachment C) to address agency comments. Both sites occur on properties that are still actively farmed for sod and other crops; PolyMet has retained options for the sites to be used for wetland mitigation. A summary of estimated credits available from each site is provided in Large Table 5.

The mitigation plan supplement (Reference (46)) included an extensive evaluation of on-site mitigation opportunities at the Project site, as requested by the USACE.

After years of effort, in 2010, PolyMet was able to successfully negotiate rights to a site with a high potential for the development of wetland mitigation credits in the St. Louis River watershed, the Zim Sod wetland mitigation site (Zim). The Zim mitigation site plan was submitted in April 2011 for review and revisions were completed in November 2011 to address agency comments (Reference (48); Attachment D). Hydrology monitoring started at the Zim site in May 2012 to document wetland drainage and provide justification for the proposed mitigation credits. Hydrology monitoring will continue at the site to document pre-restoration conditions until the permits are issued for the Project and the restoration begins. A summary of estimated credits proposed for the Zim site is included in Large Table 5.

PolyMet's wetland mitigation planning efforts helped identify the difficulties in conducting wetland mitigation in northeastern Minnesota to meet federal and state initial mitigation siting preferences. Both state and federal agencies have considerable discretion and flexibility in review and approval of mitigation sites. After the completion of a majority of PolyMet's wetland mitigation planning, the Northeastern Minnesota Wetland Mitigation Inventory and Assessment project was completed by the BWSR in January 2010 (Reference (49)). The goals of the project were to conduct a more thorough mitigation opportunity search than that conducted by PolyMet and to conduct a mitigation siting study to curtail the level of effort required by individual project proponents to meet state and federal wetland siting standards.

The BWSR study concluded that only about 10% of the private landowners may be willing and interested in wetland restoration. According to the study, approximately 13% of potential mitigation sites in northeastern Minnesota have a high potential for mitigation, but only 5% of the opportunities identified within the Lake Superior watersheds were completely-drained or farmed wetlands, the types of sites that are most likely to yield sufficient compensatory mitigation credits. In the Lake Superior watersheds, 18% of the opportunities identified were partially-drained wetlands, which have been determined to have significant issues regarding regulatory applicability. Approximately 77% of opportunities identified in the Lake Superior watersheds represent preservation methods; these are considered to be the lowest priority for mitigation and few preservation projects have been completed in Minnesota. Although some possible new mitigation opportunities were identified by this project, PolyMet had already secured and planned the majority of the wetland mitigation for the Project. In the event that additional wetland mitigation is needed, PolyMet will utilize the information resulting from the BWSR project (Reference (49)) in planning that mitigation.

15.0 Description of Mitigation Wetlands

15.1 Summary of Wetland Mitigation Ratios

The credits proposed for each mitigation site are consistent for Section 404 of the CWA and the WCA as discussed in the mitigation plans (Reference (48); Attachment D and Reference (47); Attachment C). However, the value of those credits, relative to the impacts, differs because the mitigation requirements differ between the CWA and the WCA. PolyMet proposes wetland mitigation that meets the St. Paul District USACE policy and the WCA replacement standards (Reference (44)). The on-site wetland mitigation credits will occur later in the Project and therefore are not shown as mitigation credits in Large Table 5 through Large Table 7.

15.1.1 Federal CWA Wetland Mitigation Summary

Based on the St. Paul District USACE policy for wetland mitigation (Reference (44)), the base ratio for compensation of wetland impacts is 1.5 mitigation credits to one acre of impact (1.5:1). A draft memorandum from the USACE (Reference (45)) states that an increase in the base ratio to 2:1 may be required considered for the following wetland types:

- Difficult-to-replace wetland communities, which include coniferous and open bogs (Type 8) and forested wetlands (Type 7)

- High quality wetland communities, as determined based on previous studies

The St. Paul District USACE policy for wetland mitigation (Reference (44)) provides incentives to reduce the recommended base ratios. All of the credits at the three mitigation sites fulfill at least one of the three incentive criteria required to reduce the base mitigation ratio by 0.25:1. The three incentive criteria are as follows:

- The restoration work is expected to begin on each of these sites after permit approval such that the initial phases of the restoration will be completed more than one full growing season before the Project impacts occur. Therefore, it is expected that this will qualify for the “in-advance” incentive (a reduction of 0.25:1) for the impacts to shallow marsh (Type 3) communities; it is assumed that the fresh (wet) meadow (Type 2) and deep marsh (Type 4) communities (not discussed in the draft memorandum from the St. Paul District USACE (Reference (45)) also qualify for this incentive.

- Most of the credits will qualify for the “in-kind” incentive because the wetland communities restored at each mitigation site will replace similar impacted community types at a minimum ratio of 1:1. One exception is that the deep marsh (Type 4) community impacts will not be fully replaced “in-kind” because this community type cannot be replaced with a similar high quality community at the mitigation sites. A deep marsh community is not appropriate for the landscape and geomorphic context of the mitigation sites. Therefore, in-kind compensation for this wetland type is not practicable for these sites and no incentives are applied to the portion of deep marsh impacts not replaced in-kind at a 1:1 ratio (Large Table 5).

- All credits from the Zim site qualify as “in-place” because this site is located within the same 8-digit HUC watershed as the Project impacts (Large Figure 12) and the mitigation siting sequence was followed to maximize mitigation possibilities on-site and within the same 10-digit HUC watershed (Reference (48); Attachment D).

15.1.2 State WCA Wetland Mitigation Summary

Based on the WCA wetland replacement standards (Minnesota Rules 8420.0522 Subp. 4), the mitigation credits will qualify at a ratio of either 1:1 or 1.5:1. The mitigation credits developed on-site and at the Zim site will qualify for the minimum replacement ratio of 1:1, because they are located within the same major watershed and the majority of the replacement credits are planned in-kind. The credits from the Aitkin and Hinckley sites will qualify for a replacement ratio of 1.5:1 because they are outside the major watershed of the impacts.

15.1.3 On-Site Wetland Mitigation

Upon mine reclamation, approximately 102 acres of wetlands will be created at the temporary mine stockpile areas after removal of the Category 2/3 Waste Rock Stockpile and the OSLA as described in Section 7.0 of Reference (50) and shown in Large Figure 6 of Reference (51). Because it may not be feasible to construct wetlands on the entire footprint of these temporary areas, it was assumed that only the area equivalent to the directly impacted wetlands within the footprints will be viable for wetland mitigation (Reference (7); Attachment A). Design of wetland mitigation areas will be further evaluated in the detailed reclamation design as described in Section 7.0 of Reference (50).

The design will include the preservation of upland buffer around the perimeter of the wetland mitigation areas. Approximately 102 acres of on-site wetland mitigation is proposed to be reestablished (Large Table 6 and Large Table 7). Because some of the existing watershed and soil conditions are not expected to remain in the same condition as prior to the project, this wetland establishment is proposed to be most similar to a wetland creation. Consistent with St. Paul District USACE policy (Reference (44)), the mitigation wetlands are expected to be hydrologically connected to other wetlands to support their development; therefore, this is a lower risk wetland creation and qualifies for 75% credit. Similarly, in accordance with the WCA rules in Minnesota Rules 8420.0526, Subp. 7, this qualifies for 75% credit for the proposed wetland mitigation area. Establishment of these wetlands is expected to occur during reclamation.

15.2 Off-Site Wetland Mitigation

The off-site wetland restoration projects that will provide required mitigation for the Project wetland impacts are summarized below and provided in Reference (48) (Attachment D) and Reference (47) (Attachment C). The three off-site mitigation projects include the Zim, Hinckley, and Aitkin sites. Site locations and watersheds are shown in Large Figure 12. Acreages and credits from each of these sites are summarized in Large Table 5. These three sites were selected considering the potential for each to mitigate for impacted community types. Based on the anticipated credits from each site, only the deep marsh (Type 4) community will not be fully compensated in-kind at a 1:1 ratio. The bog and forested (Type 7 and 8) community types will be mitigated at a higher ratio based on Reference (45).

15.2.1 Zim Site

Reference (48) (Attachment D) details the proposed Zim site. The site is currently an active sod farm that has been drained by ditches and sub-surface drain tiles. This site is located in two separate ownership units on approximately 569 acres of land located southwest of the city of Eveleth, Minnesota on the east side of County Road 7 as shown in Large Figure 2 of Reference (51). The site is located in St. Louis County in the St. Louis River major watershed (#3) within the Lake Superior basin (BSA #1) (Large Figure 12).

Restoration methods on the site are designed to restore a Type 8 coniferous bog community; however, developing a bog community is highly dependent on soil and groundwater parameters that may be difficult to control. Therefore, a coniferous swamp community will be the contingent community if the soil and groundwater conditions are not adequate for bog regeneration. Coniferous bog or swamp is the target for the whole site, however, where trees do not successfully establish; the target community will be an open bog or sedge meadow. If the target community changes, the credit ratios would be recalculated as discussed for the contingencies in Section 16.2. A total of 479 acres of wetland restoration, 29 acres of wetland preservation, and 23 acres of upland preservation are proposed (Reference (48) (Attachment D); Large Table 5). A total of 454 compensatory wetland mitigation credits are proposed from this site (Reference (48); Attachment D).

The credits calculations are shown in Large Table 5 following the St. Paul District Policy (Reference (44)) and the draft guidance document from the St. Paul District USACE (Reference (45)). This site is located within the same watershed as the Project so the credits from the site qualify for the in-place incentive, a credit reduction of 0.25:1. Wetlands on the site will replace wetlands of the same type, so these credits will qualify for the in-kind incentive, a credit reduction of 0.25:1. Most of the credits from the site will be developed as bog (Type 8) and/or forested wetland (Type 7) communities and, therefore, will meet the minimum replacement ratio of 1.5:1 for those communities.

Under the WCA, the replacement ratio for credits at the Zim site will be 1:1 ratio because the impacted wetlands will be replaced within the same watershed, the majority of which are to be replaced in-kind (Large Table 7).

Mitigation credits from the Zim site are summarized in Large Table 5 based on actions eligible for credit in the St. Paul District USACE policy (Reference (44)) and in the WCA rules.

Proposed actions eligible for credit include the following with references to the applicable St. Paul District USACE policy and subpart under the WCA Chapter 8420.0526:

- Restoration of drained wetlands are eligible for credit for 100% of the area restored [Section 404 (restoration via reestablishment) and WCA-Subp. 3]. This is applied to the majority of the fields on the site that are drained by sub-surface drain tiles and will be restored to coniferous bog and shallow marsh communities.

- Restoration of partially-drained wetlands are eligible for credit for 50% of the area restored [Section 404 (restoration via rehabilitation) and WCA-Subp. 4)]. This applies to the hydrologic restoration of partially-drained wooded wetlands and the restoration of the natural surface grade and wetland conditions in ditches.

- The upland areas restored and maintained in native vegetation are eligible for credit for 25% of the area [Section 404 (upland buffers) and WCA-Subp. 2]. The uplands at the Zim site occur in drained fields and filled ditches that will remain effectively drained due to open ditches that cannot be filled.

- Native coniferous bog communities that will be protected by conservation easements are eligible for credit for 12.5% of the area [Section 404 (preservation) and WCA-Subp. 9 (per Minnesota Statute 103G.2251 modified August 1, 2011.)].

The majority of the wetland mitigation at the Zim site is proposed through the restoration of drained wetlands. Those areas are currently managed for sod production, so conditions range from open soil to a fully developed turf grass mat that is regularly mowed and herbicides are applied to control weeds. The historic wetland hydrology has been removed from those areas by an extensive drain tile and ditch system. Therefore, the sod production areas of the site currently serve no natural wetland functions. The restoration of forested wetland communities within the site will restore wetland functions over the course of many years. Hydrologic and water quality functions such as water storage, hydrologic regime, and maintenance of water quality will be restored to a higher functioning level soon after the initial restoration activities are completed and to natural conditions within several years following initial restoration. Other wetland functions that rely on the reestablishment of natural wetland vegetation, such as vegetative diversity, wildlife habitat, and aesthetics/recreation will take longer to become fully restored. However, substantial improvements in those functions will occur during the first several years of restoration because permanent, native vegetation will begin to develop rapidly, the site will not be tilled, seeded or regularly mowed, and human activity within the site will be minimal.

Hydrologic restoration of partially-drained wooded wetlands qualifies for 50% credit based on the St. Paul District USACE policy (Reference (44)) for rehabilitation of an existing, degraded wetland. The 50% credit is based on the lowest percentage available for rehabilitation, despite the anticipated improvement of wetland functions to these communities. Benefits from this restoration will include an increase in the water storage capacity of the wetland, improved water quality, and increased soil saturation. The saturated soil is an important factor in maintaining a healthy bog plant community and associated wetland functions.

Restoring the natural hydrology to the wooded communities at the Zim site is anticipated to facilitate the return of critical components of the bog community and halt peat subsidence. Presently, the wooded communities subjected to partial drainage are degraded woodlands that lack critical bog community vegetation components such as low-growing ericaceous shrubs, a continuous layer of *Sphagnum* moss, and abundant sedges (i.e., *Carex lasiocarpa*). Furthermore, exposed tree roots at the base of tree trunks is evidence that the soil in these areas is likely subsiding due to increased decomposition of the peat, likely caused by reduced surface saturation. Increasing soil saturation in this area will enable this community to re-establish.

Monitoring data will be collected after restoration to document the changes in the partially-drained wooded communities. These data will be used to determine potential remedial actions and to document increased hydrology.

The vegetation and hydrology will be restored to the site over a one- to two-year construction period followed by 10 to 20 years of management or more, if warranted. The restoration work is expected to begin on the site after permit approval such that the initial phases of the restoration will be completed more than one full growing season before the Project impacts occur. Reference (48) (Attachment D) identifies the performance standards that have been developed for the mitigation site to guide the restoration activities and to monitor whether vegetation and hydrology are meeting the design goals. A permanent conservation easement or deed restrictions to protect the site will be prepared and recorded within one year after initializing the restoration activities. The wetland restoration area will be monitored for 10 to 20 years beginning in the first full growing season after completing hydrologic restoration and ending upon certification by the USACE and MDNR that the wetlands have met performance standards.

15.2.2 Hinckley Site

Reference (47) (Attachment C) describes the wetland mitigation potential for the Hinckley site, an active sod and row crop farm. The site currently has about 375 acres under agricultural production and has been drained by ditches and sub-surface drain tiles. This 511-acre site is located southwest of the city of Hinckley, Minnesota at the intersection of Sod Road and Highway 107, as shown in Large Figure 4 of Reference (51). The mitigation site is located in Pine County in the Snake River major watershed (#36) within BSA #6, adjacent to BSA #1 where the Project is located (Large Figure 12). A total of 313 acres of wetland restoration and 79 acres of upland buffer preservation are proposed (Large Table 5).

Restoration methods on the site are designed to restore seasonally flooded (Type 1), fresh wet meadow (Type 2), sedge meadow (Type 2), shallow marsh (Type 3), shrub-carr (Type 6), alder thicket (Type 6), hardwood swamp (Type 7), coniferous swamp (Type 7), and coniferous bog (Type 8) (Large Table 5).

Restoration activities at the Hinckley site will qualify for various credit ratios based on the St. Paul District USACE Policy and Guidance (Reference (44) and Reference (45)) depending on community types. The seasonally flooded (Type 1), fresh (wet) meadow (Type 2), and shallow marsh (Type 3) communities will qualify for the in-advance incentive, a reduction of 0.25:1. Also, many credits from the site will qualify for the in-kind incentive, a reduction of 0.25:1. The credits from the site that qualify for both incentives will compensate for low or medium quality non-forested and non-bog wetland impacts at a 1:1 ratio and at a 1.5:1 ratio for impacts to high quality non-forested and non-bog wetlands. The credits from forested and bog wetlands do not qualify for the in-advance incentive (Large Table 5). The majority of the credits from the site qualify for the incentive for in-kind replacement. These credits will be applied as compensation at a ratio of 1.25:1 for impacts to non-forested, non-bog, and low or medium quality wetlands and at a ratio of 1.75:1 for impacts to forested, bog, and high quality wetlands.

Under the WCA, the mitigation credits at the Hinckley site will replace Project impacts at 1.5:1 (credit to impact) because the wetlands will be replaced outside of the Project watershed (Large Table 7).

Mitigation credits from the Hinckley site are summarized in Large Table 5 based on actions eligible for credit in the St. Paul District USACE Policy (Reference (44)) and in the WCA rules. Proposed actions eligible for credit include the following with references to the applicable St. Paul District USACE Policy and subpart under the WCA Chapter 8420.0526:

- Restoration of drained wetlands are eligible for credit for 100% of the area restored [Section 404 (restoration via reestablishment) and WCA-Subp. 3]. This is applied to the fields on the site, the majority of which are drained wetlands.

- Restoration of partially-drained wetlands are eligible for credit for 50% of the area restored [Section 404 (restoration via rehabilitation) and WCA-Subp. 4)]. This applies to the hydrologic restoration of partially-drained wetlands.

- The upland areas restored and maintained in native vegetation are eligible for credit for 25% of the area [Section 404 (upland buffers) and WCA-Subp. 2]. This applies to restoration of native vegetation in the uplands adjacent to the restored wetlands.

The vegetation and hydrology will be restored to the site over a one- to two-year construction period followed by 10 to 20 years of management, or more if warranted. The restoration work is expected to begin on the site after permit approval such that the initial phases of the restoration will be completed more than one full growing season before the Project impacts occur. Performance standards have been developed for the mitigation site to guide the restoration activities and to monitor whether vegetation and hydrology are meeting the design goals (Reference (47); Attachment C). A permanent conservation easement or deed restrictions to protect the site will be prepared and recorded within one year after initiating the restoration activities. The wetland restoration area will be monitored for 10 to 20 years beginning in the first full growing season after completing hydrologic restoration and ending upon certification by the USACE and MDNR that the wetlands have met performance standards.

15.2.3 Aitkin Site

Reference (47) (Attachment C) describes the wetland mitigation plans for the Aitkin site. The site is currently an active farm producing sod and row crops that has been drained by ditches and sub-surface drain tiles. The site has been used for sod, wheat, soybeans, sunflowers, and wild rice production. The 1,070 acre site is located north of the city of Aitkin, Minnesota on either side of County Road 1, as shown in Large Figure 5 of Reference (51). The mitigation site is located in Aitkin County in the Elk-Nokasippi major watershed within BSA #5, adjacent to BSA #1 where the Project is located (Large Figure 12).

The proposed wetland mitigation area includes 810 acres of wetland restoration and 123 acres of upland buffer preservation (Reference (47); Attachment C). Restoration methods on the site are designed to restore fresh wet meadow (Type 2), sedge meadow (Type 2), shallow marsh (Type 3), deep marsh (Type 4), shrub-carr (Type 6), alder thicket (Type 6), hardwood swamp (Type 7), coniferous swamp (Type 7), and coniferous and open bog (Type 8).

Restoration activities at the Aitkin site will qualify for various credit ratios based on the St. Paul District USACE Policy and Guidance (Reference (44) and Reference (45)) depending on community types. The fresh (wet) meadow (Type 2), shallow marsh (Type 3) and deep marsh (Type 4) communities will qualify for the in-advance incentive, a reduction of 0.25:1. Many credits from the site will qualify for the in-kind incentive, a reduction of 0.25:1. The credits from the site that qualify for both incentives will compensate for impacts to low or medium quality non-forested and non-bog wetlands at a 1:1 ratio and at a 1.5:1 ratio for impacts to high quality non-forested and non-bog wetlands. The credits from forested and bog wetlands do not qualify for the in-advance incentive (Large Table 5). The majority of the credits from the site qualify only for the incentive for in-kind replacement. These credits will be applied as compensation at a ratio of 1.25:1 for impacts to non-forested, non-bog, and low or medium quality wetlands and at a ratio of 1.75:1 for impacts to forested, bog, and high quality wetlands.

Under the WCA, the replacement ratio at the Aitkin site will replace Project impacts at 1.5:1, because the wetlands will be replaced outside of the Project watershed (Large Table 7).

Mitigation credits from the Aitkin site are summarized in Large Table 5 based on actions eligible for credit in the St. Paul District USACE Policy (Reference (44)) and in the WCA rules. Proposed actions eligible for credit include the following with references to the applicable St. Paul District USACE Policy and subpart under the WCA Chapter 8420.0526:

- Restoration of drained wetlands are eligible for credit for 100% of the area restored [Section 404 (restoration via reestablishment) and WCA-Subp. 3]. This is applied to the fields on the site, the majority of which are drained wetlands.

- The upland areas restored and maintained in native vegetation are eligible for credit for 25% of the area [Section 404 (upland buffers) and WCA-Subp. 2]. This applies to restoration of native vegetation in the uplands adjacent to the restored wetlands.

The vegetation and hydrology will be restored to the site over a one- to two-year construction period followed by 10 to 20 years of management, or more if warranted. The restoration work is expected to begin on the site after permit approval such that the initial phases of the restoration will be completed more than one full growing season before the Project impacts occur. Performance standards have been developed for the mitigation site to guide the restoration activities and to monitor whether vegetation and hydrology are meeting the design goals (Reference (47); Attachment C). A permanent conservation easement or deed restrictions will be prepared and recorded to protect the site within one year after initializing the restoration activities. The wetland restoration area will be monitored for 10 to 20 years beginning in the first full growing season after completing hydrologic restoration and ending upon certification by the USACE and MDNR that the wetlands have met performance standards.

16.0 Monitoring Plan for Replacement Wetlands

Monitoring at wetland mitigation sites will assess whether or not the restored wetlands are in conformance with performance standards as described in each mitigation plan and to determine whether continued monitoring is required (Reference (48); Attachment D and Reference (47); Attachment C). The wetland mitigation site monitoring will begin during the first full growing season after completing hydrologic restoration. In addition to monitoring of the restored wetlands, one reference wetland of each restoration community type will be monitored within the general area of each restoration site in areas with relatively natural hydrologic conditions similar to that of the proposed target communities. A monitoring plan for each site will be submitted for review and approval that will include proposed locations of reference wetlands prior to implementation of the monitoring program.

Detailed vegetation surveys will be conducted each year (typically July-August) in each wetland mitigation community to evaluate the success of the restoration for each community type.

To monitor hydrology on each site, shallow water table monitoring wells will be installed at multiple locations sufficient to characterize hydrology. Continuous recording wells that record water table elevations multiple times each day will be utilized to the extent feasible. Hydrologic monitoring will be used to measure the success of hydrologic restoration relative to the established performance standards for each community type and to assess the extent of wetlands on each site.

The duration of monitoring will depend on the target wetland communities at each site and the success of establishment of those communities. Bogs and forested wetlands will be monitored for up to 20 years, or more if warranted. Monitoring of emergent and shrub-carr wetland communities will continue for up to 10 years, or more if warranted. Certain components of the monitoring may be discontinued sooner if performance standards are met and approval is provided by the USACE and MDNR.

16.1.1 On-Site

Specific monitoring plans have not been developed for on-site mitigation. However, hydrology and vegetation monitoring is expected to follow the general provisions described for the off-site monitoring, including methods, frequency, and duration. Because on-site mitigation will not occur for many years, specific plans can be developed and submitted in the future.

16.1.2 Zim Site

Several shallow water table monitoring wells were installed on the Zim site and a reference wetland) in May 2012 to characterize the pre-restoration hydrology and will continue until the initiation of restoration. After restoration, the monitoring design may be altered to better characterize restored conditions. Hydrology monitoring will be removed from the site at the end of Mine Year 5, assuming the hydrology performance standards are met (Reference (48); Attachment D).

Monitoring reports will be prepared and submitted in Mine Years 1, 2, 3, 5, 8, 10, 15, and 20 after restoration is complete. The monitoring report completed after the tenth growing season will be used to assess whether or not the restoration is sufficiently complete and if additional monitoring and reporting are warranted. The monitoring reports will describe the status of the wetland mitigation, summarize the results of the vegetative and hydrologic monitoring, discuss management activities and corrective actions conducted during the previous period, and discuss activities planned for the following period. The report will be submitted to the USACE and MDNR by December 31 of each year.

16.1.3 Hinckley and Aitkin Sites

Hydrologic monitoring at the Aitkin and Hinckley sites will be completed with monitoring stations in each community type to document water levels relative to reference monitoring wells and proposed performance standards. Monitoring will be conducted in the shallow marsh (Type 3) and deep marsh (Type 4) communities using staff gages or modified stilling wells. The modified stilling well would consist of a PVC well screen anchored into the soil with a data logger near the bottom to record water levels. Water levels would be recorded several times each day in the stilling wells for the duration of the growing season; staff gages would be checked weekly for the first 10 weeks of the growing season and twice monthly thereafter. Hydrology monitoring in saturated soil communities will be completed using shallow water table monitoring wells within each community recorded several times each day for the duration of the growing season.

Hydrologic parameters will be evaluated in the mitigation areas more intensively during the first two years and then at a level appropriate to the hydrologic characteristics of each area thereafter (Reference (47); Attachment C). Reference wells will be established for each community type and monitoring in those wells will continue for the duration of site hydrology monitoring.

Additional details on hydrologic and vegetation monitoring will be described in a monitoring plan to be submitted before restoration is initiated to show the design of the monitoring. The monitoring plan will include information regarding well-placement, installation methods, and reference wetlands. In addition, the monitoring plan will describe the methods to characterize vegetation and document survival and abundance of trees and shrubs for forest and shrub communities.

A monitoring report will be prepared annually during the first 5 years of monitoring. After year 5, monitoring reports will be provided following growing seasons 8 and 10 for the shrub communities and following growing seasons 8, 10, 15, and 20 for the forested and bog communities. The reports will describe the status of the wetland mitigation, summarize the results of the vegetative and hydrologic monitoring, and discuss management activities and corrective actions conducted during the previous period, and activities planned for the following period. The report will be submitted to the USACE and MDNR by December 31 of each year.

16.2 Contingencies for Unsuccessful Mitigation

If the restored wetland communities at any of the mitigation sites do not meet performance standards, as described in each plan (Reference (48); Attachment D and Reference (47); Attachment C), remedial or corrective actions and possibly additional mitigation credits may be required. Site conditions relative to the performance standards will be discussed in each monitoring report. If the standards are not met, PolyMet will propose remedial actions to meet the standard. Should performance standards within any planned community type not be met for three consecutive years, PolyMet will analyze the effects on the approved wetland mitigation credits and propose an alteration to the plan, which may include a modification of wetland community type, changes to the proposed credit ratios, and additional wetland mitigation. Similarly, if any wetland community is not developing as planned and defined in the performance standards after the fifth full growing season after restoration, PolyMet will work with the USACE and MDNR on appropriate, alternative plans, including alternative mitigation or revisions to the overall mitigation ratio based on changes to wetland community types. Any plan revisions will be submitted to the USACE and MDNR for review and approval prior to implementation.

Should additional wetland mitigation be required, after utilizing all of the excess credits presented in Large Table 5 through Large Table 7, PolyMet will first identify and pursue wetland mitigation opportunities, including wetland preservation options, within the Project watershed. PolyMet will utilize information available at that time regarding potential wetland mitigation opportunities available through the BWSR or other relevant entities. Information on the wetland mitigation opportunities identified and pursued will be submitted with the USACE and MDNR for review and approval prior to making final decisions on additional mitigation.

16.3 Mitigation of Indirect Impacts, if Necessary

Wetland monitoring near the Project site will be used to assess potential indirect impacts to wetlands as described in Section 17.0. If wetlands are indirectly impacted by the Project, and depending upon the nature of such impacts, compensatory mitigation credits may be used for replacement. The criteria for determining potential indirect impacts to wetlands are discussed in Section 17.0. If indirectly impacted wetlands require compensatory mitigation, the acreage will be calculated by community type and provided in annual monitoring reports.

The excess wetland mitigation credits proposed are expected to be available to compensate for potential indirect wetland impacts. If necessary in the future, PolyMet will follow the general planning methods described in Section 16.2 and below to identify, plan, and receive the USACE and MDNR approval of mitigation plans to develop additional mitigation credits.

If additional credits will be needed, PolyMet will search for wetland mitigation sites, first within the Project watershed and BSA #1 and if no practicable opportunities are identified, then within other neighboring BSAs to ensure that additional credits are available. Specifically, PolyMet will first evaluate opportunities in the Meadowlands and Floodwood area on field sites along with opportunities to preserve large areas of threatened, high quality wetland habitat in BSA #1. If credits cannot be developed in those areas, additional wetland restoration sites will be evaluated according to the appropriate criteria and polies of the USACE and the WCA.

17.0 Wetland Monitoring Plan for Potential Indirect Wetland Impacts

As discussed in section 16.3, wetland monitoring will be conducted to identify potential indirect impacts to wetlands caused by mining activities. Monitoring is proposed within all wetlands containing a potential indirect wetland impact factor rating of 3-5 and a sampling of those wetlands with factor ratings of 1-2 as shown in Large Figure 9 through Large Figure 11and described in Section 11.5. To determine if indirect impacts occur, hydrology, vegetation, and wetland boundaries will be monitored, documented, and compared with baseline monitoring and reference wetlands. A total of 42 monitoring wells and four reference wells are proposed to document potential indirect wetland impacts. The monitoring protocol described below will continue for the life of the Project, though portions of the monitoring design may be altered to improve the design or to eliminate unnecessary data collection.

17.1 Pre-Project Wetland Hydrology Monitoring Sites

Pre-Project hydrology monitoring of wetlands and groundwater within and surrounding the proposed mine has been conducted since 2005 at well locations approved by the USACE and MDNR. Hydrology data collected from previous years are presented in reports submitted to the USACE and the MDNR (Reference (52), Reference (53), Reference (54)). During 2008 through 2010, there were 21 locations monitored for hydrology (Large Figure 16 and Large Figure 17; Reference (52)). Pre-Project monitoring did not include collection of vegetation or wetland boundaries other than what was completed in the wetland delineation and baseline wetland type evaluation (Reference (16) and Reference (21)) and in other unrelated studies.

The primary objectives of the Pre-Project wetland hydrology monitoring study since 2005 have been to:

- gain a better understanding of the wetland hydrology at the Project site, i.e., defining whether specific wetlands are recharging the surficial deposits aquifer or are discharging to surface waters
- collect baseline hydrology data that could be used to assess the effect of the Project on wetland hydrology
- review the data collected in the hydrogeologic study along with the wetland hydrology data to determine whether specific wetlands have perched water tables or are in direct hydrologic connection with the surficial deposits aquifer
- determine the potential for indirect wetland impacts resulting from the Project

The majority of the Pre-Project monitoring locations will be utilized for future monitoring during mining activities. The monitoring at these locations will be expanded to include vegetation sampling and wetland boundaries. At the Mine Site, six existing monitoring wells will be removed (Wells 1, 4a, 6, 10, 12, 15, and 21; Large Figure 16 and Large Figure 17) because they are either located within areas of direct project impacts or areas where no potential indirect impacts are anticipated.

The pre-project wetland hydrology monitoring study has primarily followed the protocols described in the June 24, 2005 *Wetland Hydrology Study Plan* (Reference (55)), the May 13, 2008 *Addendum to Wetland Hydrology Monitoring Plan* (Reference (56)), and the April 12, 2010 *Addendum to Wetland Hydrology Monitoring Plan* (Reference (57)). Monitoring of the wells started in 2005 and will continue throughout the Project in accordance with the plans (Reference (55), Reference (56), Reference (57)) and changes proposed in this current plan.

Monitoring wells include either a recording well with an automatic water level data recorder or a manual well for manual data collection, which were often paired with recording wells. The manual well data were used to validate the general trends of the recording well data. Manual well data were collected twice per month in 2007 and once per month in 2008, 2009, and 2010. Electronic well data were collected every 2 to 4 hours from 2007 through 2010. Starting in 2008, all monitoring locations were instrumented with recording wells so water levels could be recorded every 2 to 4 hours during the growing season. The monitoring wells were typically installed to a depth of 2 to 5 feet below the ground surface; additional details on installation are provided in the monitoring plans (Reference (55), Reference (56), Reference (57)) and in the monitoring reports (Reference (52), Reference (53), Reference (54)).

17.2 Proposed Wetland Hydrology Monitoring Sites

In addition to the existing wetland monitoring locations, and Large Figure 16 through Large Figure 18 show proposed new wetland monitoring locations. The proposed additional monitoring locations occur in areas that lack an existing monitoring well and have been identified as having the potential for indirect wetland impacts using the potential wetland impact factor rating (from 0-6) in the potential indirect wetland impact analysis discussed in Section 11.5.

At the Mine Site, an additional 16 monitoring locations are proposed (Proposed Wells 25 through 40; Large Figure 9 and Large Figure 16). These additional wells are planned within all wetlands that have impact factor ratings of 2, 3 or 4 near the Project features and many wetlands with impact factor ratings of 1 that are located throughout the Mine Site.

Within the FTB area, four new wells are proposed (Proposed Wells TB9 through TB12; Large Figure 10 and Large Figure 17). The monitoring wells are planned within all wetlands with impact factor ratings of 3 and a sampling of wetlands with impact factor ratings of 1 and 2 located throughout the areas of potential indirect wetland impacts. The proposed monitoring locations will include a variety of wetland community types and occur throughout all areas of potential indirect impact factors (Large Figure 10 and Large Figure 17).

Within the Transportation Corridors, three new monitoring locations are proposed (Proposed Wells 41 through 43; Large Figure 11 and Large Figure 18) within wetlands that have impact factor ratings of 1.

Shallow water table monitoring wells will be installed at each of the proposed wetland monitoring locations depicted in Large Figure 16, Large Figure 17, and Large Figure 18. Each monitoring location will have one recording well and one manual well; if any wells are damaged, those will be replaced as soon as practical to maintain data continuity. Monitoring will continue in all of the existing wells, except for wells #1 and #6, which must be moved to avoid direct impact areas.

Hydrologic monitoring will continue at the existing and proposed monitoring locations and at reference wetland locations every year throughout the growing season for the life of the mine operation. If it is determined, that certain wells are not providing useful information, the monitoring may be modified with the concurrence of the USACE and MDNR. Monitoring wells will be installed following well installation methods described in the *Technical Standard for Water-Table Monitoring of Potential Wetland Sites* (Reference (58)).

17.3 Reference Wetland Hydrology Monitoring Sites

Pre-project monitoring locations include three reference wetlands approved by the USACE and MDNR to document the natural hydrologic fluctuations in wetlands that will not be affected by the Project. The reference wetland data will be used to facilitate interpretation of the Project hydrologic data. Two of the existing reference wetlands will be modified or eliminated because they are located within wetlands that have the potential for indirect impacts (Ref2, Large Figure 11 and RefTB8, Large Figure 10). Ref2 will be eliminated and a new well will be installed directly within the area of potential indirect impact and RefTB8 will remain in place to monitor potential indirect wetland impacts (Proposed Well TB8, Large Figure 10). Three new reference wetland monitoring locations are proposed, one within each major Project area. At the Mine Site, existing Well 13 will remain in place and serve as a reference wetland (Proposed Ref 4, Large Figure 9) because no potential indirect impacts are anticipated within the wetland. Along the Transportation Corridor one additional reference wetland is proposed (Proposed Ref 3, Large Figure 9 and Large Figure 11) to replace Ref 2. At the Flotation Tailings Basin, one new reference wetland (Proposed Ref TB13, Large Figure 10) is proposed to replace the existing Ref TB8 within a similar wetland type in which no potential indirect impacts are anticipated.

17.4 Wetland Vegetation Monitoring

Vegetation will be monitored in permanent plots that will be located at each of the monitoring locations, within 100 feet of the monitoring wells. The vegetation monitoring plots will be 10-meters by 10-meters in non-forested communities and 20-meters by 20-meters in forested and shrub-dominated communities. Vegetation monitoring plots will be located with a hand held GPS unit with sub-foot horizontal accuracy. The plots will be located at all monitoring locations, including reference wetlands.

Vegetation monitoring will be conducted every five years by a qualified ecologist or botanist. A vegetation inventory will be conducted within each permanent vegetation monitoring plot during June or July, when most plant species will be identifiable. At least 90% of the plant taxa will be inventoried and the percent cover estimated within each plot. All vascular plants occurring within the plots will be identified at least to genus level and preferably to species. All unidentified taxa will be enumerated so that their cover can be recorded and specimens will be collected to assist in later identification.

Baseline conditions for wetland vegetation will be established during the first growing season after permit issuance and at five year intervals throughout the life of the mine. Data will be used to document potential shifts in vegetation that are inconsistent with changes documented in the reference wetlands. Baseline data already available from existing plots, wetland delineation, monitoring, and other on-site studies may also be used to document baseline conditions, if these data may help to determine the cause of changes in vegetation characteristics or to demonstrate natural variability within the wetlands.

17.5 Wetland Boundary Monitoring

Wetland boundaries throughout the Project area, including areas of potential indirect wetland impacts, were delineated between 2005 and 2009 and were approved by the USACE and MDNR in 2012. Portions of the monitored wetlands will be reviewed every five years concurrent with the vegetation monitoring to evaluate wetland boundaries. Wetland boundaries will be field-delineated and located using a GPS with sub-foot horizontal accuracy. The field-based delineation will map at least 25% of the wetland boundary at each of the wetlands with monitoring locations (Large Figure 16, Large Figure 17, and Large Figure 18). The boundaries will be mapped on a rotating basis to include 25% of the wetland boundary every 5 years, including some overlap every 10 years. A transect composed of at least two wetland delineation sample points will be completed along a sections of the boundary reviewed in each of the monitored wetlands.

The delineation data will be compiled to map the boundary of each of the wetlands with monitoring locations. Based on the portion of the wetland that is delineated, the whole wetland boundary will be mapped using desktop review of current aerial photography, topography (LIDAR or site-specific data), and hydrology monitoring data. The results will be reported to the USACE and MDNR at the end of each year of monitoring.

17.6 Impact Criteria

The hydrology, vegetation, and wetland boundary monitoring data collected as part of this monitoring program will be evaluated to determine if adverse, indirect wetland impacts occur as a result of the Project. Criteria that may indicate an adverse, potential indirect wetland impact are based on the following threshold levels:

- A 50% reduction of the baseline wetland hydrology hydroperiod. Antecedent precipitation and reference wetland hydrology will be considered in the evaluation of wetland hydrology hydroperiod. The hydroperiod of a wetland is equal to the length of time and portion of the year the wetland holds ponded water or saturation within 12 inches of the soil surface. This period of time generally varies from year-to-year based on climatic conditions. Therefore, the judgment of surpassing this threshold will be evaluated considering the monitoring for each wetland conducted during the Pre-Project time period and data from reference wetlands of similar community types or hydrologic regime.

- A change in vegetation species composition of 25% or greater in one or more strata that is inconsistent with vegetation changes in the reference wetlands. For instance, if stinging nettles (*Urtica dioica*) cover changed from 5% to 30%, it may indicate changes in wetland hydrology and would be reviewed carefully relative to the hydrology data. Other factors may contribute to changes in vegetation (disturbances or species introductions) that may be unrelated to changes in wetland hydrology or the nearby Project; such factors would be considered, if appropriate.

- Loss of wetland area (as defined by the wetland boundary determination) that is inconsistent with wetland area loss at reference wetlands.

These criteria will be evaluated with consideration of the Project activities and likelihood that such Project activities are responsible for the changes. Should adverse, indirect wetland impacts be identified during the monitoring program, an estimation of such impacts will be included in the monitoring report in the year that they are first detected. The data for hydrology, vegetation, and wetland boundary monitoring will be compiled in a report, including methods, results, and evaluation of potential adverse indirect wetland impacts, which will be submitted to the USACE and MDNR by the end of each monitoring year.

17.7 Indirect Impact Mitigation

If indirect wetland impacts, based on the criteria of Section 17.6, occur, PolyMet will work with the USACE and MDNR to respond, which may include the option to provide compensatory mitigation for any documented indirect impacts. Compensatory mitigation would be based on the St. Paul District USACE Policy for wetland mitigation (Reference (44)) and as described in Section 16.3. Compensatory loss of wetland area may be mitigated in accordance with the mitigation ratios of direct wetland impacts described in Section 15.0. Partial drainage or other changes to the wetlands, that do not result in the wetland loss but exceed the threshold levels established in Section 17.6, may be mitigated at a lower ratio depending on the extent and degree of the changes to wetland function. The minimum ratio of mitigation credit to impact would be 0.25:1.

17.8 Adaptive Plan

An adaptive approach will be used to evaluate the most effective monitoring strategy for potential indirect effects. The monitoring plan will be updated annually based on results from the previous year. The monitoring plan criteria will be included in the Wetland Management Plan, which will contain all criteria and permit conditions. If indirect impacts are observed, additional monitoring may be developed to focus in those areas and/or to focus on a specific impact factor. Additional monitoring may include new monitoring locations in other wetlands and more detailed delineation and vegetation data collection.

The adaptive monitoring plan will be incorporated in two phases. Phase I of the adaptive monitoring plan will be broad-based monitoring to identify changes to wetlands or changes that may affect wetlands or surface waters. Phase II monitoring may be implemented to provide a more detailed assessment in a given area to analyze a potential impact factor. If necessary, the Phase II monitoring will be designed and implemented as needed to address the changes identified in Phase I monitoring. Phase II will be used to determine the need for additional mitigation or to develop a plan to control the changes identified in Phase I and minimize future impacts to wetlands.

17.9 Reporting

Monitoring data will be submitted to the USACE and MDNR annually for the life of the mine. Hydrology data will be presented every year to show monitoring locations, hydrographs, and analysis of wetland hydrologic conditions in the context of precipitation conditions. Vegetation and wetland boundary data will be presented every five years and will be used to determine the acreage of impacts and potential indirect impacts that are not evident based on hydrologic data. Indirect impacts will be assessed in the annual reports to the extent possible. Acreage of indirect impacts will be determined, if any, and will be used to determine the requirements for wetland mitigation credits, if such credits are needed. If compensatory mitigation is necessary, credits will be proposed in the annual report as described in Section 15.0.

18.0 References

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Large Table 1 Summary of Wetlands

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Fragments (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact(1)
Mine Site	1	3	0.42	0.00	0.00	0.42	Shallow marsh	Moderate	
Mine Site	3	3	0.35	0.00	0.00	0.35	Shallow marsh	Moderate	
Mine Site	5	2	0.61	0.61	0.00	0.00	Wet meadow	High	F
Mine Site	6	3	0.62	0.00	0.00	0.62	Shallow marsh	Moderate	
Mine Site	7	2	0.07	0.00	0.00	0.07	Wet meadow	Moderate	
Mine Site	8	2	6.80	6.80	0.00	0.00	Sedge meadow	Moderate	F,E
Mine Site	9	3	1.80	0.07	0.00	1.73	Shallow marsh	High	F
Mine Site	10	2	1.17	0.00	0.00	1.17	Sedge meadow	High	
Mine Site	11	8	8.88	0.00	0.00	8.88	Coniferous bog	High	
Mine Site	12	6	0.13	0.00	0.00	0.13	Alder thicket	High	
Mine Site	13	4	5.03	0.09	0.00	4.94	Deep marsh	High	F
Mine Site	14	2	0.33	0.33	0.00	0.00	Wet meadow	High	F
Mine Site	16	3	0.31	0.00	0.00	0.31	Shallow marsh	High	
Mine Site	18	3	18.90	18.90	0.00	0.00	Shallow marsh	High	E
Mine Site	19	3	1.68	0.05	0.00	1.63	Shallow marsh	High	E
Mine Site	20	2	17.06	16.96	0.10	0.00	Sedge meadow	High	E, Fr
Mine Site	22	3	1.43	0.00	0.00	1.43	Shallow marsh	High	
Mine Site	22A	7	0.89	0.00	0.00	0.89	Coniferous swamp	High	
Mine Site	24	6	0.80	0.39	0.00	0.41	Alder thicket	High	E
Mine Site	25	8	1.95	0.00	0.00	1.95	Coniferous bog	High	
Mine Site	27	8	1.07	1.07	0.00	0.00	Coniferous swamp	Moderate	E
Mine Site	29	3	12.02	0.00	0.00	12.02	Shallow marsh	High	
Mine Site	32	8	73.36	70.99	2.37	0.00	Coniferous bog	High	F,E, Fr
Mine Site	33A	6	18.46	5.77	0.00	12.69	Alder thicket	High	E
Mine Site	33B	7	4.56	0.00	0.00	4.56	Coniferous swamp	High	
Mine Site	37	6	2.39	2.39	0.00	0.00	Shrub-carr	High	F
Mine Site	43	6	8.29	7.26	0.00	1.03	Alder thicket	High	F
Mine Site	44	6	3.27	1.99	0.00	1.28	Alder thicket	High	E
Mine Site	45	6	37.55	28.83	3.58	5.14	Alder thicket	High	F,E, Fr
Mine Site	47	8	0.54	0.54	0.00	0.00	Open bog	High	F
Mine Site	48	8	89.16	27.80	1.86	59.5	Coniferous bog	High	F,E, Fr

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Fragments (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact[(1)]
Mine Site	48A	7	2.65	2.21	0.00	0.44	Coniferous swamp	High	F
Mine Site	51	6	7.47	7.45	0.02	0.00	Alder thicket	High	F, Fr
Mine Site	52	6	3.88	3.88	<0.01	0.00	Alder thicket	High	F,E, Fr
Mine Site	53	6	18.59	0.00	0.00	18.59	Alder thicket	High	
Mine Site	53A	7	2.35	0.00	0.00	2.35	Coniferous swamp	High	
Mine Site	53B	7	0.43	0.00	0.00	0.43	Coniferous swamp	High	
Mine Site	53C	7	2.88	0.00	0.00	2.88	Coniferous swamp	High	
Mine Site	54	7	4.11	0.00	0.00	4.11	Coniferous swamp	High	
Mine Site	54C	6	0.74	0.00	0.00	0.74	Alder thicket	High	
Mine Site	55	6	3.91	3.85	0.06	0.00	Alder thicket	High	F,E, Fr
Mine Site	56	8	2.79	2.79	0.00	0.00	Open bog	High	E
Mine Site	57	7	78.06	50.49	1.41	26.16	Coniferous swamp	High	F,E, Fr
Mine Site	58	6	34.58	0.00	0.00	34.58	Alder thicket	High	
Mine Site	60	6	6.71	6.71	0.00	0.00	Alder thicket	High	F
Mine Site	61	7	0.45	0.00	0.00	0.45	Coniferous swamp	High	
Mine Site	62	8	12.13	0.00	0.00	12.13	Coniferous bog	High	
Mine Site	64	7	0.31	0.00	0.00	0.31	Hardwood swamp	High	
Mine Site	68	7	23.81	10.89	0.09	12.83	Coniferous swamp	High	F,E, Fr
Mine Site	72	7	1.39	0.00	0.00	1.39	Coniferous swamp	High	
Mine Site	74	7	6.12	6.12	0.00	0.00	Hardwood swamp	High	E
Mine Site	76	8	3.92	2.21	0.00	1.71	Coniferous bog	High	E
Mine Site	77	8	13.01	0.92	<0.01	12.09	Coniferous bog	High	F,E, Fr
Mine Site	78	8	1.75	1.75	0.00	0.00	Coniferous bog	High	F
Mine Site	79	8	2.39	0.00	0.00	2.39	Coniferous bog	High	
Mine Site	80	8	0.29	0.22	0.08	0.00	Coniferous bog	High	F, Fr
Mine Site	81	7	1.68	1.44	0.24	0.00	Coniferous swamp	High	F,E, Fr
Mine Site	82	8	62.40	60.77	1.63	0.00	Coniferous bog	High	F,E, Fr
Mine Site	83	8	3.99	0.00	0.00	3.99	Open bog	High	
Mine Site	84	8	1.33	0.00	0.00	1.33	Coniferous bog	High	
Mine Site	85	8	1.41	1.41	0.00	0.00	Coniferous bog	High	E
Mine Site	86	8	2.47	2.46	0.01	0.00	Coniferous bog	High	F, Fr
Mine Site	88	8	5.58	5.02	0.00	0.56	Coniferous bog	High	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Fragments (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact[(1)]
Mine Site	90	8	176.08	34.22	0.00	141.86	Coniferous bog	High	F,E
Mine Site	90A	8	7.91	1.20	0.00	6.71	Open bog	High	F
Mine Site	95	8	2.54	2.54	0.00	0.00	Coniferous swamp	High	E
Mine Site	96	8	17.30	13.14	0.00	4.16	Coniferous bog	High	F,E
Mine Site	97	8	4.46	2.57	1.89	0.00	Coniferous bog	High	F,E, Fr
Mine Site	98	8	15.50	15.07	0.42	0.43	Coniferous bog	High	F,E, Fr
Mine Site	99	8	1.40	0.49	0.00	0.91	Coniferous bog	High	F,E
Mine Site	100	8	176.19	102.96	3.44	69.79	Coniferous bog	High	F,E, Fr
Mine Site	100A	6	1.66	1.66	0.00	0.00	Alder thicket	High	F
Mine Site	101	8	14.21	11.73	0.08	2.40	Coniferous bog	High	F,E, Fr
Mine Site	103	8	118.84	109.97	8.86	0.00	Coniferous bog	High	F,E, Fr
Mine Site	104	8	3.57	3.47	0.10	0.00	Coniferous bog	High	F, Fr
Mine Site	105	8	15.48	0.00	0.00	15.48	Coniferous bog	High	
Mine Site	107	8	40.92	31.63	0.10	9.19	Coniferous bog	High	F,E, Fr
Mine Site	107A	7	1.74	1.69	0.05	0.00	Coniferous swamp	High	F,E, Fr
Mine Site	107B	3	4.51	2.89	0.00	1.62	Shallow marsh	High	F,E
Mine Site	107C	6	27.60	27.60	0.00	0.00	Alder thicket	High	E
Mine Site	114	8	0.73	0.73	0.00	0.00	Coniferous bog	High	F
Mine Site	120	3	0.58	0.12	0.00	0.46	Shallow marsh	Moderate	E
Mine Site	200	7	6.36	6.36	0.00	0.00	Hardwood swamp	High	F
Mine Site	201	2	13.49	13.49	0.00	0.00	Wet meadow	High	F
Mine Site	202	8	3.11	3.11	0.00	0.00	Open bog	High	F
Mine Site	552	8	8.72	8.72	0.00	0.00	Coniferous bog	High	F
Mine Site	567	3	1.40	1.40	0.00	0.00	Shallow marsh	High	F
MINE SITE SUBTOTAL	**87**		**1297.78**	**758.19**	**26.39**	**513.19**		**80/87 High** **7/87 Moderate**	
Railroad Connection Corridor	1038	7	0.07	0.07	0.00	0.00	Coniferous swamp	High	F
Railroad Connection Corridor	R-3	6	0.10	0.10	0.00	0.00	Shrub-carr	High	F
Railroad Connection Corridor	R-4	6	0.20	0.20	0.00	0.00	Alder thicket	High	F
Railroad Connection Corridor	R-5	3	0.07	0.07	0.00	0.00	Shallow marsh	High	F
RAILROAD CONNECTION CORRIDOR SUBTOTAL	**4**		**0.44**	**0.44**	**0.00**	**0.00**		**4/4 High**	
Dunka Road and Utility Corridor	22B	3	0.34	0.34	0.00	0.00	Shallow marsh	High	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Fragments (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact[(1)]
Dunka Road and Utility Corridor	22C	6	0.38	0.38	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	54A	7	0.60	0.60	0.00	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	54B	6	0.13	0.13	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	54D	7	0.09	0.09	0.00	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	390	6	0.41	0.41	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	392	6	0.14	0.14	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	394	7	0.64	0.64	0.00	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	395	7	0.01	0.01	0.00	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	396	6	0.65	0.65	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	400	8	0.14	0.14	0.00	0.00	Coniferous bog	High	F
Dunka Road and Utility Corridor	553	7	0.09	0.09	0.00	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	554	7	0.11	0.11	0.00	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	569	6	0.68	0.68	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	716	6	0.02	0.02	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	814	8	0.75	0.75	0.00	0.00	Coniferous bog	High	F
Dunka Road and Utility Corridor	862	6	0.78	0.78	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1034	6	0.02	0.02	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1035	6	0.16	0.16	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1124	6	0.44	0.44	0.00	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	R-7	3	0.18	0.18	0.00	0.00	Shallow marsh	High	F
DUNKA ROAD AND UTILITY CORRIDOR SUBTOTAL	**21**		**6.76**	**6.76**	**0.00**	**0.00**		**21/21 High**	
FTB	251	6	1.43	1.43	0.00	0.00	Alder thicket	Moderate	C
FTB	272	4	1.11	1.10	0.01	0.00	Deep marsh	Low	C, Fr
FTB	278	6	1.04	0.23	0.00	0.81	Alder thicket	Low	C
FTB	279	6	4.84	3.33	<0.01	1.51	Alder thicket	Low	C, Fr
FTB	282	3	14.25	7.42	0.00	6.83	Shallow marsh	Moderate	C
FTB	284	6	2.92	2.51	0.00	0.41	Alder thicket	Low	C
FTB	290	7	0.48	0.22	0.02	0.24	Coniferous swamp	Moderate	F,E, Fr
FTB	292	4	1.71	1.29	0.00	0.42	Deep marsh	Low	C
FTB	307	3	0.78	0.77	<0.01	0.00	Shallow marsh	Low	C, Fr
FTB	308	4	7.17	1.95	0.00	5.22	Deep marsh	Low	C

Project Area	**Wetland ID**	**Dominant Circular 39 Community**	**Total Wetland Area within the Project Area (acres)**	**Direct Wetland Impacts (acres)**	**Fragments (acres)**	**Remaining Wetland Area (acres)**	**Dominant Eggers and Reed Wetland Community**	**Wetland Quality**	**Type of Direct Impact[(1)]**
FTB	309	2	0.02	0.02	0.00	0.00	Wet meadow	Low	C
FTB	312	6	1.98	1.33	0.00	0.65	Shrub-carr	Low	C
FTB	314	3	24.87	5.70	0.00	19.17	Shallow marsh	Low	C
FTB	573	3	0.12	0.00	0.00	0.12	Shallow marsh	Low	
FTB	582	4	27.49	8.11	0.00	19.38	Deep marsh	Low	C
FTB	585	6	1.58	0.00	0.00	1.58	Alder thicket	Low	
FTB	586	4	1.89	1.53	0.00	0.36	Deep marsh	Low	C
FTB	587	3	0.97	0.17	0.00	0.80	Shallow marsh	Low	C
FTB	590	3	5.43	5.38	0.00	0.05	Shallow marsh	Low	C
FTB	591	4	2.71	0.70	0.00	2.01	Deep marsh	Low	C
FTB	593	4	9.80	8.47	0.15	1.18	Deep marsh	Low	C, Fr
FTB	594	4	0.06	0.00	0.00	0.06	Deep marsh	Low	
FTB	595	4	2.14	1.09	0.01	1.04	Deep marsh	Low	F, Fr
FTB	811	7	0.20	0.20	0.00	0.00	Coniferous swamp	Low	C
FTB	968	7	13.76	10.27	0.00	3.49	Coniferous swamp	Low	C
FTB	1027	6	0.20	0.00	0.00	0.20	Alder thicket	Moderate	
FTB	1125	2	0.07	0.00	0.00	0.07	Sedge meadow	Low	
FTB	1126	7	0.69	0.00	0.00	0.69	Hardwood swamp	Low	
FTB	1134	3	14.45	8.71	0.04	5.70	Shallow marsh	Low	C, Fr
FTB	1135	4	0.51	0.00	0.00	0.51	Deep marsh	Low	
FTB	1139	3	20.25	2.54	0.00	17.71	Shallow marsh	Low	C
FTB	1155	3	0.55	0.41	0.15	0.00	Shallow marsh	Low	C, Fr
FTB	1156	3	14.49	11.08	0.06	3.35	Shallow marsh	Low	C, Fr
FTB	1159	3	0.05	0.00	0.05	0.00	Shallow marsh	Low	Fr
FTB	1160	5	0.85	0.00	0.00	0.85	Deep water	Low	
FTB	T1	4	1.94	0.11	0.00	1.83	Deep marsh	Low	F
FTB	T2	4	0.90	0.90	0.00	0.00	Deep marsh	Low	F
FTB	T3	2	0.09	0.09	0.00	0.00	Wet meadow	Low	F
FTB	T4	2	1.02	1.02	0.00	0.00	Wet meadow	Low	F
FTB	T5	2	0.24	0.24	0.00	0.00	Wet meadow	Low	F
FTB	T6	6	0.07	0.07	0.00	0.00	Shrub-carr	Low	F
FTB	T7	3	0.92	0.92	0.00	0.00	Shallow marsh	Low	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Fragments (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact(1)
FTB	T8	2	0.04	0.01	0.00	0.03	Wet meadow	Low	F
FTB	T10	4	1.48	1.48	0.00	0.00	Deep marsh	Low	F
FTB	T11	4	0.95	0.95	0.00	0.00	Deep marsh	Low	F
FTB	T12	3	0.39	0.39	0.00	0.00	Shallow marsh	Low	F
FTB	T13	4	1.05	0.52	0.00	0.53	Deep marsh	Low	F
FTB	T14	4	45.20	45.20	0.00	0.00	Deep marsh	Low	E
FTB	T15	3	1.70	1.70	0.00	0.00	Shallow marsh	Low	F
FTB SUBTOTAL	**49**		**236.85**	**139.56**	**0.49**	**96.8**		**4/49 Moderate 45/49 Low**	
HRF	1155	3	35.45	6.89	0.00	28.56	Shallow marsh	Low	F
HRF	1159	3	0.62	0.62	0.00	0.00	Shallow marsh	Low	F
HRF SUBTOTAL	**2**		**36.07**	**7.51**	**0.00**	**28.55**		**2/2 Low**	
Colby Lake Water Pipeline Corridor	P1	4	0.23	0.00	0.00	0.23	Deep marsh	Low	
Colby Lake Water Pipeline Corridor	P2	6	0.03	0.00	0.00	0.03	Shrub-carr	Low	
Colby Lake Water Pipeline Corridor	P3	3	0.25	0.00	0.00	0.25	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P4	6	1.28	0.00	0.00	1.28	Shrub-carr	Low	
Colby Lake Water Pipeline Corridor	P5-1	4	0.77	0.00	0.00	0.77	Deep marsh	Low	
Colby Lake Water Pipeline Corridor	P5-2	3	0.14	0.00	0.00	0.14	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P6	3	0.18	0.00	0.00	0.18	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P7-1	3	0.11	0.00	0.00	0.11	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P7-2	3	1.90	0.00	0.00	1.90	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P8	2	0.07	0.00	0.00	0.07	Wet meadow	Low	
Colby Lake Water Pipeline Corridor	P9	2	1.28	0.00	0.00	1.28	Wet meadow	Low	
Colby Lake Water Pipeline Corridor	P10	6	0.41	0.00	0.00	0.41	Alder thicket	Low	
Colby Lake Water Pipeline Corridor	P11	6	0.03	0.00	0.00	0.03	Shrub-carr	Low	
Colby Lake Water Pipeline Corridor	P12	6	0.31	0.00	0.00	0.31	Shrub-carr	Moderate	
COLBY LAKE WATER PIPELINE CORRIDOR	**14**		**6.99**	**0.00**	**0.00**	**6.99**		**1/14 Moderate 13/14 Low**	
PROJECT TOTAL	**177**		**1,584.89**	**912.46**	**26.88**	**645.54**		**105/177 High 12/177 Moderate 60/177 Low**	

(1) The types of direct wetland impact disturbance factors include excavation €, fill (F), fragmentation (Fr), and containment system (C).

Large Table 2 Summary of Wetland Impacts(1)

Project Area	Circular 39 Wetland Classification	1	2	2	3	4	5	6	6	7	7	8	8		
	Eggers and Reed Wetland Community	Seasonally Flooded	Fresh (Wet) Meadow	Sedge Meadow	Shallow Marsh	Deep Marsh	Shallow, Open Water	Shrub-Carr	Alder Thicket	Hardwood Swamp	Coniferous Swamp	Open Bog	Coniferous Bog	Deepwater	Wetland Total
Mine Site	Direct Impact (acres)	0.00	14.43	23.76	23.43	0.09	0.00	2.39	95.39	12.48	70.33	7.64	508.25	0.00	758.19
	Fragmented (acres)	0.00	0.00	0.10	0.00	0.00	0.00	0.00	3.66	0.00	1.79	0.00	20.84	0.00	26.39
	# of impacted wetlands	0	3	2	6	1	0	1	11	2	7	4	22	0	59
Railroad Connection Corridor	Direct Impact (acres)	0.00	0.00	0.00	0.07	0.00	0.00	0.10	0.20	0.00	0.07	0.00	0.00	0.00	0.44
	Fragmented (acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	# of impacted wetlands	0	0	0	1	0	0	1	1	0	1	0	0	0	4
Dunka Road and Utility Corridor	Direct Impact (acres)	0.00	0.00	0.00	0.52	0.00	0.00	0.00	3.81	0.00	1.54	0.00	0.89	0.00	6.76
	Fragmented (acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	# of impacted wetlands	0	0	0	2	0	0	0	11	0	6	0	2	0	21
FTB Area	Direct Impact (acres)	0.00	1.38	0.00	45.19	73.40	0.00	1.40	7.50	0.00	10.69	0.00	0.00	0.00	139.56
	Fragmented (acres)	0.00	0.00	0.00	0.3	0.17	0.00	0.00	<0.01	0.00	0.02	0.00	0.00	0.00	0.49
	# of impacted wetlands	0	5	0	13	14	0	2	4	0	3	0	0	0	41
HRF	Direct Impact (acres)	0.00	0.00	0.00	7.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.51
	Fragmented (acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	# of impacted wetlands	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Colby Lake Water Pipeline Corridor	Direct Impact (acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Fragmented (acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	# of impacted wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	(acres)	0.00	15.81	23.86	77.02	73.66	0.00	3.89	110.56	12.48	84.44	7.64	529.98	0.00	939.34

(1) Wetland impacts include direct wetland impacts and fragmented wetlands.

Large Table 3 Summary of Reduced Aquatic Ecosystem Impacts Based on Draft Alternative Development

Refinement made from Alternatives Evaluation	Project Aspects Changed	Environmental Impact Reduced
Mine Site Alternative in DEIS adopted as part of Proposed Project and refined based on additional drilling and engineering with Cat 1 Stockpile Groundwater Containment System	Only Category 1 Stockpile is permanent – all other stockpiles relocated to East Pit	Three permanent stockpiles eliminated and any associated impacts will therefore be temporary. Also, highest sulfur rock backfilled to East Pit and stored subaqueously.
	Move Temporary Category 4 Stockpile to be above Central Pit and Central Pit rescheduled so that floor of pit above East Pit backfill during operations	Reduce wetland impacts
	Eliminate Category 3 waste rock stockpile by combining Category 2/3 waste rock and lean ore stockpiles at the location of the Category 4 and Category 3 waste rock stockpiles.	Reduce wetland impacts
	Revise haul roads to reduce wetland fragmentation	Reduce wetland impacts
	All Category 1 waste rock in East Pit or Category 1 Stockpile	Category 1 stockpile can be closed and cover system construction begin in Year 14 - less water flow through the pile once cover is constructed
	Replace Category 1 liner with Groundwater Containment System and pump collected water to WWTF	Capture and treat virtually all water from stockpile
	Maximize use of Category 1 rock and overburden for construction in above liner or below the water table applications	Any water that contacts these materials will be captured and treated, or used in an application where the redox conditions will not change
	Minor changes in pit and stockpile footprints due to updated drilling	Reduce wetland impacts
Category 1 Stockpile Cover System	ET cover system replaced with membrane cover system	Minimize long term water flow through the stockpile

Refinement made from Alternatives Evaluation	Project Aspects Changed	Environmental Impact Reduced
Waste Water Treatment Facility (WWTF)	Plan for sulfate treatment during operations and upgrade to Reverse Osmosis (RO) for long term	Project discharge meets wild rice standard
New Concentrate Shipping Building near the Additive Plant with dewatering by filter instead of dryer	New dewatering equipment and required concentrate storage will not fit in existing building; alternate location evaluated	New building on disturbed ground = no wetland impacts
Relocate Hydrometallurgical Residue Facility	Move Hydrometallurgical Residue Facility from south end of Cell 2W to the Emergency Basin	Eliminate concerns about liner failure on location that is still settling and provide a virtually zero leakage liner system
FTB Containment System	Vertical wells on north side of FTB replaced by trench/barrier system on north and west sides	Capture and treat virtually all groundwater and surface seepage from FTB
Enhanced FTB Pond Cover (liner)	Additional bentonite amendment to further reduce seepage - results in routine overflow in closure	Further reduce seepage
Waste Water Treatment Plant (WWTP)	Pumping of excess water to Partridge River replaced by RO treatment of excess water also cleans up pond to allow overflow in closure	Project discharge meets wild rice standard
Adaptive Water Management Plan (AWMP)	Formal plan to adaptively manage water in operations, reclamation, and long term closure via financially assured fixed and adaptive engineering controls that relies on mechanical treatment but has the ultimate objective of non-mechanical treatment in the long term	Provides a high degree of certainty in achieving water quality objectives based on proactive management; lessens impacts in the long term with low maintenance non-mechanical treatment

Large Table 4 Adjoining Landowners

Owner Name	Mailing Address
Allete Inc.	30 West Superior Street Duluth, MN 55802
Blandin Paper Company	115 Southwest 1st Street Grand Rapids, MN 55744
Cliffs Erie LLC	c/o Cliffs Natural Resources, Inc. 200 Public Square, Suite 3100 Cleveland, OH 44114-2315
Cliffs Mining Services Company	4870 Waisanen Road PO Box 115 Embarrass, MN 55732
Cole, Bill C.	Marjorie A. Contos 129 West Anoka Street Duluth, MN 55803 or Marjorie Alison Contos Living Trust c/o US Bank Duluth-Trust 130 West Superior Street Duluth, MN 55802
Contos, M Alison et al.	NorthShore Mining Company James R. Korpi, CEO 10 Outer Drive Silver Bay, MN 55614
Cyprus Northshore Mining Corporation	115 Southwest 1st Street Grand Rapids, MN 55744
DuNord Land Company, LLC	William Blundin, Manager 138 East 65th Street New York, NY 10065
Erickson, William	1328 East 41st Street Hibbing, MN 55746
Glacier Park Company	1011 Western Avenue Seattle, WA 98104
Hilden, Teri	6309 Coyote Trail Lino Lakes, MN 55014
JER Minerals, Inc.	605 West 37th Street Hibbing, MN 55746
Johnson Minerals, Inc.	Peter J. Johnson, CEO 2214 Birch Point Road Tower, MN 55790

Owner Name	Mailing Address
Joki, Floyd E.	7607 North Skarp Road Embarrass, MN 55732
Kainz, Bruce R.	1202 Winton Road Ely, MN 55731
Lawless, John A. et.al.	7333 Mesaba Road Embarrass, MN 55732
McLean, C. Russell Jr.	2132 Woodland Avenue Duluth, MN
Mesabi Mining LLC	6714 Pointe Inverness Way Fort Wayne, IN 46804
Mesabi Nugget Delaware LLC	Jeff Hansen, Manager PO Box 235 Hoyt Lakes, MN 55750
Minnesota Power & Light	30 West Superior Street Duluth, MN 55802
Northshore Mining	James R. Korpi, CEO 10 Outer Drive Silver Bay, MN 55614
R & R Timber LLP.	Paul Scherer 4734 Byke Road Embarrass, MN 55732
Robinson Land Trust	c/o Paul Martin 729 Old Stable Place Walnut Creek, CA 94596
RGGS Land & Minerals Ltd LP	100 Waugh Drive, Suite 400 Houston, TX 77007
Salo, Robert A. et al.	4510 Kenaitze Court Kenai, Alaska 99611
Skluzacek, Paul D.	PO Box 157 Afton, MN 55001
State of Minnesota	DNR Central Office 500 Lafayette Road St. Paul, MN 55155-4040
Underland, Aaron M.	5326 Road 50 Aurora, MN 55705
United States Of America	USA, Forest Service Superior National Forest 8901 Grand Avenue Place Duluth, MN 55808

Owner Name	Mailing Address
Weinert, Christopher	403 8th Street North Sauk Rapids, MN 56739
Williams, Dorothy	4604 Heights Drive Columbia Heights, MN 55421
William J. Todd Jr. Living Trust	1075 Ortman Road Marquette, MI 49855
Williams, Richard and Beverly	16 Victoria Drive Webster, MA 01570
Youngman, David G.	25 Basswood Circle Babbitt, MN 55706

Large Table 5 Mitigation Credit Summary (1)

Community / Credit Type	Within Project Watershed				Outside Project Watershed				Total Wetland Mitigation (acres)	Credit Percent	Total Wetland Mitigation Credits
	Zim Sod Wetland Mitigation (acres)	On-Site Wetland Mitigation (acres)	Credit Percent	Total Wetland Mitigation Credits	Aitkin Wetland Mitigation (acres)	Hinckley Wetland Mitigation (acres)	Credit Percent	Total Wetland Mitigation Credits			
Off-Site Restoration of drained wetland (2)											
Type 1 Seasonally Flooded	0	---	100%	0	0	20.1	100%	20.1	20.1	100%	20.1
Type 2 Fresh (Wet) Meadow	0	---		0	21.8	14.3		36.1	36.1		36.1
Type 2 Sedge Meadow	0	---		0	47.1	39.1		86.2	86.2		86.2
Type 3 Shallow Marsh	0	---		0	86.9	1.4		88.3	88.3		88.3
Type 4 Deep Marsh	0	---		0	33.6	0		33.6	33.6		33.6
Type 5 Shallow, Open Water	8.3	---		8.3	0	0		0	8.3		8.3
Type 6 Shrub-Carr	0	---		0	83.9	87.1		171	171		171.0
Type 6 Alder Thicket	0	---		0	82.8	27.4		110.2	110.2		110.2
Type 7 Hardwood Swamp	0	---		0	52.6	7.1		59.7	59.7		59.7
Type 7 Coniferous Swamp	0	---		0	89.1	8.4		97.5	97.5		97.5
Type 8 Open Bog	0	---		0	74.2	0		74.2	74.2		74.2
Type 8 Coniferous Bog	401.5	---		401.5	238.2	101.2		339.4	740.9		740.9
Off-Site Restoration of partially-drained wetland (3)											
Type 2 Sedge Meadow	0	---	50%	0	0	0.8	50%	0.4	0.8	50%	0.4
Type 7 Hardwood Swamp	0	---		0	0	6.1		3.1	6.1		3.1
Type 8 Coniferous Bog	69.6	---		34.8	0	0		0	69.6		34.8
Off-Site Site Preservation (4)											
Type 8 Coniferous Bog	28.8	---	12.5%	3.6	0	0	12.5%	0	28.8	12.5%	3.6
Off-Site Upland Buffer (5)	22.7	---	25%	5.7	123.1	79.2	25%	50.6	225	25%	56.3
On-Site Wetland	---	101.8	---	---	---	---	---	---	101.8	---	---
On-Site Upland Buffer	---	---	---	---	---	---	---	---	---	---	---
Upland Buffer Total	**22.7**	**---**	---	**5.7**	**123.1**	**79.2**	---	**50.6**	**225.0**	---	**56.3**
Wetland Total	**508.2**	**101.8**	---	**448.2**	**810.2**	**313.0**	---	**1,119.8**	**1,733.2**	---	**1,568.0**
Total	**530.9**	**101.8**	---	**453.9**	**933.3**	**392.2**	---	**1,170.3**	**1,958.2**	---	**1,624.2**

(1) Totals may not add exactly due to rounding.

(2) Credits for restoration of completely drained wetlands are worth 100% of the acreage restored based on USACE St. Paul District Policy (Restoration via re-establishment) and the Minnesota WCA Chap. 8420.0526 Subp. 3

(3) Credits for restoration of partially-drained wetlands are worth 50% of the acreage restored based on USACE St. Paul District Policy (Restoration via rehabilitation) and the Minnesota WCA Chap. 8420.0526 Subp. 4

(4) Credits for wetland preservation are worth 12.5% of the acreage protected under a conservation easement based on USACE St. Paul District Policy (Preservation) and the Minnesota WCA Chap. 8420.0526 Subp. 9 (per Minnesota Statute 103G.2251 modified August 1, 2011.)

(5) Credits for upland buffers are worth 25% of the acreage of native, noninvasive vegetation established or maintained adjacent to the wetland based on USACE St. Paul District Policy (Preservation) and the Minnesota WCA Chap. 8420.0526 Subp. 1

Large Table 6 Wetland Mitigation Utilizing USACE Credits (1)

Wetland or Credit Type	Mitigation Credits Available					NorthMet Project Proposed Direct Wetland Impacts in Acres(1,3)			Total Credits Required for Mitigation at Base Ratio	No More Than 2 Apply			Total Applied Mitigation Credits (9), (10)	Applied Mitigation Ratio (11)
	Zim	Aitkin	Hinckley	On-site(2)	Total	Non-forested, Non-bog, and Low or Medium quality (Base Ratio 1.5:1) (4)	Bogs, Forested, and High quality Wetlands (Base Ratio 2:1) (5)	Total Impact Acres		Incentive for in-kind -0.25:1	Incentive for credits in-place -0.25:1	Incentive for credits in-advance (8) -0.25:1		
Deepwater	0	0	0	---	0	0				---		---		
Type 1 Seasonally Flooded	0	0	20.1	---	**20.1**	0	0	**0.0**	0	---	---	---		---
Type 2 Fresh (Wet) Meadow	0	21.8	14.3	---	**36.1**	1.4	14.4	**15.8**	30.9	(4.0)	---	(4.0)	**23.0**	1.46
Type 2 Sedge Meadow	0	47.1	39.5	---	**86.6**	6.8	17.1	**23.9**	44.3	(6.0)	---	---	**38.3**	1.61
Type 3 Shallow Marsh	0	86.9	1.4	---	**88.3**	53.1	23.9	**77.0**	127.5	(19.3)	---	(19.3)	**89.0**	1.16
Type 4 Deep Marsh	0	33.6	0	---	**33.6**	73.6	0.1	**73.7**	110.6	(8.4)	---	(18.4)	**83.7**	1.14
Type 5 Shallow, Open Water	8.3	0	0	---	**8.3**	0	0	**0.0**	0.0	---	---	---	**0.0**	---
Type 6 Shrub-Carr	0	83.9	87.1	---	**171.0**	1.4	2.5	**3.9**	7.1	(1.0)	---	---	**6.1**	1.57
Type 6 Alder Thicket	0	82.8	27.4	---	**110.2**	7.5	103.1	**110.6**	217.4	(27.6)	---	---	**189.9**	1.72
Type 7 Hardwood Swamp	0	52.6	10.2	---	**62.8**	0	12.5	**12.5**	24.9	(3.1)	---	---	**21.8**	1.75
Type 7 Coniferous Swamp	0	89.1	8.4	---	**97.5**	0	84.4	**84.4**	168.9	(21.1)	---	---	**147.8**	1.75
Type 8 Open Bog	0	74.2	0	---	**74.2**	0	7.6	**7.6**	15.3	(1.9)	---	---	**13.4**	1.75
Type 8 Coniferous Bog (in watershed)	440.0			---	**440.0**	0	530.0	**530.0**	1060.0	(132.5)	(110.0)	---	**817.5**	1.54
Type 8 Coniferous Bog (out-of-watershed)		238.2	101.2	---	**339.4**						---			
Wetland - In-Kind/In-Place	---	---	---	---	**---**	---	---	**---**	---	---	---	---	**---**	---
Wetland Total	*448.3*	*810.2*	*309.5*	*0*	***1,567.9***	*143.8*	*795.6*	**939.4**	*1,806.8*	---	---	---	***1,430.5***	---
Upland Buffer	5.7	30.8	19.8	---	**56.3**	---	---	---	---	---	---	---		---
Total	**454.0**	**841.0**	**329.3**	**0**	**1,624.2**	**939.4**			**1,806.8**	**(224.7)**	**(110.0)**	**(41.6)**	**1,430.5**	1.52
										(376.3)				
Total Surplus Wetland Mitigation Credits for Project (Total Credit minus Total Applied Mitigation Credit)					**193.7**									

(1) Totals may not add exactly due to rounding.

(2) No wetland types defined.

(3)The total includes fragmentation of wetlands (26.9 acres).

(4) Base ratio 1.5:1 per USACE St. Paul District Policy for wetlands that are not considered High quality or Difficult-to-Replace, which includes forested wetland and bog communities.

(5) Base ratio 2:1 per USACE May 29, 2013 Draft Memorandum for wetlands that are High quality or Difficult-to-Replace, which includes forested wetland and bog communities.

(6) Credit Surplus after 1:1 In-Kind Compensation = Total Credits Available minus Total Impact Area

(7) Remaining Mitigation Required after 1:1 In-Kind = Total Credits Required at Base Ratio minus Total Impact Area

(8) Based on USACE May 29, 2013 Draft Memorandum guidance for in-advance qualification assuming all mitigation will be constructed one full growing season before wetland impacts occur.

(9) Total Applied Mitigation Credits = Total Credits Required for Mitigation at Base Ratio minus Incentive Credits.

(10) Credits applied may include surplus credits from different wetland types.

(11) The ratio of credits applied to project impacts (not including the surplus credits).

Large Table 7 Wetland Mitigation Utilizing WCA Credits(1)

Wetland or Credit Type	Mitigation Credits					NorthMet Project Proposed Direct Wetland Impacts (acres)(1,3)	Credit Surplus after 1:1 In-Kind Replacement (Deficit)	Additional Mitigation Required (4) +0.5:1	Total Mitigation Ratio
	Zim Sod	Aitkin	Hinckley	On-site(2)	Total				
Type 1 Seasonally Flooded	0	0	20.1	---	20.1	0	20.1	---	1.5:1
Type 2 Fresh (Wet) Meadow	0	21.8	14.3	---	36.1	15.8	20.3	7.9	1.5:1
Type 2 Sedge Meadow	0	47.1	39.5	---	86.6	23.9	62.8	11.9	1.5:1
Type 3 Shallow Marsh	0	86.9	1.4	---	88.3	77.0	11.3	38.5	1.5:1
Type 4 Deep Marsh	0	33.6	0	---	33.6	73.7	(40.1)	36.8	1.5:1
Type 5 Shallow, Open Water	8.3	0	0	---	8.3	0	8.3	0.0	1.5:1
Type 6 Shrub-Carr	0	83.9	87.1	---	171.0	3.9	167.1	1.9	1.5:1
Type 6 Alder Thicket	0	82.8	27.4	---	110.2	110.6	(0.4)	55.3	1.5:1
Type 7 Hardwood Swamp	0	52.6	10.2	---	62.8	12.5	50.3	6.2	1.5:1
Type 7 Coniferous Swamp	0	89.1	8.4	---	97.5	84.4	13.1	42.2	1.5:1
Type 8 Open Bog	0	74.2	0	---	74.2	7.6	66.6	3.8	1.5:1
Type 8 Coniferous Bog (in watershed)	440.0			---	440.0	530.0	249.3	---	1:1(5)
Type 8 Coniferous Bog (out of watershed)		238.2	101.2	---	339.4			45.0	1.5:1(6)
Wetland - In-Kind/In-Place (applied to deficit)	---	---	---	---	---	---	---	---	---
Wetland Total	*448.3*	*810.2*	*309.5*	*0*	*1,567.9*	*939.4*	*628.6*	*249.7*	---
Upland Buffer	5.7	30.8	19.8	---	56.3	---	56.3	---	---
Total	**454.0**	**841.0**	**329.3**	**0**	**1,624.2**	**939.4**	**684.9**	**249.7**	1.26:1 (7)
Total Surplus Wetland Mitigation Credits for Project (Total credits minus 1:1 credits minus additional mitigation required)							**435.2**		
Total Wetland Mitigation Credits Used for Project							**1,189.1**		

(1) Totals may not add exactly due to rounding.

(2) No wetland types defined.

(3) The total includes fragmentation of wetlands (26.4 acres).

(4) Additional mitigation required for mitigation out of the watershed at Aitkin and Hinckley sites.

(5) Assumes 1:1 replacement since impacts will be compensated in-kind and ahead of time.

(6) Excess mitigation credits calculated based on bog impacts not replaced in the watershed at Zim Sod (509.1-440=69.2) times one-half (0.5) equals 34.6 credits.

(7) The ratio of total credits to project impacts (not including the total surplus credits).

Large Table 8 Summary of Soils in the Mine Site

Mapping Entity	Soil ELT/ Map Unit	Soil Name	Soil ELTP (for USFS Soils only)	Area (acres)	Percent of Project Area	Drainage/ Hydric Status
USFS	16	Upland Shallow Loamy Dry	18A[a]	912.1	30.3%	Well drained
USFS		Upland Shallow Loamy Dry	18B[a]	745.9	24.7%	Well drained
USFS	6	Lowland Organic Acid to Neutral	24[b]	887.2	29.4%	Poorly drained
USFS		Lowland Organic Acid to Neutral	32[c]	10.3	<1%	Poorly drained
USFS	2	Lowland Loamy Wet	47[d]	267.6	8.9%	Poorly drained
USFS	1	Lowland Loamy Moist	7[d]	7.3	<1%	Somewhat poorly drained
NRCS	F35D	Eveleth-Conic,, bouldery-Aquepts, rubbly complex	N/A	86.4	2.8%	Partially hydric
NRCS	F166A	Aquepts, rubbly-Tacoosh-Rifle complex	N/A	46.6	1.5%	Hydric
NRCS	F6B	Soudan-Eaglesnest-Babbit	N/A	34.7	1.2%	Not hydric
NRCS	F12B	Eaglesnest-Babbit complex	N/A	12.6	<1%	Partially hydric
NRCS	F129A	Tacoosh mucky peat	N/A	5.9	<1%	Hydric
NRCS	Unknown/ not mapped	Unknown/not mapped	N/A	18.2	<1%	Unknown

[a] This ELTP is comparable to the Whalsten and Conic NRCS St. Louis County map units

[b] This ELTP is comparable to the Rifle NRCS St. Louis County map unit

[c] This ELTP is comparable to the Cathro NRCS St. Louis County map unit

[d] This ELTP is comparable to the Babbitt NRCS St. Louis County map unit

Large Table 9 Summary of Soils in the Plant Site

Soil Map Unit	Soil Name	Area (acres)	Percent of Project Area	Hydric Status
1050	Tailings basin	3040.0	68.8%	Unknown
1003B	Udorthents, loamy (cut and fill land)	463.1	10.5%	Unknown
F3D	Eveleth-Eaglesnest-Conic complex	157.6	3.6%	Unknown
F4E	Eveleth-Conic, bouldery-Rock outcrop complex	152.3	3.4%	Unknown
F12B	Eaglesnest-Babbitt complex	118	2.7%	Partially hydric
F34A	Cathro muck	89.7	2.0%	Hydric
F30G	Conic, very bouldery-Insula, very bouldery-Rock outcrop complex	72.4	1.6%	Unknown
F13A	Babbitt, bouldery-Aquepts, rubbly, complex	67.1	1.5%	Partially hydric
F22F	Eveleth-Conic complex	58.3	1.3%	Unknown
F35D	Eveleth, bouldery-Conic, bouldery-Aquepts, rubbly, complex	57.3	1.3%	Partially hydric
F1C	Eaglesnest stony loam	42.5	1.0%	Not hydric
1021A	Rifle soils	37.1	<1%	Hydric
F177C	Eveleth-Eaglesnest complex	19.9	<1%	Partially hydric
1048	Dumps, iron mine	16.9	<1%	Unknown
W	Water	8.9	<1%	Hydric
F26E	Shagawa-Beargrease complex	7.4	<1%	Not hydric
F14D	Eveleth stony loam	4.8	<1%	Not hydric
F11B	Eaglesnest stony loam	3.3	<1%	Partially hydric
1049	Pits, iron mine	0.1	<1%	Unknown
F9B	Cloquet loam	0.1	<1%	Not hydric

Large Table 10 Summary of Soils in the Dunka Road and Utility Corridor

Soil Map Unit	Soil Name	Area (acres)	Percent of Project Area	Hydric Status
F12B	Eaglesnest-Babbitt complex, 1 to 8 percent slopes, bouldery	19.02	17.6	Partially hydric
1049	Pits, iron mine	18.59	17.2	Unknown
F2B	Eaglesnest-Wahlsten complex 2 to 8 percent slopes bouldery	16.57	15.4	Unknown
1048	Dumps iron mine (mostly rock fragments)	13.46	12.5	Unknown
1003B	Udorthents loamy cut and fill (mine iron spoil other disturbed areas)	9.85	9.1	Unknown
F13A	Babbitt bouldery-Aquepts rubbly complex 0 to 3 percent slopes	6.88	6.4	Partially hydric
F14D	Eveleth stony loam 8 to 18 percent slopes bouldery	5.93	5.5	Not hydric
F166A	Aquepts rubbly-Tacoosh-Rifle complex 0 to 2 percent slopes	5.5	5.1	Hydric
F11B	Eaglesnest stony loam 2 to 8 percent slopes bouldery	5.28	4.9	Partially hydric
B147A	Tacoosh mucky peat Upham basin 0 to 1 percent slopes	3.9	3.6	Hydric
B147A	Rifle soils Upham basin 0 to 1 percent slopes	1.7	1.6	Hydric
1020A	Bowstring and Fluvaquents loamy frequently flooded	0.86	<1%	Hydric
1021A	Rifle soils, 0 to 1 percent slopes	0.19	<1%	Hydric
B119A	Tacoosh mucky peat, 0 to 1 percent slopes	0.05	<1%	Hydric

Large Table 11 Summary of Soils in the Colby Lake Water Pipeline Corridor

Soil Map Unit	Soil Name	Area (acres)	Percent of Project Area	Hydric Status
F12B	Eaglesnest-Babbitt complex	14.9	29.5%	Partially hydric
1003B	Udorthents, loamy	12.8	25.3%	Unknown
1050	Tailings Basin	11.3	22.3%	Unknown
F14D	Eveleth stony loam	2.8	5.6%	Not hydric
F9B	Cloquet loam	1.8	3.5%	Not hydric
F35D	Eveleth, bouldery-Conic, boulder-Aquepts, rubbly, complex	1.4	2.8%	Partially hydric
F34A	Cathro muck	1.3	2.6%	Hydric
F3D	Eveleth-Eaglesnest-Conic complex	1.3	2.6%	Unknown
1021A	Rifle soils	1.0	2.0%	Hydric
F32A	Merwin peat	0.9	1.8%	Hydric
F13A	Babbitt, bouldery-Aquepts, rubbly, complex	0.8	1.5%	Partially hydric
1048	Dumps, iron mine	0.2	<1%	Unknown

Large Table 12 Summary of Federal and State Listed Plants

Scientific Name	Common Name	Status	Location	Reference[(4)]
Botrychium campestre	Prairie Moonwort	State Special Concern	T59N, R13W, Sec. 13	Barr (2011)
Botrychium michiganese	Michigan Moonwort	RFSS	T59N, R13W, Sec. 2	Johnson-Groh (2004)
			T59N, R13W, Sec. 3	Johnson-Groh (2004)
			T59N, R13W, Sec. 10	Johnson-Groh (2004)
			T59N, R13W, Sec. 11	Johnson-Groh (2004)
			T59N, R13W, Sec. 16	Johnson-Groh (2004)
Botrychium pallidum(1)	Pale Moonwort	State Endangered RFSS	T59N, R13W, Sec. 10	Johnson-Groh (2004)
			T59N, R13W, Sec. 11	Johnson-Groh (2004)
			T59N, R13W, Sec. 16	Johnson-Groh (2004)
			T59N, R13W, Sec. 17	Barr (2008)
			T59N, R13W, Sec. 18	Barr (2008)
			T59N, R14W, Sec. 13	Barr (2008)
Botrychium rugulosum(2)	St. Lawrence Grapefern	State Threatened RFSS	T59N, R13W, Sec. 1	Barr (2007)
			T59N, R13W, Sec. 2	Johnson-Groh (2004)(3)
			T59N, R13W, Sec. 11	Johnson-Groh (2004)(3)

Scientific Name	Common Name	Status	Location	Reference[(4)]
Botrychium simplex	Least Grapefern	State Special Concern RFSS	T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 2	Johnson-Groh (2004)
			T59N, R13W, Sec. 3	Johnson-Groh (2004)
			T59N, R13W, Sec. 3	Barr (2011)
			T59N, R13W, Sec. 10	Johnson-Groh (2004)
			T59N, R13W, Sec. 11	Johnson-Groh (2004)
			T59N, R13W, Sec. 11	Barr (2011)
			T59N, R13W, Sec. 16	Johnson-Groh (2004)
Caltha natans	Floating Marsh Marigold	State Endangered RFSS	T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 10	Walton (2004)
			T59N, R13W, Sec. 11	Walton (2004)
			T59N, R13W, Sec. 12	Walton (2004)
Eleocharis nitida	Neat Spike Rush	State Threatened RFSS	T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 9	Barr (2011)
			T59N, R13W, Sec. 11	Foth Van Dyke(1999)
			T59N, R13W, Sec. 11	Walton (2004)
Geocaulon lividum	False Toadflax	RFSS	T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 2	Walton (2004)
			T59N, R13W, Sec. 11	Walton (2004)
Juncus stygius var. americanus	Bog Rush	State Special Concern RFSS	T59N, R13W, Sec. 4	Barr (2011)
Juncus vaseyi	Vasey’s Rush	RFSS	T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 11	Walton (2004)
			T59N, R13W, Sec. 12	Walton (2004)

Scientific Name	Common Name	Status	Location	Reference[(4)]
Platanthera clavellata	Club-spur Orchid	State Special Concern RFSS	T59N, R13W, Sec. 4	Barr (2011)
Pyrola minor	Small Shinleaf	State Special Concern RFSS	T59N, R13W, Sec. 5	Barr (2011)
Ranunculus gmelinii	Small Yellow Water Crowfoot	RFSS	T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 2	Walton (2004)
			T59N, R13W, Sec. 11	Walton (2004)
			T59N, R13W, Sec. 12	Walton (2004)
Ranunculus lapponicus	Lapland Buttercup	State Special Concern RFSS	T49N, R12W, Sec. 6	Walton (2004)
			T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 2	Walton (2004)
Scirpus pedicellatus	Pedicellate Bulrush	RFSS	T59N, R13W, Sec. 3	Pomroy (2004)
			T59N, R13W, Sec. 9	Pomroy (2004)
			T59N, R13W, Sec. 10	Pomroy (2004)
			T59N, R13W, Sec. 13	Pomroy (2004)
Sparganium glomeratum	Clustered Bur-reed	State Special Concern RFSS	T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 2	Walton (2004)
			T59N, R13W, Sec. 3	Barr (2011)
			T59N, R13W, Sec. 4	Barr (2011)
			T59N, R13W, Sec. 9	Pomroy (2004)
			T59N, R13W, Sec. 9	Barr (2011)
			T59N, R13W, Sec. 10	Pomroy (2004)
			T59N, R13W, Sec. 11	Walton (2004)
			T59N, R13W, Sec. 16	Pomroy (2004)

Scientific Name	Common Name	Status	Location	Reference(4)
Torreyochloa pallida	Pale Manna Grass	State Special Concern RFSS	T49N, R12W, Sec. 6	Walton (2004)
			T59N, R13W, Sec. 1	Walton (2004)
			T59N, R13W, Sec. 11	Walton (2004)

(1) The MDNR is in the process of revising the state endangered and species list and a change in status for *Botrychium pallidum* from endangered to special concern is under consideration.

(2) The MDNR is in the process of revising the state endangered and species list and a change in status for *Botrychium rugulosum* from threatened to special concern is under consideration.

(3) These species were documented in one location in the Mine Site (Sections 2 and 11 of Township 59N, Range 13W); however, it is not certain that the plants identified at either location are *Botrychium rugulosum.*

(4) References:

Barr Engineering Company. (2008). Results of Sensitive Plant Species Surveys along Dunka Road and Pipeline Route.

Barr Engineering Company. (2011). Summaries of Sensitive Specieis Surveys Conducted by MNRI and Additional Sensitive Species Locations from the MNDNR NHIS Database.

Barr Engineering Company. (n.d.). Results of Autumn 2007 Field Surveys for Botrychium rugulosum in Proposed Land Exchange Parcels at PolyMet Mine Site. *2007*.

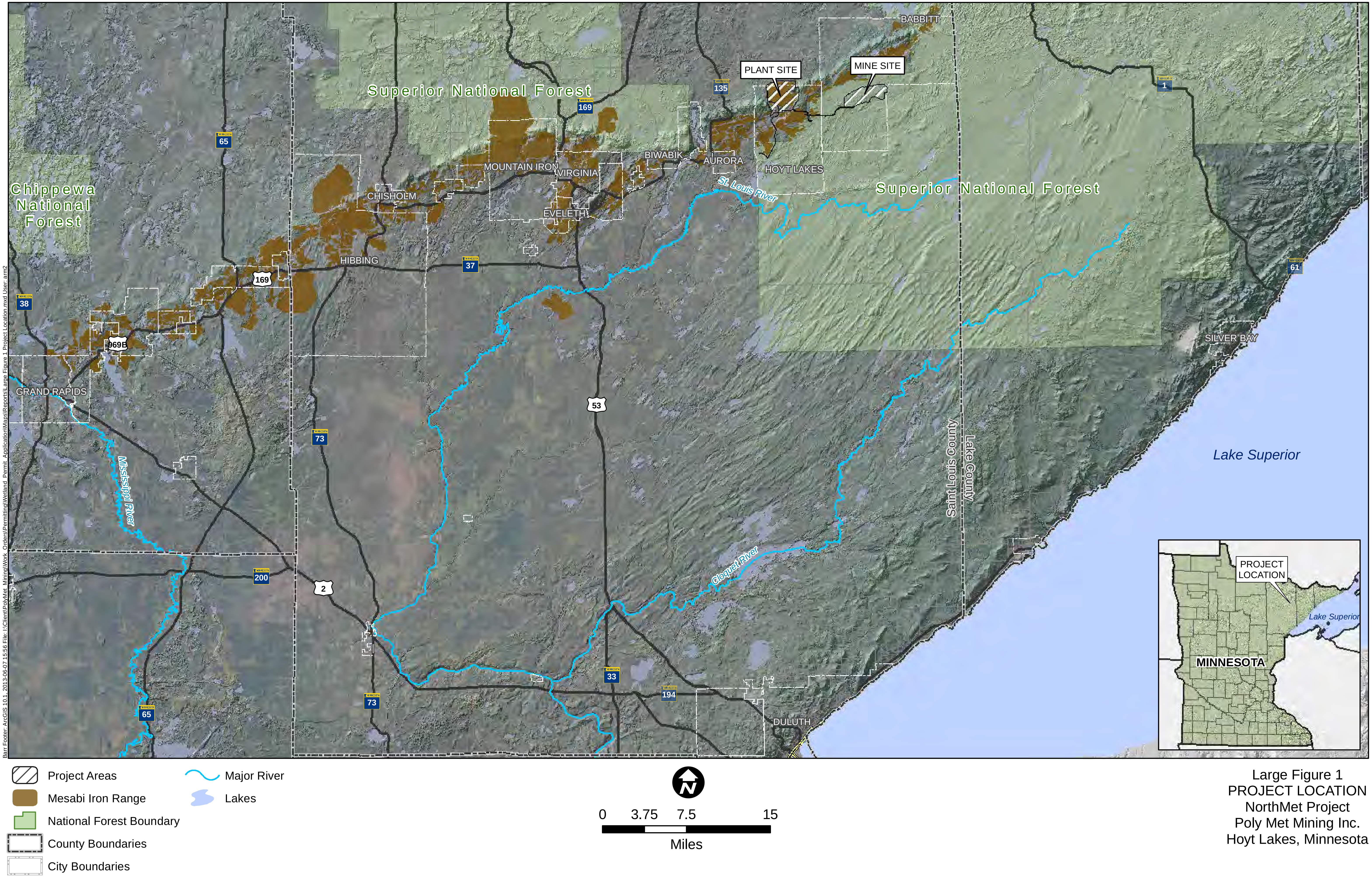
Foth and Van Dyke. (1999). Supplemental Site Specific Resource Information. PolyMet Mining Corporation NorthMet 1999 Exploration Project. Report Prepared for PolyMet Mining.

Groh-Johnson, C. (2004). *Botrychium (Moonwort) Rare Plant Surveys for Polymet Project July 2004.*

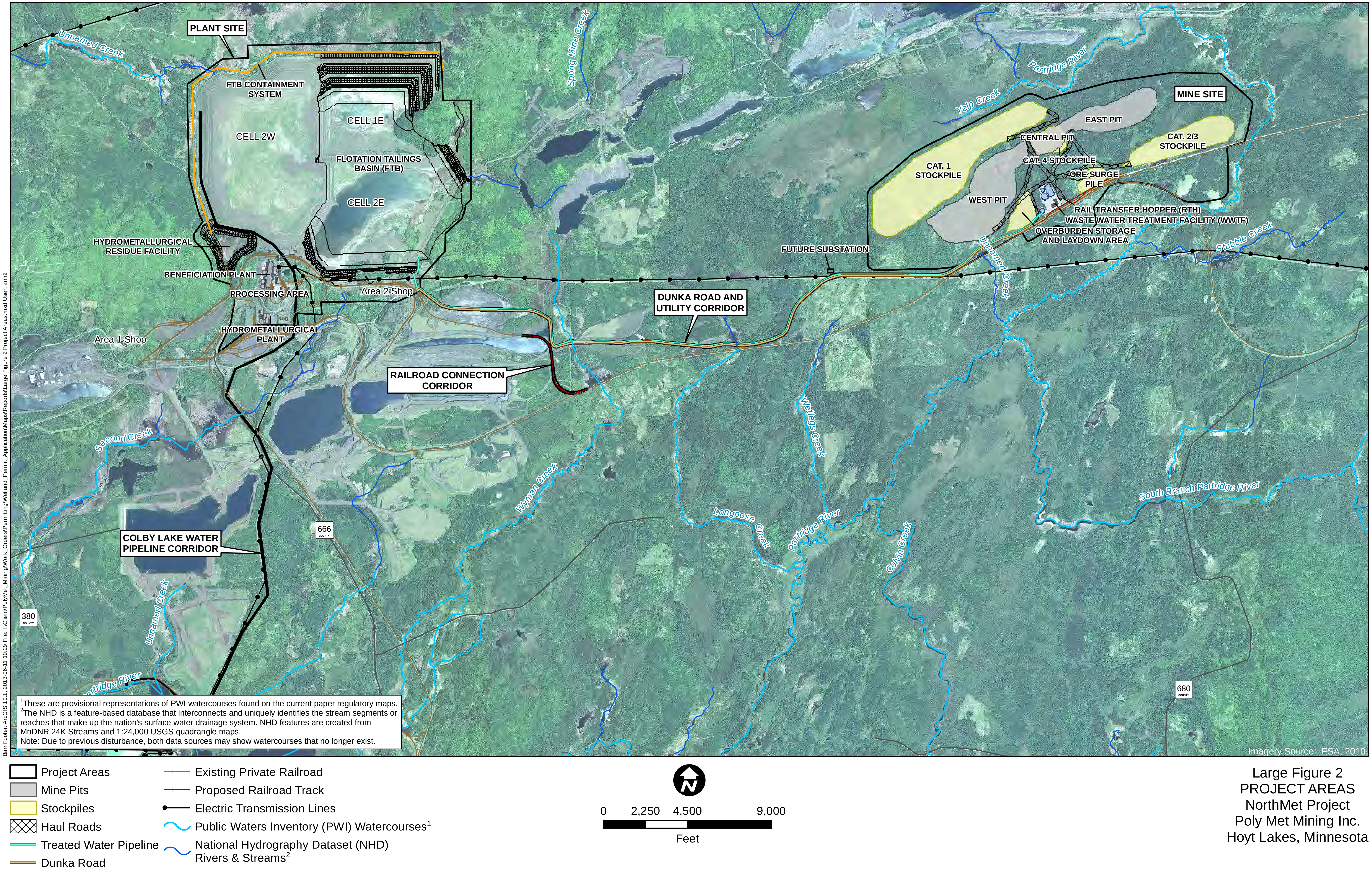
Pomroy, D. a. (2004). *2004 Rare Plant Survey at the PolyMet Mine Site Located in T59N R13W.*

Walton, G. (2004). Data Summary: Rare Plant Survey.

Large Figures

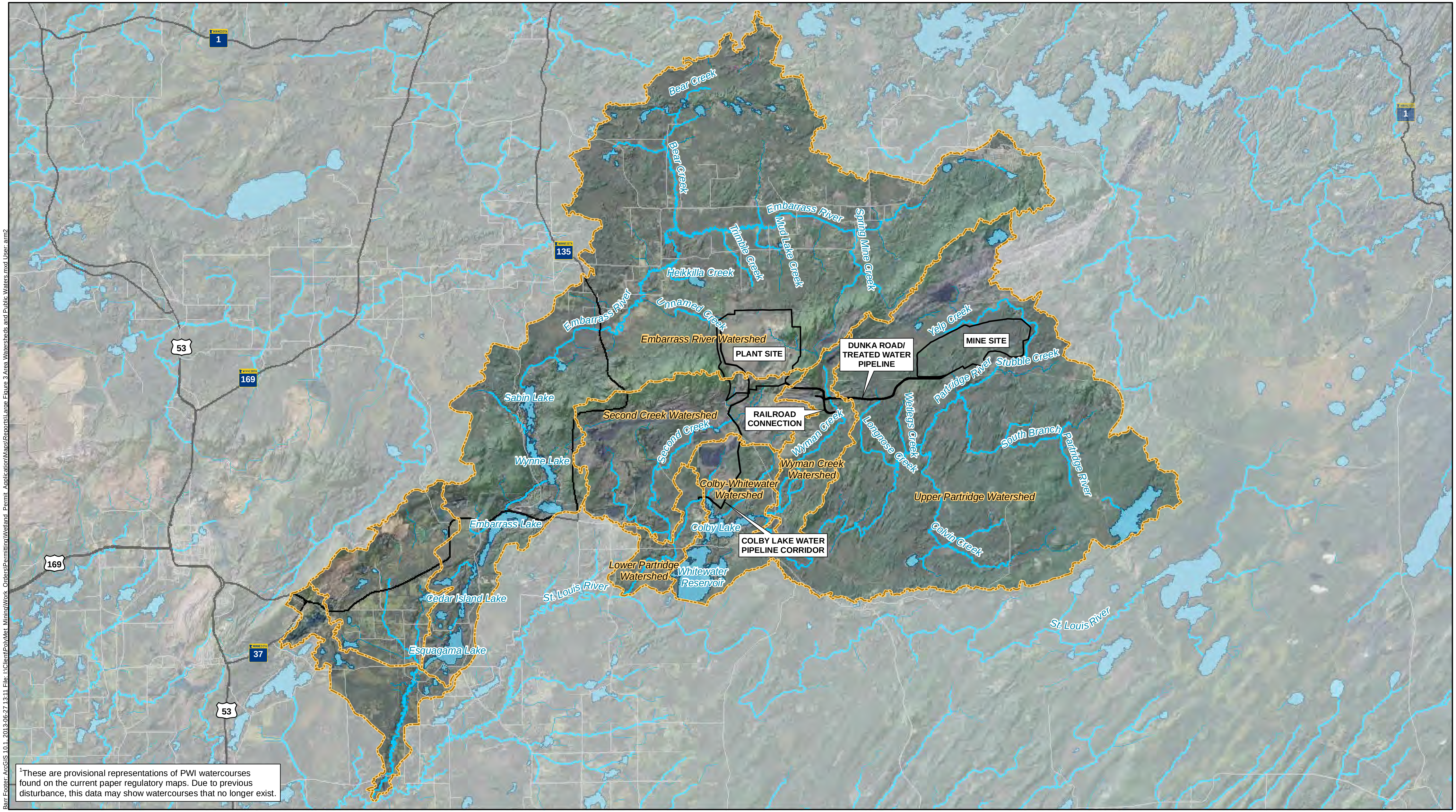


Large Figure 1
PROJECT LOCATION
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



[1] These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

Large Figure 2
PROJECT AREAS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



[1]These are provisional representations of PWI watercourses found on the current paper regulatory maps. Due to previous disturbance, this data may show watercourses that no longer exist.

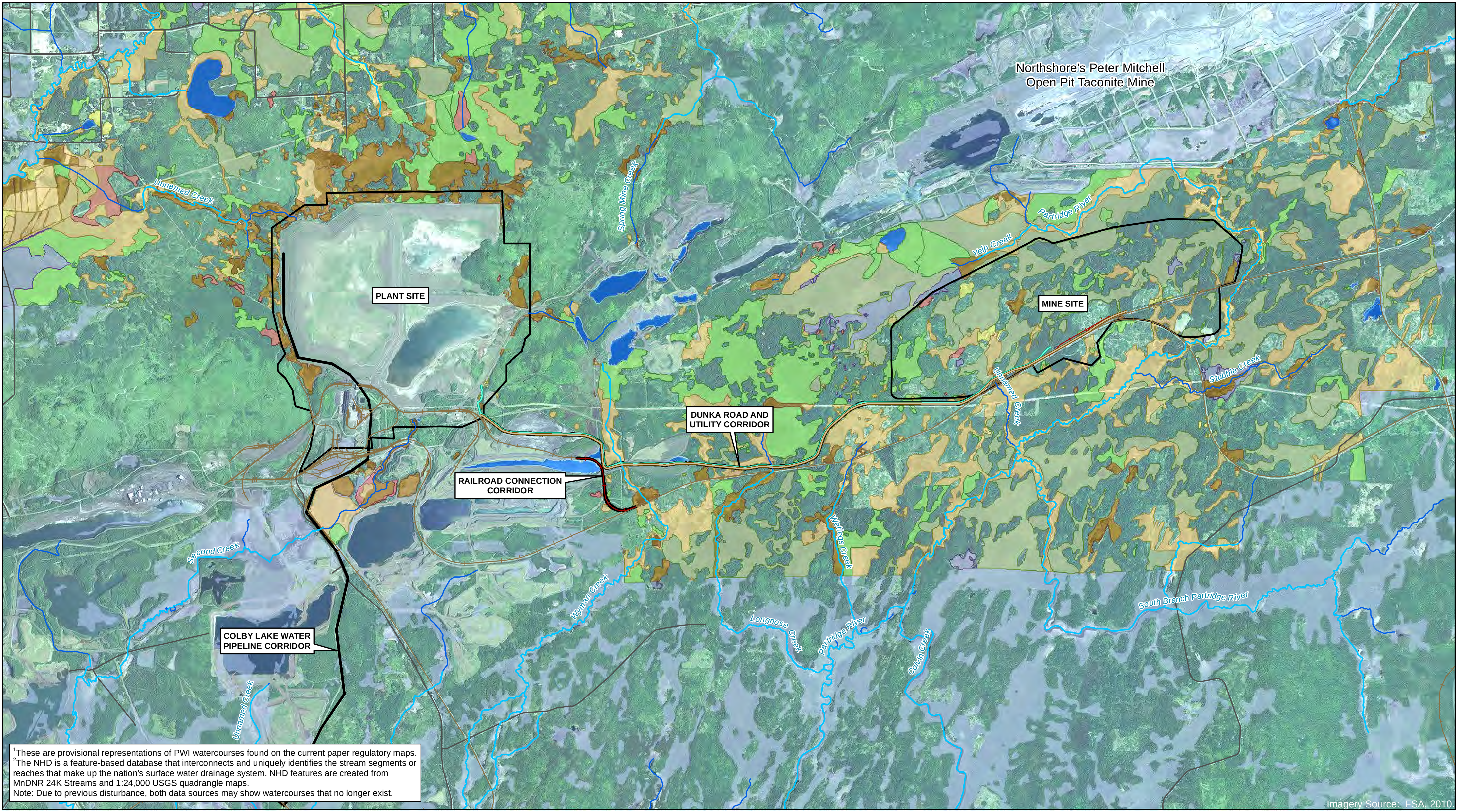
Barr Footer: ArcGIS 10.1, 2013-06-27 13:11 File: I:\Client\PolyMet Mining\Work Orders\Permitting\Wetland Permit Application\Maps\Reports\Large Figure 3 Area Watersheds and Public Waters.mxd User: arm2

⬚ Watershed Boundaries
▭ Project Areas
● Public Waters Inventory Basins[1]
〜 Public Waters Inventory Watercourses[1]
〜 Rivers and Streams

N

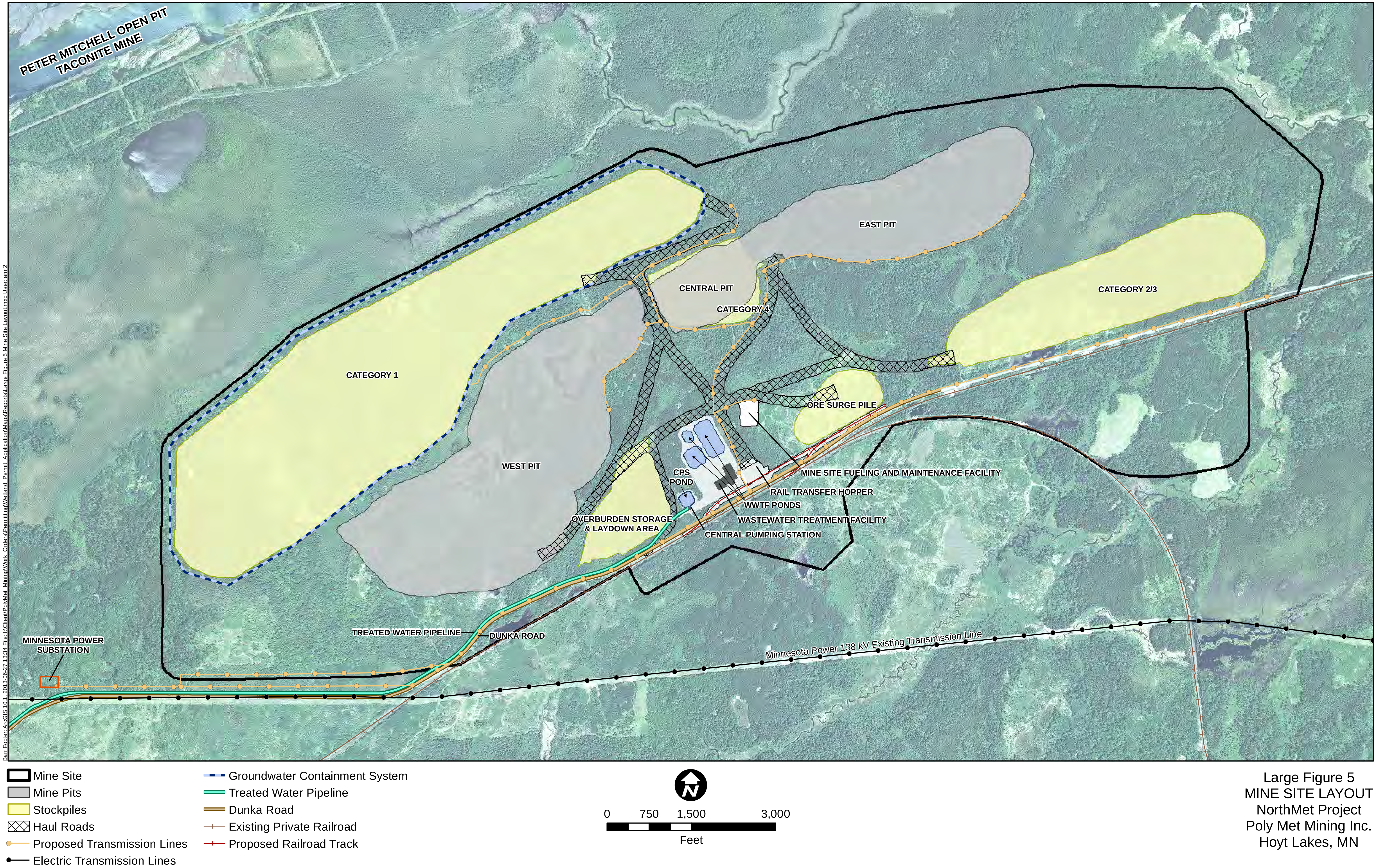
0 1.25 2.5 5
Miles

Large Figure 3
AREA WATERSHEDS
AND PUBLIC WATERS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



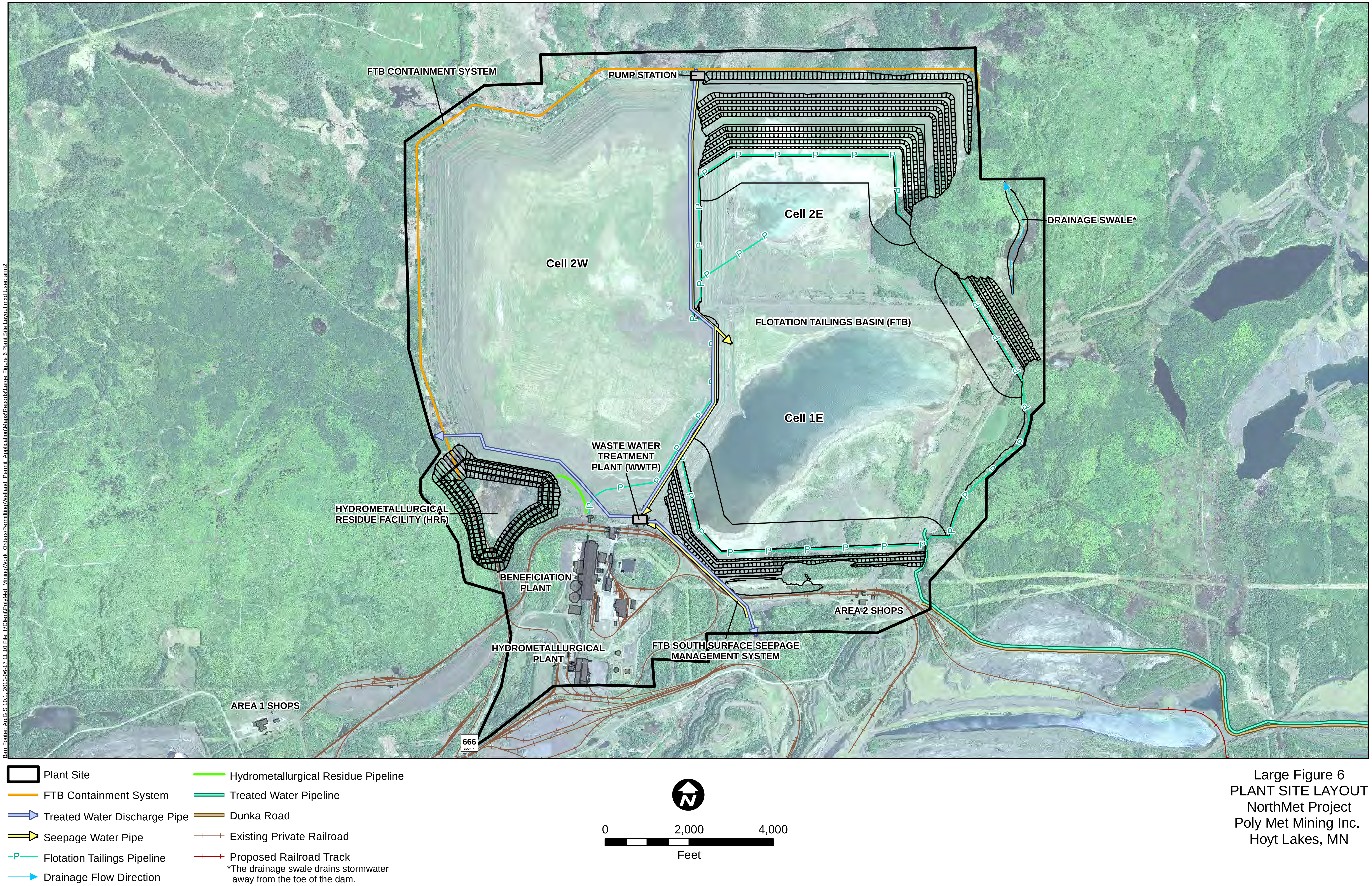
[1] These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

Large Figure 4
WETLAND DELINEATION
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



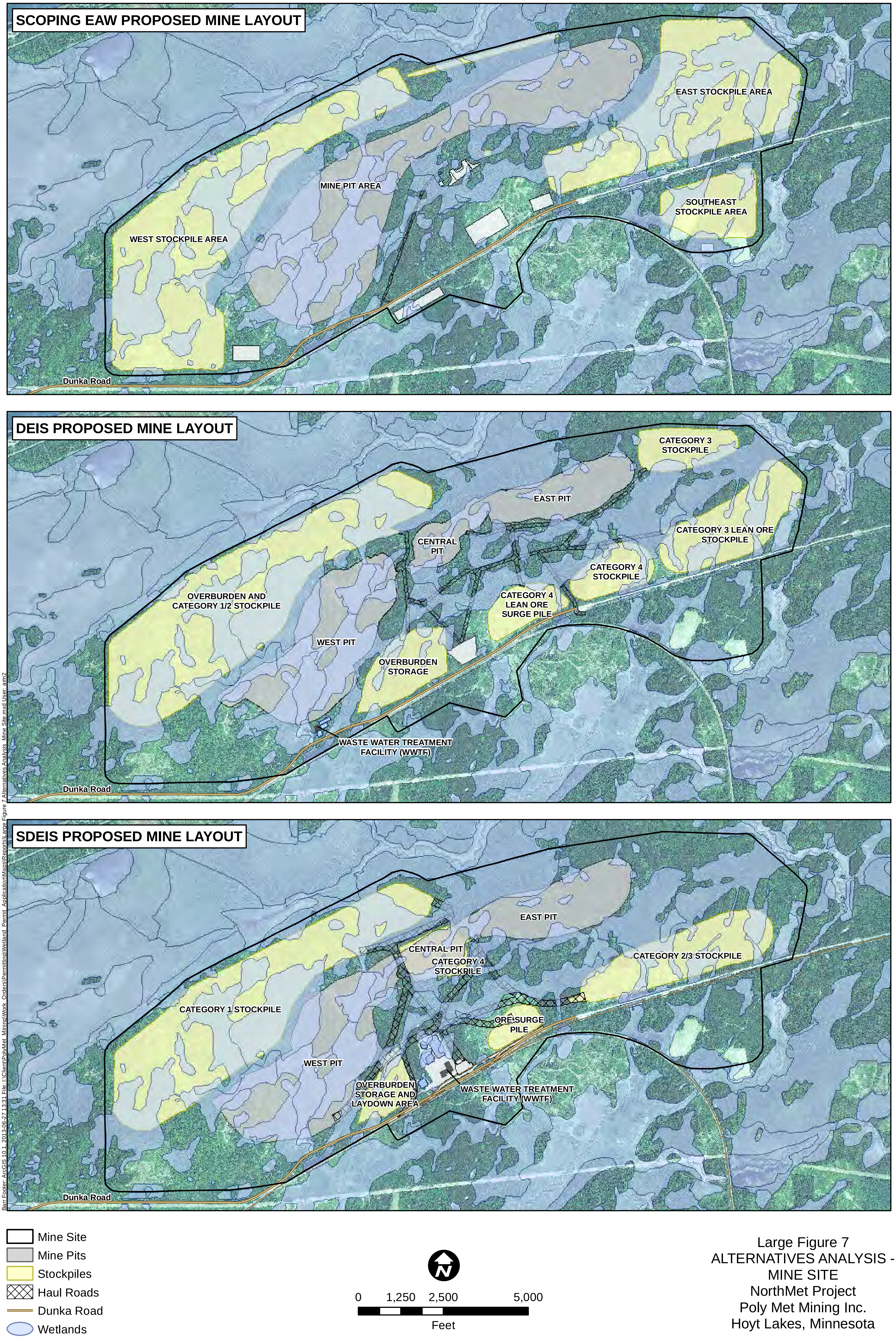
Barr Footer: ArcGIS 10.1, 2013-06-27 13:34 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\Large Figure 5 Mine Site Layout.mxd User: arm2

Large Figure 5
MINE SITE LAYOUT
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

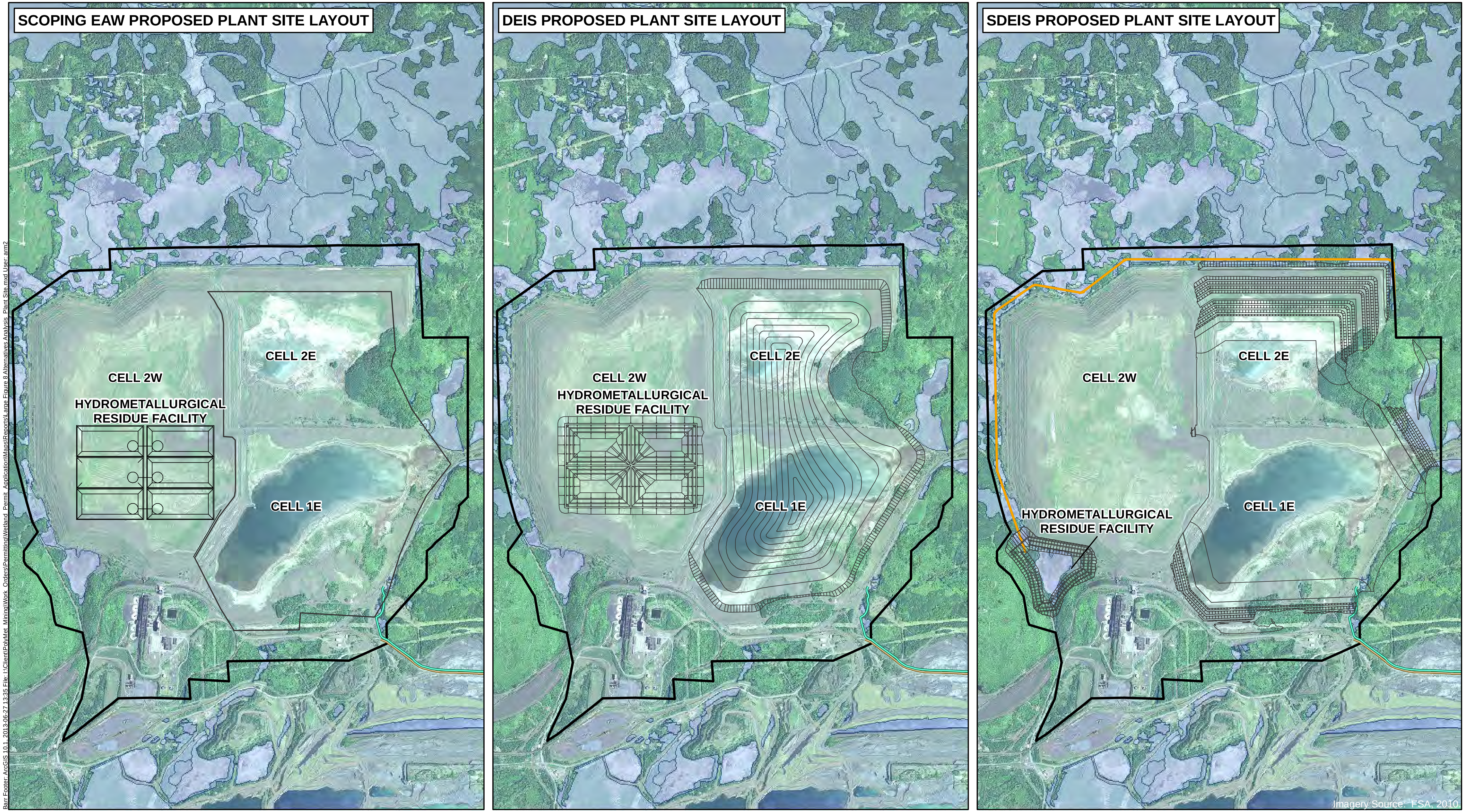


*The drainage swale drains stormwater away from the toe of the dam.

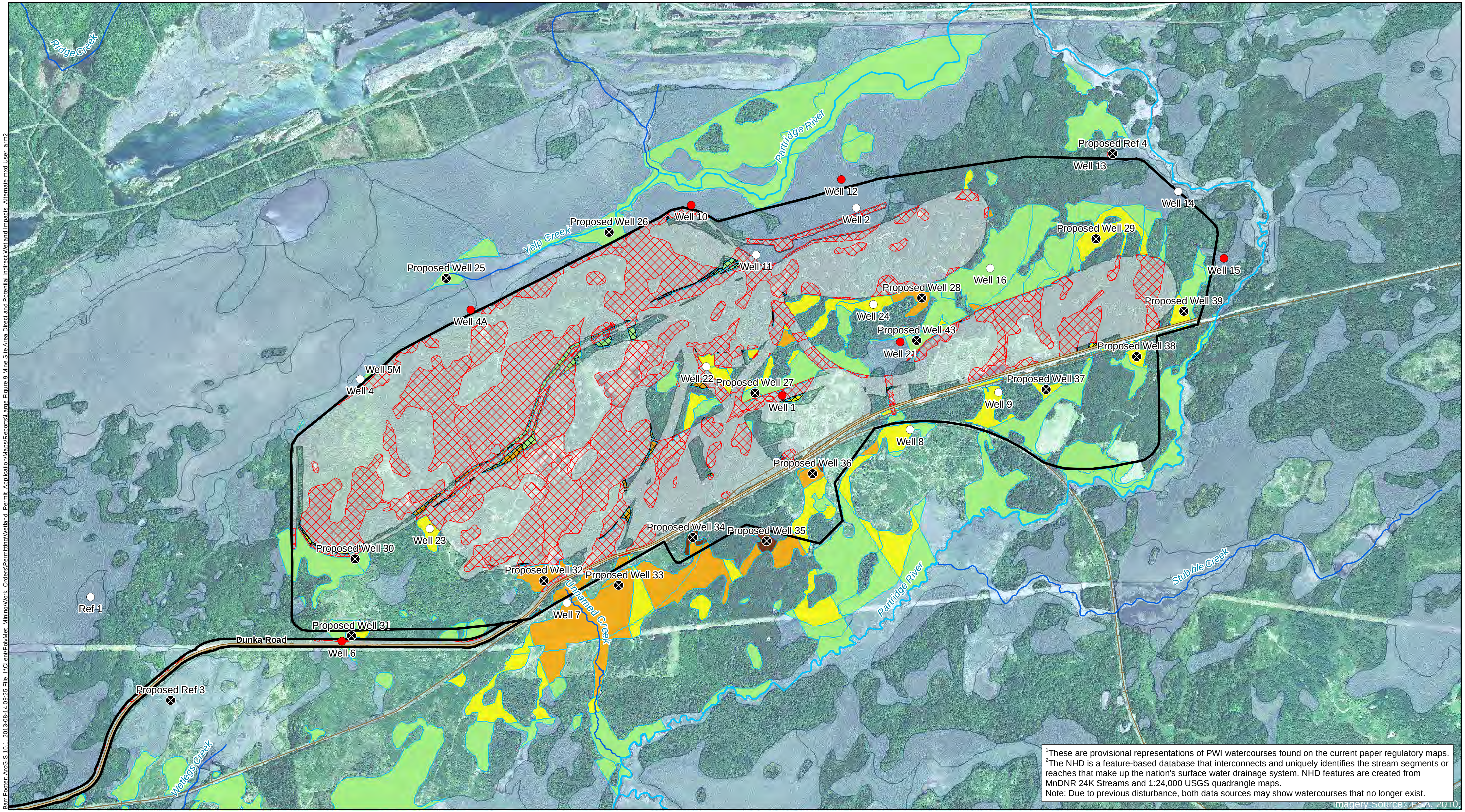
Large Figure 6
PLANT SITE LAYOUT
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



Large Figure 7
ALTERNATIVES ANALYSIS - MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 8
ALTERNATIVES ANALYSIS -
PLANT SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



[1] These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

▭ Project Areas
⊗ Proposed Wetland Impact Monitoring Locations
○ Wetland Hydrology Monitoring Locations
● Monitoring Locations to be Removed
═ Dunka Road
~ Public Waters Inventory (PWI) Watercourses[1]

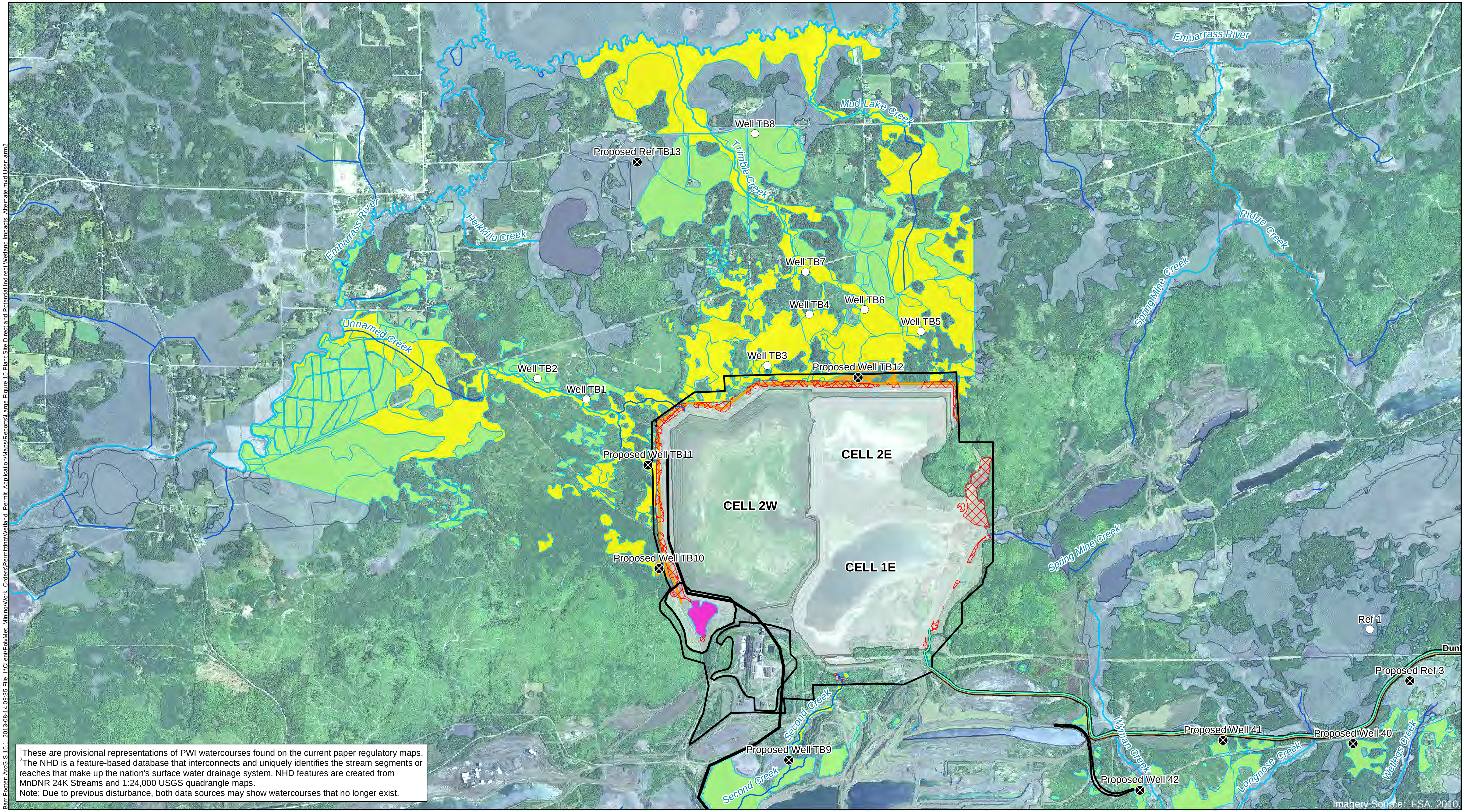
~ National Hydrography Dataset (NHD) Rivers & Streams[2]
▭ Areas Disturbed by Proposed Project Features
▨ Direct Wetland Impacts
▨ Fragmented Wetlands

Potential Indirect Wetland Impact Factor Rating
🟥 5
🟫 4
🟧 3
🟨 2
🟩 1
○ No Impact

N

0 1,000 2,000 4,000
Feet

Large Figure 9
MINE SITE DIRECT AND POTENTIAL INDIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



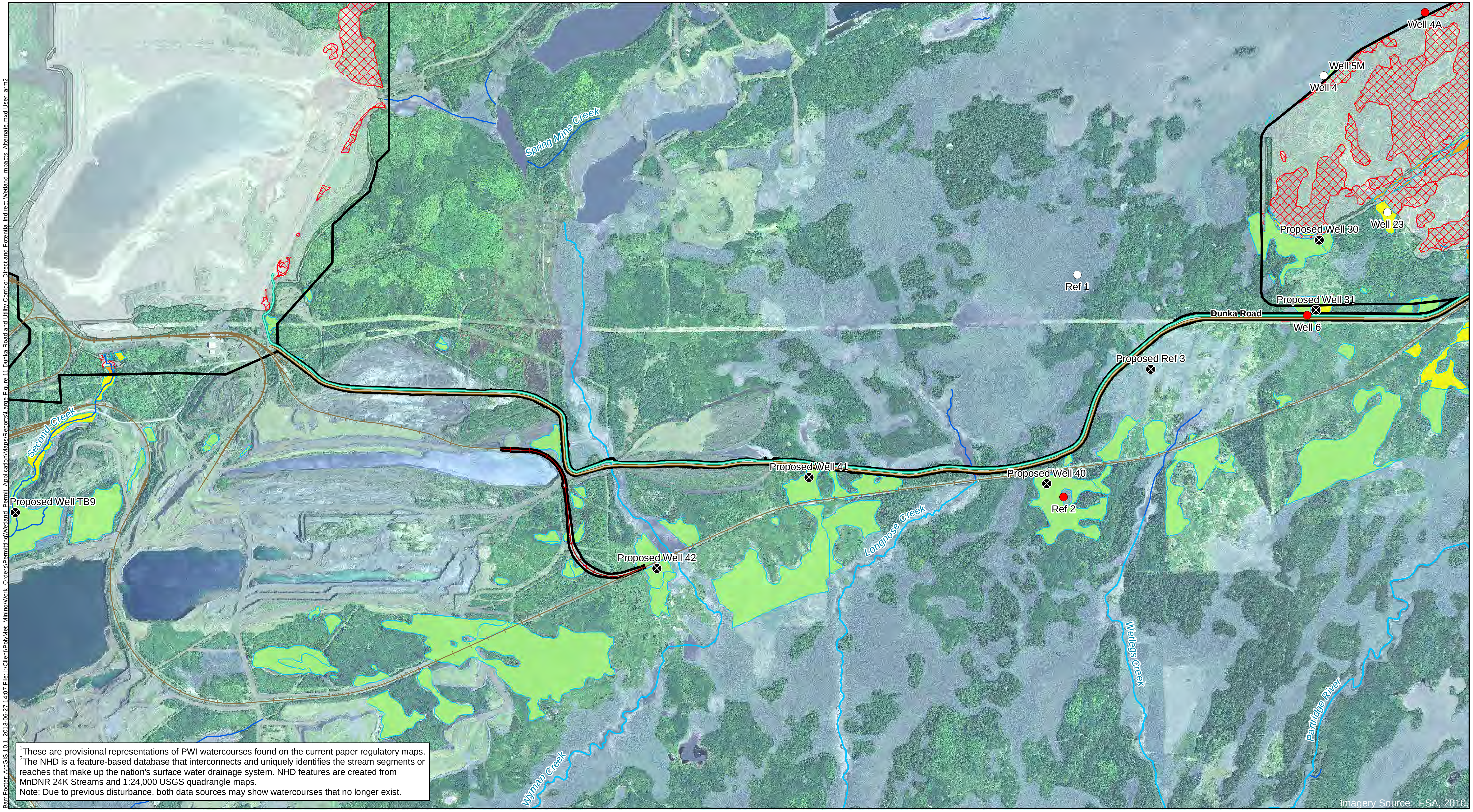
[1] These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

▭ Project Areas
⊗ Proposed Wetland Impact Monitoring Locations
○ Wetland Hydrology Monitoring Locations
FTB Containment System
Dunka Road
Public Waters Inventory (PWI) Watercourses[1]
National Hydrography Dataset (NHD) Rivers & Streams[2]
▭ Areas Disturbed by Proposed Project Features
▨ Direct Wetland Impacts
▩ Fragmented Wetlands

Potential Indirect Wetland Impact Factor Rating
🟥 5
🟫 4
🟧 3
🟨 2
🟩 1
● Exempt
○ No Impact

0 2,000 4,000 8,000
Feet

Large Figure 10
PLANT SITE DIRECT AND POTENTIAL INDIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



[1] These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

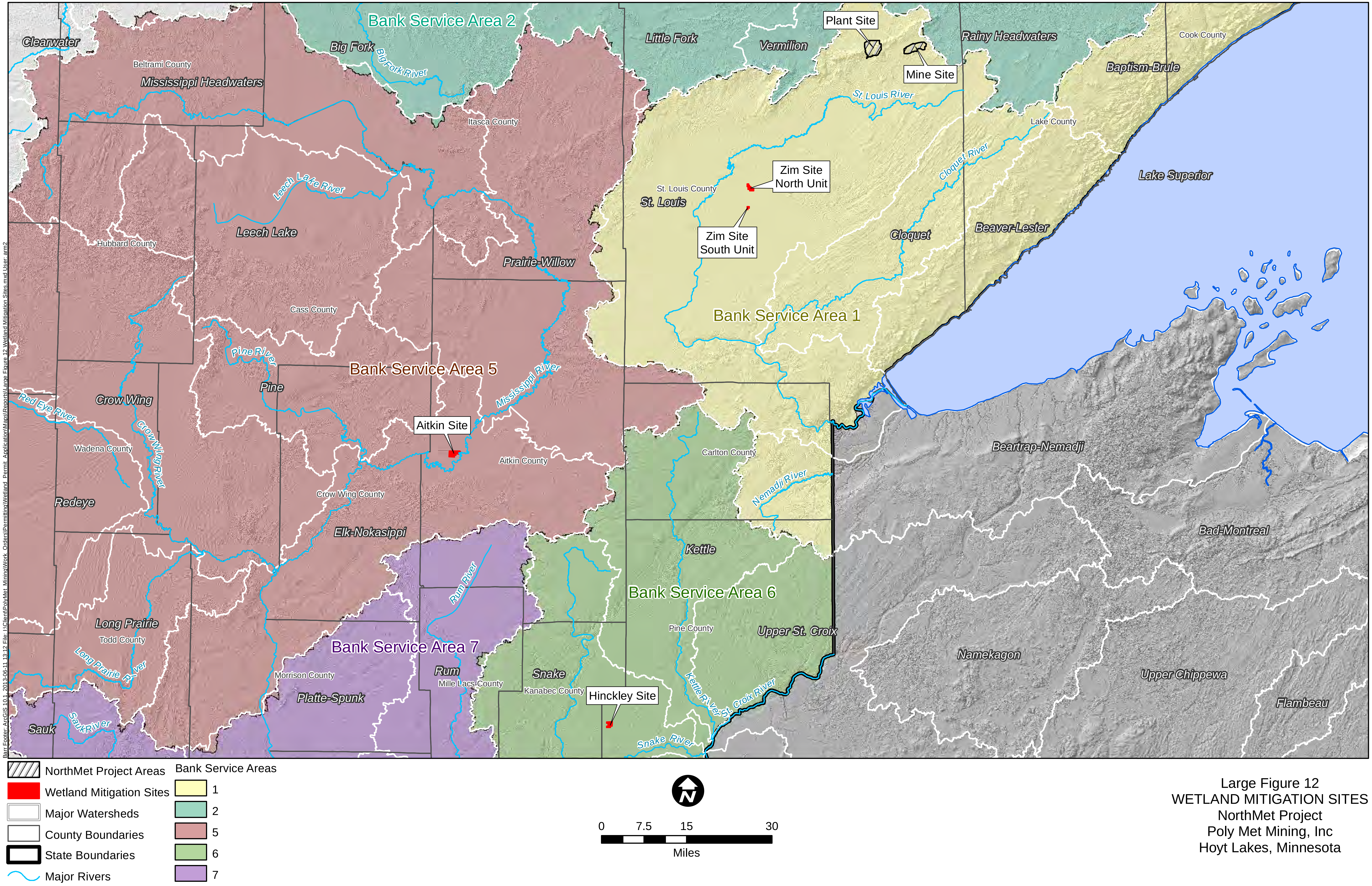
▭ Project Areas
⊗ Proposed Wetland Impact Monitoring Locations
○ Wetland Hydrology Monitoring Locations
● Monitoring Locations to be Removed
Treated Water Pipeline
Dunka Road
Existing Private Railroad
Proposed Railroad Track
Public Waters Inventory (PWI) Watercourses[1]
National Hydrography Dataset (NHD) Rivers & Streams[2]
▭ Areas Disturbed by Proposed Project Features
▨ Direct Wetland Impacts

Potential Indirect Wetland Impact Factor Rating
🟥 5
🟫 4
🟧 3
🟨 2
🟩 1
No Impact

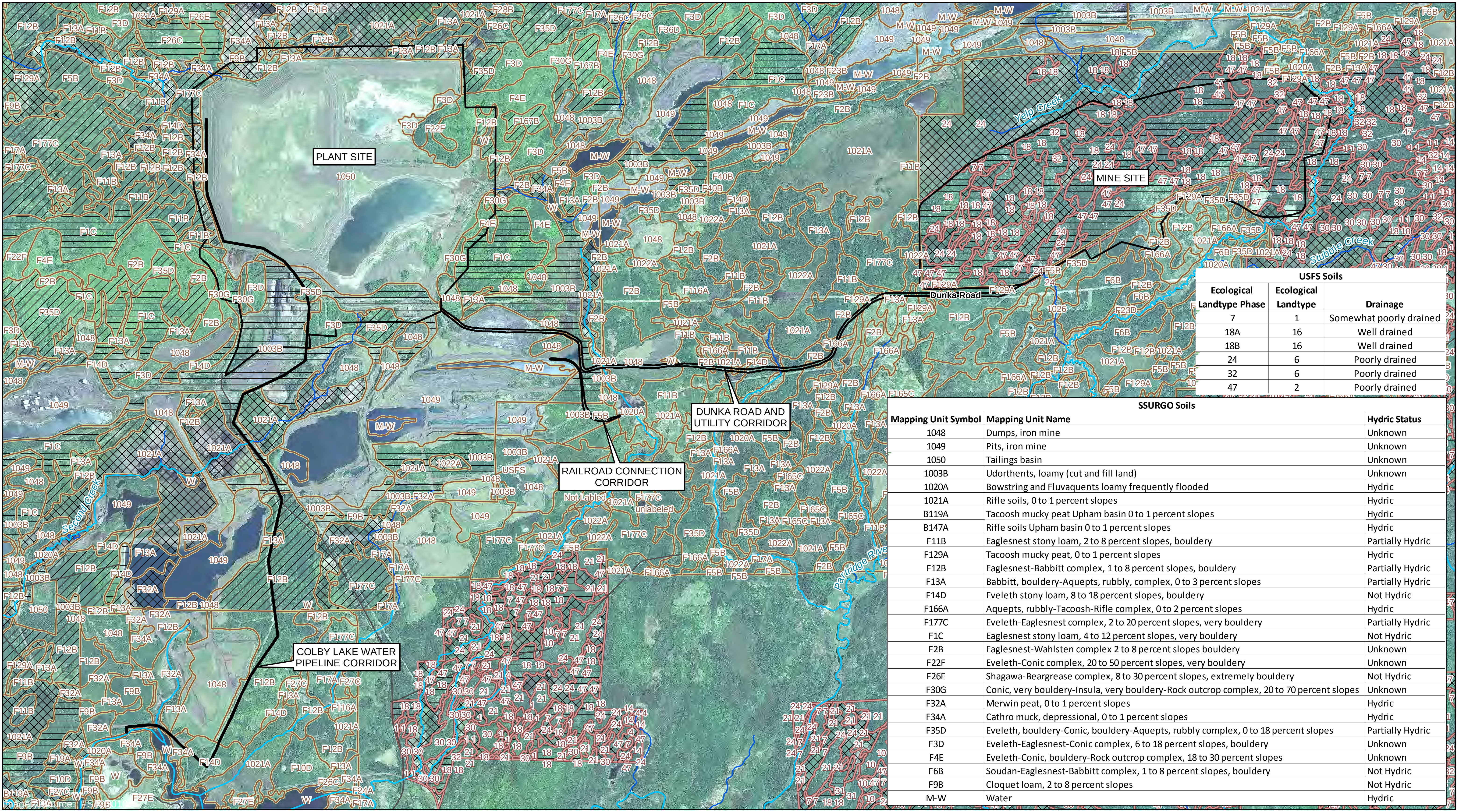
0 1,100 2,200 4,400
Feet

Large Figure 11
TRANSPORTATION CORRIDORS DIRECT AND POTENTIAL INDIRECT WETLAND IMPACTS

NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 12
WETLAND MITIGATION SITES
NorthMet Project
Poly Met Mining, Inc
Hoyt Lakes, Minnesota



USFS Soils		
Ecological Landtype Phase	Ecological Landtype	Drainage
7	1	Somewhat poorly drained
18A	16	Well drained
18B	16	Well drained
24	6	Poorly drained
32	6	Poorly drained
47	2	Poorly drained

SSURGO Soils		
Mapping Unit Symbol	Mapping Unit Name	Hydric Status
1048	Dumps, iron mine	Unknown
1049	Pits, iron mine	Unknown
1050	Tailings basin	Unknown
1003B	Udorthents, loamy (cut and fill land)	Unknown
1020A	Bowstring and Fluvaquents loamy frequently flooded	Hydric
1021A	Rifle soils, 0 to 1 percent slopes	Hydric
B119A	Tacoosh mucky peat Upham basin 0 to 1 percent slopes	Hydric
B147A	Rifle soils Upham basin 0 to 1 percent slopes	Hydric
F11B	Eaglesnest stony loam, 2 to 8 percent slopes, bouldery	Partially Hydric
F129A	Tacoosh mucky peat, 0 to 1 percent slopes	Hydric
F12B	Eaglesnest-Babbitt complex, 1 to 8 percent slopes, bouldery	Partially Hydric
F13A	Babbitt, bouldery-Aquepts, rubbly, complex, 0 to 3 percent slopes	Partially Hydric
F14D	Eveleth stony loam, 8 to 18 percent slopes, bouldery	Not Hydric
F166A	Aquepts, rubbly-Tacoosh-Rifle complex, 0 to 2 percent slopes	Hydric
F177C	Eveleth-Eaglesnest complex, 2 to 20 percent slopes, very bouldery	Partially Hydric
F1C	Eaglesnest stony loam, 4 to 12 percent slopes, very bouldery	Not Hydric
F2B	Eaglesnest-Wahlsten complex 2 to 8 percent slopes bouldery	Unknown
F22F	Eveleth-Conic complex, 20 to 50 percent slopes, very bouldery	Unknown
F26E	Shagawa-Beargrease complex, 8 to 30 percent slopes, extremely bouldery	Not Hydric
F30G	Conic, very bouldery-Insula, very bouldery-Rock outcrop complex, 20 to 70 percent slopes	Unknown
F32A	Merwin peat, 0 to 1 percent slopes	Hydric
F34A	Cathro muck, depressional, 0 to 1 percent slopes	Hydric
F35D	Eveleth, bouldery-Conic, bouldery-Aquepts, rubbly complex, 0 to 18 percent slopes	Partially Hydric
F3D	Eveleth-Eaglesnest-Conic complex, 6 to 18 percent slopes, bouldery	Unknown
F4E	Eveleth-Conic, bouldery-Rock outcrop complex, 18 to 30 percent slopes	Unknown
F6B	Soudan-Eaglesnest-Babbitt complex, 1 to 8 percent slopes, bouldery	Not Hydric
F9B	Cloquet loam, 2 to 8 percent slopes	Not Hydric
M-W	Water	Hydric

Barr Footer: ArcGIS 10.1, 2013-06-27 12:35 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\Large Figure 13 Soils.mxd User: arm2

- ▭ SSURGO Soils - Embarrass Subset (Mapping Unit Symbol)
- ▭ Ecological Landtype Phase - USFS

Hydric Rating/Drainage Class

- ☒ All Hydric/Poorly drained
- ▨ Partially Hydric/Somewhat poorly drained
- ☰ Not Hydric/Well drained
- ☐ Unknown Hydric

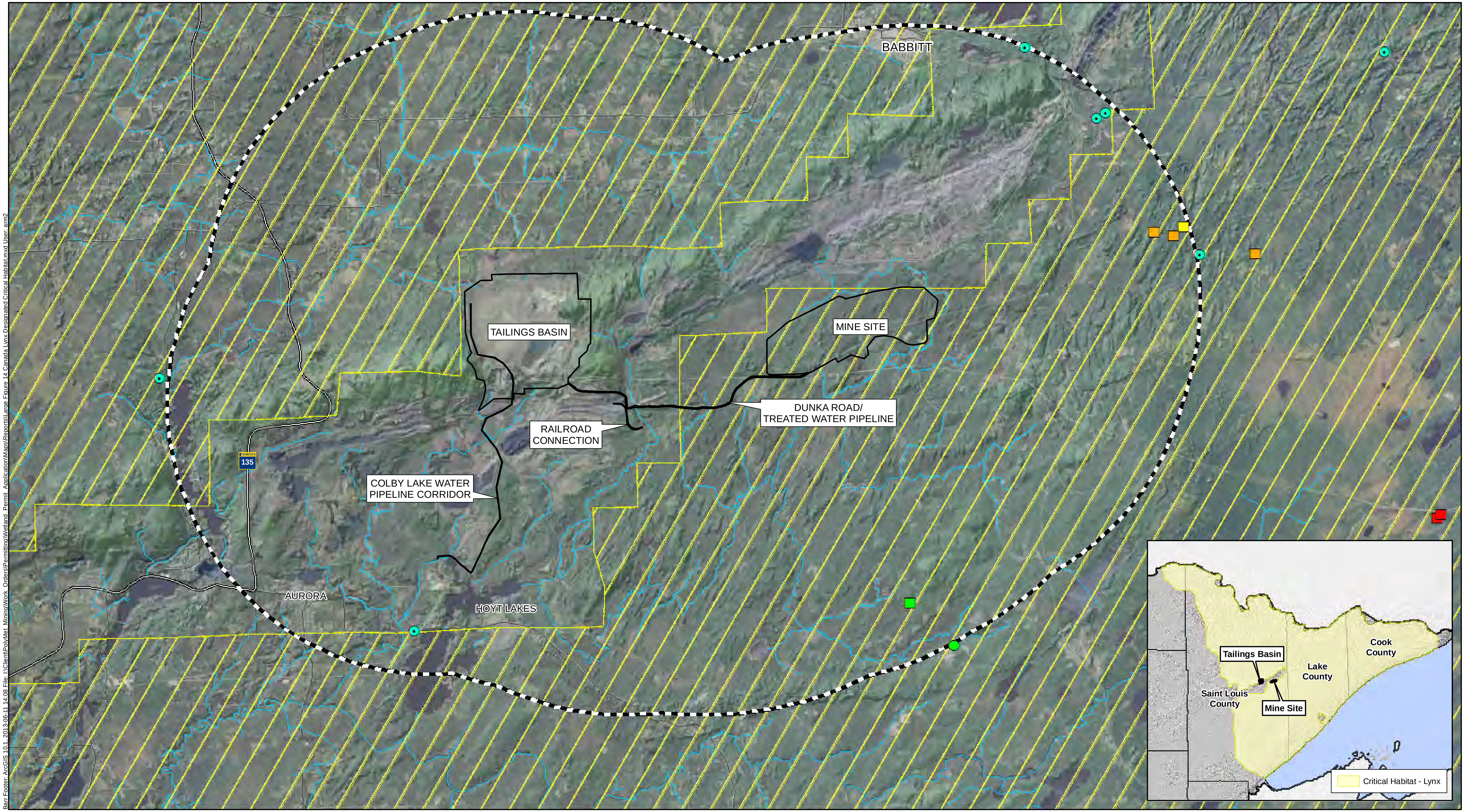
- ▭ Project Areas
- ～ Public Waters Inventory (PWI) Watercourses[1]
- ～ National Hydrography Dataset (NHD) Rivers & Streams[2]

[1]These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2]The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

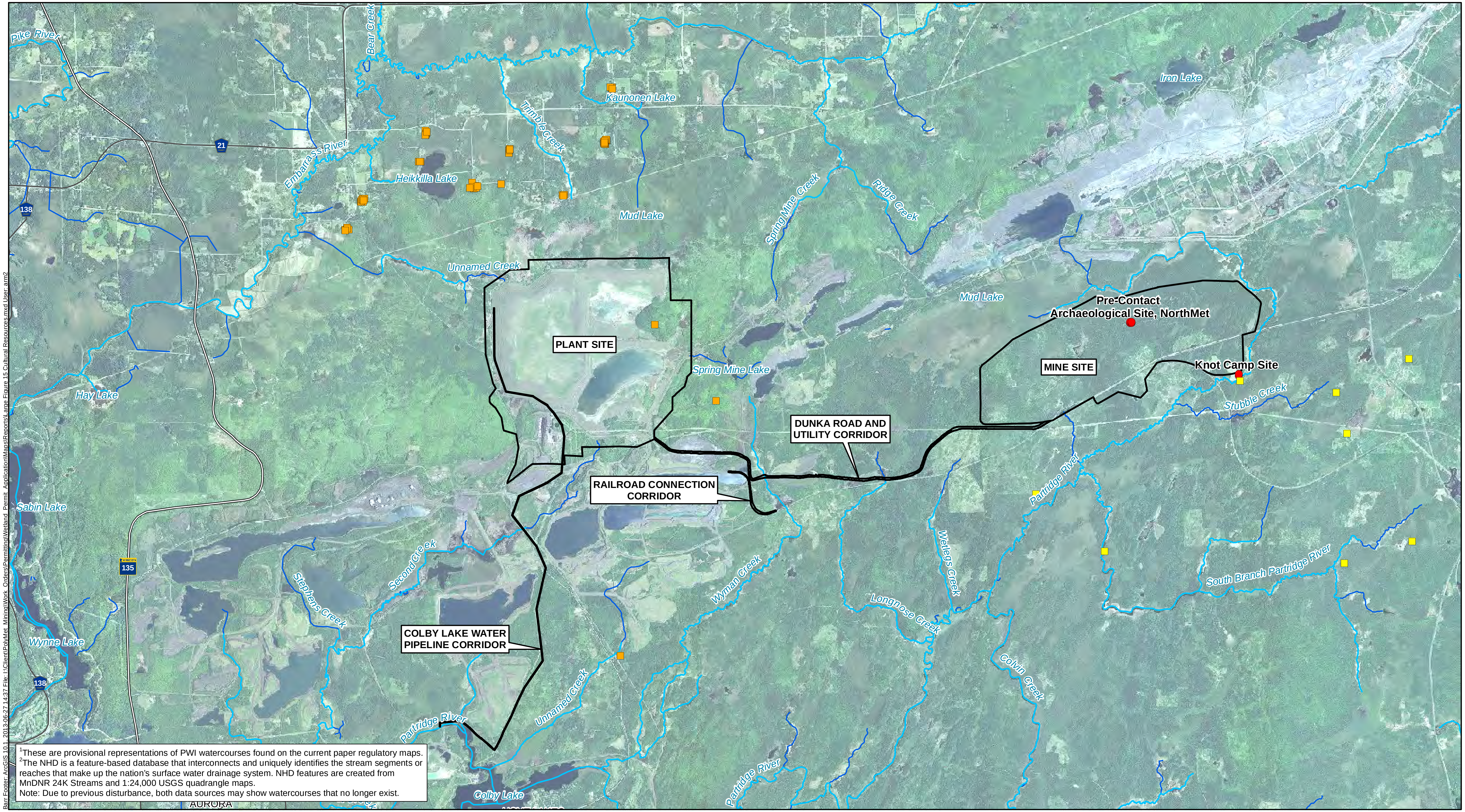
N

0 2,250 4,500 9,000
Feet

Large Figure 13
SOILS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 14
CANADA LYNX
DESIGNATED CRITICAL HABITAT
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, Minnesota



[1]These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2]The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

● Field-Documented Archaeological Sites

SHPO Database Locations

🟨 Archaeological Sites

🟧 Historic Sites

▭ Project Areas

〜 Public Waters Inventory (PWI) Watercourses[1]

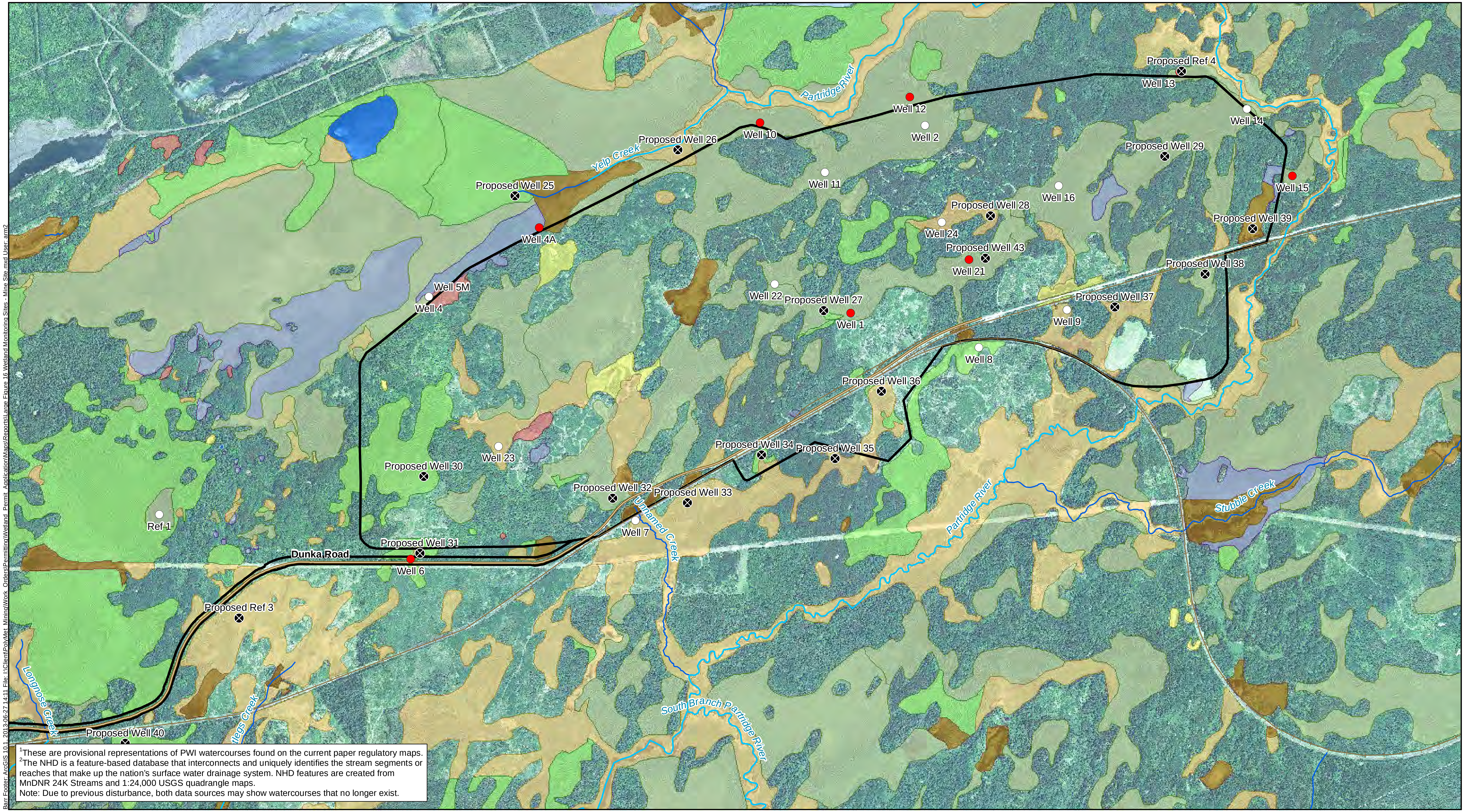
〜 National Hydrography Dataset (NHD) Rivers & Streams[2]

N

0 0.625 1.25 2.5

Miles

Large Figure 15
CULTURAL RESOURCES
WITHIN 2-MILES
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



[1] These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

- ▭ Project Areas
- ⊗ Proposed Wetland Impact Monitoring Locations
- ○ Wetland Hydrology Monitoring Locations
- ● Monitoring Locations to be Removed
- Dunka Road
- Railroads
- Public Waters Inventory (PWI) Watercourses[1]
- National Hydrography Dataset (NHD) Rivers & Streams[2]

Eggers & Reed Wetland Types

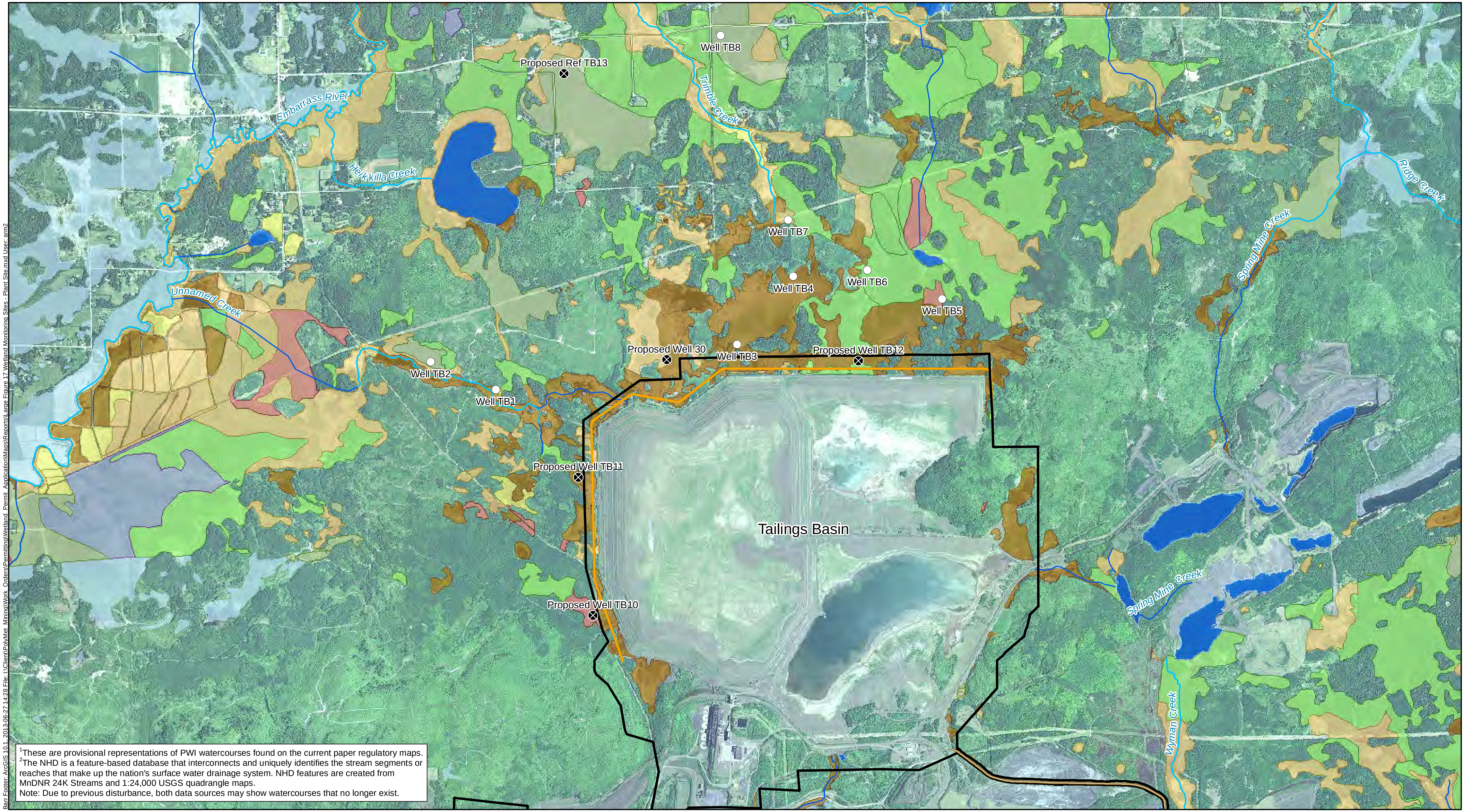
- Shrub Swamps (Alder thickets & Shrub-carrs)
- Coniferous bog
- Coniferous swamp
- Deep marsh; Shallow marsh
- Hardwood swamp
- Open water (Shallow, open water & lakes)
- Open bog
- Sedge meadow; Wet meadow

N

0 1,000 2,000 4,000

Feet

Large Figure 16
WETLAND MONITORING SITES - MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



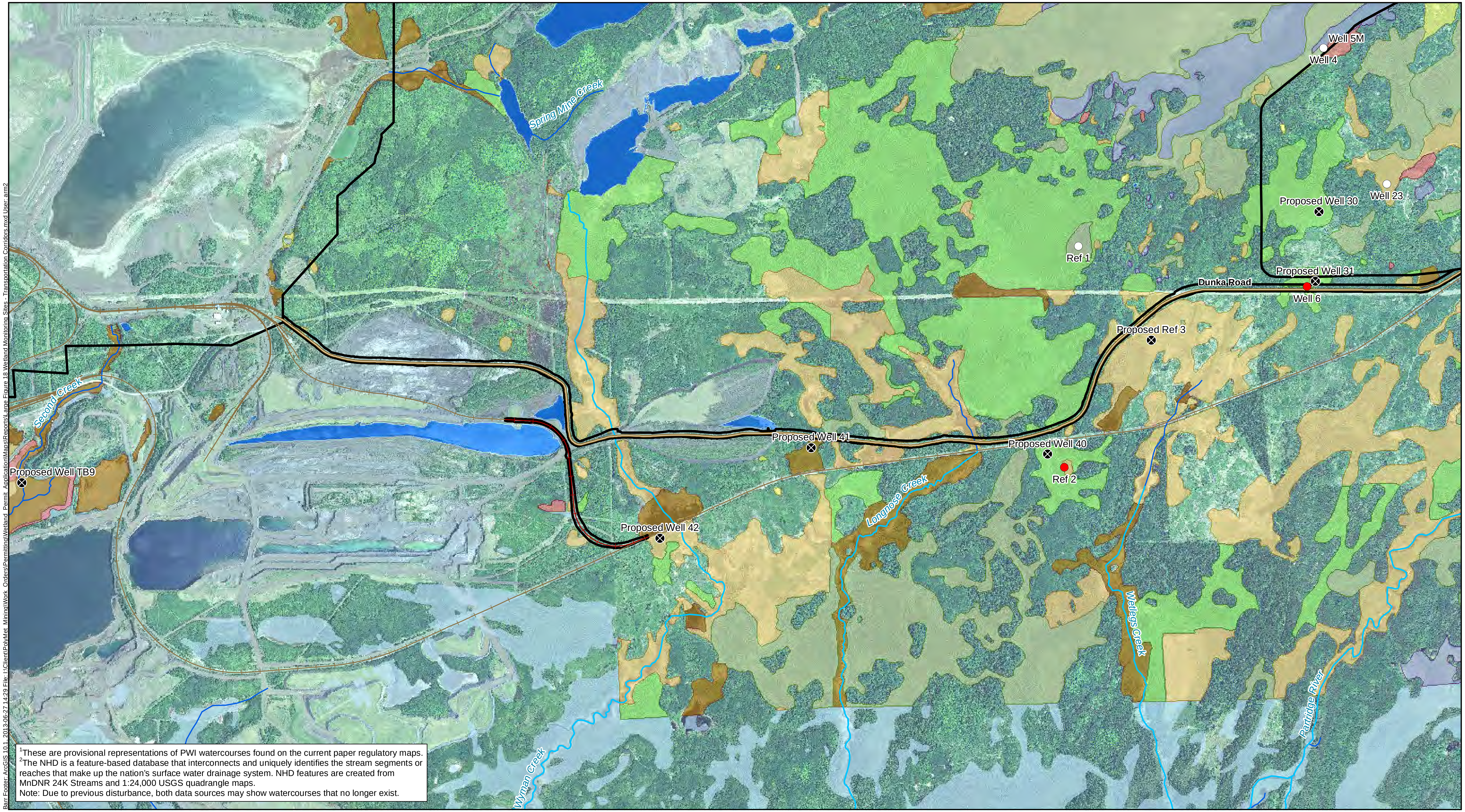
[1]These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2]The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

- ☐ Project Areas
- ⊗ Proposed Wetland Impact Monitoring Locations
- ○ Wetland Hydrology Monitoring Locations
- ● Monitoring Locations to be Removed
- ━ FTB Containment System
- ━ Dunka Road
- ∼ Public Waters Inventory (PWI) Watercourses[1]
- ∼ National Hydrography Dataset (NHD) Rivers & Streams[2]
- ⬭ National Wetlands Inventory

Eggers & Reed Wetland Types
- ⬭ Shrub Swamps (Alder thickets & Shrub-carrs)
- ⬭ Coniferous bog
- ⬭ Coniferous swamp
- ⬭ Deep marsh; Shallow marsh
- ⬭ Hardwood swamp
- ⬭ Open water (Shallow, open water & lakes)
- ⬭ Open bog
- ⬭ Sedge meadow; Wet meadow

0 1,500 3,000 6,000
Feet

Large Figure 17
WETLAND MONITORING SITES - PLANT SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



[1] These are provisional representations of PWI watercourses found on the current paper regulatory maps.
[2] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from MnDNR 24K Streams and 1:24,000 USGS quadrangle maps.
Note: Due to previous disturbance, both data sources may show watercourses that no longer exist.

▭ Project Areas
⊗ Proposed Wetland Impact Monitoring Locations
○ Wetland Hydrology Monitoring Locations
● Monitoring Locations to be Removed
═ Dunka Road

┼ Existing Private Railroad
┼ Proposed Railroad Track
~ Public Waters Inventory (PWI) Watercourses[1]
~ National Hydrography Dataset (NHD) Rivers & Streams[2]
⬭ National Wetlands Inventory

Eggers & Reed Wetland Types
⬭ Shrub Swamps (Alder thickets & Shrub-carrs)
⬭ Coniferous bog
⬭ Coniferous swamp
⬭ Deep marsh; Shallow marsh
⬭ Hardwood swamp
⬭ Open water (Shallow, open water & lakes)
⬭ Open bog
⬭ Sedge meadow; Wet meadow

N

0 1,100 2,200 4,400
Feet

Large Figure 18
WETLAND MONITORING SITES - TRANSPORTATION CORRIDORS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Barr Footer: ArcGIS 10.1, 2013-06-27 14:29 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\Large Figure 18 Wetland Monitoring Sites - Transportation Corridors.mxd User: arm2

Attachments

Attachment A

NorthMet Project Wetland Data Package v7 and v7 Addendum

POLYMET
MINING

NorthMet Project

Wetland Data Package

Version 7

Issue Date: March 1, 2013

Table of Contents

Acronyms, Abbreviations and Units

Acronym / Abbreviation	Stands For
CWA	Clean Water Act
FTB	Flotation Tailings Basin
IAP	Impact Assessment Planning
HRF	Hydrometallurgical Residue Facility
LTVSMC	LTV Steel Mining Company
MDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
NADP	National Atmospheric Deposition Program
NEPA	National Environmental Policy Act
NHIS	Natural Heritage Information System
NWI	National Wetland Inventory
OSLA	Overburden Storage and Laydown Area
OSP	Ore Surge Pile
RFSS	Regional Forester Sensitive Species
RTH	Rail Transfer Hopper
SGCN	Species of Greatest Conservation Need
TWP	Treated Water Pipeline
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
WCA	Wetland Conservation Act
WWTF	Waste Water Treatment Facility
WWTP	Waste Water Treatment Plant

Unit	Description
ac-ft/yr	acre-feet per year
dBA	Decibel
gpm	gallons per minute
g/cm^3	grams per cubic centimeter
$g/m^2/yr$	grams per square meter per year
kg/ha	Kilograms per hectare
mg/L	milligrams per Liter
mi^2	Square miles
µg/L	microgram per Liter
$\mu g/m^2/yr$	microgram per square meter per year

1.0 Introduction

This document presents the wetlands data used by the Wetland Management Plan for the NorthMet Project (Project). In cases where a supporting document is referenced, a general description of the supporting document is provided. In this document, the Tailings Basin is the entire existing former LTV Steel Mining Company (LTVSMC) tailings basin and the Flotation Tailings Basin (FTB) refers to eastern portion of the Tailings Basin with the flotation tailings impounded atop it in Tailings Basin Cells 1E and 2E.

1.1 Outline

The outline of this document is:

Section 2.0	Discussion of regulatory basis for wetland management.
Section 3.0	Data on wetlands in the vicinity of the Project.
Section 4.0	Discussion of the approach to evaluating direct, potential indirect and cumulative wetlands impacts due to the Project.
Section 5.0	Evaluation of direct, potential indirect and cumulative wetlands impacts due to the Project.

This document is intended to evolve through the environmental review, permitting, operating, reclamation, and long-term closure phases of the Project. A Revision History is included at the end of the document and the most recently updated sections are highlighted in gray.

2.0 Regulatory Basis

Wetlands are defined by the *U.S. Army Corps of Engineers Wetland Delineation Manual* (Reference (1)) for administration of Section 404 of the Clean Water Act (CWA) and the Minnesota Wetland Conservation Act (WCA) of 1991 (Minnesota Rules, chapter 8420)

2.1 Section 404 of the Clean Water Act

The U.S. Army Corps of Engineers (USACE) has the authority to issue permits for the discharge of dredged or fill material into waters of the United States under Section 404 of the CWA. The U.S. Environmental Protection Agency (USEPA) has the authority to review and veto USACE decisions on Section 404 permits, but then the decision would be elevated to USACE headquarters for final decision by USACE. Section 404 is implemented using regional general permits, letters-of-permission procedures, and individual permits. Generally, individual permits are required for project impacts exceeding 3 acres or for smaller impacts to special resources. Because the Project will impact more than 3 acres, an individual permit will be required. If the USACE issues a CWA permit for the Project, wetland compensation for Project impacts will be required. With an individual permit, Section 401 Water Quality Certification is required before the permit will be issued.

2.2 Section 401 Water Quality Certification

The Minnesota Pollution Control Agency (MPCA) has been delegated the authority by the USEPA to issue Section 401 Water Quality Certifications to ensure a project will comply with state water quality standards. Individual certification will be necessary because an individual Section 404 permit is required for the Project. The MPCA also has administrative authority under Minnesota Rules, part 7050.0186, regarding wetland mitigation.

2.3 Minnesota Wetland Conservation Act

The filling, excavation, and draining of wetlands is also regulated by the WCA, which is administered by a local governmental unit (LGU). For mining projects, the designated LGU is the Minnesota Department of Natural Resources (MDNR) Division of Lands and Minerals. The WCA requires wetland mitigation for Project impacts.

2.4 Permitting Process

Project proponents must complete a sequencing analysis before proposing to drain, flood, or excavate wetlands by completing the following steps:

- Attempt to <u>avoid</u> direct and indirect impacts to wetlands;
- <u>Minimize</u> impacts to wetlands by limiting the degree or magnitude of wetland activity;

- Rectify temporary impacts by repairing, rehabilitating, or restoring the affected wetland,

- Reduce or eliminate impacts to wetlands over time by preserving the wetlands through proper maintenance, management, and operation of the Project to avoid further draining or flooding of wetlands, and

- Replace unavoidable wetland impacts by replacing with wetland areas of equal or greater public value.

Poly Met Mining Inc. (PolyMet) initially submitted a wetland permit application to the USACE and MDNR in July 2004 (Reference (2)). Based on the revised Project plans, PolyMet will submit a revised combined wetland application form, *Minnesota Local/State/Federal Application Forms for Water/Wetland Projects*, to fulfill the requirements of Sections 404 and 401 of the CWA and the WCA for the Project. The wetland permit application will describe the proposed mining activities that may impact wetlands and identify areas with potential impacts to wildlife, state or federally listed endangered and threatened species, and cultural resources. This revised combined application will be sent to the USACE and the MDNR. The USACE will send the form to the MPCA as deemed necessary. A permit or certification must be received from each agency before Project work can begin in wetlands.

2.5 Cumulative Wetland Impact Analysis

The cumulative wetland impact study is intended to help satisfy the requirements of Section 3.3.3.2 of the Scoping Decision Document (Reference (3)) to meet National Environmental Policy Act (NEPA) requirements (42 U.S.C. 4321 et seq.). The Council on Environmental Quality (CEQ), which oversees administration of the NEPA process, has defined cumulative effects in its regulations as:

> *[T]he impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR § 1508.7).*

While Section 404 of the CWA and the WCA provide programs for evaluating project-specific wetland impacts, the NEPA establishes national goals and a process to analyze cumulative effects on protected wetland resources (Section 404 permit authorization). The consideration of resources available in the past compared to those present currently, and the effects of reasonably foreseeable future actions, provides a context for assessing the cumulative impacts on wetland, lake, and deepwater resources.

3.0 Wetland Data

This section summarizes the wetland resources within the Project. Section 3.1 describes the various assessments of wetland resources conducted for the Project. The wetlands within the Project Footprint are presented in Section 3.2.

3.1 Wetland Delineation

Delineation and functional assessment of wetlands impacted by the Project have been conducted as the Project has evolved. This section contains summaries of and references to the reports that have been submitted. Large Table 1 provides details for all wetlands located within the Project areas. For each area, the table provides the total acreage of the wetland, wetland type, total wetland area within the Project area (acres), direct wetland impacts (acres), remaining wetland area (acres), quality rating, and type of direct impact disturbance factor.

3.1.1 Initial Report (RS14 Draft-02)

Reference (2) was submitted in November 2006 and describes wetland delineation activities conducted at the Project site between August 2004 and July 2006 including the methods, findings, and a summary of wetland resources within the Project site. The Project areas have changed since the July 2004 permit application and the wetland resources within the Project areas have been refined based on additional field delineations (Sections 3.1.2 through 3.1.5).

Reference (2) presents the results of an evaluation of wetlands delineated within the following Project areas: mine pits, stockpiles, Tailings Basin, railroad access routes to the Plant Site, the Plant Site, and tailings dam drain system and water pipeline. The Tailings Basin is an actively permitted waste storage facility, and is therefore, not subject to state and federal wetland regulations.

3.1.2 Wetland Impacts – Dunka Road Improvements and Treated Water Pipeline (Technical Memorandum)

Reference (4) was submitted on April 26, 2007 and provides information pertaining to wetlands impacted by the Dunka Road improvements and the Treated Water Pipeline. The pipeline will be constructed adjacent to and north of Dunka Road. A field review was conducted in March 2007 to determine the wetland boundaries and verify wetland types in an area 100 feet south and 100 feet north of the road edge starting at the proposed location of the Minnesota Power Substation and ending just north of the junction of Dunka Road and the road to Area 5 (Large Figure 1).

3.1.3 Wetland Impacts – Tailings Basin Mitigation Alternative (Technical Memorandum)

Reference (5) was submitted on June 2, 2008 and describes potential wetland impacts resulting from the construction of the tailings dam in the FTB area. A wetland delineation and functional assessment was conducted in March 2007, November 2007, and May 2008 to identify wetlands not included in prior delineations.

3.1.4 Memo: TB-12 Pipeline Route Threatened and Endangered Species Survey and Wetland Delineation Results for Tailings Basin Alternative

Reference (6) was submitted on December 7, 2009 and describes potential wetland impacts from the construction of the TB-12 pipeline. The construction corridor was 8.4 miles long and 50 feet wide, for a total of 50.6 acres, starting at the Plant Site and ending at the Partridge River. The field delineation was conducted on September 8-9, 2009. The TB-12 Pipeline is also referred to as the Colby Lake Water Pipeline Corridor.

3.1.5 Project Baseline Wetland Type Evaluation

Reference (7) was submitted in April 2011 and provides baseline data regarding the classification and acreages of wetlands surrounding the Mine Site and Tailings Basin (Large Figure 2). Wetlands were evaluated within two areas using data collected from 2004-2010: a 23,927-acre area surrounding the Mine Site (referred to as Area One) and a 19,397-acre area located north and northwest of the Tailings Basin (referred to as Area Two). There were 11,195 acres of wetland identified within Area One (Large Figure 3) and 8,606 acres of wetland identified within Area Two (Large Figure 4). Area One and Area Two include all of the wetland delineations described in Sections 3.1.1 through 3.1.3. The wetlands identified within the TB-12 pipeline corridor (Section 3.1.4) are not found within either Area One or Area Two.

Based on Reference (7), the most common wetland types in Area One include coniferous bog (42%), shrub swamp (30%), and coniferous swamp (18%). In Area Two, the most common wetland types include shrub swamp (34%), coniferous swamp (26%), and coniferous bog (15%). Wetlands across the two areas consist of large wetland complexes that are forested wetland communities dominated by black spruce and tamarack trees.

3.1.6 Updates to Previous Wetland Delineations

Updates to previous wetland delineations were made between April 2011 when Reference (7) was submitted and fall of 2012. Following additional site visits and aerial photograph review, wetland boundaries and types were further refined. Based on these updates, there are approximately 11,201 acres of wetland identified in Area One and 8,622 acres of wetlands identified in Area Two (Table 3-1).

Table 3-1 Wetland Types within Area One and Area Two

Eggers and Reed Wetland Community	Area One (acres)	Area Two (acres)
Coniferous bog	4,581	1,018
Coniferous swamp	2,072	2,537
Deep marsh	220	514
Hardwood swamp	27	161
Open bog	283	354
Open water (includes shallow, open water and lakes)	245	285
Sedge/wet meadow	46	137
Shallow marsh	359	654
Shrub swamp (includes alder thicket and shrub-carr)	3,368	2,962
Total acres of wetland	11,201	8,622

The wetland types in Area One include coniferous bog (41%), shrub swamp (30%), coniferous swamp (18%), shallow marsh (3%), open bog (3%), open water (2%), deep marsh (2%), sedge/wet meadow (less than 1%), and hardwood swamp (less than 1%). In Area Two, the wetland types include shrub swamp (34%), coniferous swamp (29%), coniferous bog (12%), shallow marsh (8%), deep marsh (6%), open bog (4%), open water (3%), hardwood swamp (2%), and sedge/wet meadow (2%).

3.2 Wetland Summary for the Project Areas

The Project Footprint that will be used for this analysis has been defined and detailed in the Project Description (Reference (8)). The wetlands are summarized within the Project Footprint, which includes the following Project areas: the Mine Site, Railroad Connection Corridor, Dunka Road and Utility Corridor, Plant Site, FTB, Hydrometallurgical Residue Facility (HRF), and the Colby Lake Water Pipeline Corridor (Large Figure 1).

The Project areas include 177 wetlands covering approximately 1,585 acres (Large Table 1). The percentage (based on acreage) of Eggers and Reed (Reference (9)) wetland types identified in the Project areas include: coniferous bog (55%); alder thicket (12%); shallow marsh (11%); coniferous swamp (9%); deep marsh (7%); sedge meadow (2%); open bog (1%); wet meadow (1%); hardwood swamp (1%); shallow, open water (less than 1%); and shrub-carr (less than 1%).

The overall quality of the wetlands was evaluated using the Minnesota Rapid Assessment Method (MnRAM 3.0). Within the Project areas, 105 of the 177 wetlands (59%) in the Project area are rated as high quality, 12 wetlands (7%) are rated as moderate quality, and 60 wetlands (34%) are rated as low quality (Large Table 1). Low quality wetlands are located at the FTB Area, HRF, and Colby Lake Water Pipeline Corridor. Wetlands at the Mine Site, Dunka Road and Utility Corridor, and Railroad Connection Corridor are ranked as high or moderate quality.

3.2.1 Mine Site

Wetlands were delineated on the 3,014 acre Mine Site (Large Figure 5). Construction of the following systems will occur in the Mine Site: mine pits, stockpiles, haul roads, Rail Transfer Hopper (RTH), Waste Water Treatment Facility (WWTF) and Central Pumping Station (CPS), stormwater ditches and ponds, process water pipes and ponds, culverts, perimeter dike, Category 1 Waste Rock Stockpile Groundwater Containment System, Treated Water Pipeline (TWP), and Dunka Road upgrades (Reference (8)).

A summary of the wetlands, classified by Reference (9) wetland community type, is provided in Table 3-2.

Table 3-2 Wetland Types within the Mine Site

Eggers and Reed Wetland Community	Mine Site (acres)
Coniferous bog	873.43
Coniferous swamp	128.61
Deep marsh	5.03
Hardwood swamp	12.79
Open bog	18.34
Open water (includes shallow, open water and lakes)	0
Sedge/wet meadow	39.53
Shallow marsh	44.02
Shrub swamp (includes alder thicket and shrub-carr)	176.03
Total acres of wetland	1,297.78

A total of 87 wetlands covering approximately 1,298 acres have been identified within the Mine Site (Large Table 1). A total of 7 wetlands, each over 50 acres in size within the Project area, comprise approximately 774 acres of wetlands within the Mine Site. There are an additional 5 wetlands, each over 20 acres in size within the Mine Site. Together, these 12 wetlands comprise 72% of the wetland area within the Mine Site.

A total of 79% of the wetlands in the Mine Site are coniferous swamp/bog and open bog communities. Shrub swamp wetland communities comprise 13%, shallow marshes comprise about 3%, sedge/wet meadow communities make up 3%, and hardwood swamp communities comprise 1% of the wetlands in the Mine Site. Deep marshes comprise less than 1% of the wetland area in the Mine Site.

Approximately 92% of the wetlands in the Mine Site are of high quality and 8% of wetlands are of moderate quality. High quality wetlands have low disturbance levels and high vegetative diversity and integrity. Moderate quality wetlands have impounded open water because of beaver dams and downstream culverts under Dunka Road or the railroad, are adjacent to U.S. Forest Service (USFS) roads, the Dunka Road corridor, or the Railroad Connection Corridor.

3.2.2 Railroad Connection Corridor

An approximately 1.1 mile length of railroad is proposed to connect two existing rail lines between the Mine Site and the Plant Site (Large Figure 6). A summary of the wetlands, classified by Reference (9) wetland community type, is provided in Table 3-3.

Table 3-3 Wetland Types within the Railroad Connection Corridor

Eggers and Reed Wetland Community	Railroad Connection Corridor (acres)
Coniferous bog	0
Coniferous swamp	0.07
Deep marsh	0
Hardwood swamp	0
Open bog	0
Open water (includes shallow, open water and lakes)	0
Sedge/wet meadow	0
Shallow marsh	0.07
Shrub swamp (includes alder thicket and shrub-carr)	0.30
Total acres of wetland	0.44

A total of 4 wetlands covering 0.44 acres have been identified within the Railroad Connection Corridor (Large Table 1). A total of 68% of the wetlands are shrub swamp, 16% are coniferous swamp, and 16% are shallow marsh.

All of the wetlands in the Railroad Connection Corridor are high quality. While these wetlands are moderately impacted by either a haul road or an existing railroad, they have high vegetative diversity/integrity.

3.2.3 Dunka Road and Utility Corridor

This Project area will include improvements to Dunka Road and construction of the TWP that will be located adjacent to and north of Dunka Road (Large Figure 7, Reference (4)). Dunka Road is an unpaved gravel road that was used as an active mine road in the former LTVSMC operations. Dunka Road will be utilized to transport mine equipment between the Mine Site and the Area 1 Shop, as well as mine personnel between the Mine Site and the Area 2 Shop (Large Figure 1). The TWP will carry water from the CPS to the FTB. A summary of the wetlands, classified by Reference (9) wetland community type, is provided in Table 3-4.

Table 3-4 Wetland Types within the Dunka Road and Utility Corridor

Eggers and Reed Wetland Community	Dunka Road Corridor (acres)
Coniferous bog	0.89
Coniferous swamp	1.54
Deep marsh	0
Hardwood swamp	0
Open bog	0
Open water (includes shallow, open water and lakes)	0
Sedge/wet meadow	0
Shallow marsh	0.52
Shrub swamp (includes alder thicket and shrub-carr)	3.81
Total acres of wetland	6.76

A total of 21 wetlands, encompassing 6.76 acres, have been identified within the Dunka Road and Utility Corridor (Large Table 1). The wetlands in the corridor include shrub swamp (56%), coniferous swamp (23%), coniferous bog (13%), and shallow marsh (8%).

These wetlands are currently located adjacent to Dunka Road and some of the wetlands have been previously logged. Wetlands in the western half of the corridor are located within areas previously disturbed by mining activities in the former LTVSMC operations. All of the wetlands are of high quality.

3.2.4 Plant Site

The Plant Site is the location of the former LTVSMC facilities (Large Figure 8). The existing facilities will be upgraded and construction of the following systems will occur: Flotation Building, Concentrate Dewatering/Storage Building, Hydrometallurgical Plant, Oxygen Plant, and supporting infrastructure (e.g., road, etc.; Reference (8)).

Nearly the entire plant facilities area is disturbed by past mining activities. No wetlands are present within the plant area, although there is a Plant Reservoir located east of the concentrator that is not regulated as a wetland (Reference (7)).

3.2.5 Flotation Tailings Basin (FTB) Area

The proposed FTB area includes three adjacent cells identified as Cell 1E, Cell 2E, and Cell 2W (Large Figure 9). Construction of the following systems will occur in the FTB Area: a FTB Containment System to manage FTB seepage; a buttress for stability along the north and east sides of Cell 2E; a drainage swale located northeast of Cell 2E; an overflow channel located northeast of Cell 2E; and one containment system to collect seepage from Cell 1E on the south side.

A summary of the wetlands located within the Project area, classified by Reference (9) wetland community type, is provided in Table 3-5.

Table 3-5 Wetland Types within the FTB Area

Eggers and Reed Wetland Community	FTB Area (acres)
Coniferous bog	0
Coniferous swamp	14.44
Deep marsh	106.11
Hardwood swamp	0.69
Open bog	0
Open water (includes deep water, shallow, open water and lakes)	0.85
Sedge/wet meadow	1.48(1)
Shallow marsh	99.22
Shrub swamp (includes alder thicket and shrub-carr)	14.06
Total acres of wetland	236.85(1)

(1) A 0.03 acre area of sedge/wetland meadow is classified as exempt.

A total of 49 wetlands covering approximately 237 acres were identified within the FTB Area (Large Table 1). There is a 0.03 acre portion of the sedge/wet meadow wetland identified as exempt because the wetlands are located within the Cliffs Erie LLC (formerly LTVSMC) Permit To Mine Ultimate Tailings Basin Limit boundary and are not regulated by state and federal wetland regulations (Section 5.1). The wetlands in the FTB Area include deep marsh (45%), shallow marsh (42%), coniferous swamp (6%), shrub swamp (6%), sedge/wet meadow (less than 1%), open water (less than 1%), and hardwood swamp (less than 1%).

The wetlands in the FTB Area have been previously impacted by LTVSMC tailings deposition, roads, and impoundment. The majority (92%) of wetlands within the FTB Area are currently rated as low quality with low vegetative diversity/integrity. Eight percent of the wetlands are rated as moderate quality.

3.2.6 Hydrometallurgical Residue Facility (HRF)

The proposed HRF will be located near the southwest corner of the Cell 2W, at the site of the Emergency Basin used in the former LTVSMC operations (Large Figure 10, Reference (8)).

A summary of the wetlands located within the Project area, classified by Reference (9) wetland community type, is provided in Table 3-6.

Table 3-6 Wetland Types within the HRF Area

Eggers and Reed Wetland Community	HRF (acres)
Coniferous bog	0
Coniferous swamp	0
Deep marsh	0
Hardwood swamp	0
Open bog	0
Open water (includes deepwater, shallow, open water and lakes)	0
Sedge/wet meadow	0
Shallow marsh	36.07(1)
Shrub swamp (includes alder thicket and shrub-carr)	0
Total acres of wetland	36.07(1)

(1) A 28.56 acre area of shallow marsh is classified as exempt.

A total of 2 shallow marsh wetlands, covering 36.07 acres, were identified within the HRF (Large Table 1). There is a 28.56 acre portion of the shallow marsh wetland identified as exempt because wetlands located within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary are not regulated by state and federal wetland regulations (Section 5.1).

An unpaved, gravel road is located along the north side of these wetlands along with small buildings and associated facilities used in the former LTVSMC operations.

3.2.7 Colby Lake Water Pipeline Corridor

The Colby Lake Water Pipeline Corridor contains an existing pipeline that was used to provide makeup water in the former LTVSMC operations (Large Figure 11). There will be no construction within this corridor as the existing pipeline will be used to provide water for the Project. A summary of the delineated wetlands, classified by Reference (9) wetland community type, is provided in Table 3-7.

Table 3-7 Wetland Types within the Colby Lake Water Pipeline Corridor

Eggers and Reed Wetland Community	Colby Lake Water Pipeline Corridor (acres)
Coniferous bog	0
Coniferous swamp	0
Deep marsh	1.00
Hardwood swamp	0
Open bog	0
Open water (includes deep water, shallow, open water and lakes)	0
Sedge/wet meadow	1.35
Shallow marsh	2.58
Shrub swamp (includes alder thicket and shrub-carr)	2.06
Total acres of wetland	6.99

A total of 14 wetlands covering 6.99 acres were identified within the Colby Lake Water Pipeline Corridor (Large Table 1). The wetlands in the corridor include shallow marsh (37%), shrub swamp (30%), wet meadow (19%), and deep marsh (14%).

The wetlands are located adjacent to an unpaved, gravel road and within a previously disturbed corridor. The majority of wetlands in this corridor are rated as low quality (93%), with the remaining wetland rated as moderate quality (7%).

4.0 Methods for Impact Evaluation

The Wetland Work Plan (Attachment A) was approved by the Co-lead Agencies on September 16, 2011 and describes the methods that will be used to identify direct wetland impacts and potential indirect wetland impacts for the Project. The Wetland Work Plan was developed as specified in the Wetland Resources Impact Assessment Planning (IAP) Final Summary Memo and Co-lead Agency Final Work Plan Preparation Guidance of July 1, 2011 (Guidance Document) and the Wetland IAP Work Plan Compiled Comments dated August 30, 2011. Wetland impacts for the Project were previously evaluated for the Draft Environmental Impact Statement (DEIS) (Reference (10)) and included direct, potential indirect, and cumulative impacts. The results of the wetland analysis are presented in Section 5.0.

5.0 Impact Analysis

5.1 Direct Impacts

For this impact analysis, direct impacts are defined as mining-related activities that result in filling or excavation within the boundaries of a wetland. The analysis performed for the DEIS is described in Section 4.2 of Reference (11). The analysis performed for the Supplemental DEIS duplicates that effort using the revised Project Footprint and using accepted tools and protocols as defined in Attachment A. Wetlands within the Project Footprint were classified using Reference (9) wetland community types. The wetland types and acreages were identified in Reference (7), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The FTB area and the HRF are located within the LTVSMC Permit to Mine Ultimate Tailings Basin Limit boundary. When LTVSMC ceased production in January 2001, the mining related assets were transferred to Cleveland Cliffs, Inc. which formed Cliffs Erie LLC. Wetlands located within the Cliffs Erie LLC (formerly LTVSMC) Permit to Mine Ultimate Tailings Basin Limit boundary, are not regulated by state and federal wetland regulations so are not included in this analysis.

The direct impacts associated with each wetland within the Project areas are shown in Large Table 1. The direct wetland impacts are summarized by wetland type using Reference (9) wetland community types as shown in Large Table 2. Of the 177 wetlands in the Project area, 126 wetlands will be directly impacted, totaling 912.46 acres of direct wetland impact. The Mine Site will contain the majority of direct wetland impacts (83%), followed by the FTB Area (15%), HRF (less than 1%), Dunka Road and Utility Corridor (less than 1%), and the Railroad Connection Corridor (less than 0.1%). No direct impacts are associated with the Plant Site or the Colby Lake Water Pipeline Corridor.

The direct wetland impacts within the Project areas will occur in the following wetland types: coniferous bog (56%), shrub swamp (12%), coniferous swamp (9%), shallow marsh (9%), deep marsh (8%), sedge/wet meadow (4%), hardwood swamp (1%), and open bog (1%).

5.1.1 Mine Site

The Project features within the Mine Site were buffered up to 100 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 5. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 59 directly impacted wetlands located in the Mine Site covering approximately 758 acres (Large Figure 5 and Large Table 2). The total wetlands impacted by direct wetland impact include fill (39%), excavation (24%), or both fill and excavation (37%). Three wetland types comprise 89% of the proposed wetland impacts in the Mine Site and include

508 acres of coniferous bog (67%), 98 acres of shrub swamp (13%), and 70 acres of coniferous swamp (9%). In addition, 38 acres of sedge/wet meadow (5%), 24 acres of shallow marsh (3%), 12 acres of hardwood swamp (2%), 8 acres of open bog (1%), and deep marsh (less than 1%) will also be impacted.

Approximately 99% of the directly impacted wetlands are rated high quality (Large Table 1). One percent of the directly impacted wetlands are rated as moderate quality with the disturbances in these wetlands related to impoundment and proximity to roads.

5.1.2 Railroad Connection Corridor

The proposed area of disturbance for the Railroad Connection Corridor includes the entire area shown in Large Figure 6. The Project features within the Railroad Connection Corridor were buffered up to 10 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown Large Figure 6. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 4 directly impacted wetlands located in the Railroad Connection Corridor covering 0.44 acres (Large Figure 6 and Large Table 2). The type of direct wetland impact is fill (100%). The wetland types that will be directly impacted include shrub swamp (68%), coniferous swamp (16%), and shallow marsh (16%).

All of the wetlands in this area are high quality and have high vegetative diversity/integrity (Large Table 1). These wetlands have been moderately impacted by either a haul road or an existing railroad.

5.1.3 Dunka Road and Utility Corridor

The Project features within the Dunka Road and Utility Corridor were buffered up to 10 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 7. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are 21 directly impacted wetlands located in the Dunka Road and Utility Corridor covering 6.76 acres (Large Figure 7 and Large Table 2). The type of direct wetland impact is fill (100%). The wetland types that will be directly impacted include shrub swamp (56%), coniferous swamp (23%), coniferous bog (13%), and shallow marsh (8%).

Some of the wetlands have been previously logged and wetlands in the western half of the corridor are located within areas previously disturbed by mining activities in the former LTVSMC operations. All of the wetlands are of high quality (Large Table 1).

5.1.4 Plant Site

There are no direct wetland impacts in the Plant Site because no wetlands are present within the plant area. The constructed Plant Reservoir located east of the Concentrator Building is not regulated as a wetland (Large Figure 8).

5.1.5 Flotation Tailings Basin (FTB) Area

Wetlands located outside of the Cliffs Erie LLC Permit to Mine Ultimate Tailings Basin boundary but within the FTB Area are included in the direct wetland impact analysis (Large Figure 9). The wetland in the FTB Area that is not subject to state and federal regulations includes 0.03 acres of Wetland ID T8.

The Project features within the FTB Area were buffered up to 25 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown in Large Figure 9. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There will be 40 directly impacted wetlands located in the FTB Area covering 139.56 acres (Large Figure 9, Large Table 2). The total wetlands impacted by direct wetland impact include fill (35%), excavation (2.5%), excavation and fill (2.5%), and the FTB Containment System (60%). The wetland types that will be directly impacted include deep marshes (53%), shallow marshes (32%), coniferous swamps (8%), shrub swamps (6%), and fresh/wet meadows (1%).

Wetlands in this area have been disturbed by previous mining activities in the former LTVSMC operations or by impoundments caused by beaver activity throughout the area. All of the directly impacted wetlands are disturbed by impoundment, fill, or ditches, and are low or moderate quality wetlands (Large Table 1).

5.1.6 Hydrometallurgical Residue Facility (HRF)

Wetlands located outside of the Cliffs Erie LLC Permit to Mine Ultimate Tailings Basin boundary but within the HRF area are included in the direct wetland impact analysis (Large Figure 10). The wetland in this Project area that is not subject to state and federal regulations includes 28.56 acres of Wetland ID 1155.

The Project features within the HRF were buffered up to 50 feet, then the feature and buffer areas were merged, resulting in the proposed area of disturbance as shown Large Figure 10. Creating a maximum area of potential disturbance for the Project features will avoid underestimating the direct wetland impacts in the Project area.

There are two directly impacted wetlands located in the HRF covering 7.51 acres (Large Figure 10, Large Table 2). The type of direct wetland impact includes fill (100%). The wetland type that will be directly impacted includes shallow marsh (100%) which is currently a low quality wetland (Large Table 1).

5.1.7 Colby Lake Water Pipeline Corridor

There are no direct wetland impacts in the Colby Lake Water Pipeline Corridor because there will be no construction within this corridor (Large Figure 11 and Large Table 2).

5.2 Potential Indirect Impacts

The analysis of potential indirect wetland impacts was completed based on information in Attachment A. The purpose of this analysis is to provide an estimate of potential indirect wetland impacts. Potential indirect wetland impacts were assessed based on:

- Changes in wetland watershed areas (during operation and long-term closure);
- Groundwater drawdown resulting from open pit mine dewatering;
- Groundwater drawdown resulting from operation of the FTB including groundwater seepage containment;
- Changes in stream flow near the Mine Site and FTB and associated impacts to wetlands abutting the streams (during operation and long-term closure);
- Wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.; and
- Potential change in wetland water quality related to atmospheric deposition of dust and rail car spillage associated with Mine Site and FTB operations.

Each analysis in the above list was completed using the same set of wetlands that were not directly impacted (Section 5.1), therefore there are wetlands that may be potentially indirectly impacted by more than one type of assessed source (e.g., Wetland ID X may be impacted by fragmentation, change in watershed, and groundwater drawdown). Therefore, the potential indirect impacts for each wetland cannot be summed across the analysis as this may result in double-counting acres for a wetland. The results of these respective analyses and assessments identify areas to be monitored for potential wetland impacts as part of the monitoring plan that is expected to be implemented as part of the Section 404 permit conditions for the Project.

The potential indirect wetland impact analysis was completed for the Mine Site, the FTB, HRF, the transportation corridors (railroad and Dunka Road), and the Colby Lake Water Pipeline Corridor. Wetlands that were identified as directly impacted in Section 5.1 were excluded from this evaluation. No potential indirect impacts are identified within the Plant Site due to the lack of wetlands on this site.

5.2.1 Mine Site

Wetlands were identified within 500-feet increments beginning at the edge of the mine pits and continuing out to a total of 10,000 feet (Large Figure 12). The area of evaluation only included wetlands within Area One (Large Figure 12) where wetland type information has been developed and it did not include wetlands identified as directly impacted (Section 5.1). In addition, wetlands in the Peter Mitchell open pit taconite mine and areas north of this mine were excluded from evaluation as described in Attachment A). Large Table 3 identifies each wetland within each of the 500-feet zones and Large Table 4 provides a summary of wetland types within each 500-feet increment.

5.2.1.1 Potential Indirect Impacts – Wetland Fragmentation

For remaining wetlands not directly impacted (Section 5.1), an estimate of potential indirect wetland impacts from wetland fragmentation by Project features (open pits, stockpiles, haul roads, etc.) was determined based on an analysis of the various factors that may contribute to potential fragmentation. Wetland fragments in the Mine Site are identified in Table 5-1.

Wetlands were determined to be fragmented and their associated remaining acreage included as a potential indirect wetland impact if they were small remnants of a directly impacted wetland located between Project features (e.g., in the area between the Category 1 Waste Rock Stockpile and the West Pit).

Approximately 26.4 acres of wetland fragments were identified in the Mine Site (Table 5-1). The majority of the wetland fragments in the Mine Site consist of coniferous bog (79%), followed by alder thicket (14%), coniferous swamp (7%), and sedge meadow (less than 1%).

Table 5-1 Fragmented Wetlands in the Mine Site

Wetland ID	Eggers and Reed Wetland Community	Total Wetland Size (acres)	Direct Impact (acres)	Potential Indirect Impact (acres)
20	Sedge meadow	17.06	16.96	0.10
32	Coniferous bog	73.36	70.99	2.37
45	Alder thicket	37.55	28.83	3.58
48	Coniferous bog	89.16	27.8	1.86
51	Alder thicket	7.47	7.45	0.02
52	Alder thicket	3.88	3.88	<0.01
55	Alder thicket	3.91	3.85	0.06
57	Coniferous swamp	78.06	50.49	1.41
68	Coniferous swamp	23.81	10.89	0.09
77	Coniferous bog	13.01	0.92	<0.01
80	Coniferous bog	0.29	0.22	0.08
81	Coniferous swamp	1.68	1.44	0.24
82	Coniferous bog	62.4	60.77	1.63
86	Coniferous bog	2.47	2.46	0.01
97	Coniferous bog	4.46	2.57	1.89
98	Coniferous bog	15.5	15.07	0.42
100	Coniferous bog	176.19	102.96	3.44
101	Coniferous bog	14.21	11.73	0.08
103	Coniferous bog	118.84	109.97	8.86
104	Coniferous bog	3.57	3.47	0.10
107	Coniferous bog	40.92	31.63	0.10
107A	Coniferous swamp	1.74	1.69	0.05
Total acres of wetland		789.54	566.04	26.39

5.2.1.2 Potential Indirect Impacts – Change in Hydrology

5.2.1.2.1 Potential Indirect Impacts – Change in Hydrology due to Change in Watershed Area

Potential for indirect impacts to wetland acreage not directly impacted (Section 5.1) due to change in watershed area were assessed by evaluating the change in watershed area per acre of wetland. Watersheds were defined for each wetland within the Mine Site boundary as well as wetlands outside the Mine Site with watershed area that may be impacted by Project features. Wetland and watershed areas were determined for the following conditions: existing conditions, during operations when the maximum amount of watershed has been removed (i.e., maximum Project extent), and at long-term closure. The analysis was completed using the following steps:

- The watershed area is defined as the sum of the upland area and the wetland area within each watershed. For each wetland in the Mine Site, GIS was used to determine the upland area (acres) and wetland area (acres) within each watershed area (acres). Using these acreages, the percentage of a wetland within its watershed was calculated.

- The tributary acres per wetland acre were determined as a proportion of the watershed area (acres) to the wetland area (acres).

- The equivalent watershed yield (acre-feet/year (ac-ft/yr)) was determined for the existing, maximum operational extent, and long-term closure conditions. The average net precipitation rate is 11.77 inches/year, as calculated using the Partridge River streamflow data (Reference (12)). This rate was applied to each watershed to convert the tributary ratio in Step 2 to an equivalent flow (expressed as ac-ft/yr per acre of wetland) and an equivalent yield (expressed as inches/year).

- The change in the equivalent yield (inches/year) estimated over the life of the Project was evaluated relative to existing conditions equivalent yield to calculate a maximum percent change in yield. The change was compared to the range in observed yield estimated from USGS flow data of the Partridge River watershed for the historical period 1978-1988 (USGS gage 04015475).

The existing conditions include the wetlands which represent the existing, relatively undisturbed conditions at the Mine Site. Large Table 5 identifies the acreage for each wetland and its associated watershed for the existing conditions. This analysis includes wetlands and associated watersheds that are partially or completely within the Mine Site boundary. There is a total of 3,325 acres of wetlands within 6,287 acres of watershed; this results in about 53% of the analysis area covered by wetlands.

During operations, some watershed areas may be directly impacted by the Project and will no longer be considered as a tributary area to the wetland. Additionally, wetland areas may be directly impacted by the Project. As a result, the amount of water potentially contributed by the watershed to support the hydrology of the remaining wetlands may also change. Large Table 5 identifies the acreage for each wetland and its associated watershed for the operational conditions.

There were 20 wetlands that show an increase or decrease of greater than 20% equivalent yield which were identified as potentially indirectly impacted. Ombrotrophic coniferous bogs and open bogs, identified in Large Table 5 were not included in the total wetland acreage because their hydrology is supported by precipitation and not dependent on the size of the watershed. There are 11 wetlands (totaling approximately 35 acres) that have the potential to experience an increase in yield per wetland acre of greater than 20% and 9 wetlands (totaling approximately 15 acres) that may experience a decrease in yield per wetland acre in excess of 20% (Large Table 5; Large Figure 13).

The 49.39 acres of potentially indirectly impacted wetland types include alder thicket (52%), coniferous swamp (34%), minerotrophic coniferous bog (8%), shallow marsh (6%), and sedge meadow (less than 1%).

During reclamation, a portion of the wetlands and wetland watersheds within the Mine Site will be restored to the existing condition. Large Table 5 identifies the acreage for each wetland and its associated watershed for the long-term closure conditions.

5.2.1.2.2 Potential Indirect Impacts – Changes in Hydrology – due to Drawdown

Suggested guidelines for potential wetland impact zones resulting from changes in hydrology associated with the proposed mine development were provided by John Adams, ERM on February 26, 2011 (Reference (13)). Those suggested guidelines were supported by a 2009 position paper by the MDNR (Reference (14)), which provided a scientific analysis and analog data from other sites along the Mesabi Iron Range. The suggested potential impact zones were modified slightly by the Wetland IAP Group and the modified potential impact zones are referenced in Attachment A. The use of the potential impact zones referenced in Attachment A, as supported by the analog information referenced above, is a reasonable approach to estimating potential indirect wetland impacts resulting from hydrologic effects but are likely to overestimate the potential wetland impacts.

<u>Analog Data</u>

This section discusses the justification for the use of the analog data (Reference (13)) “based upon comparisons of the existing regional and site-specific geologic data (such as bedrock faults, bedrock joint systems, bedrock topography, glacial till hydraulic conductivities, etc.), site-specific engineering controls such as the Category 1 Waste Rock Stockpile seepage containment system, and the geologic settings of the analog information sites and the Mine Site” per Attachment A.

The analog data was used in place of a model such as MODFLOW, which cannot practically be used to estimate potential indirect wetland impacts, due to the complex mix of fractured bedrock, glacial till, and wetland soils at the Mine Site (Reference (14)) and therefore cannot be used to accurately assess the potential indirect impacts of pit dewatering on wetlands. As stated in Reference (14), previous versions of the MODFLOW model assumed that homogenous vertical and horizontal hydraulic conductivities were present within each model unit (i.e., bedrock, glacial till, and wetland soils), which is not the case at the Mine Site. Since the Adams and Liljegren position paper (Reference (14)) was issued, the MODFLOW model calibration was updated and the surficial deposits are represented as heterogeneous (Attachment B of Reference (12)). Despite the addition of heterogeneity to the MODFLOW model, the purpose of the model is to provide estimates of groundwater inflow rates to the pits. The model is not intended to represent the complex, localized heterogeneity that will likely exert a significant influence on whether potential indirect wetland impacts will occur.

The hydraulic properties of the bedrock and surficial deposits have been estimated at the Mine Site by a variety of methods, including conducting aquifer tests and using grain-size distribution data from soil borings. The range of hydraulic conductivities are as follows:

- Based on aquifer tests, the hydraulic conductivity of the unconsolidated deposits range from 0.012 to 31 feet/day (Reference (12)). Analysis of grain-size distribution data yielded a range of hydraulic conductivity estimates from 2 to 167 feet/day (Attachment B of Reference (12)).

- The hydraulic conductivity of bedrock of the Duluth Complex ranges from 0.00026 to 0.041 feet/day as measured by single well tests conducted in boreholes (Reference (12)).

- The hydraulic conductivity of bedrock of the Virginia Formation ranges from 0.0024 to 1.0 feet/day as measured by conducting four pumping tests (Reference (12)).

- Undecomposed, surface peat soils have hydraulic conductivities of up to several feet per day (Reference (14)).

- Deep, more decomposed peat layers have hydraulic conductivities on the order of 0.0028 feet/day (Reference (14)).

Because there is such a wide range in hydraulic conductivity within the natural geologic formations at the Mine Site, each model layer would contain widely variable hydraulic conductivities. Therefore, it is not realistic to model the expected effects of mine dewatering on wetlands in a meaningful fashion.

The Canisteo Pit analog site provides a clear example of how MODFLOW modeling cannot be expected to accurately estimate conditions in areas with highly variable, complex geology. In the Canisteo Pit modeling effort, the difference between simulated and measured water levels ranged from +28 feet to -4 feet and clearly could not accurately estimate water level changes of a few feet or less as would be necessary for estimating wetland impacts resulting from hydrologic changes (Reference (14)).

Virtually all water movement in peat wetlands occurs horizontally in the upper layers of peat. The deeper, more decomposed peat soils limit vertical seepage because of the low hydraulic conductivities (~0.0028 feet/day) (Reference (14)). Increased vertical seepage will not be induced by the lowering of groundwater below such a peat layer, the wetland hydrology is simply perched on the impermeable peat layer as in many perched wetlands with no underlying groundwater. Therefore, hydrologic impacts to peat wetlands have only been observed to occur within 1,000 feet from the edge of the mine pits.

Vertical seepage losses from wetlands without peat soils will only have the potential to occur in isolated areas of contiguous, high hydraulic conductivity bedrock faults and fracture zones located under isolated areas of high hydraulic conductivity glacial till and aligned with wetlands containing high hydraulic conductivity soils. The probability of these three features aligning on a broad scale is extremely low (Reference (14)).

The geologic and hydrogeologic settings of the Mine Site and the analog sites are relatively similar with a thin veneer of heterogeneous unconsolidated deposits underlain by fractured bedrock. The hydraulic conductivity of the unconsolidated deposits and bedrock are lower at the Mine Site than at the analog sites, so it is expected that the stated impact zones will likely overestimate the extent of potential wetland impacts (Attachment A). In addition, due to the thin, discontinuous nature of the surficial deposits at the Mine Site, drawdown effects are expected to be more localized at the Mine Site than at the analog sites. The numerous bedrock outcrops present at the Mine Site are also expected to act as barriers to flow in the unconsolidated aquifer, thereby limiting the area of influence of the pit. The analog sites have fewer or no bedrock outcrops compared to the Mine Site. Finally, the presence of the Partridge River approximately 4,000-6,000 feet south (downstream) of the mine pits, is likely to act as a natural barrier to the expansion of the cone of depression within the surficial aquifer in the zone from 3,500-10,000 feet from the pit.

Prior to conducting the analysis to identify potential indirect wetland impacts resulting from changes in hydrology, bog wetlands within and surrounding the Mine Site were reclassified as either ombrotrophic or minerotrophic consistent with the November 2011, USACE Memorandum (Reference (15)). For purposes of addressing potential indirect impacts for the Project, the Wetlands Workgroup recommended that wetlands identified as open bog or coniferous bog, using the Eggers and Reed (Reference (9)) classification system, should be subcategorized as either ombrotrophic or somewhat minerotrophic. This is important because ombrotrophic bogs would likely not be impacted by groundwater drawdown associated with dewatering during the Project, whereas more minerotrophic bogs would have a higher likelihood of being impacted (Reference (15)).

Wetlands are identified within four analog impact zones located within 0-1,000 feet, >1,000-2,000 feet, >2,000-3,500 feet, and >3,500-10,000 feet from the edge of the mine pits within Area One (Large Figure 14). Based on Attachment A, wetlands that are located within multiple analog impact zones are included in the analog impact zone that is closest to the edge of the mine pits. The likelihood of wetland hydrology impact is categorized as High, Medium, Low, and No Impact within the analog impact zones. The acreage of each wetland type within these potential impact zones is summarized in Large Table 6 and locations are shown in Attachment B, Large Figures B-1 to B5. Using this analysis, there are 1,390 acres of wetlands in the 0-1,000 feet zone (Large Figure B-1), 619 acres in the >1,000-2,000 feet zone (Large Figure B-2), 1,194 acres of wetlands in the >2,000-3,500 feet zone (Large Figure B-3), and 3,867 acres of wetlands in the >3,500-10,000 feet zone (Large Figure B-4) beyond the edge of the pits.

Large Figure B-5 shows the 7,070 acres of wetlands within these zones, with the likelihood of wetland hydrology impact categorized as: No Impact - 5,236 acres of wetlands (74%); Low likelihood - 374 acres of wetlands (5%); Moderate likelihood - 531 acres of wetlands (8%); and High likelihood - 929 acres of wetlands (13%) (Large Table 6). Within 0-10,000 feet from the edge of the mine pits, wetland types with a High likelihood of wetland hydrology impact include alder thicket (910 acres), coniferous swamp (19 acres), and sedge meadow (less than 1 acre); with a Moderate likelihood include alder thicket or shrub-carr (327 acres), coniferous swamp (195 acres), deep marsh (5 acres), shallow marsh (3 acres), and hardwood swamp (less than 1 acre); and with a Low Likelihood include coniferous swamp (223 acres), coniferous bog (77 acres), alder thicket or shrub-carr (68 acres), shallow marsh (4 acres), wet meadow (2 acres), and hardwood swamp (less than 1 acre).

The wetlands categorized as High likelihood are dominated by one alder thicket (886 acres; wetland ID 53D) that has approximately 4 acres (less than 1%) within the 0-1,000 feet analog impact zone. The remainder of this wetland (more than 99%) is located more than 1,000 feet away from the edge of the mine pits and extends out to the edge of Area One (Large Figure B-1). Based on the analog data, hydrologic impacts to peat wetlands are only observed to occur within 1,000 feet from the edge of the mine pits. Therefore, wetlands were categorized within the analog impact zones using an alternate method to determine the likelihood of wetland hydrology impact. For this method, wetlands that are located within multiple analog impact zones are split along zone edges and acreage is calculated by zone. As a result, the acreage for wetlands crossing zone edges is split among multiple zones, rather than included in the analog impact zone that is closest to the edge of the mine pits (Attachment B, Large Figures B-1 through B5). The acreage of each wetland type within these potential impact zones is summarized in Large Table 7 and locations are shown in Attachment B, Large Figures B-6 through B10. Using this analysis, there are 234 acres of wetlands in the 0-1,000 feet zone (Large Figure B-6), 311 acres in the >1,000-2,000 feet zone (Large Figure B-7), 718 acres of wetlands in the >2,000-3,500 feet zone (Large Figure B-8), and 4,564 acres of wetlands in the >3,500-10,000 feet zone (Large Figure B-9).

Large Figure B-10 shows the 5,827 acres of wetlands within these zones, with the likelihood of wetland hydrology impact categorized as: No Impact - 5,240 acres of wetlands (90%); Low likelihood - 422 acres of wetlands (7%); Moderate likelihood - 119 acres of wetlands (2%); and High likelihood - 46 acres of wetlands (1%) (Large Table 7). Within 0-10,000 feet from the edge of the Mine Pits, wetland types with a High likelihood of wetland hydrology impact include alder thicket (27 acres), coniferous swamp (19 acres), and sedge/wet meadows (less than 1 acre); with a Moderate likelihood include alder thicket and shrub-carr (96 acres), coniferous swamp (14 acres), deep marsh (5 acres), shallow marsh (3 acres), and hardwood swamp (less than 1 acre); and Low Likelihood include alder thicket and shrub-carr (247 acres), coniferous swamp (135 acres), coniferous bog (33 acres), shallow marsh (4 acres), sedge/wet meadow (2 acres), and hardwood swamp (1 acre).

Qualitative Discussion

This section includes the general discussion regarding potential indirect wetland impacts that might occur based on hypothetical hydrologic drawdown levels using the hydrologic wetland sensitivity method as described in Attachment A. The potential indirect wetland impacts may include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts.

Three categories of hydrologic wetland sensitivity, each with associated groundwater drawdown levels for each wetland community type, were defined as follows:

- **None-to-Slight**: Water level changes in which impact on the community will be slight to none with the potential for slight changes in abundance of various species but no change in species present. Monitoring or mitigation not anticipated.

- **Moderate**: Water level changes that may have a moderate impact on the wetland community with the potential for the loss and addition of some species. Monitoring recommended with mitigation based on monitoring results.

- **Severe**: Water level changes expected to result in severe impacts on the community with the potential for considerable loss of characteristic plant species and invasion by other species, conversion of wetland type or conversion to upland. Monitoring should be conducted and mitigation may be required. According to the hydrologic wetland sensitivity method, wetlands in which groundwater is not the principal source of water and in which mitigation of surface water is planned (e.g., streamflow augmentation) should be excluded from this category.

The wetland community sensitivity and estimating of changes to wetland communities as a result of groundwater drawdown for the hydrologic wetland sensitivity method were determined based on evaluating the vegetation characteristics of numerous Minnesota wetlands contained in the MDNR Natural Heritage Information System (NHIS) database (Attachment A). That data was used to develop an ordination, which groups wetlands within the various native plant community system groups (Reference (16)) reflecting differences in the degree of wetness of each community. However, the degree of wetness and the source of wetness information were not well-documented so it is unclear if the wetness parameter is related to persistence of wetness throughout the growing season, the typical maximum depth of water within the wetland, or some other wetness characteristic.

That ordination was then used to estimate how wetland communities will respond to decreasing water levels, with the main assumption that wetlands will move to the drier part of the ordination. The three categories of potential impact to the wetland communities were defined as None-to-Slight, Moderate, or Severe. The method states that the changes in the wetland communities associated with the Severe category are less valid for estimating vegetation changes than wetland communities included in the Moderate or None-to-Slight categories (Attachment A). Therefore, the hydrologic wetland sensitivity method simply estimated how wetland communities will respond to groundwater drawdown by assuming that they will change to drier native plant communities or variants of the original community. No data or research was utilized from actual wetlands responding to groundwater drawdown so this analysis and related data should only be used as an initial estimate of what changes might be expected should groundwater levels actually fall as a result of the proposed mining activities. Monitoring of hydrology and vegetation within potentially impacted wetlands represents the best method for documenting actual community changes resulting from hydrology changes, understanding complex hydrologic conditions, and identifying potential future indirect impacts related from mine features.

The preliminary information developed for the hydrologic wetland sensitivity method was utilized to estimate what type of wetland impacts might occur at the Mine Site assuming various, theoretical groundwater drawdown levels. Large Table 8 provides a summary of the estimated wetland community changes using the groundwater drawdown thresholds for each wetland type as indicated in the hydrologic wetland sensitivity method (Attachment A). The hydrologic wetland sensitivity method did not evaluate shallow marsh, deep marsh, or shallow open water communities, so the groundwater breaks and estimated community changes were developed based on past experience and professional judgment.

5.2.1.2.3 Quantification of Potential Indirect Impacts due to Change in Hydrology

Large Table 8 shows that for minor groundwater drawdown, ranging from 0.5 feet to 2 feet for the various wetland communities, no substantial wetland community changes are identified. In the moderate impact sensitivity category with water level changes ranging from 0.5 feet to 4 feet, some changes to vegetation are possible in all wetland communities with marshes, open water, and meadow communities potentially resulting in conversion of wetland type and increased shrub and tree growth in shrub and forested wetlands. In the severe impact sensitivity category, nearly all wetland community types are estimated to convert to other wetland types with a few wetlands estimated to convert to upland, including meadow wetlands and possibly hardwood swamps. Monitoring to document impacts to wetlands is recommended for all potential impacts in the moderate and severe impact categories.

Because groundwater modeling cannot reasonably estimate potential indirect wetland impacts, Attachment A concluded that analog impact zones can provide a reasonable estimate of the areal extent of potential indirect wetland impacts resulting from hydrologic effects. In addition, the evaluation of theoretical groundwater drawdown levels can help estimate what types of potential indirect wetland impacts might occur. However, wetland hydrology is a complex mix of precipitation, surface runoff, and in some cases, groundwater. The response of complex natural systems to human disturbances can only be estimated. Therefore, monitoring of wetland hydrology and vegetation communities is the best way to document the extent and magnitude of wetland responses (potential indirect impacts) to human disturbances.

5.2.1.3 Potential Indirect Impacts – Wetlands Abutting the Partridge River

Wetlands abutting the Partridge River within Area One (Large Figure 3) are identified by wetland ID, wetland type using the Eggers and Reed (Reference (9)) wetland community types, and acreage in Table 5-2. There are approximately 1,478 acres of wetlands which include alder thicket or shrub-carr (86% of total acres), coniferous bog (13% of total acres), and shallow marsh (1% of total acres).

Table 5-2 Wetlands Abutting the Partridge River

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
53D	Alder thicket	885.97
315	Alder thicket or Shrub-carr	322.84
678	Alder thicket	58.42
691	Alder thicket	6.23
708	Shallow marsh	3.92
709	Shallow marsh	8.14
888	Coniferous bog	192.96
Total acres of wetland		1,478.48

The XP-SWMM model identified that the changes in average annual flow (and therefore stage) of the Partridge River will be within the naturally occurring annual variation for the Partridge River (Reference (12)). Therefore, no potential indirect wetland impacts are identified for the wetlands abutting the Partridge River.

5.2.1.4 Potential Indirect Impacts – Water Quality Changes

5.2.1.4.1 Fugitive Dust / Metals and Sulfide Dust Emissions

As described in Attachment A, a screening analysis was conducted that estimated potential annual deposition of dust, metals, and sulfur to wetlands within and adjacent to the proposed Mine Site and the FTB, respectively, from fugitive dust emissions. Note that this section discusses only the Mine Site and FTB unlike other subsections of 5.2.1. Emission rates and particle size distributions were based on total particulate matter. The estimated deposition from fugitive dust emissions is then used to identify those wetlands that have the potential for water quality changes (e.g., potential for water chemistry changes related to sulfide dust deposition).

The potential additions of dust, metals, and sulfur to wetlands from fugitive dust emissions at the Mine Site and the FTB were estimated using air dispersion/deposition modeling. The estimated inputs of the dust, metals, and sulfur to wetlands were evaluated for significance to potential changes in water quality. Specific components of the analysis identified in Attachment A are summarized below.

Sources of Fugitive Dust and Estimated Air Emissions

Sources of dust to be modeled at the Mine Site and at the FTB are identified in Table 5-3 and include the sources specified in Attachment A. One model run was conducted for each area – the Mine Site and the FTB. Each respective model run provided an estimate of potential dust deposition from a number of general fugitive dust sources. The source grouping function within the AERMOD model was used to identify the different sources of metals and sulfur.

Table 5-3 Emission Sources Modeled in the Assessment of Potential Indirect Wetland Impacts Related to Deposition of Dust, Metals, and Sulfur

Fugitive Dust Source[(1)]	Mine Site Modeling for Dust	Mine Site Modeling for Metals and Sulfur	FTB Modeling for Dust	FTB Modeling for Metals and Sulfur
Overburden and other construction rock screening and/or crushing	Included	Excluded	n/a	n/a
Loading/unloading of tailings from the former LTVSMC operations and construction of dams	n/a	n/a	Included	Included
Dust generation from traffic on unpaved roads at the ground surface (not in mine pits)				
• Roads made of general construction material	Included	Excluded	Included	Excluded
• Roads made of LTVSMC Tailings	n/a	n/a	Included	n/a(4)
Handling activities associated with ore and waste rock outside of the pits, includes truck loading and unloading outside of the pits. Activities related to:	Included	Included	n/a	n/a
• Category 1 waste rock stockpile	Included	Excluded	n/a	n/a
• Category 2/3 waste rock stockpile	Included	Included	n/a	n/a
• Category 4 waste rock stockpile	Included	Included	n/a	n/a

Fugitive Dust Source(1)	**Mine Site Modeling for Dust**	**Mine Site Modeling for Metals and Sulfur**	**FTB Modeling for Dust**	**FTB Modeling for Metals and Sulfur**
Rail car loading (RTH (ore))	Included	Included	n/a	n/a
Rock handling and roads within the pits(2)	Excluded	Excluded	n/a	n/a
Wind erosion				
• From stockpiles(3)	Excluded	Excluded	n/a	n/a
• From beaches consisting of Flotation Tailings	n/a	n/a	Included	Included
• From dams constructed of LTVSMC tailings	n/a	n/a	Included	Included

n/a = not applicable

(1) sources as identified in Attachment A

(2) Fugitive dust sources excluded from the analysis per Attachment A include rock handling and roads within the pits as these emissions are expected to be trapped within the respective pits and have minimal contribution to estimated air concentrations.

(3) The potential for wind erosion from the stockpiles was evaluated as part of the air emissions inventory and it was determined that wind erosion will not occur through the use of USEPA approved wind erosion calculations procedures in Section 13.2.5 of Reference (17).

(4) General road construction material assumed to be laid over the top of the LTVSMC tailings.

Potential fugitive dust emissions from the specified sources were calculated based on the following information:

- Particulate matter as Total Particulate Matter (TPM); particles smaller than about 20 to 50 µm (microns) in aerodynamic diameter.
- Current Mine Site layout; Mine Year 8 and Mine Year 13.
- Expected operations at the FTB (e.g., dam construction, wind erosion)

At the Mine Site, the material handling emissions occurring on the stockpiles and at the RTH were modeled as surface-based volume sources. The stockpile volume source dimensions were based on a typical haul truck height of 30 feet and a dumping zone side length of 197 feet, similar to the particulate emissions modeling conducted for Class II areas (Reference (18)).

The RTH volume source parameters were also identical to the parameters used in the particulate modeling conducted for Class II areas (Reference (18)).

For the Class II modeling for the Mine Site (Reference (18)), the maximum emissions were identified to occur in Mine Year 8 and Mine Year 13. Emissions from both years were modeled for this assessment.

For the FTB, the emissions and modeling were based in part on the assumption that non-reactive road construction material will be used to construct a roadbed on top of the LTVSMC tailings and that haul trucks will not be travelling on roads made from LTVSMC tailings.

Modeling with AERMOD in Deposition Mode

Modeling was conducted with the AERMOD model (version 12060) in deposition mode with plume wet and dry depletion to estimate annual particle deposition. Surface meteorological data used in the modeling are for Hibbing, Minnesota (2006-2010) and upper air meteorology from International Falls, Minnesota. Meteorological data were processed using AERMET (version 11059). See Class II Modeling Protocol (Reference (18). Each year of meteorological data was modeled individually and the highest estimated dust deposition rate for each receptor node was brought forward into the mapping of deposition isopleths.

Deposition modeling with AERMOD requires inputs for particle size, particle density, and mass fraction within each particle size category. The modeling for this assessment used one particle size (30 microns) and a particle density of 2.7 grams per cubic centimeter (g/cm^3), which is consistent with inputs used for Class II air modeling.

Receptors

The receptors of interest for this analysis are the wetlands that are not identified as directly impacted (Section 5.1). The respective initial receptor grids for the Mine Site and FTB were set up with near-field and far-field spacing. For the Mine Site, the near-field receptor spacing was 250 meters (within the ambient air boundary and out to 1,000 meters beyond the ambient air boundary). The far-field receptor spacing was 1,000 meters (from 1 kilometer out to 5 kilometers from the ambient air boundary). For the FTB, the near-field receptor spacing was 250 meters within the ambient air boundary. The far-field receptor spacing was 1,000 meters from the ambient air boundary out to 5 kilometers.

At both the Mine Site and the FTB, the fine grid (i.e., near-field grid) receptor spacing of 250 meters generally had at least one receptor being located over the wetlands within the property boundary and out to 1 kilometer beyond the property boundary (Large Figure 15 and Large Figure 16). However, for the area encompassed by the fine grid, a visual check was made using GIS mapping tools to ensure that wetland areas encompassed by the fine grid had at least once receptor within their boundaries. Additional receptors were then included in the grid such that at least one receptor node was specifically located within the area of each wetland. For the coarse grid (i.e., far-field grid), the specific assignment of a receptor to a wetland area was not done for either the Mine Site or the FTB. A visual review (again using GIS mapping) identified that most wetland areas for the coarse grid had a receptor within their respective boundaries or relatively close to them. In other words, the coarse grid receptor spacing of 1,000 meters provided good coverage of the wetland areas. In addition, initial modeling of dust deposition identified that deposition rates changed very little beyond about 1 kilometer from the ambient air boundary. Based on these two pieces of information, it was determined that for those wetland areas covered by the coarse grid that did not have a receptor within their respective area, the modeled deposition at the nearest receptor would be used.

Dust Deposition and Speciation to Individual Metals and Sulfur

For the general dust emission sources identified in Table 5-3, total particulate emissions on an annual basis were modeled for the Mine Site and the FTB, respectively. Each year of meteorological data (5 years in total) were modeled individually. The estimated annual dust deposition rate (grams per square meter; $g/m^2/yr$) for each receptor node for each modeled year was then post-processed in a calculation spreadsheet to identify the highest estimated dust deposition rate for each receptor node.

For the dust emission sources identified for assessing potential metals and sulfur deposition at the Mine Site and the FTB, respectively, the highest estimated dust deposition rate for each receptor node was then speciated to the respective metal and sulfur deposition rates based on the contribution of the sources to a receptor node and the metal and sulfur composition identified for each contributing source (ore and waste rock at the Mine Site and tailings at the FTB). The estimated metal or sulfur deposition for each contributing dust source at a receptor node was then summed to provide a "total" deposition rate for each respective metal and for sulfur at that receptor location.

Dust deposition rates were speciated for the following metals: arsenic, cadmium, chromium, lead, manganese, nickel, and selenium (Attachment A). Copper and vanadium were added to the evaluation because background deposition estimates were provided in Reference (19). Attachment C provides the chemical composition of ore, waste rock and tailings used in the dust speciation. The maximum concentration for each metal and sulfur was used in the speciation calculations.

For both the Mine Site and the FTB, for each receptor node, the post-processing of the dust deposition rate by source contribution was then summed to provide a "total" metal deposition rate and a "total" sulfur deposition rate.

The speciation of the model-estimated dust deposition rate to the respective metal and sulfur deposition rates is slightly different from the approach identified in Attachment A; page 6 for the Mine Site; page 10 for the FTB) which identified that "*... the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. ...*". However, with regard to estimating a potential deposition rate for the individual metals and sulfur, there is no difference in the two approaches.

Estimates of Rural Background Deposition

Estimates of rural background deposition rates for dust, metals and sulfur are provided in Table 5-4. The background dust deposition rate is based on an effects-level for vegetation (Reference (20), Reference (21)). Background metal deposition rates are estimated from monitoring data collected at a site near the shore of Lake Superior near Eagle Harbor, Michigan (Reference (19)). The background sulfur deposition rate is from data collected at the Fernberg Road Monitoring Site (National Atmospheric Deposition Program, NADP) near Ely, Minnesota (Reference (22)).

For dust, an annual effects-level deposition rate of 365 grams per square meter ($g/m^2/yr$) is compared to modeled annual dust deposition rates. This deposition rate is a potential effects threshold for photosynthesis (i.e., potential for reduced photosynthesis due to "dusting" of the plant surface) (References (20), Reference (21)). However, for this analysis, the vegetative surface area of the wetlands is not calculated or included in the analysis. The modeled dust deposition rate is assumed to be applied to the land surface area which is a smaller area than the vegetative surface area. Vegetative surface area can be up to 13 times greater than the land surface area (Reference (23)). For example, the ratio of leaf area in a forest compared to the ground surface area ranges from 1.4 to 8.4 and for grasslands it can range from 2.5 to 6.3. By only assessing dust deposition to the land surface area instead of the vegetative surface area, it is likely the ratio of modeled deposition rate to the effects level is being overestimated. In other words, the modeled deposition rate is not being spread over the larger surface area of the vegetation which would reduce the effective deposition rate. For example, for a minimally vegetated ground surface with a surface area of 1.4 m^2, the deposition of 365 g to the 1.4 m^2 of vegetation surface results in deposition rate of 261g/m^2. Because this application does not include the deposition of dust to the vegetative surface area, it is likely that the areas identified to exceed the effects threshold of 365 $g/m^2/yr$ has been overestimated.

For metals, background deposition is based on the data from Reference (19). Sweet et al. (Reference (19)) indicated that precipitation was under-collected by 45% to 70% when sample volumes were compared to corresponding rain gage amounts. Because wet deposition was considered to be underestimated, the wet deposition component was adjusted upward by a factor of 1.6 (see Attachment D for calculations). Table 5-4 presents the adjusted total deposition estimates.

Table 5-4 Estimated Background Deposition of Metals and Sulfur

Parameter	Background Deposition Rate (wet + dry)	Units(1)	Comments
Arsenic(4)	216	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.
Cadmium(4)	505	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.
Chromium(4)	255	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.
Copper(4)	3,520	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.

Parameter	Background Deposition Rate (wet + dry)	Units(1)	Comments
Dust(2),(3)	365	$g/m^2/yr$	Dust from total particulate matter (TPM). A "no effects" deposition rate related to photosynthesis.
Lead(4)	1,800	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.
Manganese(4)	5,580	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.
Nickel(4)	938	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.
Selenium(4)	572	$\mu g/m^2/yr$	Selenium deposition as reported in Reference (21).
Sulfur(5),(6)	0.16	$g/m^2/yr$	Wet deposition estimated from 2007-2011 NADP data (Reference (22)); dry deposition estimated to be 22% of total deposition based on recent estimates from Voyageurs National Park and from Reference (23)).
Vanadium(4)	385	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.
Zinc(4)	10,900	$\mu g/m^2/yr$	Wet deposition adjusted by a factor of 1.6. See Attachment D.

(1) Units are $\mu g/m^2/yr$ = microgram per square meter per year or $g/m^2/yr$ = grams per square meter per year
(2) Reference (20)
(3) Reference (21)
(4) Reference (19)
(5) Reference (22)
(6) Reference (23)

Total background sulfur deposition includes both wet and dry deposition. Background wet deposition rates of sulfate are available from the NADP. The NADP maintains a network of monitors throughout the United States to measure wet deposition and includes several monitors in northeastern Minnesota. The closest monitoring site to Hoyt Lakes is the "Fernberg" site (ID: MN18) near Ely, Minnesota. The average annual wet deposition rate of sulfate over the past five years (2007-2011) at the Fernberg site was estimated (3.75 kg/ha), then converted to sulfur (sulfur is 33% of the sulfate; 1.25 kg/ha), and used as the background estimate for the wet deposition rate.

The Clean Air Status and Trends Network (CASTNET) operates a similar monitoring network for dry deposition and coordinates some sites with the NADP, however, this network does not have a site near Ely. The closest CASTNET site to Hoyt Lakes is in Voyageurs National Park near Sullivan Bay. Dry deposition monitored at this site in Voyageurs National Park indicates that dry sulfur deposition is approximately 19% of total (wet+dry) deposition. A 1991-1993 study (Reference (23)) estimated the percentage of dry deposition to total (wet + dry) deposition for various monitoring sites in Minnesota, including the Fernberg site near Ely (22.2%). This percentage of dry sulfur deposition to total (wet + dry) sulfur deposition (22%; average of three years) was used to estimate a total (wet + dry) background deposition of sulfur in the Hoyt Lakes area.

The calculation for background deposition in g/m^2/year, the deposition units in AERMOD, is as follows:

- average wet deposition of sulfate at NADP monitoring station MN18 = 3.75 kg/ha/yr
- sulfur as a percent of sulfate (SO4) = molecular weight of 32 / molecular weight of 96 = 33%
- sulfur content of wet sulfate deposition = 3.75 kg/ha x 0.33 = 1.25 kg/ha/yr
- percentage of dry deposition to total (wet + dry) sulfur deposition at Ely = 22.2%
- total (wet + dry) deposition of sulfur = wet deposition/(100 - %dry)/100 = 1.6 kg/ha/yr
- total background deposition of sulfur = 0.16 g/m^2/yr

The estimated background deposition for metals and sulfur is from data collected at sites characterized as open areas in rural settings that are reasonably distant from industrial sources and population centers. Reference (24) identifies that for forested areas, dry deposition may be underestimated. Vegetation can effectively scavenge fine particles and aerosols from the atmosphere and this interception can result in dry deposition being 50% or more of the total deposition. As noted for the Fernberg Road monitoring site, dry deposition is assumed to be 22% of total deposition. It is possible that the background sulfur deposition estimated for this analysis may be low due to an underestimation of dry deposition. However, no adjustments were made to the background sulfur deposition estimated for this analysis.

Significance Levels for Estimating the Potential Effects

For dust, metals, and sulfur, the following breakpoints are used for assessing the significance of a modeled deposition rate at a receptor node:

< 100% of background: no potential for effects expected

> 100% of the background value: potential for effects, include in future wetland monitoring

These are general categories of potential for effects. As this is a screening analysis to identify wetlands for potential inclusion in a monitoring program, there is some flexibility in identifying a potential level of deposition that suggests a potential for effect. Another consideration for selecting a deposition rate that is a high percent of the background rates is the likely overestimation of modeled deposition and the underestimation of background deposition. For example, with regard to model-estimated metal deposition, this screening evaluation used a maximum concentration from a range of possible values (see Attachment C for metal and sulfur concentrations) to speciate a maximum estimated dust deposition for a receptor node. Using a maximum metal concentration to speciate a maximum modeled deposition rate for each receptor node likely overestimates individual metal deposition. The underestimation of background metal deposition (i.e., wet deposition due to under-collection of precipitation) was identified in (Reference (19)). In addition, wet sulfate deposition may be underestimated as well because the NADP data for the Fernberg Road monitoring site (site MN18 in Reference (22)) indicates rainfall in the last 3 years is about 22% below the annual average. If sulfate deposition from 2007 and 2008 is used (both years approximately normal for precipitation amount), a background sulfur deposition rate of 0.23 $g/m^2/yr$ is calculated, about 44% higher than the background deposition used in this screening analysis. Also, Reference (24) identifies that for forested areas, dry deposition may be systematically underestimated due to sample collection and analysis methodology. It is possible that the background sulfur deposition estimated for this analysis may be low due to an underestimate of dry deposition.

Given the potential for overestimation of modeled deposition and underestimation of background deposition, and balancing the conservatism when their respective results are combined in this analysis, it seems reasonable to select the wetlands estimated to receive greater than 100% of background deposition (a potential doubling of the background deposition) for consideration in potential future monitoring.

Results (Modeled Deposition Rates Compared to Background Values

Model results in the form of isopleths where model-estimated deposition exceeds background deposition (i.e., modeled deposition is greater than 100% of background deposition) are overlain on the wetlands. For this screening analysis, the maximum extent of potential for effects on the wetlands for dust are presented and then for metals and sulfur at the Mine Site and the FTB, respectively. The model results for the individual metals and sulfur are not presented here, only the maximum area having the potential for effects from one or more the dust constituents.

Dust Deposition

At the Mine Site, dust deposition is concentrated relatively close to the ore loading pocket near the southern portion of the ambient air boundary (Large Figure 17). All receptors have model-estimated dust deposition of 25% or less of the effects-level background of 365 $g/m^2/yr$.

At the FTB, dust deposition is highest in three locations: southwest corner, northwest of the Plant Site; southeast corner; and the northeast corner, towards Area 5. All receptors have model-estimated dust deposition of 50% or less of the effects-level background of 365 $g/m^2/yr$ (Large Figure 18).

Overall, model-estimated dust deposition is largely constrained to within the respective ambient air boundaries at the Mine Site and at the FTB and model-estimated deposition is 50% or less of the effects-level background dust deposition.

Metals and Sulfur Deposition

The highest model-estimated metal and sulfur deposition at the Mine Site are in two defined areas: 1) near the ore loading pocket; and 2) at the east end of the Category 2/3 Waste Rock Stockpile near the eastern portion of the ambient air boundary (Large Figure 19). All of the receptor nodes with the highest model-estimated deposition rates (deposition rates greater than 100% of background) are located within the ambient air boundary.

At the FTB, there are two locations showing model-estimated deposition rates greater than 100% of background deposition: 1) approximately the southern and western two-thirds of the basin; and 2) a small area on the northern and eastern portion of the ambient air boundary (Large Figure 20). Approximately 90% of the receptor nodes with the highest model-estimated deposition rates (rates greater than 100% of background deposition) are located within the ambient air boundary. The remaining 10% of the receptor nodes with the highest-modeled deposition are located to the south and east of the FTB outside of the ambient air boundary.

Summary and Conclusions

There are 19,914 acres of wetlands identified within the receptor grid at the Mine Site. The deposition modeling results indicates that 1.1% of the wetlands within the receptor grid area are identified for consideration in future monitoring. There are 234 acres of wetland potentially indirectly impacted (modeled metal deposition greater than 100% of background), with 228 acres (97%) of the wetlands located within the Mine Site ambient air boundary. Based on the modeling results, approximately 234 acres of wetlands in the Mine Site Area are identified for potential inclusion in future monitoring.

At the FTB, there are 25,846 acres of wetlands identified within the receptor grid. Wetland ID 1155 in the HRF, which is not subject to state and federal regulations (Section 5.1.6), and a deepwater pit area located south of the FTB were not included in the total wetland acreage. The deposition modeling results indicates that 0.2% of the wetlands within the receptor grid area are identified for consideration in future monitoring. There are 184 acres of wetland potentially indirectly impacted (modeled metal deposition greater than 100% of background), with 52 acres (28%) of the wetlands located within the FTB ambient air boundary. Based on the modeling results, approximately 184 acres of wetlands in the FTB are identified for potential inclusion in future monitoring.

The deposition modeling results for dust, metals and sulfur do not indicate or suggest a degree of impact or that adverse effects will be expected to occur. The modeling only indicates those areas that were estimated to have deposition rates greater than 100% of background deposition. These specific wetland areas are identified for consideration in any future monitoring to be conducted for the Project.

5.2.1.4.2 Ore Spillage

See Section 5.2.3.2.1 for a discussion of potential indirect wetland impacts as related to ore spillage along the transportation corridors.

5.2.1.4.3 Leakage from Stockpiles/Mine Features and Seepage from Mine Pits

The stockpiles, mine pits, and other mine features (e.g., WWTF) are located within the Partridge River watershed. Water containing constituents generated in the waste rock stockpiles and mine pits has the potential to enter the shallow groundwater system via potential leakage from the liners (stockpiles and WWTF equalization basins) or seepage from the pits (Reference (12)). The leakage or seepage that enters groundwater will then be transported toward the Partridge River along groundwater flow paths. The Groundwater IAP process identified five such groundwater flow paths connecting the mine features to the Partridge River. These flow paths are being considered in the assessment of potential groundwater quality impacts (Reference (12)). The five flow paths are described in (Reference (12)) and include: East Pit – Category 2/3 flow path, Ore Surge Pile (OSP) flow path, WWTF flow path, Overburden Storage and Laydown Area (OSLA) flow path, and West Pit flow path. Because the water quality within these flow paths has the potential to change as a result of the Project, these same flow paths are considered in the assessment of potential indirect wetland impacts associated with leakage or seepage from mine features.

Wetlands within the groundwater flow paths were identified by wetland type using the Eggers and Reed (Reference (9)) wetland community types and acreage in Large Table 9. There are approximately 516 acres of wetlands, which include alder thicket or shrub-carr (56% of total acres), coniferous bog (33% of total acres), coniferous swamp (6% of total acres), open bog (2% of total acres), shallow marsh (2% of total acres), deep marsh (1% of total acres), and sedge/wet meadow (less than 1% of total acres).

Bog wetlands within and surrounding the Mine Site were reclassified as either ombrotrophic or minerotrophic consistent with the November 2011, USACE Memorandum (Large Table 10; Reference (15)). Other wetlands were classified as dominated by groundwater, although all wetlands receive precipitation and, as stated in Section 5.2.1.2.2, virtually all water movement in peat wetlands occurs horizontally in the upper layers of peat. Approximately 55% of the wetlands within the flow paths are classified as dominantly groundwater-fed while 45% of the wetlands are supported only by precipitation.

The Partridge River currently represents the primary discharge location for shallow groundwater at the Mine Site. During operations, reclamation and long-term closure, groundwater in areas south of the mine pits will continue to discharge to the Partridge River while groundwater in areas north of the mine pits will discharge to the pits. The amount of groundwater discharge to surface water and wetlands between the mine features and the

Partridge River is expected to be minimal relative to the amount of groundwater discharge to the Partridge River itself. Significant quantities of groundwater are not expected to discharge to the wetlands because of the very low hydraulic conductivities of the underlying peat layers, as cited in Section 5.2.1.2.2. In the water quality model, it is assumed that the leakage/seepage from mine features discharges to the Partridge River; there is assumed to be no groundwater discharge to surface water or wetlands along intermediate portions of the flow paths (Reference (12)). Therefore, the water quality model cannot be used to quantify the amount of leakage/seepage from mine features that discharges directly to individual wetlands. However, the water quality model can be used to provide a conservative estimate of the potential indirect wetlands impacts caused by water quality changes due to leakage/seepage from mine features. This approach and the resulting estimates are described in the following paragraphs.

The water quality model includes groundwater quality evaluation locations within the surficial aquifer and located along the Dunka Road for each of the groundwater flow paths. These evaluation locations are within the PolyMet property boundary, typically within close proximity of the mine features and are located up gradient of most of the groundwater-fed wetlands at the Mine Site. Thus, results of the water quality modeling within these flow paths can be used to evaluate groundwater quality that could flow to down gradient groundwater fed wetlands.

Water quality modeling results indicate groundwater quality along each flow path is likely to change from existing conditions. For this indirect wetland impact analysis, it is conservatively assumed that these changes may cause potential indirect impacts to the character, function, and quality of groundwater fed wetlands. Therefore this analysis also assumes that all down gradient groundwater-fed wetlands located within the five Mine Site surficial aquifer flow paths may have potential indirect wetland impacts related to water quality changes as a result off leakage/seepage from mine features.

The leakage/seepage rates associated the mine features are summarized in Table 5-5. Large Table 9 summarizes the wetland types within the flow paths with potential indirect wetland impacts resulting from mine feature leakage/seepage changes to water quality. Large Table 11 identifies wetlands within the flow path. Consistent with other potential indirect wetland impacts identified in this Data Package, the wetlands identified in Large Table 11 can be used to inform the development of a monitoring plan for potential future indirect impacts related water quality changes resulting from leakage/seepage from mine features.

Table 5-5 Leakage/Seepage Rates Associated with Mine Features

Mine Feature	Type of Flow	Maximum Rate[(1)] (gpm)
East Pit – Category 2/3 Stockpile	Seepage from the Mine Pit	6.5
	Liner Leakage	0.13
OSP	Liner Leakage	0.0062
WWTF	Liner Leakage	0.030
OSLA	Infiltration	32
West Pit	Seepage from the Mine Pit	6.4

(1) Flows shown represent the maximum monthly rate at a 90% probability.

This analysis does not indicate or suggest that actual adverse effects will occur or that adverse effects are expected to occur. The analysis only indicates areas that can be conservatively assumed to have potential indirect impacts due to changes in groundwater quality. These specific wetland areas are identified for consideration in future monitoring to be conducted during facility operations.

5.2.1.5 Potential Indirect Impacts – Wildlife Utilization of Nearby Habitats from Project Noise

The following sections summarize the potential indirect impacts to wildlife utilization of nearby habitats from Project noise. As outlined in Attachment A, the following three steps were used in the potential indirect impact analysis: 1) potential sources and range of Project noise were identified; 2) potential wildlife species and habitat preferences within the area were identified; and 3) potential impacts to wildlife utilization of nearby habitats from Project noise were qualitatively assessed.

5.2.1.5.1 Potential Sources and Range of Project Noise

Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (Reference (25)). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site will be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Noise from equipment such as graders, bull dozers, and support trucks will be less dominant sources of noise, ranging from 75-95 dBA (Reference (26). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111-115 dBA at 50 feet from the blasting site (Table 5.5-7 of Reference (27)). Within most of the Mine Site, the sound from the blast will be similar to a loud clap of thunder.

5.2.1.5.2 General Habitat Types

Vegetation within the Mine Site consists primarily of forested and shrub wetlands, older forested uplands dominated by black spruce and/or jack pine, young aspen stands, and recently logged areas dominated by aspen, ferns, and grasses. Upland areas are likely to be used more by wildlife than wetlands in the Mine Site as preferred habitat, likely because uplands offer more cover and browse during the winter than wetlands.

5.2.1.5.3 Wildlife Species Present

Common wildlife species utilizing the Mine Site include the following (Reference (28), Reference (29)):

- large mammals, including white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), moose (*Alces americanus*), gray wolf (*Canis lupus*), coyote (*Canis latrans*)
- intermediate mammals, including muskrat (*Ondatra zimbethicus*), beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), grey fox (*Urocyon cinereoargenteus*) and woodchucks (*Marmota monax*)
- small mammals, including species of bats, squirrels, voles, and mice
- wetland birds, including ducks and other waterfowl, wading birds, and perching birds with specific wetland habitat preferences
- upland birds, including most perching birds, owls, turkey vultures (*Cathartes aura*), hawks, and other birds of prey
- reptiles and amphibians, including common turtles, frogs, snakes, and lizards
- a wide range of insect species in wetland, upland, and transitional habitats

The MDNR Comprehensive Wildlife Conservation Strategy lists 65 Species of Greatest Conservation Need (SGCN) in the combined Laurentian Uplands and Nashwauk Uplands Subsections, in which the Mine Site is located (Reference (30)). Large Table 12 lists the SGCN species, along with their specific preferred habitat types. Habitat preferences for the SGCN species were reviewed, and the species were sorted in Large Table 12 to separate those species which utilize only wetland habitat types, those species which utilize only upland habitat types, and those species which utilize both wetland and upland habitats.

Based on the preferred habitat utilization, there are ten SGCN species that utilize only wetland habitats and fourteen SGCN species that utilize only upland habitats. The remaining 41 SGCN species utilize both wetland and upland habitats. The wetland habitat types utilized by the most SGCN species are lowland coniferous forest (25 species) and lowland shrub (22 species).

According to the MDNR NHIS database, the following three state-listed species (Reference (31)) have documented occurrences within ten miles of the Mine Site:

- gray wolf (*Canis lupus*), special concern, proposed for de-listing in 2013
- bald eagle (*Haliaeetus leucocephalus*), special concern
- wood turtle (*Clemmys insculpta*), threatened

The wood turtle was found approximately 0.8 mile south of the Mine Site in 2004. The bald eagle may also be in the vicinity of the Mine Site, although the MDNR NHIS database has no records for bald eagle nests within 5 miles of the Mine Site. The bald eagle is no longer listed under the Endangered Species Act, but is protected under the Bald and Golden Eagle Protection Act. The habitat preferences for these three species are summarized in Large Table 12.

There are two federally listed species in St. Louis County; they include the Canada lynx (*Lynx canadensis*), a threatened mammal species, and the piping plover (*Charadrius melodus*), an endangered wading bird species. Canada lynx may occasionally utilize the Mine Site (Reference (29)); however, there is no suitable habitat for piping plover at the Mine Site.

In addition to species listed under State and Federal endangered species acts, some wildlife species are also protected as Regional Forester Sensitive Species (RFSS) by the USFS (Reference (32)). The habitat preferences for these species are summarized in Large Table 12.

5.2.1.5.4 Potential Indirect Impacts to Wildlife Utilization of Nearby Habitats

The impacts of noise on wildlife are largely unknown and the assessment of impacts remains subjective (Reference (33)). Wildlife are receptive to different sound frequency spectrums, many of which may be inaudible to humans. Local wildlife are likely to be accustomed to the sound from mine activities currently found in the area. Noise from sources such as mine construction, mine and plant operations, and ore transport are sources of noise that will be relatively low-toned and constant, consistent with industrial fans, so it should present less annoyance than higher-pitched or variable tones of changing loudness (Reference (33)).

Some animals can adapt to predictable human activities, so if the activity generally occurs at predictable time periods at the same places or along the same routes, animals may become habituated to the activity (Reference (33)). Response of the animal depends on the context within which a human/animal encounter takes place, the behavioral state of the animal, the type of human activity, and the time and location of the activity.

Potential noise-related impacts to wildlife vary between species. The more common wildlife species (deer, small mammals, common birds) are habitat generalists with a relatively high tolerance of disturbance and human presence, and the noise generated by human activities. These species may temporarily abandon habitats immediately adjacent to the Mine Site at the onset of the Project, but would likely return to those habitats as they become habituated to the activity.

Wildlife species with more specific habitat needs, and/or those that are more sensitive to proximity to human activities may abandon habitats near the Mine Site and migrate to habitats further from the noise sources. The distances migrated from the Mine Site will vary depending on the sensitivity to noise of each species.

5.2.2 Flotation Tailings Basin (FTB)

Wetlands were identified within the 500-feet increments beginning at the FTB and continuing out to a total of 30,000 feet (Large Figure 21). The area of evaluation included only wetlands within Area Two where wetland type information has been developed and it did not include wetlands identified as directly impacted (Section 5.1). Large Table 13 identifies each wetland within each of the 500-feet zones and Large Table 14 provides a summary of wetland types within each 500-feet increment.

5.2.2.1 Potential Indirect Impacts – Wetland Fragmentation

For remaining wetlands not directly impacted as discussed in Section 5.1, an estimate of potential indirect wetland impacts from wetland fragmentation by Project features (i.e., containment system) was determined based on an analysis of the various factors that may contribute to potential fragmentation. Wetland fragments in the FTB area are identified in Table 5-6.

Approximately 0.5 acres of wetland fragments were identified in the FTB area. The majority of wetland fragments consist of shallow marsh (61%), followed by deep marsh (35%), coniferous swamp (4%), and alder thicket (less than 0.01%).

Table 5-6 Fragmented Wetlands in the FTB Area

Wetland ID	Eggers and Reed Wetland Community	Total Wetland Size (acres)	Direct Impact (acres)	Potential Indirect Impact (acres)
272	Deep marsh	1.11	1.10	0.01
279	Alder thicket	4.84	3.33	<0.01
290	Coniferous swamp	0.48	0.22	0.02
307	Shallow marsh	0.78	0.77	<0.01
593	Deep marsh	9.80	8.47	0.15
595	Deep marsh	2.14	1.09	0.01
1134	Shallow marsh	14.45	8.71	0.04
1155	Shallow marsh	0.55	7.30(1)	0.15
1156	Shallow marsh	14.49	11.08	0.06
1159	Shallow marsh	0.05	0.62(2)	0.05
Total acres of wetland		48.69	35.18	0.49

(1) Wetland 1155 is directly impacted by the HRF and FTB.
(2) Wetland 1159 is directly impacted by the HRF.

5.2.2.2 Potential Indirect Impacts – Changes in Hydrology

5.2.2.2.1 Wetlands within the FTB Surficial Groundwater Flow Paths

The three surficial aquifer groundwater flow paths are shown in Large Figure 22 and include Unnamed Creek (west flow path), Trimble Creek (northwest flow path), and Mud Lake Creek (north flow path) (Reference (34). Large Figure 22 also includes several surface water model evaluation locations within these flow paths (e.g., PM-11) and the approximate locations of Project surface water discharges (e.g., SD006). Large Table 15 summarizes the wetland types within the flow paths with potential indirect wetland impacts resulting from changes in hydrology. Large Table 16 identifies wetlands within the flow paths and hydrology source. Consistent with other potential indirect wetland impacts identified in this Data Package, the wetlands identified in Large Table 16 can be used to inform the development of a monitoring plan for potential future indirect impacts related water quality changes resulting from leakage/seepage from mine features.

5.2.2.2.2 Seepage from the FTB

Seepage modeling from the FTB is described in detail in Reference (34). The following discussion is a summary of that information. The FTB Containment System (Reference (34)) will collect approximately 90% of the seepage from the FTB to groundwater and 100% of the seepage from the FTB to surface water. The seepage water to the west that bypasses the FTB Containment System is estimated to be about 11 gallons per minute (gpm). The seepage to the west is assumed to travel all the way to the Embarrass River via the west flow path. The seepage water to the northwest that bypasses the FTB Containment System is estimated to be about 6 gpm. The seepage to the northwest discharges to Trimble Creek at PM-19 via the northwest flow path. The seepage water to the north that bypasses the FTB Containment System is estimated to be about 4 gpm. The seepage to the north discharges to Mud Lake Creek at MLC-2 via the north flow path. The total amount of groundwater that is estimated to discharge to surface water from the west, northwest, and north flow paths is on average approximately 170 gpm, 85 gpm, and 70 gpm respectively. The total flow discharging to surface water is higher than the seepage flow entering groundwater because of the addition of recharge to the flow paths along the length of each flow path.

The aquifer capacity at the north, northwest, and west toes (which feed the north, northwest, and west flow paths respectively) is estimated to be 44 gpm, 55 gpm, and 110 gpm respectively. Under existing conditions, seepage from the Tailings Basin is in excess of the aquifer capacity at the toes of the Tailings Basin. Therefore, excess seepage that cannot be contained within the aquifer upwells to surface flow near the toes of the Tailings Basin and contributes flow to the nearby tributaries via surface runoff.

Under Project conditions, the FTB Containment System will capture all of the surface flow that is currently upwelling near the north, northwest, and west toes of the FTB. To prevent significant hydrologic impacts to the nearby tributaries due to reduction in flow, the water collected by the FTB Containment System will be treated by the WWTP and discharged to the tributaries. Additionally, during periods when there is insufficient flow from the WWTP, water will be transferred from Colby Lake to augment the discharge to the tributaries in order to prevent significant hydrologic impacts. To the west, the discharge(s) will be directed to a location near the existing surface discharge SD006. To the northwest and north, the discharge(s) will be spigotted at multiple locations along the downstream side of the FTB Containment System to add flow to the adjacent wetlands, similar to what is occurring under existing conditions. Table 5-7 shows the expected amount of discharge needed on an average annual basis; discharge needs can be met by either water from the WWTP or from Colby Lake.

Table 5-7 Determination of Combined Flow Requirement for the Watersheds from the WWTP and Colby Lake in gallons per minute

Type of Flow Requirement	Mud Lake Creek (MLC-3)$^{(5)}$	Trimble Creek (TC-1)	Unnamed Creek (PM-11)
Total annual average surface flow(1)	665	1888	1180
Expected future contribution from the watershed(2)	439 / 734	599	664
Minimum requirement from WWTP/Colby Lake(3)	93 / 0	911	280
Maximum allowable from WWTP/Colby Lake(4)	359 / 64	1667	752
Percent of WWTP discharge before the drainage swale is constructed	5.53%	54.09%	16.63%
Percent of WWTP discharge after the drainage swale is constructed	0%	57.26%	17.60%

(1) Existing annual average flow in the tributary.
(2) The future contribution from the watershed decreases because the FTB Containment System, which is away from the toes of the Tailings Basin, removes watershed area and any runoff from the outer banks of the Tailings Basin.
(3) 80% of the existing total annual average surface flow, less the expected future watershed contribution.
(4) 120% of the existing total annual average surface flow, less the expected future watershed contribution.
(5) X / Y values: X indicates the flow values before the drainage swale is in place; Y indicates the flow values after the watershed area to Mud Lake Creek is increased (from 1.34 mi2 to 2.24 mi2) because of the construction of the drainage swale at time > 7 years.

5.2.2.2.3 Potential Indirect Impacts – Changes in Hydrology due to Drawdown or Surcharge

The augmentation described in Section 5.2.2.2.2 is designed such that the average annual water yield at the toe of the Tailings Basin is within +/- 20% of the No Action condition. Plus or minus 20% is within the range of annual variability in precipitation, as well as streamflow, in the Embarrass watershed (Reference (12) and Reference (34)). Therefore, anticipated changes to downstream hydrology, including wetlands, is expected to be within the range of that typically observed due to natural variability.

The potential for indirect impacts due to reduced or increased seepage at the toe of the Tailings Basin is greatest immediately downstream of the toe, where seepage and augmentation account for nearly all the water yield (i.e., there is no upstream watershed). Downstream of the toe, the potential for impact will be reduced as the watershed area tributary to that location increases, and the portion of total water yield derived from runoff increases. That is, the potential for hydrologic impact diminishes radially as distance from the FTB increases. Large Table 13 categorizes wetland areas downstream of the Tailings Basin according to distance from the Tailings Basin. Wetlands located further from the

Tailings Basin are anticipated to have less potential for indirect impacts due to hydrologic changes.

Wetland hydrology is a complex mix of precipitation, surface runoff, and in some cases, groundwater. Despite the use of augmentation to mitigate impacts, the response of complex natural systems to human disturbances can only be estimated. Therefore, monitoring of wetland hydrology and vegetation communities is the most appropriate way to document the extent and magnitude of wetland responses (potential indirect impacts) to the Project.

5.2.2.2.4 Quantification of Potential Indirect Impacts due to Change in Hydrology

See Section 5.2.1.2.2 for a discussion of potential indirect wetland impacts due to change in hydrology.

5.2.2.3 Potential Indirect Impacts – Wetlands Abutting Unnamed Creek, Trimble Creek, and Mud Lake Creek

Wetlands abutting Unnamed Creek, Trimble Creek, and Mud Lake Creek within Area Two (Large Figure 3) are identified by wetland ID, wetland type using the Eggers and Reed (Reference (9)) wetland community types, and acreage in Table 5-8 through Table 5-10.

There are approximately 2,576 acres of wetlands which include alder thicket or shrub-carr (63% of total acres), coniferous swamp (24% of total acres), hardwood swamp (5% of total acres), shallow marsh (5% of total acres), deep marsh (2% of total acres), and wet meadow (1% of total acres).

Wetlands abutting Unnamed Creek within Area Two include approximately 527 acres of wetlands which include alder thicket and shrub-carr (52% of total acres), hardwood swamp (19% of total acres), shallow marsh (16% of total acres), deep marsh (10% of total acres), and coniferous swamp (3% of total acres) (Table 5-8).

Table 5-8 Wetlands Abutting Unnamed Creek

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
270	Shallow marsh	85.84
593A	Deep marsh	25.73
625	Coniferous swamp	3.70
627	Alder thicket or Shrub-carr	187.09
788	Hardwood swamp	98.13
820	Deep marsh	26.92
845	Coniferous swamp	12.64
876	Alder thicket	39.13

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
1071	Alder thicket or Shrub-carr	29.18
1147	Alder thicket or Shrub-carr	13.46
996	Alder thicket or Shrub-carr	4.10
593	Deep marsh	1.18
	Total acres of wetland	527.10

Wetlands abutting Trimble Creek within Area Two include approximately 886 acres of wetlands which include alder thicket and shrub-carr (78% of total acres), coniferous swamp (15% of total acres), shallow marsh (4% of total acres), wet meadow (2% of total acres), and deep marsh (1% of total acres) (Table 5-9).

Table 5-9 Wetlands Abutting Trimble Creek

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
253	Deep marsh	5.89
254	Shallow marsh	36.72
953	Alder thicket or Shrub-carr	614.34
955	Alder thicket or Shrub-carr	39.24
956	Wet meadow	17.40
989	Coniferous swamp	130.31
990	Alder thicket or Shrub-carr	42.22
529	Wet meadow	0.30
	Total acres of wetland	886.42

Wetlands abutting Mud Lake Creek within Area Two include approximately 1,162 acres of wetlands which include alder thicket and shrub-carr (56% of total acres), coniferous swamp (41% of total acres), and hardwood swamp (3 of total acres) (Table 5-10).

Table 5-10 Wetlands Abutting Mud Lake Creek

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
285	Coniferous swamp	364.87
953	Alder thicket or Shrub-carr	614.34
866	Hardwood swamp	31.04
652	Coniferous swamp	109.44
986	Alder thicket or Shrub-carr	22.21
988	Alder thicket or Shrub-carr	20.51
	Total acres of wetland	1,162.41

A detailed hydrologic model has not been developed for the streams downstream of the Tailings Basin. Water management at the Plant Site consists of flow augmentation immediately downstream of the FTB Containment System (see Section 5.2.2.2.2 and Reference (34)) to minimize hydrologic impacts to downstream watercourses. The hydrologic analysis presented in Reference (34) estimates that the changes in average annual flow (and therefore stage) of Unnamed Creek, Trimble Creek, and Mud Lake Creek will be within the annual variability that naturally occurs in the Embarrass River watershed. Therefore, no potential indirect wetland impacts are identified for the wetlands abutting Unnamed Creek, Trimble Creek, and Mud Lake Creek.

5.2.2.4 Potential Indirect Impacts – Water Quality Changes

5.2.2.4.1 Fugitive Dust / Metals and Sulfide Dust Emissions

The discussion, tables, and figures for this section are found in Section 5.2.1.4.1 which discusses the Mine Site and FTB.

5.2.2.4.2 Potential Indirect Impacts – Water Quality Changes

The Project will impact water quality downstream of the Tailings Basin by altering the chemistry and volume of seepage and surface water discharges leaving the Tailings Basin. Impacts to surface water and groundwater quality are quantified in (Reference (34)). The collection of existing seepage by the containment system and augmentation with Colby Lake and WWTP effluent water will generally improve downstream water quality relative to current conditions. Water quality impacts to receiving waters are described in (Reference (34)). Even if water quality is improved, there is potential for indirect impacts to wetlands due to changes in water quality.

Potential indirect wetland impacts due to water quality changes may occur due to:

- Changes in groundwater quality,
- Changes in surface water quality, or
- Changes in both groundwater and surface water quality.

Wetland areas potentially impacted by water quality changes are shown in Large Figure 22 and listed in Table 5-11. Note that within this section, the term groundwater and surface water refer to the path by which Project water leaves the Tailings Basin (e.g., potential impacts from Tailings Basin groundwater seepage that discharges to surface water at a downstream location are classified as a potential impact due to changes in *groundwater* quality).

Table 5-11 Wetland Area Potentially Indirectly Impacted by Changes in Water Quality

Wetland Area (acres) Potentially Impacted by Changes in Water Quality	Mud Lake Creek (North)	Trimble Creek (Northwest)	Unnamed Creek (West)	Downstream of Groundwater Flow Paths(3)	Total
Groundwater Quality[1]	296.50	514.03	1,162.15	--	1972.68
Surface Water and Groundwater Quality[2]	835.77	568.92	690.87	570.16	2665.72
Total	1,132.27	1,082.95	1,853.02	570.16	4638.40

(1) Groundwater refers to water leaving the FTB within the surficial aquifer. Impacts resulting from the discharge of that seepage to surface water are considered an impact due to groundwater in this analysis.

(2) All areas potentially impacted by changes in surface water quality are also potentially impacted by changes in groundwater quality

(3) Potentially impacted wetlands are located along Trimble Creek and Mud Lake Creek, but outside of groundwater flow paths (see also Footnote (1)).

Potential for indirect impacts from changes in groundwater quality may occur anywhere along the modeled groundwater flow paths (Section 5.2.2.2.1). Wetlands that may be impacted in this manner are identified in Large Figure 22 and include a total of 4,068 acres. Potential for impacts to groundwater quality are diminished as distance from the Tailings Basin increases, as the relative portion of total groundwater that originates from the Tailings Basin decreases (Reference (34)). It should be noted that the amount of Tailings Basin seepage remaining in the surficial aquifer is very small (Section 5.2.2.2.1). Thus, the potential for indirect impacts due to changes in groundwater quality is anticipated to be small.

Potential impacts from changes in groundwater quality may also occur in any wetlands abutting tributary streams into which impacted groundwater may discharge. This includes all reaches of Unnamed Creek, Trimble Creek, and Mud Lake Creek (Large Figure 22).

Wetlands abutting these streams and outside of the modeled groundwater flow paths add an additional 570 acres of potential indirect impacts due to changes in groundwater quality.

Changes in surface water quality may also potentially indirectly impact wetlands. Potential indirect impacts from changes in surface water quality may occur in wetlands within the surface watersheds immediately downstream of the Tailings Basin (Large Figure 22). This includes watersheds upstream of modeling locations UC-1a, TC-1, and MLC-3. These areas include 1,158 acres of wetlands (all of which may also be potentially indirectly impacted by changes in groundwater quality). Downstream of these locations, potential indirect impacts due to changes in surface water quality are limited to wetlands abutting the tributary streams. These areas include an additional 1,505 acres of wetlands (all of which may also be potentially indirectly impacted by changes in groundwater quality).

As with impacts from changes in groundwater quality, potential impacts due to changes in surface water quality are expected to diminish as distance from the Tailings Basin increases and flows originating from the Project are diluted by natural runoff.

The wetland hydrology downstream of the Tailings Basin is too complex to be accurately incorporated into the Plant Site probabilistic model detailed in Reference (34). The response of such complex natural systems to water quality changes originating at the Tailings Basin can only be estimated. Therefore, monitoring of wetland hydrology and vegetation communities is the best way to document the extent and magnitude of wetland responses (potential indirect wetland impacts) to the Project.

5.2.2.5 Potential Indirect Impacts – Wildlife Utilization of Nearby Habitats from Project Noise

The following sections summarize the potential indirect impacts to wildlife utilization of nearby habitats from Project noise. As outlined in Attachment A, the following three steps were used in the potential indirect impact analysis: 1) potential sources and range of Project noise were identified; 2) potential wildlife species and habitat preferences within the area were identified; and 3) potential impacts to wildlife utilization of nearby habitats from Project noise were qualitatively assessed.

5.2.2.5.1 Potential Sources and Range of Project Noise

Noise at the FTB will be generated primarily by the placement of FTB Containment System, construction of tailings dams, and by operation of various types of pumping equipment used to transport the tailings slurry and recovered water from the FTB Containment System. Noise levels heard by individual wildlife species cannot be exactly determined, because wildlife species are mobile. As an individual moves, the noise level from a given source changes with the distance between the source and the receptor (the individual animal).

5.2.2.5.2 General Habitat Types

The FTB and surrounding area is currently dominated by grasslands, extensive wetland complexes, and open water areas. The existing Tailings Basin is dominated by upland grassland communities across its flat upper surface and down the tailings dams that descend to the wetlands to the north and west. A natural upland promontory occurs along the northeastern edge of the FTB. This promontory is dominated by young aspen along the lower two-thirds of the slope, and by mixed hardwood and coniferous forest on the upper slopes.

5.2.2.5.3 Wildlife Species Present

Wildlife species within and adjacent to the FTB are similar to those described in Section 5.2.1.5 for the Mine Site. Most of the same common SGCN and RFSS species present at the Mine Site are also present at the FTB.

5.2.2.5.4 Potential Impacts to Wildlife Utilization of Nearby Habitats

Noise-related potential indirect impacts to wildlife utilization of nearby habitats will be similar to those for the Mine Site, described in Section 5.2.1.5, with one notable exception - the FTB is at least 5.5 miles from the nearest potential blasting site. At this distance, the sound of the blast will be under 61 dBA, based on a sound pressure level of 115 dBA at 50 feet from the blast (Reference (25). As a result, the physiological and behavioral changes potentially induced by blast noise will be greatly diminished at the FTB as compared to the Mine Site. In addition, the level of activity, including use of heavy equipment and number of support vehicles in operation, is expected to be lower at the FTB than at the Mine Site. As a result, overall noise generation should be lower at the FTB, resulting in fewer impacts to wildlife.

5.2.3 Transportation Corridors

Wetlands abutting the railroad corridor from the Mine Site to the Plant Site, within Area One and Area Two, are identified by wetland ID, wetland type using the Eggers and Reed (Reference (9)) wetland community types, and acreage in Large Table 17. There are approximately 543 acres of wetlands which include alder thicket or shrub-carr (75% of total acres), coniferous swamp (15% of total acres), shallow marsh (7% of total acres), deep marsh (1% of total acres), shallow, open water (1% of total acres), and sedge/wet meadow (less than 1% of total acres). Wetlands abutting the Dunka Road and Utility Corridor are identified in Section 3.2.3 and shown in Large Figure 7.

5.2.3.1 Potential Indirect Impacts – Wetland Fragmentation

For remaining wetlands not directly impacted as discussed in Section 5.1, an estimate of potential indirect wetland impacts from wetland fragmentation by Project features (Dunka Road and Utility Corridor and Railroad Connection Corridor) was determined based on an analysis of the various factors that may contribute to potential fragmentation.

An approximately 0.01 acre alder thicket (Wetland ID 1034A), which is located just outside of the Dunka Road and Utility Corridor, was identified as a wetland fragment. Wetland ID 1034A is connected to Wetland ID 1034, which is directly impacted by the Dunka Road and Utility Corridor.

5.2.3.2 Potential Indirect Impacts – Water Quality Changes

5.2.3.2.1 Mine to Plant Railroad

The potential release of dust from railcars transporting ore from the Mine Site to the Plant Site was addressed in the May 6, 2011 Air Impact Assessment Planning Summary Memo: "The Air IAP group concluded that there will be minimal air impacts from any dust generated from ore hauled in the railcars due to the coarse nature of the ore." Based on this conclusion, air modeling of potential release of dust from railcars was not performed because the potential wetland impacts will not be significant.

The Air IAP group concluded that any dust generated from ore hauled in railcars will be coarse in nature (i.e., relatively large particles). These larger particles will tend to deposit on the soil surface near the railcar and not be dispersed to any great extent. An estimate of the spillage of ore fines along the rail corridor is shown in Section 8.4.3 of Reference (35). It was assumed that all spillage of the coarse material will occur in a 2-meter wide strip on both sides of the centerline of the railway (total width = 4 meters) over the entire haul distance after loading (~ 8 miles; ~13,000 meters), resulting in approximately 0.11 Kg/square meter of ore fines deposited annually or 2.14 Kg/square meter deposited for the 20-year Project. This equates to 0.002 inch of depth of ore fines deposited annually or 0.05 inches deposited for the 20-year Project.

Using the geochemical modeling methods described in Section 8.4.3 of Reference (35) for the spilled ore, the quality of water contacting this material was estimated on a per-unit area basis which is also a per unit length of the rail corridor (see Attachment E for details). The contact water was assumed to mix with the background surface runoff, using the runoff water quality and quantity determined in Sections 5.3.2 and 6.1.3.3.2 of Reference (12) for the Mine Site water quality model. For each meter of railway (2 meter spillage strip on one side), the area required to have a less than 10% likelihood of the mixed contact and natural runoff exceeding water quality standards (as defined in Section 2.2 of Reference (12)) was estimated by successive runs of a probabilistic water quality model.

For most chemical constituents, the contact water leaving the spillage strip is estimated to have a greater than 90% likelihood of complying with surface water standards at all times. Constituents that have the potential to exceed surface water standards at the edge of the 2-meter spillage strip include aluminum, cobalt, copper, and nickel. Aluminum concentrations are often above the surface water standard in the background runoff, and it is not possible to achieve a less than 10% likelihood of exceeding the standard in the mixed water (Section 4.4.4.1.1 of Reference (12)). For cobalt, copper, and nickel the estimated area (square meters per meter of railroad track on each side) necessary to provide sufficient dilution for 90% probability of compliance is shown in Table 5-12.

Table 5-12 Estimated Runoff Area Required for Dilution of Spillage Contact Water

Constituent	Surface Water Standard (µg/L)	Natural runoff area (m^2 per m of track)
Cobalt	5.0	2.5
Copper	9.3(1)	675
Nickel	52(1)	30

(1) Standard is hardness-based, value shown for 100 mg/L hardness

The limiting area required to provide sufficient dilution water for all constituents is estimated at 675 square meters per meter of track (one-sided). Approximately 543 acres of wetlands along the railroad corridor that may have potential indirect impacts are identified in Large Table 17. Watersheds were delineated for each wetland that abutted the railroad corridor as well as wetlands with contributing watersheds abutting the railroad corridor.

Wetlands that have contributing watersheds that include no segments of the railway (e.g., many of the wetlands uphill to the north of the rail corridor) were identified as having no potential indirect impacts from rail spillage. Wetlands immediately abutting the railway and whose watersheds include the rail centerline were identified as potentially being impacted, although the impacts may not extend to the full area of the wetland. Wetlands that have contributing watersheds which include natural areas that are larger than 675 square meters per meter of track (one-sided) in the contributing watershed were identified as having no potential indirect impacts.

5.2.3.2.2 Dunka Road

Loaded mine haul trucks will not travel on the Dunka Road. Empty mine haul trucks will only travel on the Dunka Road when they are in need of maintenance at the Area 1 Shop. It is estimated that each truck will travel to Area 1 Shop twice per year. The total one-way trips per year are estimated at 44. Given the low traffic volumes (< 1 trip per week on average) and the consideration that the ore trucks will be empty, it was determined in Attachment A that a quantitative assessment of impacts from ore particle discharge from haul truck travelling down the Dunka Road is not warranted. Therefore, no potential indirect wetland impacts were identified for wetlands abutting the Dunka Road.

5.2.3.2.3 Product Shipping

Products produced in the hydrometallurgical plant (Gold and Platinum Group Metals concentrate, mixed hydroxide precipitate) will be loaded into super sacks (i.e., large industrial sacks used to transport solid material) and then loaded onto trucks or railcars. There is little or no potential for spillage with this method of shipping and Attachment A concluded that with respect to flotation concentrate, as stated in the Project Description (Reference (8)), "Each filtered concentrate will be conveyed to separate stockpiles within an enclosed 10,000 ton storage facility for loading into covered rail cars. The storage facility will store about 7 to 10 days of production capacity when flotation concentrate will be directed to Concentrate Dewatering/Storage. The storage facility will have a concrete floor and provisions to wash wheeled equipment leaving the facility to prevent concentrates from being tracked out of the facility." Best Management Practices adopted at other mining facilities, such as enclosed storage and loading, covered cars, top-loaded gondola-type cars, and vehicle wash facilities, are proposed for use at the Project. PolyMet will be paid on tons received by customers so it has a vested interest in not losing any concentrate. The covered rail cars will be inspected for holes and any holes repaired before concentrate loading. Attachment A determined that because the common carrier route (i.e., the rail line used to transport products) is not known (ultimate customer not known and could change), there is no way to assess impacts along the common carrier route. Therefore, no potential indirect wetland impacts were identified for wetlands along a common carrier route.

5.2.3.3 Potential Indirect Impacts – Wildlife Utilization of Nearby Habitats from Project Noise

The following sections summarize the potential indirect impacts to wildlife utilization of nearby habitats from Project noise. As outlined in Attachment A, the following three steps were used in the potential indirect impact analysis: 1) potential sources and range of Project noise were identified; 2) potential wildlife species and habitat preferences within the area were identified; and 3) potential impacts to wildlife utilization of nearby habitats from Project noise were qualitatively assessed.

5.2.3.3.1 Potential Sources and Range of Noise

Noise along the transportation corridors will be generated by trucks along Dunka Road and trains. Noise from trucks passing along Dunka Road is estimated to range from 67 dBA for light trucks to 90 dBA for larger dump trucks (Table 3.7-1 of Reference (36)). The decibel level of a passing freight train at approximately 50 feet is 80 dBA. A locomotive’s horn decibel level is 96 dBA at 100 feet ahead of the locomotive (Table 3.7-1 of Reference (36)).

5.2.3.3.2 General Habitat Types

Wildlife habitat along the transportation corridors is varied, and includes wetlands, forested uplands, and maintained grasslands adjacent to existing roads and railroads.

5.2.3.3.3 Wildlife Species Present

Wildlife species present in the transportation corridors are similar to those described in Section 5.2.1.5 for the Mine Site. Most of the same common SGCN and RFSS species present at the Mine Site are also present along the transportation corridors.

5.2.3.3.4 Potential Impacts to Wildlife Utilization of Habitats

Noise-related impacts to wildlife utilization of habitats nearby the transportation corridors will be similar to those for the Mine Site, described in Section 5.2.1.5.

Blasting noise along the transportation corridors will be somewhat reduced relative to the Mine Site. For portions of transportation corridors within one mile of the Mine Site, the noise generated from a blast will range from 71-75 dBA. Tree cover and atmospheric absorption will decrease these levels further.

Species currently utilizing the grassland rights-of-way along Dunka Road and the railroad will likely continue to use these areas. Currently there is low to moderate traffic along Dunka Road. During the Project, increased traffic along the transportation routes may cause some wildlife species to abandon the adjacent habitats. However, these are already moderately disturbed habitats, and are therefore most likely used by habitat generalists rather than SGCN and other more sensitive species. As a result, increases in traffic along Dunka Road and the railroad are not likely to result in significant abandonment of adjacent habitats.

5.2.4 Summary of Potential Indirect Wetland Impacts

The analysis in Section 5.2 identified six factors that may result in potential indirect wetland impacts and include wetland fragmentation, change in wetland hydrology from changes in watershed area, changes in wetland hydrology from groundwater drawdown, water quality changes related to deposition of dust, water quality changes related to ore spillage along the transportation corridor, and changes in water quality related to leakage from stockpiles/mine features and seepage from mine pits. A wetland may be potentially indirectly impacted by none of these factors or up to a maximum of six, with different combinations of factors possible. A rating was developed for the wetlands based on the number of factors that may potentially affect it – from No Impact (0 factors) to 6 (all six factors potentially indirectly impacting the wetland). Using this approach, no wetlands were rated as a 6 in this analysis.

Using the method identified in Attachment A to identify potential indirect wetland impacts from drawdown (Section 5.2.1.2.2), approximately 54% of wetlands received a rating of 1, with one factor potentially indirectly impacting the wetland; 42% of wetlands received a rating of 2, with two factors potentially indirectly impacting the wetland; 3% of wetlands received a rating of 3, with three factors potentially indirectly impacting the wetland; less than 1% of wetlands received a rating of 4, with four factors potentially indirectly impacting the wetland; and less than 0.1% of wetlands received a rating of 5, with five factors potentially indirectly impacting the wetland. Table 5-13 shows the wetland acreage for each rating for Ratings 1, 2, 3, 4, and 5. Large Figure 23 through Large Figure 25 shows the rating for wetlands in the Project areas.

Table 5-13 Rating for Wetlands Potentially Indirectly Impacted in the Project Area

Rating	Attachment A Method		Alternate Method	
	Wetlands (acres)	Wetlands (% of total acres)	Wetlands (acres)	Wetlands (% of total acres)
1	3,936.99	54.5%	3,298.97	52.3%
2	3,030.69	41.9%	2,800.83	44.4%
3	244.53	3.4%	205.19	3.3%
4	15.64	0.2%	7.86	0.1%
5	0.24	<0.1%	0.24	<0.1%
Total acres of wetland	7,228.09		6,313.09	

Using the alternative method to identify potential indirect wetland impacts from drawdown (Section 5.2.1.2.2), approximately 52% of wetlands received a rating of 1, with one factor potentially indirectly impacting the wetland; 44% of wetlands received a rating of 2, with two factors potentially indirectly impacting the wetland; 3% of wetlands received a rating of 3, with three factors potentially indirectly impacting the wetland; less than 1% of wetlands received a rating of 4, with four factors potentially indirectly impacting the wetland; and less than 0.1% of wetlands received a rating of 5, with five factors potentially indirectly impacting the wetland. Table 5-13 shows the wetland acreage for Ratings 1, 2, 3, 4, and 5. Large Figure 26 through Large Figure 28 show the rating for wetlands in the Project areas.

5.3 Cumulative Wetland Impacts

An analysis was conducted to determine the cumulative effects of direct impacts from all past, present, and reasonably foreseeable future projects to the wetlands, lakes, and deepwater resources located in the Partridge River and Embarrass River watersheds. The number and extent of wetland, lake, and deepwater resources were estimated for three time periods, including pre-settlement, existing, and the foreseeable future. Attachment A summarizes the methodology used for the cumulative wetland impact analysis.

5.3.1 Pre-settlement Wetland and Water Resources

The pre-settlement condition time period represents wetland, lake, and deepwater resources as they existed prior to mining and urban development in the late 1800s to early 1900s. An estimate of pre-settlement wetland, lake, and deepwater acreages within the Partridge River and Embarrass River watersheds was developed using the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps and the original survey maps developed using data from the original Government Land Surveys.

In order to develop a relationship between NWI mapping and pre-settlement mapping of wetland, lake, and deepwater resources, townships in each watershed with minimal disturbance were used to calculate ratios of NWI to original survey wetland, lake, and deepwater resources. These ratios were used as adjustment factors to conform the original survey data to the standards and scales of the NWI data for estimating the pre-settlement wetland, lake, and deepwater resources within the disturbed areas of each watershed. The methodology used to identify disturbed areas in each watershed is summarized in Attachment A.

5.3.1.1 Partridge River Watershed

Township 58, Range 12 is one of the least disturbed townships in the Partridge River Watershed (0.2% disturbance in the entire township and 0.4% disturbance for the portion contained within the watershed: Large Figure 29). Using the disturbance at the township level (0.2%), the ratio of NWI to original survey wetlands, lakes, and deepwater resources was calculated to be 1.21 for the least disturbed township in the Partridge River Watershed. This ratio indicates there were approximately 21% more wetlands, lakes, and deepwater resources identified on the NWI maps than the original survey maps in the Partridge River Watershed.

Disturbance within the townships located in the Partridge River Watershed range between 0.4% and 52.4%, with approximately 15% of the entire Partridge River Watershed containing significant human disturbance since settlement of the area (Large Figure 29). The disturbance types (and percent of the disturbance area) include: mining features including stockpiles, pits, roads, and other infrastructure (82% of the disturbance area); primarily municipal/residential development (e.g., Cities of Aurora and Hoyt Lakes) with some barren land and cultivated crops (13% of the disturbance area); and roads and railroads (5% of the disturbance area). Approximately 85% of the Partridge River Watershed was judged to be relatively undisturbed, so NWI mapping was used in these areas to represent pre-settlement conditions for wetland, lake, and deepwater resources.

Based on the original survey maps, approximately 2,991 acres of wetland were mapped within the disturbed areas in the Partridge River Watershed. This wetland acreage was adjusted to 3,620 acres using the 1.21 adjustment factor. After accounting for the disturbed areas, a total of 33,601 acres of wetlands were identified in the 101,812 acre Partridge River Watershed, comprising 33% of the watershed (Large Table 18, Large Figure 29).

Based on the original survey maps, 24 acres of lake were mapped within the disturbed areas in the Partridge River Watershed. This lake acreage was adjusted to 29 acres using the 1.21 adjustment factor. After accounting for the disturbed areas, a total of 2,688 acres of lake were identified in the 101,812 acre watershed comprising 2.6% of the watershed (Large Table 19, Large Figure 29).

No deepwater habitat (i.e., mine pits; Large Table 20, Large Figure 29) was identified in the watershed for the pre-settlement conditions.

5.3.1.2 Embarrass River Watershed

Township 61, Range 14 is one of the least disturbed townships in the Embarrass River Watershed (0.6% disturbance in the entire township and 0.7% disturbance for the portion contained within the watershed: Large Figure 29). Using the disturbance at the township level (0.6%), the ratio of NWI to original survey wetlands, lakes, and deepwater resources was calculated to be 0.85 for the least disturbed township in the Embarrass River Watershed. Based on this analysis, the ratio of NWI to original survey wetlands, lakes, and deepwater resources was calculated to be approximately 15% fewer wetlands, lakes, and deepwater resources identified on the NWI maps than the original survey maps in the Embarrass River Watershed.

Disturbance within the portions of townships located in the Embarrass River Watershed range between 0.7% and 63.3%, with approximately 12% of the entire Embarrass River Watershed containing significant human disturbance since settlement of the area (Large Figure 29). The disturbance types (and percent of the disturbance area) include: mining features including stockpiles, pits, roads, and other infrastructure (61% of the disturbance area); primarily municipal/residential development (e.g., Cities of Babbitt, Biwabik, Gilbert, and McKinley) with some barren land and cultivated crops (27% of the disturbance area); and roads and railroads (12% of the disturbance area). Approximately 88% of the Embarrass River watershed was judged to be relatively undisturbed, so NWI mapping was used in these areas to represent pre-settlement conditions for wetland, lake, and deepwater resources.

Based on the original survey maps, approximately 2,388 acres of wetland were mapped within the disturbed areas of the Embarrass River Watershed. This wetland acreage was adjusted to 2,030 acres using the 0.85 adjustment factor. After accounting for the disturbed areas, a total of 34,650 acres of wetlands were identified in the 116,797 acre Embarrass River Watershed, comprising approximately 30% of the watershed (Large Table 18, Large Figure 29).

Based on the original survey maps, 224 acres of lake were mapped within the disturbed areas in the Embarrass River Watershed. This lake acreage was adjusted to 190 acres using the 0.85 adjustment factor. After accounting for the disturbed areas, a total of 3,121 acres of lakes were identified in the 116,797 acre watershed comprising less than 3% of the watershed (Large Table 19, Large Figure 29).

No deepwater habitat (i.e., mine pits; Large Table 20, Large Figure 29) was identified in the watershed for the pre-settlement conditions.

5.3.2 Existing Wetland and Water Resources

The existing conditions time period represents wetlands, lakes, and deepwater resources as they exist today, prior to the development of the Project (Large Figure 30). Existing wetlands, lakes, and deepwater resources were estimated using the following sources of data:

wetland delineations completed in the area (described in Section 3.0), NWI maps, USGS National Hydrograph Dataset to estimate lake or lacustrine water bodies, and MDNR Mesabi Mining Features (2009) in combination with 2010 LiDAR data and aerial photographs from 2003, 2008, 2009, and 2010 to estimate deepwater or mine pit water bodies.

5.3.2.1 Partridge River Watershed

A total of 31,318 acres of existing wetlands were identified in the 101,812 acre watershed, comprising 31% of the land area (Large Table 18, Large Figure 30). There has been a decrease of approximately 2,283 acres of wetland; this represents a 7% decrease in wetland area compared to pre-settlement conditions (Large Table 21).

A total of 3,194 acres of lakes were identified in the 101,812 acre watershed, comprising 3% of the land area (Large Table 19, Large Figure 30). There has been an increase of approximately 506 acres of lakes; this represents a 19% increase in lake area compared to pre-settlement conditions (Large Table 22).

A total of 3,146 acres of deepwater resources (i.e., mine pits) were identified in the 101,812 acre watershed, comprising 3% of the land area (Large Table 20, Large Figure 30). There has been an increase of 3,146 acres of deepwater resources in the watershed compared to no deepwater resources present under pre-settlement conditions (Large Table 23).

The change in wetland, lake, and deepwater acreage has resulted primarily from mining projects, development of municipalities, and construction of transportation infrastructure such as roads and railroads.

5.3.2.2 Embarrass River Watershed

A total of 34,249 acres of existing wetlands were identified in the 116,797 acre watershed, comprising 29% of the land area (Large Table 18, Large Figure 30). There has been a decrease of approximately 402 acres of wetland; this represents a 1% decrease in wetland area compared to pre-settlement conditions (Large Table 21).

A total of 2,904 acres of lakes were identified in the 116,797 acre watershed, comprising 3% of the land area (Large Table 19, Large Figure 30). There was a decrease of approximately 217 acres of lakes in the watershed; this represents a 7% decrease in lake area compared to pre-settlement conditions (Large Table 22).

A total of 977 acres of deepwater resources (i.e., mine pits) were identified in the 116,797 acre watershed, comprising 1% of the land area (Large Table 20, Large Figure 30). There has been an increase of 977 acres of deepwater resources in the watershed compared to no deepwater resources present under pre-settlement conditions (Large Table 23).

The change in wetland, lake, and deepwater acreage has resulted primarily from mining projects, development of municipalities, and construction of transportation infrastructure such as roads and railroads.

5.3.3 Projected Future Wetland and Water Resources

The future conditions time period represents wetlands, lakes, and deepwater resources expected to be present following the conclusion and long-term closure of the Project. It is assumed that the future conditions represents the time period after the conclusion of the future projects when the mine pits will have flooded with water.

Relevant agencies were contacted to identify foreseeable future actions within the Partridge River and Embarrass River watersheds. Agency officials were asked to identify actual or potential development projects that may occur during the life of the Project. The Project Description (Reference (8) describes a 20-year mine life followed by reclamation and long-term closure. Public officials from city, county, state, and federal agencies were contacted as shown in Attachment F. Based on Reference (37), foreseeable future actions did not include projects that have only been proposed because it is too speculative to include in this analysis.

Future projects were identified in the Partridge and Embarrass River watersheds that may impact wetland, lake, and deepwater resources including:

- The Project, located in the Embarrass and Partridge River watersheds, has identified the potential for 912 acres of direct wetland impact over the next 20 years (Large Table 24, Large Figure 31). Approximately 661 acres of wetland restoration is planned on-site in the Partridge River watershed as part of the Project mitigation plan. Approximately 321 acres of deepwater habitat is planned at the Mine Site at the conclusion of the Project.

- The proposed Mesabi Nugget Phase II project, located in the Partridge River watershed, has identified the potential for approximately 267 acres of direct wetland impact (Reference (38)) over the life of the project (Large Table 24, Large Figure 31). Approximately 1,601 acres of deepwater habitat is planned at the conclusion of the project (Reference (39), resulting in an increase of 49 acres from existing 1,552 acres of deepwater habitat (Large Table 24).

- The Laskin Energy Park is located in the Partridge River watershed and south of the Minnesota Power Laskin Energy Center (Large Table 24, Large Figure 31). It is located adjacent to Colby and Whitewater Lakes, near the City of Hoyt Lakes. If every lot in the 220-acre industrial park was fully developed, the potential direct wetland impacts could range from zero to seven acres. The amount of wetland mitigation that may be conducted in the Partridge River watershed is unknown at this time.

- St. Louis County Public Works will be conducting 8 bridge replacements in the Partridge and Embarrass River watersheds over the next 10 years. Bridge replacements generally directly impact 10,000 square feet of wetlands or less, so the maximum direct wetland impact from the bridge projects will be 1.8 acres (Large Table 24). Information was not provided regarding potential indirect wetland impacts for this project.

- The 3.5 mile extension of County Road 4 north of Biwabik in the Embarrass River watershed may impact an unknown number of wetlands. The road construction project is slated to begin in 2018, and analysis of wetland impacts will begin in 2016, according to St. Louis County Public Works.

To estimate the future projected wetland, lake, and deepwater resources impacts from the Project, the Mesabi Nugget Phase II project, the Laskin Energy Park project, and the St. Louis County bridge replacement, the maximum impact acreages were used to calculate total acreages in Large Table 24. For the projected future conditions, the acreage of wetland, lake, and deepwater resources was estimated by subtracting the future projected wetland impacts and adding the future projected development of wetland, lake, and deepwater resources to the existing resource totals (Large Table 24).

5.3.3.1 Partridge River Watershed

In addition to the Project, development of other projects (and associated impacts to and mitigation of wetland, lake and deepwater resources in the Partridge River Watershed) will occur under the foreseeable future conditions. Large Table 21 through Large Table 23 summarize future conditions for wetland, lake, and deepwater resources.

Approximately 30,937 acres of wetlands are projected to be present in the watershed in the foreseeable future comprising 30% of the land area (Large Table 18, Large Figure 31). The change in wetlands, as a proportion of all wetlands within the study area, will be an 8% reduction from pre-settlement conditions and a 1% reduction compared to existing conditions (Large Table 21).

Approximately 3,194 acres of lakes are projected to be present in the watershed in the foreseeable future, comprising 3% of the land area (Large Table 19, Large Figure 31). The change in lakes, as a proportion of the total study area, will be a 19% increase from pre-settlement conditions and there will be no changes compared to existing conditions (Large Table 22).

Approximately 3,516 acres of deepwater resources are projected to be present in the watershed in the foreseeable future, comprising 3% of the land area (Large Table 20, Large Figure 31). The change in deepwater, as a proportion of the total study area, will be a 100% increase from pre-settlement conditions and a 12% increase compared to existing conditions (Large Table 23).

5.3.3.2 Embarrass River Watershed

In addition to the Project, development of other projects (and associated impacts to and mitigation of wetland, lake, and deepwater resources in the Embarrass River Watershed) will occur under the foreseeable future conditions. Large Table 21 through Large Table 23 summarize future conditions for wetland, lake, and deepwater resources.

Approximately 34,074 acres of wetlands are projected to be present in the watershed in the foreseeable future comprising 29% of the land area (Large Table 18, Large Figure 31). The change in wetlands, as a proportion of all wetlands within the study area, will be a 2% reduction from pre-settlement conditions and less than 1% reduction compared to existing conditions (Large Table 21).

Approximately 2,904 acres of lakes are projected to be present in the watershed in the foreseeable future, comprising 3% of the land area (Large Table 19, Large Figure 31). The change in lakes, as a proportion of the total study area, will be a 7% increase from pre-settlement conditions and there will be no changes compared to existing conditions (Large Table 22).

Approximately 977 acres of deepwater resources are projected to be present in the watershed in the foreseeable future, comprising 1% of the land area (Large Table 20, Large Figure 31). The change in deepwater, as a proportion of the total study area, will be a 100% increase from pre-settlement conditions and no changes compared to the existing conditions (Large Table 23).

5.3.4 Qualitative Analysis of Cumulative Wetland Impacts for the St. Louis River below the Ordinary High Water Mark from Its Confluence with the Embarrass River to Lake Superior

The XP-SWMM model developed for the Partridge River identified that the changes in average annual flow (and therefore stage) of the Partridge River will be within the naturally occurring annual variation for the Partridge River (Section 5.2.1.3). Therefore, no potential indirect wetland impacts are identified for the wetlands abutting the Partridge River.

The St. Louis River is located downstream of the Partridge River. Thus, impacts to flows (and by extension water surface elevations) generated by the Project are anticipated to be less than those estimated for the Partridge River and within the natural variation of flow within the St. Louis River. Therefore, no potential indirect wetland impacts are identified for the wetlands within the St. Louis River below the ordinary high water mark from its confluence with the Embarrass River to Lake Superior.

5.3.5 Quantitative Analysis of Cumulative Wetland Impacts

The quantitative analysis of cumulative wetland impacts for the Partridge and Embarrass River watersheds is discussed in Section 5.3.3.

5.3.6 Climate Change

The qualitative assessment of the potential impacts of climate change on wetlands was included in the Climate Change Evaluation Report developed by the Air IAP. No additional assessment was conducted for this data package.

Revision History

Date	Version	Description
10/14/2011	1	Initial release
12/16/2011	2	Revisions based on comments received for Version 1 and additional information regarding Mine Site features.
1/20/2012	3	Revisions based on reviewing the status of wetlands within the currently permitted (Cliffs Erie LLC) waste facility boundary.
2/16/2012	4	Revisions based on comments received for Version 3
12/12/2012	5	Revisions based on additional information regarding Project features and wetland information.
12/28/2012	6	Revisions based on analysis of potential indirect wetland impacts.
3/1/2013	7	Revisions based on analysis of potential indirect wetland impacts.

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Large Table 1 **Summary of Wetlands**

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact(1)
Mine Site	1	3	0.42	0.00	0.42	Shallow marsh	Moderate	
Mine Site	3	3	0.35	0.00	0.35	Shallow marsh	Moderate	
Mine Site	5	2	0.61	0.61	0.00	Wet meadow	High	F
Mine Site	6	3	0.62	0.00	0.62	Shallow marsh	Moderate	
Mine Site	7	2	0.07	0.00	0.07	Wet meadow	Moderate	
Mine Site	8	2	6.80	6.80	0.00	Sedge meadow	Moderate	F,E
Mine Site	9	3	1.80	0.07	1.73	Shallow marsh	High	F
Mine Site	10	2	1.17	0.00	1.17	Sedge meadow	High	
Mine Site	11	8	8.88	0.00	8.88	Coniferous bog	High	
Mine Site	12	6	0.13	0.00	0.13	Alder thicket	High	
Mine Site	13	4	5.03	0.09	4.94	Deep marsh	High	F
Mine Site	14	2	0.33	0.33	0.00	Wet meadow	High	F
Mine Site	16	3	0.31	0.00	0.31	Shallow marsh	High	
Mine Site	18	3	18.90	18.90	0.00	Shallow marsh	High	E
Mine Site	19	3	1.68	0.05	1.63	Shallow marsh	High	E
Mine Site	20	2	17.06	16.96	0.10	Sedge meadow	High	E
Mine Site	22	3	1.43	0.00	1.43	Shallow marsh	High	
Mine Site	22A	7	0.89	0.00	0.89	Coniferous swamp	High	
Mine Site	24	6	0.80	0.39	0.41	Alder thicket	High	E
Mine Site	25	8	1.95	0.00	1.95	Coniferous bog	High	
Mine Site	27	8	1.07	1.07	0.00	Coniferous swamp	Moderate	E
Mine Site	29	3	12.02	0.00	12.02	Shallow marsh	High	
Mine Site	32	8	73.36	70.99	2.37	Coniferous bog	High	F,E
Mine Site	33A	6	18.46	5.77	12.69	Alder thicket	High	E
Mine Site	33B	7	4.56	0.00	4.56	Coniferous swamp	High	
Mine Site	37	6	2.39	2.39	0.00	Shrub-carr	High	F
Mine Site	43	6	8.29	7.26	1.03	Alder thicket	High	F
Mine Site	44	6	3.27	1.99	1.28	Alder thicket	High	E
Mine Site	45	6	37.55	28.83	8.72	Alder thicket	High	F,E
Mine Site	47	8	0.54	0.54	0.00	Open bog	High	F
Mine Site	48	8	89.16	27.80	61.36	Coniferous bog	High	F,E
Mine Site	48A	7	2.65	2.21	0.44	Coniferous swamp	High	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact[(1)]
Mine Site	51	6	7.47	7.45	0.02	Alder thicket	High	F
Mine Site	52	6	3.88	3.88	0.00	Alder thicket	High	F,E
Mine Site	53	6	18.59	0.00	18.59	Alder thicket	High	
Mine Site	53A	7	2.35	0.00	2.35	Coniferous swamp	High	
Mine Site	53B	7	0.43	0.00	0.43	Coniferous swamp	High	
Mine Site	53C	7	2.88	0.00	2.88	Coniferous swamp	High	
Mine Site	54	7	4.11	0.00	4.11	Coniferous swamp	High	
Mine Site	54C	6	0.74	0.00	0.74	Alder thicket	High	
Mine Site	55	6	3.91	3.85	0.06	Alder thicket	High	F,E
Mine Site	56	8	2.79	2.79	0.00	Open bog	High	E
Mine Site	57	7	78.06	50.49	27.57	Coniferous swamp	High	F,E
Mine Site	58	6	34.58	0.00	34.58	Alder thicket	High	
Mine Site	60	6	6.71	6.71	0.00	Alder thicket	High	F
Mine Site	61	7	0.45	0.00	0.45	Coniferous swamp	High	
Mine Site	62	8	12.13	0.00	12.13	Coniferous bog	High	
Mine Site	64	7	0.31	0.00	0.31	Hardwood swamp	High	
Mine Site	68	7	23.81	10.89	12.92	Coniferous swamp	High	F,E
Mine Site	72	7	1.39	0.00	1.39	Coniferous swamp	High	
Mine Site	74	7	6.12	6.12	0.00	Hardwood swamp	High	E
Mine Site	76	8	3.92	2.21	1.71	Coniferous bog	High	E
Mine Site	77	8	13.01	0.92	12.09	Coniferous bog	High	F,E
Mine Site	78	8	1.75	1.75	0.00	Coniferous bog	High	F
Mine Site	79	8	2.39	0.00	2.39	Coniferous bog	High	
Mine Site	80	8	0.29	0.22	0.07	Coniferous bog	High	F
Mine Site	81	7	1.68	1.44	0.24	Coniferous swamp	High	F,E
Mine Site	82	8	62.40	60.77	1.63	Coniferous bog	High	F,E
Mine Site	83	8	3.99	0.00	3.99	Open bog	High	
Mine Site	84	8	1.33	0.00	1.33	Coniferous bog	High	
Mine Site	85	8	1.41	1.41	0.00	Coniferous bog	High	E
Mine Site	86	8	2.47	2.46	0.01	Coniferous bog	High	F
Mine Site	88	8	5.58	5.02	0.56	Coniferous bog	High	F
Mine Site	90	8	176.08	34.22	141.86	Coniferous bog	High	F,E
Mine Site	90A	8	7.91	1.20	6.71	Open bog	High	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact$^{(1)}$
Mine Site	95	8	2.54	2.54	0.00	Coniferous swamp	High	E
Mine Site	96	8	17.30	13.14	4.16	Coniferous bog	High	F,E
Mine Site	97	8	4.46	2.57	1.89	Coniferous bog	High	F,E
Mine Site	98	8	15.50	15.07	0.43	Coniferous bog	High	F,E
Mine Site	99	8	1.40	0.49	0.91	Coniferous bog	High	F,E
Mine Site	100	8	176.19	102.96	73.23	Coniferous bog	High	F,E
Mine Site	100A	6	1.66	1.66	0.00	Alder thicket	High	F
Mine Site	101	8	14.21	11.73	2.48	Coniferous bog	High	F,E
Mine Site	103	8	118.84	109.97	8.87	Coniferous bog	High	F,E
Mine Site	104	8	3.57	3.47	0.10	Coniferous bog	High	F
Mine Site	105	8	15.48	0.00	15.48	Coniferous bog	High	
Mine Site	107	8	40.92	31.63	9.29	Coniferous bog	High	F,E
Mine Site	107A	7	1.74	1.69	0.05	Coniferous swamp	High	F,E
Mine Site	107B	3	4.51	2.89	1.62	Shallow marsh	High	F,E
Mine Site	107C	6	27.60	27.60	0.00	Alder thicket	High	E
Mine Site	114	8	0.73	0.73	0.00	Coniferous bog	High	F
Mine Site	120	3	0.58	0.12	0.46	Shallow marsh	Moderate	E
Mine Site	200	7	6.36	6.36	0.00	Hardwood swamp	High	F
Mine Site	201	2	13.49	13.49	0.00	Wet meadow	High	F
Mine Site	202	8	3.11	3.11	0.00	Open bog	High	F
Mine Site	552	8	8.72	8.72	0.00	Coniferous bog	High	F
Mine Site	567	3	1.40	1.40	0.00	Shallow marsh	High	F
MINE SITE SUBTOTAL	**87**		**1297.78**	**758.19**	**539.59**		**80/87 High** **7/87 Moderate**	
Railroad Connection Corridor	1038	7	0.07	0.07	0.00	Coniferous swamp	High	F
Railroad Connection Corridor	R-3	6	0.10	0.10	0.00	Shrub-carr	High	F
Railroad Connection Corridor	R-4	6	0.20	0.20	0.00	Alder thicket	High	F
Railroad Connection Corridor	R-5	3	0.07	0.07	0.00	Shallow marsh	High	F
RAILROAD CONNECTION CORRIDOR SUBTOTAL	**4**		**0.44**	**0.44**	**0.00**		**4/4 High**	
Dunka Road and Utility Corridor	22B	3	0.34	0.34	0.00	Shallow marsh	High	F
Dunka Road and Utility Corridor	22C	6	0.38	0.38	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	54A	7	0.60	0.60	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	54B	6	0.13	0.13	0.00	Alder thicket	High	F

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact(1)
Dunka Road and Utility Corridor	54D	7	0.09	0.09	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	390	6	0.41	0.41	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	392	6	0.14	0.14	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	394	7	0.64	0.64	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	395	7	0.01	0.01	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	396	6	0.65	0.65	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	400	8	0.14	0.14	0.00	Coniferous bog	High	F
Dunka Road and Utility Corridor	553	7	0.09	0.09	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	554	7	0.11	0.11	0.00	Coniferous swamp	High	F
Dunka Road and Utility Corridor	569	6	0.68	0.68	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	716	6	0.02	0.02	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	814	8	0.75	0.75	0.00	Coniferous bog	High	F
Dunka Road and Utility Corridor	862	6	0.78	0.78	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1034	6	0.02	0.02	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1035	6	0.16	0.16	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	1124	6	0.44	0.44	0.00	Alder thicket	High	F
Dunka Road and Utility Corridor	R-7	3	0.18	0.18	0.00	Shallow marsh	High	F
DUNKA ROAD AND UTILITY CORRIDOR SUBTOTAL	**21**		**6.76**	**6.76**	**0.00**		**21/21 High**	
FTB	251	6	1.43	1.43	0.00	Alder thicket	Moderate	C
FTB	272	4	1.11	1.10	0.01	Deep marsh	Low	C
FTB	278	6	1.04	0.23	0.81	Alder thicket	Low	C
FTB	279	6	4.84	3.33	1.51	Alder thicket	Low	C
FTB	282	3	14.25	7.42	6.83	Shallow marsh	Moderate	C
FTB	284	6	2.92	2.51	0.41	Alder thicket	Low	C
FTB	290	7	0.48	0.22	0.26	Coniferous swamp	Moderate	F,E
FTB	292	4	1.71	1.29	0.42	Deep marsh	Low	C
FTB	307	3	0.78	0.77	0.01	Shallow marsh	Low	C
FTB	308	4	7.17	1.95	5.22	Deep marsh	Low	C
FTB	309	2	0.02	0.02	0.00	Wet meadow	Low	C
FTB	312	6	1.98	1.33	0.65	Shrub-carr	Low	C
FTB	314	3	24.87	5.70	19.17	Shallow marsh	Low	C
FTB	573	3	0.12	0.00	0.12	Shallow marsh	Low	
FTB	582	4	27.49	8.11	19.38	Deep marsh	Low	C

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact[(1)]
FTB	585	6	1.58	0.00	1.58	Alder thicket	Low	
FTB	586	4	1.89	1.53	0.36	Deep marsh	Low	C
FTB	587	3	0.97	0.17	0.80	Shallow marsh	Low	C
FTB	590	3	5.43	5.38	0.05	Shallow marsh	Low	C
FTB	591	4	2.71	0.70	2.01	Deep marsh	Low	C
FTB	593	4	9.80	8.47	1.33	Deep marsh	Low	C
FTB	594	4	0.06	0.00	0.06	Deep marsh	Low	
FTB	595	4	2.14	1.09	1.05	Deep marsh	Low	F
FTB	811	7	0.20	0.20	0.00	Coniferous swamp	Low	C
FTB	968	7	13.76	10.27	3.49	Coniferous swamp	Low	C
FTB	1027	6	0.20	0.00	0.20	Alder thicket	Moderate	
FTB	1125	2	0.07	0.00	0.07	Sedge meadow	Low	
FTB	1126	7	0.69	0.00	0.69	Hardwood swamp	Low	
FTB	1134	3	14.45	8.71	5.74	Shallow marsh	Low	C
FTB	1135	4	0.51	0.00	0.51	Deep marsh	Low	
FTB	1139	3	20.25	2.54	17.71	Shallow marsh	Low	C
FTB	1155	3	0.55	0.41	0.14	Shallow marsh	Low	C
FTB	1156	3	14.49	11.08	3.41	Shallow marsh	Low	C
FTB	1159	3	0.05	0.00	0.05	Shallow marsh	Low	
FTB	1160	5	0.85	0.00	0.85	Deep water	Low	
FTB	T1	4	1.94	0.11	1.83	Deep marsh	Low	F
FTB	T2	4	0.90	0.90	0.00	Deep marsh	Low	F
FTB	T3	2	0.09	0.09	0.00	Wet meadow	Low	F
FTB	T4	2	1.02	1.02	0.00	Wet meadow	Low	F
FTB	T5	2	0.24	0.24	0.00	Wet meadow	Low	F
FTB	T6	6	0.07	0.07	0.00	Shrub-carr	Low	F
FTB	T7	3	0.92	0.92	0.00	Shallow marsh	Low	F
FTB	T8	2	0.04	0.01	0.03	Wet meadow	Low	F
FTB	T10	4	1.48	1.48	0.00	Deep marsh	Low	F
FTB	T11	4	0.95	0.95	0.00	Deep marsh	Low	F
FTB	T12	3	0.39	0.39	0.00	Shallow marsh	Low	F
FTB	T13	4	1.05	0.52	0.53	Deep marsh	Low	F
FTB	T14	4	45.20	45.20	0.00	Deep marsh	Low	E

Project Area	Wetland ID	Dominant Circular 39 Community	Total Wetland Area within the Project Area (acres)	Direct Wetland Impacts (acres)	Remaining Wetland Area (acres)	Dominant Eggers and Reed Wetland Community	Wetland Quality	Type of Direct Impact[(1)]
FTB	T15	3	1.70	1.70	0.00	Shallow marsh	Low	F
FTB SUBTOTAL	**49**		**236.85**	**139.56**	**97.29**		**4/49 Moderate 45/49 Low**	
HRF	1155	3	35.45	6.89	28.56	Shallow marsh	Low	F
HRF	1159	3	0.62	0.62	0.00	Shallow marsh	Low	F
HRF SUBTOTAL	**2**		**36.07**	**7.51**	**28.55**		**2/2 Low**	
Colby Lake Water Pipeline Corridor	P1	4	0.23	0.00	0.23	Deep marsh	Low	
Colby Lake Water Pipeline Corridor	P2	6	0.03	0.00	0.03	Shrub-carr	Low	
Colby Lake Water Pipeline Corridor	P3	3	0.25	0.00	0.25	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P4	6	1.28	0.00	1.28	Shrub-carr	Low	
Colby Lake Water Pipeline Corridor	P5-1	4	0.77	0.00	0.77	Deep marsh	Low	
Colby Lake Water Pipeline Corridor	P5-2	3	0.14	0.00	0.14	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P6	3	0.18	0.00	0.18	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P7-1	3	0.11	0.00	0.11	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P7-2	3	1.90	0.00	1.90	Shallow marsh	Low	
Colby Lake Water Pipeline Corridor	P8	2	0.07	0.00	0.07	Wet meadow	Low	
Colby Lake Water Pipeline Corridor	P9	2	1.28	0.00	1.28	Wet meadow	Low	
Colby Lake Water Pipeline Corridor	P10	6	0.41	0.00	0.41	Alder thicket	Low	
Colby Lake Water Pipeline Corridor	P11	6	0.03	0.00	0.03	Shrub-carr	Low	
Colby Lake Water Pipeline Corridor	P12	6	0.31	0.00	0.31	Shrub-carr	Moderate	
COLBY LAKE WATER PIPELINE CORRIDOR	**14**		**6.99**	**0.00**	**6.99**		**1/14 Moderate 13/14 Low**	
PROJECT TOTAL	**177**		**1,584.89**	**912.46**	**672.43**		**105/177 High 12/177 Moderate 60/177 Low**	

(1) The types of direct wetland impact disturbance factors include excavation €, fill (F), and containment system (C).

Large Table 2 Summary of Direct Wetland Impacts

Project Area	Circular 39 Wetland Classification	1	2	2	3	4	5	6	6	7	7	8	8	Deepwater	Wetland Total
	Eggers and Reed Wetland Community	Seasonally Flooded	Fresh (Wet) Meadow	Sedge Meadow	Shallow Marsh	Deep Marsh	Shallow, Open Water	Shrub-Carr	Alder Thicket	Hardwood Swamp	Coniferous Swamp	Open Bog	Coniferous Bog		
Mine Site	Direct Impact (acres)	0.00	14.43	23.76	23.43	0.09	0.00	2.39	95.39	12.48	70.33	7.64	508.25	0.00	758.19
	# of directly impacted wetlands	0	3	2	6	1	0	1	11	2	7	4	22	0	59
Railroad Connection Corridor	Direct Impact (acres)	0.00	0.00	0.00	0.07	0.00	0.00	0.10	0.20	0.00	0.07	0.00	0.00	0.00	0.44
	# of directly impacted wetlands	0	0	0	1	0	0	1	1	0	1	0	0	0	4
Dunka Road and Utility Corridor	Direct Impact (acres)	0.00	0.00	0.00	0.52	0.00	0.00	0.00	3.81	0.00	1.54	0.00	0.89	0.00	6.76
	# of directly impacted wetlands	0	0	0	2	0	0	0	11	0	6	0	2	0	21
FTB Area	Direct Impact (acres)	0.00	1.38	0.00	45.19	73.40	0.00	1.40	7.50	0.00	10.69	0.00	0.00	0.00	139.56
	# of directly impacted wetlands	0	5	0	12	14	0	2	4	0	3	0	0	0	40
HRF	Direct Impact (acres)	0.00	0.00	0.00	7.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.51
	# of directly impacted wetlands	0	0	0	2	0	0	0	0	0	0	0	0	0	2
Colby Lake Water Pipeline Corridor	Direct Impact (acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	# of directly impacted wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	(acres)	0.00	15.81	23.76	76.72	73.49	0.00	3.89	106.90	12.48	82.63	7.64	509.14	0.00	912.46

Large Table 3 Wetlands within 500-feet increments – Mine Site

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1	Shallow marsh	0	0	0	0	0	0	0	0.10	0.33	0	0	0	0	0	0	0	0	0	0	0
3	Shallow marsh	0	0	0	0	0	0	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0
4	Wet meadow	0	0	0	0	0	0	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Shallow marsh	0	0	0	0	0	0	0	0.62	0	0	0	0	0	0	0	0	0	0	0	0
7	Wet meadow	0	0	0	0	0	0	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Shallow marsh	0	1.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Sedge meadow	0	0	0	0	0.12	1.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Coniferous bog	0	0	0	0	0	0	0	0.44	4.98	3.46	0	0	0	0	0	0	0	0	0	0
12	Alder thicket	0	0	0	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0	0
13	Deep marsh	0.01	4.93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Shallow marsh	0	0	0.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	Shallow marsh	0	0	0	0	0	0	0	0.12	1.00	0	0	0	0	0	0	0	0	0	0	0
19	Shallow marsh	0	0	0	0	0	1.62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	Sedge meadow	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Shallow marsh	0	0	1.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22A	Coniferous swamp	0	0	0.39	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22D	Shallow marsh	0	0	0.62	1.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22E	Alder thicket or Shrub-carr	0	0	0	2.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	Alder thicket	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	Coniferous bog	1.62	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
29	Shallow marsh	0	0	0	0	0	0	0	0	0.02	11.75	0.24	0	0	0	0	0	0	0	0	0
32	Coniferous bog	2.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33A	Alder thicket	11.77	0.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33B	Coniferous swamp	1.96	2.47	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	Alder thicket	0	0.70	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	Alder thicket	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	Alder thicket	8.17	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	Shrub-carr	0	0	0	0	0.52	3.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	Coniferous bog	1.54	14.29	37.40	7.77	0.30	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48A	Coniferous swamp		0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	Alder thicket	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	Alder thicket	0	0	0	1.48	0.44	0	4.51	10.24	1.91	0	0	0	0	0	0	0	0	0	0	0
53A	Coniferous swamp	0	0	0	0	0	0	0	1.36	0.99	0	0	0	0	0	0	0	0	0	0	0
53B	Coniferous swamp	0	0	0	0	0	0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0
53C	Coniferous swamp	0	0	0	2.67	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53D	Alder thicket	0	3.67	30.49	44.04	31.61	14.74	19.96	27.72	42.97	48.42	73.99	129.85	107.42	52.72	39.85	33.10	38.85	35.91	31.97	16.02
53E	Coniferous swamp	0	0	0	0	0	0	0.05	1.83	0.04	0	0	0	0	0	0	0	0	0	0	0
54	Coniferous swamp	0	0	0	0	0	1.86	2.23	0.01	0	0	0	0	0	0	0	0	0	0	0	0
54C	Alder thicket	0	0	0	0	0	0.06	0.69	0	0	0	0	0	0	0	0	0	0	0	0	0
54E	Coniferous swamp	0	0	0	0	0	0	1.43	1.17	0	0	0	0	0	0	0	0	0	0	0	0
54F	Alder thicket	0	0	0	0	0	0	0.43	0	0	0	0	0	0	0	0	0	0	0	0	0
54G	Coniferous swamp	0	0	0	0	0	0.77	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0
55	Alder thicket	0	0	0	0	0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
57	Coniferous swamp	0	0	0	2.66	5.98	11.25	5.70	1.95	0	0	0	0	0	0	0	0	0	0	0	0
58	Alder thicket	0	0	0	0	0	3.36	9.33	18.26	2.98	0.64	0	0	0	0	0	0	0	0	0	0
61	Coniferous swamp	0	0	0	0.35	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	Coniferous bog	0	0.17	2.58	7.52	1.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	Hardwood swamp	0	0	0	0.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	Coniferous swamp	0.83	0.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	Coniferous bog	1.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	Coniferous bog	2.20	8.79	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	Coniferous bog	0	2.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	Coniferous bog	0	0	0.05	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	Coniferous swamp	0	0	0	0	0	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	Coniferous bog	1.63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	Open bog	0	0	0	0	0	0	0	0	0	2.45	1.54	0	0	0	0	0	0	0	0	0
84	Coniferous bog	0	0	0	0	0	0.82	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0
84A	Coniferous bog	0	0	0	0	0	1.04	3.33	3.04	0.80	0	0	0	0	0	0	0	0	0	0	0
86	Coniferous bog	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	Coniferous bog	0	0	0	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	Coniferous bog	17.53	28.70	19.37	14.09	15.60	13.04	13.05	15.21	5.19	0.00	0	0	0	0	0	0	0	0	0	0
90A	Open bog	0	0	3.97	2.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	Coniferous bog	4.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
97	Coniferous bog	1.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	Coniferous bog	0	0	0	0	0	0	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0
99	Coniferous bog	0.91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	Coniferous bog	29.61	37.10	6.43	0.04	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	Coniferous bog	2.26	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	Coniferous bog	8.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	Coniferous bog	0	0	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	Coniferous bog	0	0	0	0	0	0	0	0	0	5.78	8.38	1.31	0	0	0	0	0	0	0	0
105A	Coniferous bog	0	0	0	0	0	0	0	0	0	0.04	0.09	0	0	0	0	0	0	0	0	0
106	Coniferous swamp	0	0	0	0	0	1.60	10.47	4.55	8.97	28.37	26.58	3.00	0	0	0	0	0	0	0	0
106B	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0.16	16.44	4.72	0	0	0	0	0
106C	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	5.70	10.75	3.48	0	0	0	0	0
106D	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.79	16.01	1.00	0	0	0
107	Coniferous bog	7.94	1.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107A	Coniferous swamp	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107B	Shallow marsh	1.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	Shallow marsh	0	0	0	0	0	0.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0
315	Alder thicket or Shrub-carr	0	0	6.31	10.90	34.96	60.64	57.68	46.65	44.89	25.08	16.34	6.77	12.04	0.42	0	0	0	0	0	0
394A	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.48	6.95	21.58	37.21

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		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
396A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.80	1.88	0	0	0
397	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0.54	11.99	23.56	29.74	39.05	37.66	34.16	34.53
404	Coniferous swamp	0	0	0	0	0	0	0	1.09	8.72	2.97	0	0	0	0	0	0	0	0	0	0
406	Coniferous bog	0	0	0	0	2.26	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
407	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	2.27	6.93	5.38	0	0	0	0
409	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.16	11.30	11.10	15.53	19.45
410	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	1.96	0	0	0	0	0
457	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.90	16.40	31.66
458	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33
459	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.29	7.47	5.00	5.87	8.89	4.50
460	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	1.82	4.82	0.09	0	0	0	0	0
461	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.85	2.80
465	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.53	5.58	11.36	3.29	0
466	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	6.35	6.25	6.88	4.28	1.10	0	0
467	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	2.20	10.27	7.10	8.72	1.29	0	0
468	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.46	6.45	8.81	3.95	0	0
470	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.20
473	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.64	3.52	0.50
474	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.15	10.08	8.18	0.02	0	0

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		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
477	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.69
478	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.21	1.79	0
479	Coniferous bog	0	0	0	0	0	0	0	0	0.94	13.70	9.82	9.28	2.74	0.40	0	0	0	0	0	0
480	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	4.44	2.84	1.59	0	0	0	0	0	0	0	0
487	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	4.14	7.32
489	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	9.04	47.95	45.51	34.46	33.56	7.82	0.39	0
491	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.42	1.05
492	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	7.30	0.11
493	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.62	12.10	12.29	10.88	10.69	0
494	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.59
510	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02
512	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.54	12.01	3.79	0	0
513	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.52	5.86	2.99	0
514	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.96	5.09	0.26	0
515	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.30
516	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.40
519	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.09
530	Coniferous bog	0	0	0	0	0	0	0	0	0	0.31	14.88	11.79	29.83	34.75	28.28	24.43	27.89	17.32	4.79	9.41

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
531	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	6.34	17.16	7.18	5.22	10.40	11.52	10.15	2.48
532	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.79	5.10	8.32	1.03	0
533	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.76	5.44	1.60	0
534	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.86	10.19	7.15
535	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
538	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.29
539	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.01	8.34
540	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.45
546	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	5.93	20.25	24.83	39.97	47.95	30.85	19.89	33.37
547	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.58	9.57	1.18	0	0	0
548	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.25	10.11	1.21
553A	Coniferous swamp	0	0	0	0	0	0	0.73	1.73	0	0	0	0	0	0	0	0	0	0	0	0
554A	Coniferous swamp	0	0	0	0	0	0	0	0.83	1.22	0	0	0	0	0	0	0	0	0	0	0
555	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	2.45	3.28	9.06	20.65	25.15	25.81	16.25	11.96	11.14	4.04	1.44	0.40
556	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	1.84	0	0	0	0	0	0	0	0	0
557	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	2.72	0.20	0	0	0	0	0	0	0	0	0	0
558	Coniferous bog	0	0	0	0	0	0	0	0		4.65	7.57	3.85	0	0	0	0	0	0	0	0
559	Coniferous bog	0	0	0	0	0	0	0.09	2.61	7.89	10.74	8.29	4.49	0.01	0	0	0	0	0	0	0
561	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.87	11.82	3.84
562	Coniferous bog	0	0	0	0	0	3.60	1.67	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
564	Coniferous bog	0	0	0	0	0	0	0.44	3.14	0	0	0	0	0	0	0	0	0	0	0	0
565	Alder thicket or Shrub-carr	0	0	0	0	0.06	1.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0
566	Alder thicket or Shrub-carr	0	0	0	0	0	0	2.54	3.00	0.32	0	0	0	0	0	0	0	0	0	0	0
568	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.32	0.10	0	0	0	0
569A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	1.17	3.89	3.25	0	0	0	0	0
570	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.69	10.02	5.27	8.71	12.38	4.88
571	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	2.85
678	Alder thicket	0	0	0	0	0	0	0	0	0	0.15	14.50	15.18	18.90	9.66	0	0	0	0	0	0
679	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0	0	0
68	Coniferous swamp	7.97	4.94	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
681	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0.88	1.21	0	0	0	0	0	0	0
682	Open bog	0	0	0	0	0	0	0	0	0	0	0	2.14	0.02	0	0	0	0	0	0	0
688	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	1.28	0.74	0	0	0	0	0	0
689	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	4.20	0.42	0	0	0	0	0	0
691	Alder thicket	0	0	0	0	0	0	0	0	0	0	0.35	3.62	2.27	0	0	0	0	0	0	0
693	Coniferous bog	0	0	0	0	0	0	0	0	0	0	3.46	8.87	0	0	0	0	0	0	0	0
695	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	3.30	0	0	0	0	0	0	0	0
697	Coniferous bog	0	0	0	0	0	0	0	0	2.52	2.02	0	0	0	0	0	0	0	0	0	0
699	Coniferous bog	0	0	0	0	0	0	0	0.76	1.44	0	0	0	0	0	0	0	0	0	0	0
700	Open bog	0	0	0	0	0	0	0	0	0	0	0.63	0	0	0	0	0	0	0	0	0
701	Coniferous swamp	0	0	0	0.37	12.42	28.46	32.50	56.82	22.12	0.24	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
708	Shallow marsh	0	0	0	0	0	0	0	0	1.31	2.61	0	0	0	0	0	0	0	0	0	0
709	Shallow marsh	0	0	0	0	0	0	0	0	0	1.70	6.43	0	0	0	0	0	0	0	0	0
713	Coniferous bog	0	0	0	0	0	0	0	0	1.13	6.33	0.44	0	0	0	0	0	0	0	0	0
714	Coniferous bog	0	0	0	0	0	19.80	44.26	45.74	28.37	18.99	19.10	13.19	5.08	0.12	0	0	0	0	0	0
716A	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08
725	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.62	5.21	2.17
726	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0.92	5.18	0.72	0	0	0	0	0
727	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0
728	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0
729	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0.57	0.20	0	0	0	0	0	0
730	Open bog	0	0	0	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0
731	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0
732	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.10	0	0	0	0	0	0	0
733	Open bog	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0
734	Open bog	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0	0
735	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0.91	0	0	0	0	0	0
736	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0.16	0.42	0	0	0	0	0	0	0
737	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0.17	0.25	0	0	0	0	0	0	0
738	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.59	0	0	0	0	0	0	0
739	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.26	0	0	0	0	0	0	0
740	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0
741	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0.20	0.38	0	0	0	0	0	0	0
742	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0.01	2.56	0.91	0	0	0	0	0	0	0
743	Alder thicket	0	0	0	0	0	0	0	0	0	0.44	0.20	0	0	0	0	0	0	0	0	0

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		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
744	Alder thicket	0	0	0	0	0	0	0	0	0	0.96	0	0	0	0	0	0	0	0	0	0
745	Coniferous swamp	0	0	0	0	0	0	5.66	6.23	1.43	0	0	0	0	0	0	0	0	0	0	0
746	Alder thicket	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0	0	0	0	0	0
747	Alder thicket	0	0	0	0	0	0	0	0.23	0.70	0	0	0	0	0	0	0	0	0	0	0
748	Alder thicket	0	0	0	0	0	0	0	0	0.47	0	0	0	0	0	0	0	0	0	0	0
749	Alder thicket	0	0	0	0	0	0	0	0	0.69	8.52	0.23		0	0	0	0	0	0	0	0
752	Alder thicket	0	0	0	0	0	0	0.16	3.43	0	0	0	0	0	0	0	0	0	0	0	0
753	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.27	0.25	0	0
754	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.18	0.80	0	0	0	0
755	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	0.36	0	0	0	0	0
756	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.54	0	0	0	0	0
757	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.30	0	0	0	0	0	0	0
759	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	5.79	4.29	0	0	0
760	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0.57	0	0	0	0	0	0	0
764	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.65	3.28	4.12	3.41	13.77	24.20
765	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.15	0
766	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.88	0	0
768	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.29
773	Coniferous bog	0	0	0	4.96	3.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
774	Coniferous bog	0	0	0	0	0	5.29	2.93	0	0	0	0	0	0	0	0	0	0	0	0	0
775	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.78	2.28	0
776	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.61	2.89	0.39	0	0
777	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0	0	0	0	0
778	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0.02	0.46	0	0	0	0	0	0	0	0
779	Alder thicket	0	0	0	0	0	0	0	0	0	0	0.96	0.07	0	0	0.55	0	0	0	0	0

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		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
780	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0.45	1.00	0	0	0	0	0	0	0	0
781	Coniferous bog	0	0	0	0	0	0	0	0	0.62	0.00	0	0	0	0	0	0	0	0	0	0
782	Coniferous bog	0	0	0	0	0	0	0	0		0.99	1.11	0	0	0	0	0	0	0	0	0
783	Coniferous bog	0	0	0	0	0	0	0	0	0.83	1.09	0	0	0	0	0	0	0	0	0	0
784	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	1.41	0.24	0	0	0	0	0	0	0
785	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	1.33	0	0	0	0	0	0	0
790	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.59	2.81	2.09
791	Lake	0	0	0	0	0	0	0	0	0	0	0	0	1.01	16.84	11.83	0.91	0	0	0	0
792	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	1.36	5.59	0.15	0	0	0	0
802	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	3.55	6.23	8.90	9.00	5.19	2.69	4.51
805	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
807	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	3.61
808	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	1.69	8.31	6.90	3.41	0	0	0	0	0
856	Coniferous swamp	0	0	0.00	6.90	2.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
864	Coniferous swamp	0	0	0	0	0	0.02	9.54	25.19	30.52	28.01	13.68	5.38	0.14	0	0	0	0	0	0	0
885	Open bog	0	0	0	0	0	0	0	12.96	37.36	37.85	23.34	9.32	10.84	5.11	2.46	0	0	0	0	0
887	Coniferous bog	0	0	0	0	0	0.65	20.75	43.72	33.07	27.97	44.84	54.45	47.30	44.90	50.38	51.06	43.00	29.33	20.15	14.11
888	Coniferous bog	0	1.18	36.50	50.85	55.24	25.94	14.79	8.37	0	0	0	0	0	0	0	0	0	0	0	0
889	Shallow marsh	0	0	0	0	12.22	17.96	6.48	0.31	0	0	0	0	0	0	0	0	0	0	0	0
890	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	3.34	11.24	19.69	3.00	0	0	0	0	0	0	0	0

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		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
891	Coniferous swamp	0	0	0	0	0	0	0	0	0.58	6.36	7.82	0.02	0	0	0	0	0	0	0	0
899	Open bog	0	0	0	0	0.68	10.96	16.35	2.15	0	0	0	0	0	0	0	0	0	0	0	0
900	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.23	7.97	1.37	0	0	0
901	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.02	0.46	0	0	0	0	0	0	0
903	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.89	3.64	4.17	0
904	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	2.33	0	0	0	0	0	0
906	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	3.38	0	0
924	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.58	0.03	0
925	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.93	2.46	0
930	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0.05	2.18	0	0	0	0	0	0
931	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	1.54	2.78	0	0	0	0	0	0
949	Coniferous bog	0	0	0	0	0	0	0	0	0.30	1.50	0	0	0	0	0	0	0	0	0	0
972	Hardwood swamp	0	0	0	0	0	0	0.90	0	0	0	0	0	0	0	0	0	0	0	0	0
973	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.47	4.59	3.93	0	0	0
984	Coniferous bog	0	0	0	0	14.64	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
997	Shallow marsh	0	0	0	0	0	0	0	0	0	0	1.15	0.36	0	0	0	0	0	0	0	0
999	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0.01	0.70	0	0	0	0	0	0	0	0
1004	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0.94	0	0	0	0	0	0	0
1005	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.91	0.50	0
1131	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0.36	4.19	0	0	0	0	0	0	0

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		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1132	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.16	0	0	0	0	0
1136	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.12	11.88	24.49	3.01	0
1137	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.76	4.35	6.73	0.25	0	0
1138	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.59	0.64		0	0	0
1144	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.08	9.41	14.78	19.60	7.49	0.44
1145	Coniferous swamp	0	0	0	0	0	0	0	0	0	2.80	16.78	23.58	28.22	8.51	0.66	0	0	0	0	0
1146	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.39	2.77	0	0	0	0
1149	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.80	0	0	0	0	0
1153	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.39	9.39	4.14	0	0	0
1154	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	4.06	11.06	1.99	0	0	0	0	0
Total acres of wetland		118.36	114.99	147.94	162.94	195.14	231.13	291.33	351.58	306.52	326.40	357.56	345.18	355.05	381.79	343.77	405.60	422.32	348.93	318.66	298.94

Large Table 4 Summary of wetlands within 500-feet increments – Mine Site

Eggers and Reed Wetland Community	**Wetlands (acres) within 500-Feet Increments From the Edge of the Mine Pits**																			
	0 - 500 Feet	**500 - 1,000 Feet**	**1,000 - 1,500 Feet**	**1,500 – 2,000 Feet**	**2,000 – 2,500 Feet**	**2,500 – 3,000 Feet**	**3,000 – 3,500 Feet**	**3,500 – 4,000 Feet**	**4,000 – 4,500 Feet**	**4,500 – 5,000 Feet**	**5,000 – 5,500 Feet**	**5,500 – 6,000 Feet**	**6,000 – 6,500 Feet**	**6,500 – 7,000 Feet**	**7,000 – 7,500 Feet**	**7,500 – 8,000 Feet**	**8,000 – 8,500 Feet**	**8,500 – 9,000 Feet**	**9,000 – 9,500 Feet**	**9,500 – 10,000 Feet**
Alder thicket	21.62	5.85	30.82	45.52	32.05	18.16	35.08	59.88	50.11	59.13	90.36	149.08	130.72	62.67	40.76	33.10	41.12	38.04	33.12	16.10
Alder thicket or Shrub-carr	0	0	6.31	13.35	35.02	62.49	60.22	49.65	53.72	44.24	49.77	32.01	38.36	33.82	44.36	50.24	50.64	34.92	46.90	54.54
Coniferous bog	84.21	94.51	103.53	85.82	93.07	70.80	102.23	123.03	88.08	97.57	118.94	116.91	122.29	203.43	187.58	221.64	216.50	144.79	120.87	101.11
Coniferous swamp	10.81	7.96	0.96	13.45	21.46	44.20	69.51	102.76	74.59	68.75	64.88	34.13	47.67	57.03	49.68	75.88	78.83	80.02	75.97	86.37
Deep marsh	0.01	4.93	0	0	0	0	0	0	0	0	0	0	0	0	1.91	1.86	12.64	29.93	5.62	8.34
Hardwood swamp	0	0	0	0.31	0	0	0.90	0	0	0	0	0	0.57	0	0.18	0.80	0	0.78	2.28	4.29
Lake	0	0	0	0	0	0	0	0	0	0	0	0	1.01	16.84	11.83	0.91	0	0	0	0
Open bog	0	0	3.97	2.74	0.68	10.96	16.35	15.11	37.36	40.30	25.78	11.97	12.31	7.80	6.12	17.89	16.58	12.81	13.15	0
Sedge meadow	0.10	0	0	0	0.12	1.05	0	0	0	0	0	0	0.57	0.20	0	0	0	0	0	0
Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.70
Shallow marsh	1.61	1.74	2.35	1.75	12.22	20.04	6.48	1.15	2.66	16.41	7.83	1.06	0.94	0	0.16	0	1.89	4.23	6.98	3.29
Shallow, open water	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0
Shrub-carr	0	0	0	0	0.52	3.43	0	0	0	0	0	0.02	0.46	0	1.19	3.28	4.12	3.41	13.77	24.20
Wet meadow	0	0	0	0	0	0	0.56	0.00	0	0	0	0	0	0	0	0	0	0	0	0
Total acres of wetland	118.36	114.99	147.94	162.94	195.14	231.13	291.33	351.58	306.52	326.40	357.56	345.18	355.05	381.79	343.77	405.60	422.32	348.93	318.66	298.94

Large Table 5

Wetland and Watershed Acreages During Existing Operations Conditions, and Reclamation Conditions – Mine Site

			Pre-Mining (Existing) Conditions						Operations Conditions [(1)]						Reclamation Conditions					
Wetland ID[(2)]	Eggers and Reed Wetland Type	**Change in Equivalent Yield[(3)] (%)**	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)
1	shallow marsh	0%	2.63	2.21	0.42	16.0%	6.26	6.14	2.63	2.21	0.42	16.0%	6.26	6.14	2.64	2.21	0.42	16.1%	6.22	5.86
3	shallow marsh	0%	1.95	1.60	0.35	17.9%	5.57	5.46	1.95	1.60	0.35	17.9%	5.57	5.46	1.95	1.60	0.35	18.1%	5.51	5.19
5	wet meadow	R	5.99	5.38	0.61	10.2%	9.82	9.63												
6	shallow marsh	50%	3.22	2.60	0.62	19.3%	5.19	5.09	1.61	0.99	0.62	38.5%	2.60	2.55	3.22	2.60	0.62	19.2%	5.21	4.91
7	wet meadow	0%	0.72	0.65	0.07	9.7%	10.29	10.09	0.72	0.65	0.07	9.7%	10.29	10.09	0.72	0.65	0.07	9.2%	10.88	10.25
8	sedge meadow	R	33.23	26.43	6.80	20.5%	4.89	4.79	2.94	2.94	0.00				33.24	26.43	6.80	20.5%	4.89	4.60
9	shallow marsh	18%	8.04	6.24	1.80	22.4%	4.47	4.38	6.36	4.63	1.73	27.2%	3.68	3.61	8.04	6.31	1.73	21.5%	4.65	4.38
10	sedge meadow	0%	9.64	8.47	1.17	12.1%	8.24	8.08	9.64	8.47	1.17	12.1%	8.24	8.08	9.63	8.47	1.17	12.1%	8.25	7.77
11	coniferous bog	NA	23.99	15.11	8.88	37.0%	2.70	2.65	23.99	15.11	8.88	37.0%	2.70	2.65	23.99	15.11	8.88	37.0%	2.70	2.54
12	alder thicket	0%	0.13	0.00	0.13	100.0%	1.00	0.98	0.13	0.00	0.13	100.0%	1.00	0.98	0.13	0.00	0.13	100.0%	1.00	0.94
13	deep marsh	11%	11.60	6.57	5.03	43.4%	2.31	2.26	10.13	5.19	4.94	48.8%	2.05	2.01	11.60	6.66	4.94	42.6%	2.35	2.21
14	wet meadow	R	4.44	4.11	0.33	7.4%	13.45	13.20							4.25	3.92	0.33	7.8%	12.86	12.11
16	shallow marsh	86%	15.07	14.76	0.31	2.1%	48.61	47.68	2.08	1.77	0.31	14.9%	6.71	6.58	15.06	14.76	0.31	2.0%	48.88	46.03
18	shallow marsh	R	38.67	19.77	18.90	48.9%	2.05	2.01												
19	shallow marsh	-2%	8.46	6.78	1.68	19.9%	5.04	4.94	8.38	6.75	1.63	19.5%	5.14	5.04	8.46	6.83	1.63	19.2%	5.20	4.90
20	sedge meadow	30%	24.44	7.38	17.06	69.8%	1.43	1.41	0.10		0.10	100.0%	1.00	0.98	0.10		0.10	100.0%	1.00	0.94
22	shallow marsh	0%	3.47	2.04	1.43	41.2%	2.43	2.38	3.47	2.04	1.43	41.2%	2.43	2.38	3.47	2.04	1.43	41.1%	2.43	2.29
22A	coniferous swamp	0%	12.49	11.60	0.89	7.1%	14.03	13.76	12.49	11.60	0.89	7.1%	14.03	13.76	12.49	11.60	0.89	7.1%	14.06	13.24
22E	coniferous swamp	0%	8.06	5.61	2.45	30.4%	3.29	3.23	8.06	5.61	2.45	30.4%	3.29	3.23	8.06	5.61	2.45	30.4%	3.29	3.10
24	alder thicket	57%	12.68	11.88	0.80	6.3%	15.85	15.55	2.78	2.37	0.41	14.7%	6.78	6.65	2.79	2.37	0.41	14.8%	6.73	6.34
25	coniferous bog	NA	5.59	3.64	1.95	34.9%	2.87	2.81	5.59	3.64	1.95	34.9%	2.87	2.81	5.59	3.64	1.95	34.8%	2.87	2.70
27	coniferous swamp	R	13.33	12.26	1.07	8.0%	12.46	12.22												
29	shallow marsh	7%	22.17	10.15	12.02	54.2%	1.84	1.81	20.64	8.62	12.02	58.2%	1.72	1.68	22.16	10.15	12.02	54.2%	1.84	1.74
32	coniferous bog	-159%	131.46	58.10	73.36	55.8%	1.79	1.76	10.98	8.61	2.37	21.6%	4.63	4.54	45.79	0.90	44.89	98.0%	1.02	0.96
33A	alder thicket	30%	43.79	25.33	18.46	42.2%	2.37	2.33	21.11	8.42	12.69	60.1%	1.66	1.63	21.12	8.42	12.69	60.1%	1.66	1.57
33B	coniferous swamp	0%	9.16	4.60	4.56	49.8%	2.01	1.97	9.16	4.60	4.56	49.8%	2.01	1.97	9.16	4.60	4.56	49.8%	2.01	1.89
37	shrub-carr	R	11.22	8.83	2.39	21.3%	4.69	4.60												
43	alder thicket	56%	25.17	16.88	8.29	32.9%	3.04	2.98	1.39	0.36	1.03	74.1%	1.35	1.32	25.17	16.88	8.29	32.9%	3.04	2.86
44	alder thicket	-65%	20.79	17.52	3.27	15.7%	6.36	6.24	13.42	12.14	1.28	9.5%	10.48	10.28	13.42	12.14	1.28	9.5%	10.52	9.91
45	alder thicket	-63%	70.31	32.76	37.55	53.4%	1.87	1.84	26.67	17.95	8.72	32.7%	3.06	3.00	29.15	20.43	8.72	29.9%	3.34	3.15
47	open bog	R	28.60	28.06	0.54	1.9%	52.96	51.95												
48	coniferous bog	20%	199.33	110.17	89.16	44.7%	2.24	2.19	109.87	48.51	61.36	55.8%	1.79	1.76	188.28	120.80	67.47	35.8%	2.79	2.63
48A	coniferous swamp	60%	6.68	4.03	2.65	39.7%	2.52	2.47	0.44	0.00	0.44	100.0%	1.00	0.98	4.87	4.43	0.44	9.0%	11.06	10.42
51	alder thicket	-3635%	18.60	11.13	7.47	40.2%	2.49	2.44	1.86	1.84	0.02	1.1%	93.00	91.22	18.29	14.93	3.36	18.4%	5.44	5.12
52	alder thicket	R	23.44	19.56	3.88	16.6%	6.04	5.93	1.88	1.88	0.00				23.44	20.80	2.64	11.3%	8.89	8.37
53	alder thicket	0%	53.71	35.12	18.59	34.6%	2.89	2.83	53.71	35.12	18.59	34.6%	2.89	2.83	53.70	35.12	18.59	34.6%	2.89	2.72
53A	coniferous swamp	0%	3.77	1.42	2.35	62.3%	1.60	1.57	3.77	1.42	2.35	62.3%	1.60	1.57	3.77	1.42	2.35	62.3%	1.60	1.51
53B	coniferous swamp	20%	6.14	5.71	0.43	7.0%	14.28	14.01	4.92	4.49	0.43	8.7%	11.44	11.22	6.14	5.71	0.43	7.0%	14.29	13.45
53C	coniferous swamp	36%	24.02	21.14	2.88	12.0%	8.34	8.18	15.41	12.53	2.88	18.7%	5.35	5.25	24.15	21.27	2.88	11.9%	8.38	7.89
53D	coniferous swamp	0%	1320.57	651.40	669.17	50.7%	1.97	1.94	1319.65	650.48	669.17	50.7%	1.97	1.93	1321.47	652.30	669.17	50.6%	1.97	1.86
54	coniferous swamp	0%	36.06	31.95	4.11	11.4%	8.77	8.61	36.06	31.95	4.11	11.4%	8.77	8.61	36.06	31.95	4.11	11.4%	8.78	8.27
54C	alder thicket	0%	0.74	0.00	0.74	100.0%	1.00	0.98	0.74	0.00	0.74	100.0%	1.00	0.98	0.74	0.00	0.74	100.0%	1.00	0.94
54E	alder thicket	-7%	5.82	3.22	2.60	44.7%	2.24	2.20	6.21	3.61	2.60	41.9%	2.39	2.34	6.21	3.61	2.60	41.9%	2.39	2.25
54F	alder thicket	0%	0.43	0.00	0.43	100.0%	1.00	0.98	0.43	0.00	0.43	100.0%	1.00	0.98	0.43	0.00	0.43	100.0%	1.00	0.94
54G	alder thicket	33%	6.48	4.94	1.54	23.8%	4.21	4.13	4.36	2.82	1.54	35.3%	2.83	2.78	6.47	4.94	1.54	23.8%	4.21	3.96
55	alder thicket	-364%	17.70	13.79	3.91	22.1%	4.53	4.44	1.26	1.20	0.06	4.8%	21.00	20.60	17.70	13.79	3.91	22.1%	4.52	4.26
56	open bog	R	13.21	10.42	2.79	21.1%	4.73	4.64	2.48	2.48										
57	coniferous swamp	-12%	137.06	59.00	78.06	57.0%	1.76	1.72	54.12	26.55	27.57	50.9%	1.96	1.93	54.12	26.55	27.56	50.9%	1.96	1.85
58	alder thicket	0%	107.19	72.61	34.58	32.3%	3.10	3.04	107.19	72.61	34.58	32.3%	3.10	3.04	107.20	72.61	34.58	32.3%	3.10	2.92
60	alder thicket	R	28.48	21.77	6.71	23.6%	4.24	4.16							0.00					
61	coniferous swamp	0%	2.70	2.25	0.45	16.7%	6.00	5.89	2.70	2.25	0.45	16.7%	6.00	5.89	2.70	2.25	0.45	16.7%	5.98	5.63
62	coniferous bog	NA	24.35	12.22	12.13	49.8%	2.01	1.97	24.35	12.22	12.13	49.8%	2.01	1.97	24.35	12.22	12.13	49.8%	2.01	1.89
64	hardwood swamp	0%	4.80	4.49	0.31	6.5%	15.48	15.19	4.80	4.49	0.31	6.5%	15.48	15.19	4.79	4.49	0.31	6.4%	15.68	14.77
68	coniferous swamp	23%	59.24	35.43	23.81	40.2%	2.49	2.44	24.73	11.81	12.92	52.2%	1.91	1.88	39.78	26.51	13.27	33.4%	3.00	2.82
72	coniferous swamp	0%	5.67	4.28	1.39	24.5%	4.08	4.00	5.67	4.28	1.39	24.5%	4.08	4.00	5.66	4.28	1.39	24.5%	4.09	3.85
74	hardwood swamp	R	10.64	4.52	6.12	57.5%	1.74	1.71												
76	coniferous bog	NA	13.10	9.18	3.92	29.9%	3.34	3.28	6.49	4.78	1.71	26.3%	3.80	3.72	6.49	4.78	1.71	26.3%	3.80	3.58
77	coniferous bog	NA	25.28	12.27	13.01	51.5%	1.94	1.91	15.20	3.11	12.09	79.5%	1.26	1.23	17.18	4.18	13.01	75.7%	1.32	1.24
78	coniferous bog	R	5.73	3.98	1.75	30.5%	3.27	3.21												
79	coniferous bog	NA	10.62	8.23	2.39	22.5%	4.44	4.36	10.62	8.23	2.39	22.5%	4.44	4.36	10.62	8.23	2.39	22.5%	4.45	4.19
80	coniferous bog	-17%	5.68	5.39	0.29	5.1%	19.59	19.21	1.61	1.54	0.07	4.3%	23.00	22.56	1.61	1.54	0.07	4.4%	22.93	21.59
81	coniferous swamp	-41%	51.06	49.38	1.68	3.3%	30.39	29.81	10.32	10.08	0.24	2.3%	43.00	42.18	51.57	50.59	0.98	1.9%	52.65	49.58
82	coniferous bog	32%	113.19	50.79	62.40	55.1%	1.81	1.78	2.00	0.37	1.63	81.5%	1.23	1.20	1.99	0.36	1.63	81.8%	1.22	1.15
83	open bog	NA	18.64	14.65	3.99	21.4%	4.67	4.58	18.64	14.65	3.99	21.4%	4.67	4.58	18.64	14.65	3.99	21.4%	4.67	4.40
84	coniferous bog	NA	5.67	4.34	1.33	23.5%	4.26	4.18	5.67	4.34	1.33	23.5%	4.26	4.18	5.67	4.34	1.33	23.4%	4.28	4.03
84A	coniferous bog	NA	11.50	3.28	8.22	71.5%	1.40	1.37	11.50	3.28	8.22	71.5%	1.40	1.37	11.50	3.28	8.22	71.4%	1.40	1.32
85	coniferous bog	R	5.07	3.66	1.41	27.8%	3.60	3.53												
86	coniferous bog	NA	8.25	5.78	2.47	29.9%	3.34	3.28	1.16	1.15	0.01	0.9%	116.00	113.78	1.16	1.15	0.01	0.8%	121.57	114.47
88	coniferous bog	NA	9.86	4.28	5.58	56.6%	1.77	1.73	3.09	2.53	0.56	18.1%	5.52	5.41	1.56	1.00	0.56	35.8%	2.79	2.63
90	coniferous bog	NA	328.07	151.99	176.08	53.7%	1.86	1.83	234.60	92.74	141.86	60.5%	1.65	1.62	305.32	129.70	175.62	57.5%	1.74	1.64
90A	open bog	NA	8.25	0.34	7.91	95.9%	1.04	1.02	7.05	0.34	6.71	95.2%	1.05	1.03	8.25	0.34	7.91	95.8%	1.04	0.98
95	coniferous swamp	R	17.43	14.89	2.54	14.6%	6.86	6.73												
96	coniferous bog	NA	39.02	21.72	17.30	44.3%	2.26	2.21	10.63	6.47	4.16	39.1%	2.56	2.51	10.82	6.66	4.16	38.4%	2.60	2.45

Large Table 5
Wetland and Watershed Acreages During Existing Operations Conditions, and Reclamation Conditions – Mine Site

			Pre-Mining (Existing) Conditions						Operations Conditions [1]						Reclamation Conditions					
Wetland ID[2]	Eggers and Reed Wetland Type	**Change in Equivalent Yield[3] (%)**	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)	Watershed Total Area (acres)	Upland Area (acres)	Wetland Area (acres)	Wetland Area (%)	Tributary Acres per Wetland Acre	Contributing Net Precipitation (ac-ft/yr)
97	coniferous bog	NA	11.03	6.57	4.46	40.4%	2.47	2.43	3.61	1.72	1.89	52.4%	1.91	1.87	3.60	1.71	1.89	52.4%	1.91	1.80
98	coniferous bog	NA	49.43	33.93	15.50	31.4%	3.19	3.13	2.36	1.93	0.43	18.2%	5.49	5.38	49.42	33.93	15.50	31.4%	3.19	3.00
99	coniferous bog	58%	5.38	3.98	1.40	26.0%	3.84	3.77	1.47	0.56	0.91	61.9%	1.62	1.58	3.83	2.56	1.27	33.2%	3.01	2.83
100	coniferous bog	24%	295.25	119.06	176.19	59.7%	1.68	1.64	93.20	19.97	73.23	78.6%	1.27	1.25	101.43	25.32	76.11	75.0%	1.33	1.25
100A	alder thicket	R	1.66		1.66	100.0%	1.00	0.98												
101	coniferous bog	34%	34.92	20.71	14.21	40.7%	2.46	2.41	4.01	1.53	2.48	61.8%	1.62	1.59	10.14	3.58	6.56	64.7%	1.54	1.45
103	coniferous bog	11%	157.93	39.09	118.84	75.2%	1.33	1.30	10.52	1.65	8.87	84.3%	1.19	1.16	10.52	1.65	8.87	84.3%	1.19	1.12
104	coniferous bog	NA	8.30	4.73	3.57	43.0%	2.32	2.28	0.87	0.77	0.10	11.5%	8.70	8.53	0.87	0.77	0.10	11.3%	8.88	8.36
105	coniferous bog	NA	59.43	43.95	15.48	26.0%	3.84	3.77	59.43	43.95	15.48	26.0%	3.84	3.77	59.44	43.95	15.48	26.0%	3.84	3.62
105A	coniferous bog	NA	0.62	0.50	0.12	19.4%	5.17	5.07	0.62	0.50	0.12	19.4%	5.17	5.07	0.63	0.50	0.12	19.7%	5.08	4.78
106	coniferous bog	0%	168.57	84.99	83.58	49.6%	2.02	1.98	168.57	84.99	83.58	49.6%	2.02	1.98	168.58	84.99	83.58	49.6%	2.02	1.90
107	coniferous bog	NA	90.50	49.58	40.92	45.2%	2.21	2.17	42.80	33.51	9.29	21.7%	4.61	4.52	40.97	29.93	11.04	26.9%	3.71	3.49
107A	coniferous swamp	-1118%	4.40	2.66	1.74	39.5%	2.53	2.48	1.54	1.49	0.05	3.2%	30.80	30.21	1.92	1.68	0.24	12.6%	7.96	7.49
107B	shallow marsh	-67%	7.41	2.90	4.51	60.9%	1.64	1.61	4.44	2.82	1.62	36.5%	2.74	2.69	3.03	1.41	1.62	53.3%	1.88	1.77
107C	alder thicket	R	28.29	0.69	27.60	97.6%	1.03	1.01												
114	coniferous bog	R	8.00	7.27	0.73	9.1%	10.96	10.75												
120	shallow marsh	-23%	8.93	8.35	0.58	6.5%	15.40	15.10	8.73	8.27	0.46	5.3%	18.98	18.61	8.93	8.47	0.46	5.1%	19.57	18.43
200	hardwood swamp	R	13.51	7.15	6.36	47.1%	2.12	2.08												
201	wet meadow	R	24.54	11.05	13.49	55.0%	1.82	1.78												
202	open bog	R	6.52	3.41	3.11	47.7%	2.10	2.06												
315	alder thicket/shrub-car	0%	533.68	210.84	322.84	60.5%	1.65	1.62	533.68	210.84	322.84	60.5%	1.65	1.62	533.68	210.84	322.84	60.5%	1.65	1.56
552	coniferous bog	R	24.35	15.63	8.72	35.8%	2.79	2.74												
566	alder thicket/shrub-car	11%	32.49	26.62	5.87	18.1%	5.53	5.43	29.05	23.18	5.87	20.2%	4.95	4.85	32.49	26.62	5.87	18.1%	5.53	5.21
567	shallow marsh	R	3.72	2.32	1.40	37.6%	2.66	2.61												
678	alder thicket	0%	148.21	89.79	58.42	39.4%	2.54	2.49	148.21	89.79	58.42	39.4%	2.54	2.49	148.22	89.79	58.42	39.4%	2.54	2.39
679	coniferous bog	NA	0.50		0.50	100.0%	1.00	0.98	0.50	0.00	0.50	100.0%	1.00	0.98	0.50	0.00	0.50	100.0%	1.00	0.94
682	open bog	NA	4.85	2.69	2.16	44.5%	2.25	2.20	4.85	2.69	2.16	44.5%	2.25	2.20	4.85	2.69	2.16	44.6%	2.24	2.11
691	alder thicket	0%	32.11	25.88	6.23	19.4%	5.15	5.06	32.11	25.88	6.23	19.4%	5.15	5.06	32.12	25.88	6.23	19.4%	5.15	4.85
693	coniferous bog	NA	26.40	14.07	12.33	46.7%	2.14	2.10	26.40	14.07	12.33	46.7%	2.14	2.10	26.40	14.07	12.33	46.7%	2.14	2.02
699	coniferous bog	NA	2.21		2.21	100.0%	1.00	0.98	2.21	0.00	2.21	100.0%	1.00	0.98	2.21	0.00	2.21	100.0%	1.00	0.94
745	coniferous bog	NA	24.65	11.32	13.33	54.1%	1.85	1.81	24.65	11.32	13.33	54.1%	1.85	1.81	24.65	11.32	13.33	54.1%	1.85	1.74
782	coniferous bog	NA	6.54	4.44	2.10	32.1%	3.11	3.05	6.54	4.44	2.10	32.1%	3.11	3.05	6.54	4.44	2.10	32.1%	3.11	2.93
783	coniferous bog	NA	4.85	2.94	1.91	39.4%	2.54	2.49	4.85	2.94	1.91	39.4%	2.54	2.49	4.86	2.94	1.91	39.4%	2.54	2.39
887	coniferous bog	4%	701.48	146.12	555.36	79.2%	1.26	1.24	670.31	114.95	555.36	82.9%	1.21	1.18	670.31	114.95	555.36	82.9%	1.21	1.14
888	coniferous bog	NA	260.25	67.29	192.96	74.1%	1.35	1.32	260.25	67.29	192.96	74.1%	1.35	1.32	260.25	67.29	192.96	74.1%	1.35	1.27
889	shallow marsh	11%	75.69	8.55	67.14	88.7%	1.13	1.11	67.35	0.21	67.14	99.7%	1.00	0.98	67.35	0.21	67.14	99.7%	1.00	0.94
972	hardwood swamp	0%	0.90		0.90	100.0%	1.00	0.98	0.90	0.00	0.90	100.0%	1.00	0.98	0.90	0.00	0.90	100.0%	1.00	0.94
984	coniferous bog	4%	16.04	0.98	15.06	93.9%	1.07	1.04	15.32	0.26	15.06	98.3%	1.02	1.00	15.32	0.26	15.06	98.3%	1.02	0.96

(1) Wetland areas include fragments identified in Section 5.2.1.1

(2) Wetlands in bold are identified as ombrotrophic.

(3) Change in the equivalent yield from existing conditions to operational conditions is identified as increasing (+), decreasing (-), no change (0), watershed is removed (R), or not applicable (NA) for ombrotrophic coniferous and open bogs.

Large Table 6 Summary of Wetlands Crossing Analog Impact Zones Resulting from Changes in Hydrology – Mine Site

Likelihood of wetland hydrology impact based on wetland type for each analogue distance	Wetland Area (acres) within each Analogue Increment (feet)				Eggers and Reed Wetland Community
	0-1,000 feet	1,000-2,000 feet	2,000-3,500 feet	3,500-10,000 feet	
0 – 1,000 feet					
High Likelihood	929.15	---	---	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
Moderate Likelihood	8.30	---	---	---	deep marsh, shallow marsh, and shallow, open water
Low Likelihood	76.71	---	---	---	minerotrophic coniferous bog
No Impact	376.10	---	---	---	ombrotrophic coniferous bog and open bog
1,000 – 2,000 feet					
Moderate Likelihood	---	522.40	---	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
Low Likelihood	---	4.11	---	---	deep marsh, shallow marsh, and shallow, open water
No Impact	---	92.05	---	---	minerotrophic and ombrotrophic coniferous bog and open bog
2,000 – 3,500 feet					
Low Likelihood	---	---	293.12	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
No Impact	---	---	901.04	---	deep marsh, shallow marsh, and shallow, open water, minerotrophic and ombrotrophic coniferous bog and open bog
3,500 – 10,000 feet					
No Impact	---	---	---	3,866.54	all wetland types
Total acres of wetland	1,390.26	618.56	1,194.16	3,866.54	

Large Table 7 Summary of Wetlands within Analog Impact Zones Resulting from Changes in Hydrology – Mines Site

Likelihood of wetland hydrology impact based on wetland type for each analogue distance	Wetland Area (acres) within each Analogue Increment (feet)				Eggers and Reed Wetland Community
	0-1,000 feet	1,000-2,000 feet	2,000-3,500 feet	3,500-10,000 feet	
0 – 1,000 feet					
High Likelihood	46.37	---	---	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
Moderate Likelihood	8.3	---	---	---	deep marsh, shallow marsh, and shallow, open water
Low Likelihood	32.51	---	---	---	minerotrophic coniferous bog
No Impact	146.29	---	---	---	ombrotrophic coniferous bog and open bog
1,000 – 2,000 feet					
Moderate Likelihood	---	110.77	---	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
Low Likelihood	---	4.11	---	---	deep marsh, shallow marsh, and shallow, open water
No Impact	---	196.14	---	---	minerotrophic and ombrotrophic coniferous bog and open bog
2,000 – 3,500 feet					
Low Likelihood	---	---	384.99	---	coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket
No Impact	---	---	332.99	---	deep marsh, shallow marsh, and shallow, open water, minerotrophic and ombrotrophic coniferous bog and open bog
3,500 – 10,000 feet					
No Impact	---	---	---	4,564.38	all wetland types
Total acres of wetland	233.47	311.02	717.98	4,564.38	

Large Table 8 Summary of Potential Wetland Community Changes Due to Drawdown

Impact Sensitivity Category(1)	None		Moderate		Severe	
Community Type	**Water Level Drawdown (feet)**	**Potential Impact**	**Water Level Drawdown (feet)**	**Potential Impact**	**Water Level Drawdown (feet)**	**Potential Impact**
Ombrotrophic Coniferous and Open bog	<1	None	1-2	Minor vegetation changes; Increased tree growth	>2	Possible conversion of wetland type
Minerotrophic Coniferous and Open bog	<0.5-1	None	0.5-2	Change in vegetation; Increased tree growth	>2	Possible conversion of wetland type
Shallow marsh(2)	<1	None	1-3	Conversion of type	>3	Conversion of wetland type
Deep marsh(2)	<2	None	2-4	Conversion of type	>4	Conversion of wetland type
Shallow, open water(2)	<2	None	2-4	Conversion of type	>4	Conversion of wetland type
Conifer swamp	<0.75-2	None	0.75-4	Minor changes in vegetation; Increased tree growth	>2-4	Change in vegetation
Hardwood swamp	<2	None	2-4	Change in vegetation; Increased tree growth	>4	Conversion of wetland type; possible conversion to upland
Alder thicket	<1	None	1-4	Change in vegetation; Increased shrub growth	>4	Conversion of wetland type; increased shrub growth
Shrub-carr	<0.5	None	0.5-3	Change in vegetation; Increased shrub growth	>3	Conversion of wetland type
Wet/Sedge meadow	<0.5	None	0.5-3	Change in vegetation; Conversion of type	>3	Conversion to upland

(1) Interpreted from information provided in the hydrologic wetland sensitivity method as described in the Wetland Work Plan (Attachment A).

(2) Shallow marsh, deep marsh, and shallow open water communities were not evaluated in the hydrologic wetland sensitivity method as described in the Wetland Work Plan (Attachment A), but are estimated in this table based on best professional judgment.

Large Table 9 Summary of Wetlands within the Mine Site Groundwater Flow Paths

Eggers and Reed Wetland Community	Hydrology	Wetlands within the Mine Site Groundwater Flow Paths (acres)				
		West Pit	Overburden Storage and Laydown Area (OSLA)	Wastewater Treatment Facility (WWTF)	Ore Surge Pile (OSP)	Category 2/3 Stockpile
Alder thicket	Groundwater	90.53	40.87	18.79	27.59	103.06
Alder thicket or Shrub-carr	Groundwater	0	2.87	0	0	0
Minerotrophic coniferous bog	Precipitation/ Groundwater	0.04	0	0	0	6.27
Ombrotrophic coniferous bog	Precipitation	16.48	0	0	0	148.18
Coniferous swamp	Groundwater	0	2.88	20.06	10.16	0.04
Deep marsh	Groundwater	4.94	0	0	0	0
Open bog	Precipitation	0	0	0	0	8.87
Sedge meadow	Groundwater	0	0	0	0	1.17
Shallow marsh	Groundwater	3.35	0.11	0	0	5.48
Shrub-carr	Groundwater	0	3.95	0	0	0
Wet meadow	Groundwater	0	0	0	0	0.07
Total acres of wetland		115.34	50.68	38.85	37.75	273.14

Large Table 10 Summary of Coniferous and Open Bogs in Area One

Wetland ID	Eggers and Reed Community	Status
11	Coniferous bog	Ombrotrophic
25	Coniferous bog	Ombrotrophic
32	Coniferous bog	Minerotrophic
48	Coniferous bog	Minerotrophic
62	Coniferous bog	Ombrotrophic
76	Coniferous bog	Ombrotrophic
77	Coniferous bog	Ombrotrophic
79	Coniferous bog	Ombrotrophic
80	Coniferous bog	Ombrotrophic
82	Coniferous bog	Minerotrophic
83	Open bog	Ombrotrophic
84	Coniferous bog	Ombrotrophic
84A	Coniferous bog	Ombrotrophic
86	Coniferous bog	Ombrotrophic
88	Coniferous bog	Ombrotrophic
90	Coniferous bog	Ombrotrophic
90A	Open bog	Ombrotrophic
96	Coniferous bog	Ombrotrophic
97	Coniferous bog	Ombrotrophic
98	Coniferous bog	Ombrotrophic
99	Coniferous bog	Ombrotrophic
100	Coniferous bog	Ombrotrophic
101	Coniferous bog	Ombrotrophic
103	Coniferous bog	Ombrotrophic
104	Coniferous bog	Ombrotrophic
105	Coniferous bog	Ombrotrophic
105A	Coniferous bog	Ombrotrophic
106B	Coniferous bog	Ombrotrophic
106C	Coniferous bog	Ombrotrophic
106D	Coniferous bog	Ombrotrophic
107	Coniferous bog	Ombrotrophic
400A	Coniferous bog	Ombrotrophic
406	Coniferous bog	Ombrotrophic

Wetland ID	Eggers and Reed Community	Status
409	Coniferous bog	Ombrotrophic
415	Coniferous bog	Ombrotrophic
418	Coniferous bog	Ombrotrophic
419	Coniferous bog	Ombrotrophic
422	Coniferous bog	Ombrotrophic
423	Coniferous bog	Ombrotrophic
425	Coniferous bog	Ombrotrophic
435	Coniferous bog	Ombrotrophic
437	Coniferous bog	Ombrotrophic
438	Coniferous bog	Ombrotrophic
439	Coniferous bog	Ombrotrophic
441	Coniferous bog	Ombrotrophic
442	Coniferous bog	Ombrotrophic
451	Coniferous bog	Ombrotrophic
456	Coniferous bog	Ombrotrophic
459	Coniferous bog	Ombrotrophic
460	Coniferous bog	Ombrotrophic
465	Coniferous bog	Ombrotrophic
467	Coniferous bog	Ombrotrophic
469	Coniferous bog	Ombrotrophic
473	Coniferous bog	Ombrotrophic
474	Coniferous bog	Ombrotrophic
477	Coniferous bog	Ombrotrophic
478	Coniferous bog	Ombrotrophic
479	Coniferous bog	Ombrotrophic
489	Coniferous bog	Ombrotrophic
490	Coniferous bog	Ombrotrophic
492	Coniferous bog	Ombrotrophic
493	Open bog	Ombrotrophic
494	Coniferous bog	Ombrotrophic
496	Coniferous bog	Ombrotrophic
498	Coniferous bog	Ombrotrophic
499	Coniferous bog	Ombrotrophic
502	Coniferous bog	Ombrotrophic

Wetland ID	Eggers and Reed Community	Status
503	Coniferous bog	Ombrotrophic
507	Coniferous bog	Ombrotrophic
508	Coniferous bog	Ombrotrophic
510	Coniferous bog	Ombrotrophic
513	Coniferous bog	Ombrotrophic
514	Coniferous bog	Ombrotrophic
519	Coniferous bog	Ombrotrophic
520	Coniferous bog	Ombrotrophic
526	Coniferous bog	Ombrotrophic
528	Coniferous bog	Ombrotrophic
530	Coniferous bog	Ombrotrophic
531	Coniferous bog	Ombrotrophic
535	Coniferous bog	Ombrotrophic
538	Coniferous bog	Ombrotrophic
540	Coniferous bog	Ombrotrophic
541	Coniferous bog	Ombrotrophic
546	Coniferous bog	Ombrotrophic
547	Coniferous bog	Ombrotrophic
548	Coniferous bog	Ombrotrophic
550	Open bog	Ombrotrophic
558	Coniferous bog	Ombrotrophic
559	Coniferous bog	Ombrotrophic
560	Coniferous bog	Ombrotrophic
561	Coniferous bog	Ombrotrophic
562	Coniferous bog	Ombrotrophic
564	Coniferous bog	Ombrotrophic
679	Coniferous bog	Ombrotrophic
681	Coniferous bog	Ombrotrophic
682	Open bog	Ombrotrophic
693	Coniferous bog	Ombrotrophic
695	Coniferous bog	Ombrotrophic
697	Coniferous bog	Ombrotrophic
699	Coniferous bog	Ombrotrophic
700	Open bog	Ombrotrophic

Wetland ID	Eggers and Reed Community	Status
713	Coniferous bog	Ombrotrophic
714	Coniferous bog	Ombrotrophic
727	Open bog	Ombrotrophic
728	Open bog	Ombrotrophic
730	Open bog	Ombrotrophic
732	Open bog	Ombrotrophic
733	Open bog	Ombrotrophic
734	Open bog	Ombrotrophic
735	Coniferous bog	Ombrotrophic
737	Coniferous bog	Ombrotrophic
738	Open bog	Ombrotrophic
739	Open bog	Ombrotrophic
740	Open bog	Ombrotrophic
742	Coniferous bog	Ombrotrophic
757	Open bog	Ombrotrophic
759	Open bog	Ombrotrophic
773	Coniferous bog	Ombrotrophic
774	Coniferous bog	Ombrotrophic
776	Coniferous bog	Ombrotrophic
777	Open bog	Ombrotrophic
780	Coniferous bog	Ombrotrophic
781	Coniferous bog	Ombrotrophic
782	Coniferous bog	Ombrotrophic
783	Coniferous bog	Ombrotrophic
784	Coniferous bog	Ombrotrophic
795	Coniferous bog	Ombrotrophic
799	Coniferous bog	Ombrotrophic
814A	Coniferous bog	Ombrotrophic
885	Open bog	Ombrotrophic
887	Coniferous bog	Minerotrophic
888	Coniferous bog	Ombrotrophic
899	Open bog	Ombrotrophic
900	Coniferous bog	Minerotrophic
925	Open bog	Ombrotrophic

Wetland ID	Eggers and Reed Community	Status
930	Open bog	Ombrotrophic
931	Coniferous bog	Ombrotrophic
949	Coniferous bog	Ombrotrophic
984	Coniferous bog	Ombrotrophic
1044	Coniferous bog	Ombrotrophic
1131	Coniferous bog	Ombrotrophic
1149	Coniferous bog	Ombrotrophic

Large Table 11 Wetlands within the Mine Site Groundwater Flow Paths

Wetland ID	Eggers and Reed Wetland Community	Dominant Source of Hydrology	Wetland Size (acres)
East Pit – Category 2/3 Stockpile			
1	Shallow marsh	Groundwater	0.42
3	Shallow marsh	Groundwater	0.35
6	Shallow marsh	Groundwater	0.62
7	Wet meadow	Groundwater	0.07
10	Sedge meadow	Groundwater	1.17
11	Coniferous bog	Precipitation	8.88
12	Alder thicket	Groundwater	0.13
24	Alder thicket	Groundwater	0.41
29	Shallow marsh	Groundwater	4.09
33A	Alder thicket	Groundwater	6.31
43	Alder thicket	Groundwater	1.03
48	Coniferous bog	Groundwater	6.27
53D	Alder thicket	Groundwater	29.79
55	Alder thicket	Groundwater	0.06
58	Alder thicket	Groundwater	34.57
77	Coniferous bog	Precipitation	12.08
90	Coniferous bog	Precipitation	108.62
90A	Open bog	Precipitation	6.71
98	Coniferous bog	Precipitation	0.42
105	Coniferous bog	Precipitation	15.47
105A	Coniferous bog	Precipitation	0.12
106	Coniferous swamp	Groundwater	0.04
678	Alder thicket	Groundwater	30.76
679	Coniferous bog	Precipitation	0.50
681	Coniferous bog	Precipitation	2.09
682	Open bog	Precipitation	2.16
Waste Water Treatment Facility (WWTF)			
53	Alder thicket	Groundwater	0.38
53D	Alder thicket	Groundwater	18.41
106	Coniferous swamp	Groundwater	20.06

Wetland ID	**Eggers and Reed Wetland Community**	**Dominant Source of Hydrology**	**Wetland Size (acres)**
Ore Surge Pile (OSP)			
53	Alder thicket	Groundwater	0.52
53D	Alder thicket	Groundwater	27.07
106	Coniferous swamp	Groundwater	10.16
Overburden Storage and Laydown Area (OSLA)			
4	Wet meadow	Groundwater	0.00
9	Shallow marsh	Groundwater	0.11
46	Shrub-carr	Groundwater	3.95
52	Alder thicket	Groundwater	0.00
53	Alder thicket	Groundwater	1.92
53C	Coniferous swamp	Groundwater	2.88
53D	Alder thicket	Groundwater	38.95
557	Alder thicket or Shrub-carr	Groundwater	2.87
West Pit			
9	Shallow marsh	Groundwater	1.43
13	Deep marsh	Groundwater	4.94
16	Shallow marsh	Groundwater	0.31
32	Coniferous bog	Groundwater	0.04
53D	Alder thicket	Groundwater	90.53
79	Coniferous bog	Precipitation	0.07
107	Coniferous bog	Precipitation	9.29
107B	Shallow marsh	Groundwater	1.61
558	Coniferous bog	Precipitation	3.08
559	Coniferous bog	Precipitation	1.24
562	Coniferous bog	Precipitation	2.80
Total acres of wetland			515.76

Large Table 12 Summary of Wildlife Species and Associated Habitat Types

Taxa(1)	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Wetland Habitats								Upland Habitats									Wetland and Upland Habitat s
								Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	
BI	*Gavia immer*	Common Loon	NL	NL	x		1			x															W
BI	*Limnodromus griseus*	Short-billed Dowitcher	NL	NL	x		1								x										W
BI	*Melospiza georgiana*	Swamp Sparrow	NL	NL	x		3	x						x	x										W
BI	*Rallus limicola*	Virginia Rail	NL	NL	x		3				x			x	x										W
FI	*Ichthyomyzon fossor*	Northern Brook Lamprey	SPC	NL	x		1					x													W
IN	*Erebia disa mancinus*	Disa Alpine	SPC	NL	x	x	1	x																	W
IN	*Erebia discoidalis discoidalis*	Red-diked alpine	NL	NL		x	2	x						x											W
IN	*Lycaena epixanthe michiganensis*	Bog Copper	NL	NL	x		2	x						x											W
IN	*Oeneis jutta ascerta*	Jutta Arctic	NL	NL		x	2	x						x											W

								Wetland Habitats								Upland Habitats									
Taxa[(1)]	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	Wetland and Upland Habitat s
IN	*Somatochlora brevicincta*	Quebec emerald	NL	NL		x	1								x										W
MO	*Lasmigona compressa*	Creek Heelsplitter	SPC	NL	x		1					x													W
MO	*Ligumia recta*	Black Sandshell	SPC	NL	x		2					x	x												W
RE	*Clemmys insculpta*	Wood turtle	T	NL		x	5	x	x			x		x	x										W
RE	*Chelydra serpentina*	Common Snapping Turtle	SPC	NL	x		5			x	x	x	x		x										W
BI	*Aegolius funereus*	Boreal Owl	NL	NL	x	x	4	x						x				x	x						B
BI	*Ammodramus leconteii*	Le Conte's Sparrow	NL	NL	x	x	4							x	x						x	x			B
BI	*Anas rubripes*	American Black Duck	NL	NL	x		9	x	x		x				x			x	x	x	x			x	B
BI	*Botaurus lentiginosus*	American Bittern	NL	NL	x		5	x						x	x						x	x			B
BI	*Calidris alpina*	Dunlin	NL	NL	x		2								x								x		B

Taxa[(1)]	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Wetland Habitats								Upland Habitats									Wetland and Upland Habitat s
								Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	
BI	*Calidris pusilla*	Semipalmated Sandpiper	NL	NL	x		2								x								x		B
BI	*Catharus fuscescens*	Veery	NL	NL	x		5	x	x									x	x	x					B
BI	*Circus cyaneus*	Northern Harrier	NL	NL	x		6	x						x	x						x	x		x	B
BI	*Cistothorus platensis*	Sedge Wren	NL	NL	x		5	x						x	x						x	x			B
BI	*Coccyzus erythropthalmus*	Black-billed Cuckoo	NL	NL	x		6		x					x				x	x	x				x	B
BI	*Contopus cooperi*	Olive-sided Flycatcher	NL	NL	x	x	4	x						x				x						x	B
BI	*Contopus virens*	Eastern Wood-pewee	NL	NL	x		5		x									x	x	x		x			B
BI	*Dendroica castanea*	Bay-breasted Warbler	NL	NL	x	x	2	x										x							B
BI	*Dendroica tigrina*	Cape May Warbler	NL	NL	x		2	x										x							B
BI	*Dolichonyx oryzivorus*	Bobolink	NL	NL	x		6							x	x	x					x	x		x	B

								Wetland Habitats								Upland Habitats									
Taxa[1]	**Scientific Name**	**Common Name**	**State ETSC**	**Federal ESA or BGEPA (eagle)**	**SGCN**	**USFS RFSS**	**Number of habitats**	**Forest- Lowland Coniferous**	**Forest- Lowland Deciduous**	**Lake- Deep**	**Lake- Shallow**	**River- Headwater to large**	**River- Very Large**	**Shrub- Lowland**	**Wetland- Non-forest**	**Cropland**	**Developed**	**Forest- Upland Coniferous**	**Forest- Upland Deciduous (Aspen)**	**Forest- Upland Deciduous**	**Grassland**	**Prairie**	**Shoreline-dunes-cliff/talus**	**Shrub/woodland- Upland**	**Wetland and Upland Habitat s**
BI	*Empidonax minimus*	Least Flycatcher	NL	NL	x		4		x									x	x	x					B
BI	*Falcipennis canadensis*	Spruce Grouse	NL	NL	x		4	x						x				x						x	B
BI	*Falco peregrinus*	Peregrine Falcon	THR	NL	x	x	10	x			x		x	x	x		x				x	x	x	x	B
BI	*Haliaeetus leucocephalus*	Bald Eagle	SPC	THR	x	x	7		x	x		x						x	x	x				x	B
BI	*Melanerpes erythrocephalus*	Red-headed Woodpecker	NL	NL	x		8		x							x	x		x	x	x	x		x	B
BI	*Oporornis agilis*	Connecticut Warbler	NL	NL	x	x	2	x										x							B
BI	*Pheucticus ludovicianus*	Rose-breasted Grosbeak	NL	NL	x		5		x									x	x	x		x			B
BI	*Picoides arcticus*	Black-backed Woodpecker	NL	NL	x		3	x										x						x	B
BI	*Pluvialis dominica*	American Golden-plover	NL	NL	x		2								x								x		B
BI	*Podiceps grisegena*	Red-necked Grebe	NL	NL	x		2				x				x										B

Taxa$^{(1)}$	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Wetland Habitats								Upland Habitats									Wetland and Upland Habitat s
								Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	
BI	*Poecile hudsonica*	Boreal Chickadee	NL	NL	x		2	x										x							B
BI	*Scolopax minor*	American Woodcock	NL	NL	x		4							x					x		x			x	B
BI	*Seiurus aurocapilla*	Ovenbird	NL	NL	x		4		x									x	x	x					B
BI	*Sphyrapicus varius*	Yellow-bellied Sapsucker	NL	NL	x		4		x									x	x	x					B
BI	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow	NL	NL	x		3					x									x		x		B
BI	*Strix nebulosa*	Great grey owl	NL	NL		x		x										x							B
BI	*Tringa melanoleuca*	Greater Yellowlegs	NL	NL	x		2								x								x		B
BI	*Troglodytes troglodytes*	Winter Wren	NL	NL	x		3	x	x									x							B
BI	*Tympanuchus phasianellus*	Sharp-tailed Grouse	NL	NL	x	x	6							x	x	x					x	x		x	B

								Wetland Habitats								Upland Habitats									
Taxa(1)	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	Wetland and Upland Habitat s
BI	*Vermivora chrysoptera*	Golden-winged Warbler	NL	NL	x		3	x						x					x						B
BI	*Wilsonia canadensis*	Canada Warbler	NL	NL	x		4	x										x	x	x					B
BI	*Zonotrichia albicollis*	White-throated Sparrow	NL	NL	x		7	x	x					x				x	x	x				x	B
MA	*Canis lupus*	Gray Wolf	SPC	NL	x	x	11	x						x	x	x		x	x	x	x	x	x	x	B
MA	*Lynx canadensis*	Canada lynx	NL	THR	x		7	x	x					x				x	x	x				x	B
MA	*Microtus chrotorrhinus*	Rock Vole	NL	NL	x		6		x					x				x	x				x	x	B
MA	*Sorex fumeus*	Smoky Shrew	SPC	NL	x		3	x										x					x		B
MA	*Spermophilus franklinii*	Franklin's Ground Squirrel	NL	NL	x		5							x	x						x	x		x	B
AM	*Plethodon cinereus*	Eastern Red-backed Salamander	NL	NL	x		3											x	x	x					U

Taxa(1)	Scientific Name	Common Name	State ETSC	Federal ESA or BGEPA (eagle)	SGCN	USFS RFSS	Number of habitats	Wetland Habitats								Upland Habitats									Wetland and Upland Habitat s
								Forest- Lowland Coniferous	Forest- Lowland Deciduous	Lake- Deep	Lake- Shallow	River- Headwater to large	River- Very Large	Shrub- Lowland	Wetland- Non-forest	Cropland	Developed	Forest- Upland Coniferous	Forest- Upland Deciduous (Aspen)	Forest- Upland Deciduous	Grassland	Prairie	Shoreline-dunes-cliff/talus	Shrub/woodland- Upland	
BI	*Accipiter gentilis*	Northern Goshawk	NL	NL	x	x	3											x	x	x					U
BI	*Caprimulgus vociferus*	Whip-poor-will	NL	NL	x		2											x		x					U
BI	*Chordeiles minor*	Common Nighthawk	NL	NL	x		2										x						x		U
BI	*Dendroica caerulescens*	Black-throated Blue Warbler	NL	NL	x	x	3											x	x	x					U
BI	*Hylocichla mustelina*	Wood Thrush	NL	NL	x		3											x	x	x					U
BI	*Picoides tridactylus*	Three-toed woodpecker	NL	NL		x	1											x							U
BI	*Sturnella magna*	Eastern Meadowlark	NL	NL	x		2														x	x			U
BI	*Toxostoma rufum*	Brown Thrasher	NL	NL	x		2										x							x	U
BI	*Tryngites subruficollis*	Buff-breasted Sandpiper	NL	NL	x		4									x	x				x	x			U
IN	*Lycaeides idas nabokovi*	Nabokov's Blue	SPC	NL	x	x	2											x						x	U

								Wetland Habitats								Upland Habitats									
Taxa[(1)]	**Scientific Name**	**Common Name**	**State ETSC**	**Federal ESA or BGEPA (eagle)**	**SGCN**	**USFS RFSS**	**Number of habitats**	**Forest- Lowland Coniferous**	**Forest- Lowland Deciduous**	**Lake- Deep**	**Lake- Shallow**	**River- Headwater to large**	**River- Very Large**	**Shrub- Lowland**	**Wetland- Non-forest**	**Cropland**	**Developed**	**Forest- Upland Coniferous**	**Forest- Upland Deciduous (Aspen)**	**Forest- Upland Deciduous**	**Grassland**	**Prairie**	**Shoreline-dunes-cliff/talus**	**Shrub/woodland- Upland**	**Wetland and Upland Habitat s**
IN	*Oeneis macounii*	Macoun's Arctic	NL	NL	x		1											x							U
IN	*Phyciodes batesii*	Tawny Crescent	NL	NL	x		2											x						x	U
IN	*Pyrgus centaureae freija*	Grizzled Skipper	SPC	NL	x	x	1																	x	U
MA	*Taxidea taxus*	American Badger	NL	NL	x		7									x	x	x		x	x	x		x	U

(1) Taxa include amphibians (AM), birds (BI), fish (FI), insects (IN), mammals (MA), mollusks (MO), reptiles (RE), and spiders (SP).

Large Table 13 **Wetlands within 500-feet increments – Flotation Tailings Basin Area**

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1000	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1002	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1003	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1006	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1008	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1009	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1010	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1011	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1012	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1013	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.78	7.80
1014	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1015	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1016	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1017	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1018	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1019	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1020	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1021	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.73	5.83
1023	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.35

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1024	Coniferous swamp	0	0	0	1.41	5.42	3.92	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0
1025	Hardwood swamp	0	0	1.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1026	Shallow open water	0	0	0	0	0	3.76	6.06	2.93	0.00	0	0	0	0	0	0	0	0	0	0	0
1027	Alder thicket	0	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027A	Alder thicket or Shrub-carr	0	0.28	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1056	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.04	0	0	0	0	0
1057	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.83	2.04	0	0	0
1058	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.66	1.19	0
1059	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.72	3.74
1060	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.49
1065	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1066	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1067	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1069	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1070	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1071	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1072	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1073	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1074	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1076	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1077	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
1078	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	7.54	17.86
1079	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1080	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.55
1081	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	2.15	7.55	17.16	14.94	10.31	11.98	13.90	16.61	11.15
1082	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	4.78	4.57	13.17	12.91	6.75	0.92
1083	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	4.96	9.32	0.16	0	0	0	0	0	0
1084	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.37
1085	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.09	1.23	0	0	0
1086	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.64	1.30	0
1091	Shallow marsh	0	0.05	1.74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1092	Alder thicket or Shrub-carr	0	0	0	0	4.62	6.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1093	Shallow marsh	0.64	4.29	1.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1094	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	Coniferous swamp	0	0	0	0	0	0	0	1.11	3.53	0.14	0	0	0	0	0	0	0	0	0	0
1096	Shallow open water	0	0	0	0	0	0	0	2.55	10.55	12.16	13.08	12.22	11.48	8.33	2.66	0	0	0	0	0
1105	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1106	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1107	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1108	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1109	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1110	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1111	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1112	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1113	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1114	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1115	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1116	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06	5.76	0.19	0	0
1117	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.38	7.64	2.29	2.71	0	0
1125	Sedge meadow	0	0.07		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1126	Hardwood swamp	0	0.45	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1129	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	Coniferous swamp	0	0	0	0	0	0	0	0	6.53	8.95	9.19	6.86	0.75	0	0	0	0	0	0	0
1133	Coniferous swamp	0	10.36	12.10	13.66	24.26	10.00	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0
1134	Shallow marsh	2.65	3.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134A	Shallow marsh	0	1.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135	Deep marsh	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135A	Deep marsh	0	2.06	4.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	Shallow marsh	2.39	12.42	2.87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139A	Shallow marsh	0	4.39	0.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139B	Shallow marsh	0	1.05	8.64	9.48	15.32	9.87	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0
1140	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1141	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1142	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1143	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
1147	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1148	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1150	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1151	Coniferous swamp	0	0	0	0	2.23	25.56	32.98	26.57	9.69	3.85	1.26	3.60	10.35	1.18	0	0	0	0	0	0
1156	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1157	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.59	0.34	0	0	0	0
1158	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.13	0	0	0	0
252	Coniferous swamp	0	0	0	0	0	0	0	0	0.15	7.65	9.99	8.64	10.43	5.51	3.34	0	0	0	0	0
253	Deep marsh	0	0	0	0	0	0	0	0	1.15	4.12	0.62	0	0	0	0	0	0	0	0	0
254	Shallow marsh	0	0	0	0	0	0	0	1.41	7.93	11.19	10.52	5.65	0	0	0	0	0	0	0	0
255	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	2.88	2.54	0.60	0	0	0
256	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	1.68	7.89	8.80	5.03	0.02	0	0	0	0	0	0	0
257	Coniferous bog	0	0	0	0	0	0	0	0.79	15.47	20.86	13.04	10.94	8.40	11.78	3.27	0.18		0	0	0
259	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0.30	0.05	0	0	0	0	0	0	0	0	0
260	Shallow marsh	0	1.09	18.63	30.93	32.42	34.56	25.79	4.17	1.57	0.37	0	0	0	0	0	0	0	0	0	0
261	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0.84	0	0	0	0	0	0	0	0	0	0	0
262	Shallow marsh	0	0	0	0	0	0	0	1.85	0.02	0	0	0	0	0	0	0	0	0	0	0
263	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.74	0	0	0	0	0	0	0	0	0	0	0	0
264	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.14	5.79	1.92	0	0	0
265	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	1.15	1.89	1.45	0.30	0	0	0	0	0	0	0	0	0
267	Alder thicket or Shrub-carr	0	0	0	0	0	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
268	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0		0.24	2.77	1.75	1.18	1.27	5.99	2.22	0	0	0	0
270	Shallow marsh	0	1.34	5.65	17.76	13.22	6.24	3.64	5.28	2.35	2.46	4.85	5.01	4.85	5.12	4.47	3.56	0	0	0	0
271	Coniferous swamp	0	0	0	0	1.23	3.69	7.70	5.11	0.35	0	0	0	0	0	0	0	0	0	0	0

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		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
272	Deep marsh	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
275	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.38	5.22	12.77	7.23	3.97	0
276	Coniferous swamp	0	0.86	4.42	3.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
277	Alder thicket or Shrub-carr	0	0	0	0	0	0	2.39	7.93	3.87	0.26	0	0	0	0	0	0	0	0	0	0
278	Alder thicket	0.75	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278A	Alder thicket or Shrub-carr	0	1.84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279	Alder thicket	1.39	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279A	Alder thicket or Shrub-carr	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279B	Alder thicket or Shrub-carr	0	1.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
280	Sedge meadow	0	0	0	0	3.36	5.28	8.08	0.40	0	0	0	0	0	0	0	0	0	0	0	0
281	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0.24	1.22	0	0	0	0	0	0	0	0	0	0
282	Shallow marsh	6.69	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282A	Shallow marsh	0	5.99	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282B	Shallow marsh	0.20	10.14	2.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
283	Deep marsh	0	0	0	0	0	0	0	0	0.04	6.46	2.39	0	0	0	0	0	0	0	0	0
284	Alder thicket	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284A	Alder thicket or Shrub-carr	0.03	2.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	Coniferous swamp	0	0	0	2.51	11.37	15.49	20.26	23.81	21.64	13.77	34.18	43.36	49.32	44.66	35.27	20.51	16.01	12.44	0.10	0
286	Shallow open water	0	0	0	0	0	0		5.13	2.31	0	0	0	0	0	0	0	0	0	0	0
287	Alder thicket or Shrub-carr	0	0	0	0	0	0	1.66	4.27	0	0	0	0	0	0	0	0	0	0	0	0
288	Deep marsh	0	0	0.46	1.94	2.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
289	Alder thicket or Shrub-carr	0	0	0	1.54	1.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290	Coniferous swamp	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

		Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
Wetland ID	**Eggers and Reed Wetland Community**	**0 - 500 Feet**	**500 - 1,000 Feet**	**1,000 – 1,500 Feet**	**1,500 – 2,000 Feet**	**2,000 – 2,500 Feet**	**2,500 – 3,000 Feet**	**3,000 – 3,500 Feet**	**3,500 – 4,000 Feet**	**4,000 – 4,500 Feet**	**4,500 – 5,000 Feet**	**5,000 – 5,500 Feet**	**5,500 – 6,000 Feet**	**6,000 – 6,500 Feet**	**6,500 – 7,000 Feet**	**7,000 – 7,500 Feet**	**7,500 – 8,000 Feet**	**8,000 – 8,500 Feet**	**8,500 – 9,000 Feet**	**9,000 – 9,500 Feet**	**9,500 – 10,000 Feet**
292	Deep marsh	0.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292A	Deep marsh	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
293	Deep marsh	0	0	0	0	1.47	4.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
307	Shallow marsh	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308	Deep marsh	3.53	1.69	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
308A	Deep marsh	0	5.72	20.29	25.10	24.08	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0
312	Shrub-carr	0.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314	Shallow marsh	10.94	8.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314A	Shallow marsh	0	8.46	4.80	6.07	1.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
475	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.66	4.95	9.09	2.02	0	0
476	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.77	0.05	0	0
529	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.30	0	0
549	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
572	Deep marsh	3.28	4.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573	Shallow marsh	0	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573A	Shallow marsh	0	5.44	8.19	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
574	Deep marsh	0	0	5.77	6.29	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
575	Alder thicket or Shrub-carr	0	0	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
576	Sedge meadow or Wet meadow	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
577	Alder thicket or Shrub-carr	0	0	0	0.05	3.93	8.43	1.05	0	0	0	0	0	0	0	0	0	0	0	0	0
578	Deep marsh	0	0	0	0	0	0	0	0.38	7.99	7.93	1.18	0	0	0	0	0	0	0	0	0
579	Deep marsh	0	0	0	0	0	0	0	0	0	0.91	1.23	0	0	0	0	0	0	0	0	0
580	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0.28	1.44	0	0	0	0	0	0	0	0
581	Coniferous swamp	0	0	0	0	0	1.59	8.53	9.32	1.17	0	0	0	0	0	0	0	0	0	0	0
582	Deep marsh	6.69	12.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582A	Deep marsh	0	16.88	3.85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	**Eggers and Reed Wetland Community**	**Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin**																			
		0 - 500 Feet	**500 - 1,000 Feet**	**1,000 – 1,500 Feet**	**1,500 – 2,000 Feet**	**2,000 – 2,500 Feet**	**2,500 – 3,000 Feet**	**3,000 – 3,500 Feet**	**3,500 – 4,000 Feet**	**4,000 – 4,500 Feet**	**4,500 – 5,000 Feet**	**5,000 – 5,500 Feet**	**5,500 – 6,000 Feet**	**6,000 – 6,500 Feet**	**6,500 – 7,000 Feet**	**7,000 – 7,500 Feet**	**7,500 – 8,000 Feet**	**8,000 – 8,500 Feet**	**8,500 – 9,000 Feet**	**9,000 – 9,500 Feet**	**9,500 – 10,000 Feet**
584	Alder thicket or Shrub-carr	0	0.03	7.00	13.64	10.10	10.80	10.92	0.49	0	0	0	0	0	0	0	0	0	0	0	0
585	Alder thicket	0	0.86	0.72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585A	Alder thicket or Shrub-carr	0	0.04	2.73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
586	Deep marsh	0.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
587	Shallow marsh	0.51	0.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
588	Alder thicket or Shrub-carr	0	0	0	0	0	0	0.07	8.36	8.63	1.14	0	0	0	0	0	0	0	0	0	0
589	Deep marsh	0	0	0	0	2.81	13.77	14.84	8.60	0	0	0	0	0	0	0	0	0	0	0	0
590	Shallow marsh	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591	Deep marsh	1.70	0.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591A	Deep marsh	0.18	2.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
592	Alder thicket or Shrub-carr	0	0	0	0	0	0	1.64	0.14	0	0	0	0	0	0	0	0	0	0	0	0
593	Deep marsh	1.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593A	Deep marsh	1.04	8.27	9.52	5.98	0.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594	Deep marsh	0.03	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594A	Deep marsh	0	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
596	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.24	0	0	0	0	0	0	0	0	0	0	0	0
597	Hardwood swamp	0	0	0	0	0	0	0	1.76	2.45	0.23	0	0	0	0	0	0	0	0	0	0
598	Alder thicket or Shrub-carr	0	0	0	0	0.55	3.99	1.77	0	0	0	0	0	0	0	0	0	0	0	0	0
599	Alder thicket or Shrub-carr	0	0	0	0	0	2.79		0	0	0	0	0	0	0	0	0	0	0	0	0
600	Shallow marsh	0	0	0	0	0	3.50	4.97	0.31	0	0	0	0	0	0	0	0	0	0	0	0
601	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0.21	1.13	0	0	0	0	0	0	0	0
602	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0.59	0.01	0	0	0	0	0	0	0	0	0
603	Shallow marsh	0	0	0	0	0	0	0	0	0.07	0.03	0	0	0	0	0	0	0	0	0	0
604	Shallow marsh	0	0	0	0	0	0	0	0	0.12	0	0	0	0	0	0	0	0	0	0	0
605	Shallow marsh	0	0	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
606	Shallow marsh	0	0	0	0	0	0	0	0	0.12	0.07	0	0	0	0	0	0	0	0	0	0
607	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0.09	0	0	0	0	0	0	0	0	0	0	0
608	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0	0	0	0	0	0	0
609	Coniferous swamp	0	0	0	0	0	0	0	0.86	1.99	6.79	8.77	12.32	7.07	0.98	0	0	0	0	0	0
610	Shallow marsh	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0
611	Coniferous bog	0	0	0	0	0	0	0	0	0.58	0	0	0	0	0	0	0	0	0	0	0
612	Coniferous bog	0	0	0	0	0	0	0.21	1.98	0	0	0	0	0	0	0	0	0	0	0	0
613	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	1.45	0.14	0	0	0	0	0	0	0	0	0
614	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	1.23	0	0	0	0	0	0	0
615	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0.44	0	0	0	0	0	0	0	0
616	Deep marsh	0	0	0	0	0	0	0	0	0	0	5.45	0.53	0	0	0	0	0	0	0	0
617	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	1.48	0.60	0	0	0	0	0	0	0
618	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0.08	1.38	0	0	0	0	0	0
619	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.17	0.71	0	0	0	0	0	0	0
620	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0
621	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.52	0	0	0	0	0	0	0
622	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.29	0.08	0	0	0	0	0	0
623	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0.88	0	0	0	0	0	0
624	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.05	1.79	0	0	0	0
625	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.18	2.52	0
626	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.22
627	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.42	6.80	23.55	26.28	26.35	25.01
628	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
629	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.19	6.17	0.30
630	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.15	2.77	3.08	1.92	0.13
631	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.21	5.92
632	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
633	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.51
635	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
636	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.24	0.01	0
637	Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	14.79	18.98	17.15	18.68	25.45
638	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.07	7.31	0	0	0
639	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.04	0	0	0	0	0
640	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.58	6.19
641	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
642	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
643	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.99	0.61	0	0	0	0	0	0
644	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
645	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
646	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
647	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
648	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
649	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
650	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
651	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
652	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.30	21.91	35.19
653	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
654	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
655	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
656	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.89	1.05
657	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.01	2.34	3.42	3.64	9.70	18.01	8.76	15.09
659	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
660	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.82	2.08	0	0	0	0	0
662	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
663	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
664	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
665	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
667	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
669	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.38	4.19	7.26	6.56	0	0
670	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	2.37
672	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.78	4.27	0	0	0
673	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.40	22.11
674	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
675	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
676	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
677	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
786	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
787	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
788	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.80	4.67	11.51
810	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.62	10.37	0.74	0	0
816	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
817	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
818	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
819	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
820	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
821	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
822	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
823	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
824	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
825	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
826	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
827	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
828	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
829	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
830	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
831	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
832	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
833	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
834	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
835	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
836	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
841	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
842	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
843	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
844	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
845	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
846	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
847	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
848	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
849	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
850	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
851	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
852	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
854	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
866	Hardwood swamp	0	0	0	0	0	0	0	0	1.95	9.04	9.05	5.87	4.50	0.61	0	0	0	0	0	0
867	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	6.92	19.74	22.04	11.64	9.18	4.66	5.26	0	0	0	0	0	0
868	Hardwood swamp	0	0	0	0	1.90	7.01	0.95	0	0	0	0	0	0	0	0	0	0	0	0	0
869	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
870	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	4.49	19.86	20.61	21.30	0.45	0	0	0
871	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
872	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
873	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
874	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
875	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
877	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
878	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
908	Shallow marsh	0	0	0	0	0	1.59	3.75	2.64	0.73	0	0	0	0	0	0	0	0	0	0	0
915	Alder thicket	0	0	0	0	0	0	0	0	0	0	5.18	0.29	0	0	0	0	0	0	0	0
917	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0.01	5.23	6.38	5.83	2.42	0	0	0	0	0
918	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	3.19	3.62	2.36	0.28	0	0	0	0	0	0
921	Alder thicket or Shrub-carr	0	0	0	0	0	0	0.13	0.25	0	0	0	0	0	0	0	0	0	0	0	0
923	Wet meadow	0	0	0	0	0	0	0.17	0.52	0	0	0	0	0	0	0	0	0	0	0	0
942	Deep marsh	0	0	0	0	0	1.40	1.56	0	0	0	0	0	0	0	0	0	0	0	0	0
943	Deep marsh	0	0	0	0.87	5.51	7.42	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0
944	Hardwood swamp	0	0	0	0	1.43	0.99	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0
945	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.32	2.00	0	0	0	0	0	0	0	0	0	0	0
946	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.44	0.51	0	0
947	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	2.09	5.57	6.15	5.75	0.81	0	0	0	0	0	0
950	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
951	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.88	18.88	33.02	32.26	26.22
952	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
953	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
954	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
955	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	2.44	7.40	6.81	2.70	12.59	6.91	0.37	0	0
956	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	2.70	3.83	7.27	3.51	0	0
957	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	1.41	1.81	3.65	0	0	0	0
958	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	1.38	2.19	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
963	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.35	7.40
964	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.70
965	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.44	5.78	0.01
966	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.19	4.22	1.90	1.84	0	0
968	Coniferous swamp	3.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
974	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.23
975	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	5.79	6.68	8.71	4.70	0	0
976	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.20	7.69	9.11
977	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
978	Hardwood swamp	0	0	0	0	1.33	1.42	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0
979	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	2.15	3.37	0.22	0	0	0	0
980	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	1.25	1.57	0	0	0	0	0	0	0	0	0	0
981	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0	0	0
982	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
983	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.85	0.84	0	0	0	0
985	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
986	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
987	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
988	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
989	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		0 - 500 Feet	500 - 1,000 Feet	1,000 – 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
990	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.40	8.25	6.17
991	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.30	20.05	21.40
992	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
993	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
994	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
995	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
996	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.73	2.37	0	0	0
T1	Deep marsh	1.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13	Deep marsh	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13A	Deep marsh	2.96	4.17	2.97	1.46	1.05	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T8	Wet meadow	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Total acres of wetland		55.05	147.62	133.17	142.59	174.34	195.34	159.99	138.45	140.81	157.22	162.95	160.46	161.41	146.60	149.87	173.90	214.77	209.31	219.15	285.35

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1000	Coniferous swamp	0	0	0.43	7.90	4.60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.16	21.99
1002	Coniferous swamp	0	0	0	0	1.03	3.26	1.52	0	0	0	0	0	0	0	0	0	0	0	0	0
1003	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1006	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1008	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1009	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06
1010	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1011	Alder thicket or Shrub-carr	0	0	0	0.49	1.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1012	Coniferous swamp	0	2.08	0.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1013	Coniferous bog	1.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1014	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0	0	0
1015	Coniferous bog	0	1.21	12.56	17.14	18.08	21.96	14.91	10.89	2.56	0	0	0	0	0	0	0	0	0	0	0
1016	Sedge meadow or Wet meadow	0	0	0.21	0.52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1017	Alder thicket or Shrub-carr	0	0	0	1.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1018	Coniferous bog	0	0	0	0.11	5.00	3.86	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0
1019	Coniferous bog	0	0	0		2.70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1020	Sedge meadow or Wet meadow	0	0	0.25	1.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1021	Coniferous bog	0	0	0	0	0	0	0	2.75	2.35	0	0	0	0	0	0	0	0	0	0	0
1022	Deep marsh	4.98	6.58	1.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1023	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1024	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1025	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1026	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1056	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1057	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1059	Shallow open water	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1060	Shallow open water	3.52	4.61	4.62	3.19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1065	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	2.31	8.45	23.25	67.41	57.03	3.96	0	0	0
1066	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.92	2.29	17.46	28.73	24.55	19.79	13.46	1.14	0	0	0	0	0
1067	Alder thicket or Shrub-carr	0	0	0	0	0.73	15.22	13.06	17.41	9.51	1.14	0	0	0	0	0	0	0	0	0	0
1069	Shallow marsh	0	0	0	0	0	0	3.22	4.82	10.33	1.55	0	0	0	0	0	0	0	0	0	0
1070	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	2.44	1.36	0	0	0	0	0	0	0	0
1071	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.03	2.00	11.77	4.36	3.42	2.85	4.71	0.03	0	0	0	0	0
1072	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	2.77	4.18	1.67	0	0	0
1073	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	3.34	0	0
1074	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1076	Coniferous swamp	0	2.73	7.74	21.47	17.17	1.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1077	Alder thicket or Shrub-carr	4.39	15.47	24.09	7.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1078	Shallow marsh	3.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1079	Coniferous swamp	0	0.37	2.10	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1080	Coniferous swamp	4.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1081	Alder thicket or Shrub-carr	11.32	5.26	3.44	8.13	8.29	2.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1082	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1083	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1084	Deep marsh	8.80	3.69	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1085	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1086	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1091	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1092	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1093	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1094	Sedge meadow or Wet meadow	0	1.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1096	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1105	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	5.33	0	0	0	0
1106	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.34	15.97	14.87	4.43	0	0
1107	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.43	0.41	0	0	0	0	0	0	0
1108	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0		0.80	1.71	0	0	0	0	0	0
1109	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.62	0.14	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1110	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0.28	0	0	0	0	0	0	0	0
1111	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0.00	0.63	0	0	0	0	0	0	0
1112	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	1.92	0.35	0	0	0	0	0
1113	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1114	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.59
1115	Shallow marsh	0	0	0	0	0	0.43	0.66	0	0	0	0	0	0	0	0	0	0	0	0	0
1116	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1117	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1125	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1126	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1129	Coniferous swamp	0	0	0.01	4.91	4.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1133	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139B	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1140	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0.01	2.60	6.19	13.39	15.05	19.32	21.57	0.86
1141	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0.21	7.60	1.60	0	0	0	0	0	0	0
1142	Alder thicket or Shrub-carr	0	0	0	0	2.39	9.09	8.30	0.57	0	0	0	0	0	0	0	0	0	0	0	0
1143	Coniferous swamp	0	0	0	0	0.63	3.69	3.33	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
1147	Alder thicket or Shrub-carr	0	0	0	0	3.69	9.56	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0
1148	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1150	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.69
1151	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1156	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1157	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1158	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
252	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
253	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
254	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
259	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
260	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
261	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
262	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
263	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
265	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
267	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
268	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
270	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
271	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
272	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
275	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
276	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
277	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279B	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
280	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
281	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282B	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
283	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
286	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
287	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
288	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
289	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
293	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
307	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
312	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
475	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
476	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
529	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
549	Alder thicket or Shrub-carr	0	0	0.28	1.93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
572	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
574	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
575	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
576	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
577	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
578	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
579	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
580	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
581	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
586	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
587	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
588	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
589	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
590	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
592	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
596	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
597	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
598	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
599	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
600	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
601	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
602	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
603	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
604	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
605	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
606	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
607	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
608	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
609	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
610	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
611	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
612	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
613	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
614	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
615	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
616	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
617	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
618	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
619	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
621	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
622	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
623	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
624	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
625	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
626	Coniferous swamp	6.13	8.81	9.97	16.88	32.70	31.67	32.28	36.12	36.53	22.97	15.52	6.69	1.31	0	0	0	0	0	0	0
627	Alder thicket or Shrub-carr	13.82	11.86	11.05	11.52	12.17	9.85	4.02	0.30	0	0	0	0	0	0	0	0	0	0	0	0
628	Deep marsh	4.45	5.54	0.54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
629	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
630	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
631	Coniferous swamp	1.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
632	Alder thicket or Shrub-carr	0.99	2.39	6.43	1.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
633	Alder thicket or Shrub-carr	0.73	0.34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
635	Alder thicket or Shrub-carr	1.54	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
636	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
637	Lake	25.17	10.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
638	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
639	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
640	Coniferous bog	9.27	5.50	4.44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
641	Coniferous swamp	0	0	0	0	2.77	6.00	3.25	2.22	1.50	0.40	0	0	0	0	0	0	0	0	0	0
642	Shallow open water	0	0	0	0	0.02	4.67	3.65	0	0	0	0	0	0	0	0	0	0	0	0	0
643	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
644	Coniferous swamp	0	0	0	0	0	0	0	6.51	7.82	0	0	0	0	0	0	0	0	0	0	0
645	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0.78	0.26	0	0	0	0	0	0	0
646	Alder thicket or Shrub-carr	0	0	0	0	0	0.45	1.30	1.43	1.48	1.49	1.43	1.39	1.40	0.67	2.28	3.29	0.14	1.31	5.02	0.34
647	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	3.37	3.17	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
648	Alder thicket	0	0	0	0	0	0.26	2.98	2.14	3.95	1.96	14.82	18.53	1.32	0	0	0	0	0	0	0
649	Sedge meadow or Wet meadow	0	0	0	0	1.28	7.39	1.95	0	0	0	0	0	0	0	0	0	0	0	0	0
650	Sedge meadow or Wet meadow	0	0	0	5.37	2.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
651	Alder thicket	0	0	0	0	0	0	0	0	1.03	1.06	0	0	0	0	0	0	0	0	0	0
652	Coniferous swamp	28.35	12.35	0.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
653	Coniferous bog	0	0	0	0	0.12	5.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
654	Shrub-carr	0	0	0	0	0	0	0	1.41	6.59	1.85	1.97	3.03	0.32	0	0	0	0	0	0	0
655	Alder thicket or Shrub-carr	3.55	1.95	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
656	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	Alder thicket or Shrub-carr	12.43	17.82	8.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
659	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.20	1.88	2.99	0	0	0
660	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
662	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	6.66	7.61	6.64	5.45	0	0	0	0	0
663	Coniferous swamp	0	0	0	0	0	0	1.88	4.34	6.86	0.04	0	0	0	0	0	0	0	0	0	0
664	Coniferous swamp	0	0	0	0	4.74	8.52	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0
665	Shallow open water	0	0	0	0	5.69	9.83	3.75	1.44	0	0	0	0	0	0	0	0	0	0	0	0
667	Coniferous swamp	0	0	0	0	4.42	6.06	6.75	0.11	0	0	0	0	0	0	0	0	0	0	0	0
669	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
670	Coniferous swamp	4.18	6.69	11.60	5.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
672	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
673	Coniferous swamp	33.66	30.42	20.90	10.76	3.39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
674	Open bog	0	0	0	0	0	0	0	0	0	1.13	1.22	0	0	0	0	0	0	0	0	0
675	Open bog	0	0	0	0	0	0	0	3.39	6.12	0.16	0	0	0	0	0	0	0	0	0	0
676	Deep marsh	0	0	0	0	0	0	0	0	0	5.77	3.71	0	0	0	0	0	0	0	0	0
677	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	9.27	24.90	23.93	12.82	30.73	30.94	24.51	8.55	0
786	Open bog	0	0	0		0.20	5.05	11.72	14.91	12.41	22.95	28.97	35.42	38.55	35.06	29.30	16.59	10.32	5.39	0	0
787	Alder thicket or Shrub-carr	0	0	0	2.64	5.79	3.02	2.93	1.85	0	0	0	0	0	0	0	0	0	0	0	0
788	Hardwood swamp	19.91	28.49	24.01	4.99	3.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
810	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
816	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	1.29	11.32	2.85	0	0	0	0	0	0
817	Deep marsh	0	0	0	0	0	0	0	0	0	2.62	6.89	0.52	0	0	0	0	0	0	0	0
818	Deep marsh	0	0	0	0	0	0	0	0	0	0	0.00	7.10	0.02	0	0	0	0	0	0	0
819	Deep marsh	0	0	0	0	0	0	0	0	0	0	0.12	0.85	0	0	0	0	0	0	0	0
820	Deep marsh	0	0	0	0	0	0	1.35	11.73	11.71	2.12		0	0	0	0	0	0	0	0	0
821	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.57	4.80	2.81	0	0	0
822	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0.07	4.39	0	0	0	0	0
823	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0.27	5.39	0.55	0	0	0	0
824	Shallow marsh	0	0	0	0	0	4.40	1.34	0	0	0	0	0	0	0	0	0	0	0	0	0
825	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09	1.70	0	0
826	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.02	4.91	0	0
827	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	2.42	0.09	0	0
828	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.39	3.06	0.80	0	0
829	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.99	3.82	0	0	0
830	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.13	1.75	0	0	0	0
831	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	5.63	8.03	0	0	0	0	0
832	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	2.92	6.45	0	0	0	0	0	0
833	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	2.59	12.54	0	0	0	0	0	0

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		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
834	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	2.30	5.95	0	0	0	0	0	0	0
835	Wet meadow	0	0	0	0	0	0	0	0	0.10	5.19	6.12	1.25	0	0	0	0	0	0	0	0
836	Shrub-carr	0	0	0	0	0	0	0	0	3.11	6.46	1.93	0	0	0	0	0	0	0	0	0
837	Shrub-carr	0	0	0	0	0	0	0	3.48	8.80	1.21	0	0	0	0	0	0	0	0	0	0
838	Shrub-carr	0	0	0	0	0	0.57	10.59	7.82	0	0	0	0	0	0	0	0	0	0	0	0
839	Shrub-carr	0	0	0	0	0	0	0	1.44	10.63	0.99	0	0	0	0	0	0	0	0	0	0
840	Shrub-carr	0	0	0	0	10.93	19.41	0.95	0	0	0	0	0	0	0	0	0	0	0	0	0
841	Shrub-carr	0	0	0	0	0	0	0	0	0	0.52	8.72	0	0	0	0	0	0	0	0	0
842	Shrub-carr	0	0	0	0	0	0	0	0	0	0	2.60	5.70	0	0	0	0	0	0	0	0
843	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	6.14	6.42	0	0	0	0	0	0	0
844	Shrub-carr	0	0	0	0	0	0	0.27	9.54	14.75	3.96	0	0	0	0	0	0	0	0	0	0
845	Coniferous swamp	0	0	0	0	0	1.11	7.43	4.10	0	0	0	0	0	0	0	0	0	0	0	0
846	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	1.47	6.15	0.01	0	0	0	0	0	0
847	Shallow marsh	0	0	0	0	0	4.32	12.89	0.65	0	0	0	0	0	0	0	0	0	0	0	0
848	Shrub-carr	0	0	0	0	0	0	0	0	0.90	13.73	1.39	0	0	0	0	0	0	0	0	0
849	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	5.68	5.19	0	0	0	0	0	0	0
850	Shrub-carr	0	0	0	0	0	0	0	0	0.08	5.49	14.84	9.32	0	0	0	0	0	0	0	0
851	Shrub-carr	0	0	0	0	0	0	4.76	11.87	3.10	0	0	0	0	0	0	0	0	0	0	0
852	Shrub-carr	0	0	0	0	0	0	3.68	0	0	0	0	0	0	0	0	0	0	0	0	0
854	Coniferous swamp	0	0	0	4.77	9.22	0.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
866	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
867	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
868	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
869	Alder thicket or Shrub-carr	0	8.71	7.13	0.66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
870	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
871	Alder thicket or Shrub-carr	0	0	0	4.48	13.40	14.67	7.74	0.82	0	0	0	0	0	0	0	0	0	0	0	0

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		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
872	Coniferous swamp	0	0	0	0	0	2.80	7.05	8.28	9.27	9.12	5.76	0	0	0	0	0	0	0	0	0
873	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	1.04	4.96	4.00	0	0	0	0	0	0	0
874	Coniferous swamp	0	0	0	0	0	1.80	3.53	0.48	0	0	0	0	0	0	0	0	0	0	0	0
875	Alder thicket or Shrub-carr	0	0	0	0.12	9.26	17.59	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0
876	Alder thicket	0	0	11.28	18.38	9.46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
877	Alder thicket or Shrub-carr	2.04	7.62	2.98	0.00		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
878	Alder thicket or Shrub-carr	0	9.36	14.46	8.09	3.63	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
908	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
915	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
917	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
918	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
921	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
923	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
942	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
943	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
944	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
945	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
946	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
947	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
950	Alder thicket or Shrub-carr	0	0	0	0	0	0	3.10	0.03	0	0	0	0	0	0	0	0	0	0	0	0
951	Coniferous bog	19.26	13.61	10.97	8.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
952	Alder thicket or Shrub-carr	0	0	0	0	4.94	23.47	42.90	27.02	9.36	0.79	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
953	Alder thicket or Shrub-carr	0	0	0	4.73	24.50	17.23	18.39	23.70	33.71	84.51	117.24	113.24	62.20	32.44	30.16	35.05	16.92	0	0	0
954	Coniferous swamp	0	0	0	14.52	17.18	17.76	28.98	32.92	44.34	19.73	0.09	0	0	0	0	0	0	0	0	0
955	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
956	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
957	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
958	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
963	Alder thicket or Shrub-carr	4.63	13.45	13.39	11.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
964	Coniferous swamp	12.02	9.76	13.44	4.94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
965	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
966	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
968	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
974	Coniferous bog	20.70	15.80	18.13	9.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
975	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
976	Coniferous swamp	4.41	7.17	22.41	27.66	12.23	1.68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
977	Coniferous swamp	0	0	0	0	0	0	0.61	12.15	11.04	2.47	2.54	16.46	8.41	0	0	0	0	0	0	0
978	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
979	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
981	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
982	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0.73	10.83	16.56	39.66	21.81	9.15	4.48	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		10,000 – 10,500 Feet	10,500 – 11,000 Feet	11,000 – 11,500 Feet	11,500 – 12,000 Feet	12,000 – 12,500 Feet	12,500 – 13,000 Feet	13,000 – 13,500 Feet	13,500 – 14,000 Feet	14,000 – 14,500 Feet	14,500 – 15,000 Feet	15,000 – 15,500 Feet	15,500 – 16,000 Feet	16,000 – 16,500 Feet	16,500 – 17,000 Feet	17,000 – 17,500 Feet	17,500 – 18,000 Feet	18,000 – 18,500 Feet	18,500 – 19,000 Feet	19,000 – 19,500 Feet	19,500 – 20,000 Feet
983	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0.25	6.97	6.22	7.73	13.03	19.24	1.81	0	0	0	0	0	0
986	Alder thicket or Shrub-carr	0	0.69	11.37	10.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
987	Shallow open water	0	0	0	0	1.47	0.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
988	Alder thicket or Shrub-carr	0	0	0	3.27	14.24	3.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
989	Coniferous swamp	0	0	0	0.00	9.96	5.41	3.33	15.36	30.62	29.93	24.04	11.59	0	0	0	0	0	0	0	0
990	Alder thicket or Shrub-carr	3.49	5.40	8.39	7.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
991	Coniferous swamp	8.27	2.65	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
992	Alder thicket or Shrub-carr	0	0	0	7.77	7.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
993	Alder thicket or Shrub-carr	0.14	3.04	3.83	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
994	Coniferous bog	0	0	0	5.81	12.99	7.24	0.73	0	0	0	0	0	0	0	0	0	0	0	0	0
995	Coniferous swamp	0.01	3.69	8.54	6.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
996	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T1	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T8	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total acres of wetland		283.28	287.31	302.15	292.22	310.86	312.02	281.38	285.38	311.82	286.76	304.43	326.61	248.66	186.85	198.60	233.91	135.33	74.95	44.78	27.53

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1000	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001	Coniferous bog	11.90	11.97	19.50	6.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1002	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1003	Alder thicket or Shrub-carr	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1006	Alder thicket or Shrub-carr	4.99	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1008	Alder thicket or Shrub-carr	0	0	0	0.08	1.41	2.91	3.54	1.85	2.53	1.60	2.82	3.07	5.34	3.73	0	0	0	0	0	0
1009	Alder thicket or Shrub-carr	3.67	1.96	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1010	Coniferous bog	0	0	0	2.56	12.32	13.93	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0
1011	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1012	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1013	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1014	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1015	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1016	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1017	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1018	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1019	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1020	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1021	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1023	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1024	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1025	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1026	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1027A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1056	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1057	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1059	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1060	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1065	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1066	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1067	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1069	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1070	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1071	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1072	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1073	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1074	Coniferous bog	0	0	0	0	0	7.69	21.21	22.67	19.66	14.63	15.24	21.34	11.21	9.79	2.79	0	0	0	0	0
1076	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1077	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1078	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1079	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1080	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1081	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1082	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1083	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1084	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1085	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1086	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1091	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1092	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1093	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1094	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1096	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1105	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1106	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1107	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1108	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1109	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1110	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1111	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1112	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1113	Coniferous bog	0	0	0	0	0	0	0	0	0	0.44	1.99	8.13	18.67	7.24	12.35	12.94	10.54	5.31	3.27	0.95
1114	Hardwood swamp	2.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1115	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1116	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1117	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1125	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1126	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1129	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1133	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1135A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139B	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1140	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1141	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1142	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1143	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
1147	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1148	Open bog	0	0	0	0	0	0	0.18	9.89	19.57	24.98	19.66	0.24	0	0	0	0	0	0	0	0
1150	Shallow marsh	2.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1151	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1156	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1157	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1158	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
252	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
253	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
254	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
256	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
257	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
259	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
260	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
261	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
262	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
263	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
264	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
265	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
267	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
268	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
270	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
271	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
272	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
275	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
276	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
277	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
278A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279B	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
280	Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
281	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
282B	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
283	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
284A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
285	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
286	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
287	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
288	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
289	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
293	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
307	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
308A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
312	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
475	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
476	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
529	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
549	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
572	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
573A	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
574	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
575	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
576	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
577	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
578	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
579	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
580	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
581	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
582A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
585A	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
586	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
587	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
588	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
589	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
590	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
591A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
592	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
593A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
594A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
596	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
597	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
598	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
599	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
600	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
601	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
602	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
603	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
604	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
605	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
606	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
607	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
608	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
609	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
610	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
611	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
612	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
613	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
614	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
615	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
616	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
617	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
618	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
619	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
621	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
622	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
623	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
624	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
625	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
626	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
627	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
628	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
629	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
630	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
631	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
632	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
633	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
635	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
636	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
637	Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
638	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
639	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
640	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
641	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
642	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
643	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
644	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
645	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
646	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
647	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
648	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
649	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
650	Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
651	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
652	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
653	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
654	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
655	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
656	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
659	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
660	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
662	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
663	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
664	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
665	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
667	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
669	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
670	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
672	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
673	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
674	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
675	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
676	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
677	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
786	Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
787	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
788	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
810	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
816	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
817	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
818	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
819	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
820	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
821	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
822	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
823	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
824	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
825	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
826	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
827	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
828	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
829	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
830	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
831	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
832	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
833	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
834	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
835	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
836	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
841	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
842	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
843	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
844	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
845	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
846	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
847	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
848	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
849	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
850	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
851	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
852	Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
854	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
866	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
867	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
868	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
869	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
870	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
871	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
872	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
873	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
874	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
875	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
877	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
878	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
908	Shallow marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
915	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
917	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
918	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
921	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
923	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
942	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
943	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
944	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
945	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
946	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
947	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
950	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
951	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
952	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
953	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
954	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
955	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
956	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
957	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
958	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
963	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
964	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
965	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
966	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
968	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
974	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
975	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
976	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
977	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
978	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
979	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
980	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
981	Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
982	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Wetland ID	Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Flotation Tailings Basin																			
		20,000 – 20,500 Feet	20,500 – 21,000 Feet	21,000 – 21,500 Feet	21,500 – 22,000 Feet	22,000 – 22,500 Feet	22,500 – 23,000 Feet	23,000 – 23,500 Feet	23,500 – 24,000 Feet	24,000 – 24,500 Feet	24,500 – 25,000 Feet	25,000 – 25,500 Feet	25,500 – 26,000 Feet	26,000 – 26,500 Feet	26,500 – 27,000 Feet	27,000 – 27,500 Feet	27,500 – 28,000 Feet	28,000 – 28,500 Feet	28,500 – 29,000 Feet	29,000 – 29,500 Feet	29,500 – 30,000 Feet
983	Hardwood swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
986	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
987	Shallow open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
988	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
989	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
990	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
991	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
992	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
993	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
994	Coniferous bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
995	Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
996	Alder thicket or Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T1	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T13A	Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T8	Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total acres of wetland		26.18	14.49	19.51	9.47	13.73	24.53	24.99	34.41	41.76	41.65	39.71	32.78	35.22	20.76	15.14	12.94	10.54	5.31	3.27	0.95

Large Table 14 Summary of Wetlands within 500-Feet Increments – Flotation Tailings Basin Area

Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Floatation Tailings Basin																			
	0 - 500 Feet	500 - 1,000 Feet	1,000 - 1,500 Feet	1,500 – 2,000 Feet	2,000 – 2,500 Feet	2,500 – 3,000 Feet	3,000 – 3,500 Feet	3,500 – 4,000 Feet	4,000 – 4,500 Feet	4,500 – 5,000 Feet	5,000 – 5,500 Feet	5,500 – 6,000 Feet	6,000 – 6,500 Feet	6,500 – 7,000 Feet	7,000 – 7,500 Feet	7,500 – 8,000 Feet	8,000 – 8,500 Feet	8,500 – 9,000 Feet	9,000 – 9,500 Feet	9,500 – 10,000 Feet
Alder thicket	2.55	1.25	0.72	0	0	0	0	0	0	0	5.18	0.29	0.08	1.76	0	0	0	0	0	0
Alder thicket or Shrub-carr	0.03	6.60	10.73	15.23	20.59	33.58	19.63	30.81	40.23	40.24	29.77	29.44	29.08	37.38	41.50	46.33	73.99	69.93	68.68	69.03
Coniferous bog	0	0	0	0	0	0	0.21	2.77	16.05	20.86	13.05	16.17	19.27	37.47	26.30	24.51	22.10	38.34	36.55	45.57
Coniferous swamp	3.76	11.22	16.52	20.98	44.51	60.25	69.63	66.78	45.05	41.15	66.58	83.36	89.60	54.91	56.17	56.15	65.94	67.72	79.39	104.50
Deep marsh	23.96	59.69	47.71	41.64	38.68	27.29	16.63	8.98	9.18	19.42	10.87	0.53	0	0	1.97	9.17	8.05	2.90	1.73	7.20
Hardwood swamp	0	0.45	1.79	0	4.66	9.42	1.20	1.76	4.40	9.27	9.05	5.87	4.50	1.43	2.93	0.84	0	0.80	4.67	11.51
Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.87	14.79	18.98	17.15	18.68	25.45
Open bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedge meadow	0	0.07	0	0	3.36	5.28	8.08	0.40	0	0	0	0	0	0	0	0	0	0	0	0
Sedge meadow or Wet meadow	0	0	0	0.35	0	0	0	0	0	0	0	0	0	0	0	3.09	1.23	0	0	0
Shallow marsh	24.07	68.34	55.70	64.39	62.54	55.76	38.38	15.82	13.04	14.12	15.37	12.58	6.96	5.23	14.77	12.36	15.17	7.00	7.54	17.86
Shallow, open water	0	0	0	0	0	3.76	6.06	10.61	12.86	12.16	13.08	12.22	11.92	8.33	2.66	2.83	2.04	1.66	1.91	4.23
Shrub-carr	0.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wet meadow	0.03	0	0	0	0	0	0.17	0.52	0	0	0	0	0	0.09	2.70	3.83	7.27	3.81	0	0
Total acres of wetland	55.05	147.62	133.17	142.59	174.34	195.34	159.99	138.45	140.81	157.22	162.95	160.46	161.41	146.60	149.87	173.90	214.77	209.31	219.15	285.35

Eggers and Reed Wetland Community	**Wetlands (acres) within 500-Feet Increments From the Edge of the Floatation Tailings Basin**																			
	10,000 - 10,500 Feet	**10,500 - 11,000 Feet**	**11,000 - 11,500 Feet**	**11,500 - 12,000 Feet**	**12,000 - 12,500 Feet**	**12,500 - 13,000 Feet**	**13,000 - 13,500 Feet**	**13,500 - 14,000 Feet**	**14,000 - 14,500 Feet**	**14,500 - 15,000 Feet**	**15,000 - 15,500 Feet**	**15,500 - 16,000 Feet**	**16,000 - 16,500 Feet**	**16,500 - 17,000 Feet**	**17,000 - 17,500 Feet**	**17,500 - 18,000 Feet**	**18,000 - 18,500 Feet**	**18,500 - 19,000 Feet**	**19,000 - 19,500 Feet**	**19,500 - 20,000 Feet**
Alder thicket	0	0	11.28	18.38	9.46	0.26	2.98	2.14	4.98	3.02	14.82	18.53	1.32	0	0	0	0	0	0	0
Alder thicket or Shrub-carr	59.07	103.58	115.75	92.44	111.84	125.28	101.99	74.51	65.32	123.38	162.14	178.28	137.86	89.56	65.76	112.91	71.92	38.31	18.05	0.40
Coniferous bog	50.41	36.12	46.10	41.07	38.89	38.17	15.67	13.64	4.91	0	0	0	0.01	2.60	6.19	13.39	15.05	19.32	26.73	22.85
Coniferous swamp	103.52	86.72	98.16	125.25	124.90	91.92	99.96	122.59	147.98	84.66	48.99	48.67	29.78	31.81	74.75	74.88	21.82	4.43	0	0
Deep marsh	18.23	15.81	1.77	0	0	0	1.35	11.73	11.71	10.51	10.72	9.76	11.34	2.85	0	0	0	0	0	0
Hardwood swamp	19.91	28.49	24.01	4.99	3.69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.59
Lake	25.17	10.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Open bog	0	0	0	0	0.20	5.05	11.72	18.30	18.53	24.24	30.19	35.42	38.55	35.06	29.30	16.59	10.32	5.39	0	0
Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedge meadow or Wet meadow	0	1.06	0.46	6.90	3.77	7.39	1.95	0	0	0	0	0.28	0	0	0.09	5.33	0	0	0	0
Shallow marsh	3.37	0	0	0	0	9.15	18.11	5.47	10.33	1.55	0	0.78	2.85	12.88	14.48	7.10	2.81	0	0	1.69
Shallow, open water	3.60	4.61	4.62	3.19	7.18	14.82	7.40	1.44	0	0	0	0	0	0	0	0	0	0	0	0
Shrub-carr	0	0	0	0	10.93	19.98	20.25	35.56	47.96	34.21	31.45	31.34	18.08	0.01	0	0	0	0	0	0
Wet meadow	0	0	0	0	0	0	0	0	0.10	5.19	6.12	3.55	8.87	12.08	8.03	3.71	13.41	7.50	0	0
Total acres of wetland	283.28	287.31	302.15	292.22	310.86	312.02	281.38	285.38	311.82	286.76	304.43	326.61	248.66	186.85	198.60	233.91	135.33	74.95	44.78	27.53

Eggers and Reed Wetland Community	Wetlands (acres) within 500-Feet Increments From the Edge of the Floatation Tailings Basin																			
	20,000 - 20,500 Feet	20,500 - 21,000 Feet	21,000 - 21,500 Feet	21,500 - 22,000 Feet	22,000 - 22,500 Feet	22,500 - 23,000 Feet	23,000 - 23,500 Feet	23,500 - 24,000 Feet	24,000 - 24,500 Feet	24,500 - 25,000 Feet	25,000 - 25,500 Feet	25,500 - 26,000 Feet	26,000 - 26,500 Feet	26,500 - 27,000 Feet	27,000 - 27,500 Feet	27,500 - 28,000 Feet	28,000 - 28,500 Feet	28,500 - 29,000 Feet	29,000 - 29,500 Feet	29,500 - 30,000 Feet
Alder thicket	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alder thicket or Shrub-carr	9.16	2.52	0.01	0.08	1.41	2.91	3.54	1.85	2.53	1.60	2.82	3.07	5.34	3.73	0	0	0	0	0	0
Coniferous bog	11.90	11.97	19.50	9.39	12.32	21.62	21.27	22.67	19.66	15.07	17.23	29.47	29.88	17.03	15.14	12.94	10.54	5.31	3.27	0.95
Coniferous swamp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Deep marsh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardwood swamp	2.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Open bog	0	0	0	0	0	0	0.18	9.89	19.57	24.98	19.66	0.24	0	0	0	0	0	0	0	0
Sedge meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sedge meadow or Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shallow marsh	2.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shallow, open water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrub-carr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wet meadow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total acres of wetland	26.18	14.49	19.51	9.47	13.73	24.53	24.99	34.41	41.76	41.65	39.71	32.78	35.22	20.76	15.14	12.94	10.54	5.31	3.27	0.95

Large Table 15 Summary of wetlands within the FTB groundwater flow paths

Eggers and Reed Wetland Community	Hydrology	Wetlands within the FTB Groundwater Flow Paths (acres)		
		Unnamed Creek	Trimble Creek	Mud Lake Creek
Alder thicket	Groundwater	53.36	8.90	0
Alder thicket or Shrub-carr	Groundwater	433.41	227.34	144.85
Ombrotrophic coniferous bog	Precipitation	37.56	196.63	58.14
Coniferous swamp	Groundwater	375.48	308.35	630.61
Deep marsh	Groundwater	130.89	97.59	125.83
Hardwood swamp	Groundwater	126.05	0	40.91
Open bog	Precipitation	157.48	0	0
Sedge meadow	Groundwater	17.13	0	0
Sedge or Wet meadow	Groundwater	17.88	0	0.35
Shallow marsh	Groundwater	196.48	225.79	124.14
Shallow, open water	Groundwater	8.34	0	7.44
Shrub-carr	Groundwater	234.72	0.65	0
Wet meadow	Groundwater	64.24	17.70	0
Total acres of wetland		1853.02	1082.95	1132.27

Large Table 16 Wetlands within the FTB groundwater flow paths

Wetland ID	Eggers and Reed Wetland Community	Dominant Source of Hydrology	Area (acres)
Unnamed Creek			
264	Coniferous swamp	Groundwater	10.86
265	Alder thicket or Shrub-carr	Groundwater	0.42
268	Alder thicket or Shrub-carr	Groundwater	15.44
270	Shallow marsh	Groundwater	85.84
271	Coniferous swamp	Groundwater	18.08
275	Coniferous swamp	Groundwater	30.59
276	Coniferous swamp	Groundwater	8.68
277	Alder thicket or Shrub-carr	Groundwater	14.46
278	Alder thicket	Groundwater	0.81
278A	Alder thicket or Shrub-carr	Groundwater	1.84
279	Alder thicket	Groundwater	1.50
279A	Alder thicket or Shrub-carr	Groundwater	0.33
279B	Alder thicket or Shrub-carr	Groundwater	1.13
280	Sedge meadow	Groundwater	17.13
281	Alder thicket or Shrub-carr	Groundwater	1.46
282	Shallow marsh	Groundwater	6.83
282A	Shallow marsh	Groundwater	6.63
282B	Shallow marsh	Groundwater	12.41
283	Deep marsh	Groundwater	8.89
284	Alder thicket	Groundwater	0.41
284A	Alder thicket or Shrub-carr	Groundwater	2.99
287	Alder thicket or Shrub-carr	Groundwater	5.93
293	Deep marsh	Groundwater	5.74
591	Deep marsh	Groundwater	0.36
591A	Deep marsh	Groundwater	0.15
593	Deep marsh	Groundwater	1.18
593A	Deep marsh	Groundwater	25.73
594	Deep marsh	Groundwater	0.06
594A	Deep marsh	Groundwater	0.75
596	Alder thicket or Shrub-carr	Groundwater	0.24
597	Hardwood swamp	Groundwater	4.45
598	Alder thicket or Shrub-carr	Groundwater	6.31

Wetland ID	Eggers and Reed Wetland Community	Dominant Source of Hydrology	Area (acres)
599	Alder thicket or Shrub-carr	Groundwater	2.79
600	Shallow marsh	Groundwater	8.79
601	Alder thicket or Shrub-carr	Groundwater	1.34
602	Alder thicket or Shrub-carr	Groundwater	0.60
624	Alder thicket or Shrub-carr	Groundwater	4.84
625	Coniferous swamp	Groundwater	3.70
626	Coniferous swamp	Groundwater	200.75
627	Alder thicket or Shrub-carr	Groundwater	187.10
628	Deep marsh	Groundwater	10.53
629	Alder thicket or Shrub-carr	Groundwater	10.66
630	Coniferous bog	Precipitation	8.05
631	Coniferous swamp	Groundwater	10.05
632	Alder thicket or Shrub-carr	Groundwater	11.13
633	Alder thicket or Shrub-carr	Groundwater	1.07
634	Alder thicket or Shrub-carr	Groundwater	0.51
635	Alder thicket or Shrub-carr	Groundwater	1.76
636	Coniferous bog	Precipitation	2.26
641	Coniferous swamp	Groundwater	16.16
642	Shallow, open water	Groundwater	8.34
644	Coniferous swamp	Groundwater	11.73
645	Shallow marsh	Groundwater	1.04
646	Alder thicket or Shrub-carr	Groundwater	16.76
647	Alder thicket or Shrub-carr	Groundwater	6.55
648	Alder thicket	Groundwater	11.51
649	Sedge meadow or Wet meadow	Groundwater	10.01
650	Sedge meadow or Wet meadow	Groundwater	7.87
656	Alder thicket or Shrub-carr	Groundwater	1.94
786	Open bog	Precipitation	157.48
787	Alder thicket or Shrub-carr	Groundwater	16.23
788	Hardwood swamp	Groundwater	98.13
816	Deep marsh	Groundwater	15.46
817	Deep marsh	Groundwater	10.03
818	Deep marsh	Groundwater	7.13
819	Deep marsh	Groundwater	0.97
820	Deep marsh	Groundwater	26.92

Wetland ID	Eggers and Reed Wetland Community	Dominant Source of Hydrology	Area (acres)
821	Shallow marsh	Groundwater	9.19
822	Shallow marsh	Groundwater	4.46
823	Shallow marsh	Groundwater	6.22
824	Shallow marsh	Groundwater	5.74
825	Wet meadow	Groundwater	0.07
826	Wet meadow	Groundwater	8.93
827	Wet meadow	Groundwater	2.84
828	Wet meadow	Groundwater	4.25
829	Wet meadow	Groundwater	3.50
830	Shallow marsh	Groundwater	4.88
831	Wet meadow	Groundwater	13.66
832	Wet meadow	Groundwater	9.38
833	Shallow marsh	Groundwater	15.14
834	Wet meadow	Groundwater	8.26
835	Wet meadow	Groundwater	12.66
836	Shrub-carr	Groundwater	11.50
837	Shrub-carr	Groundwater	13.50
838	Shrub-carr	Groundwater	19.00
839	Shrub-carr	Groundwater	13.07
840	Shrub-carr	Groundwater	31.30
841	Shrub-carr	Groundwater	9.24
842	Shrub-carr	Groundwater	8.30
843	Shrub-carr	Groundwater	12.56
844	Shrub-carr	Groundwater	28.54
845	Coniferous swamp	Groundwater	12.64
846	Shrub-carr	Groundwater	7.63
847	Shallow marsh	Groundwater	17.87
848	Shrub-carr	Groundwater	16.03
849	Shrub-carr	Groundwater	10.88
850	Shrub-carr	Groundwater	29.75
851	Shrub-carr	Groundwater	19.74
852	Shrub-carr	Groundwater	3.68
876	Alder thicket	Groundwater	39.13
877	Alder thicket or Shrub-carr	Groundwater	12.65
878	Alder thicket or Shrub-carr	Groundwater	35.55

Wetland ID	Eggers and Reed Wetland Community	Dominant Source of Hydrology	Area (acres)
917	Coniferous bog	Precipitation	19.88
918	Coniferous swamp	Groundwater	9.44
921	Alder thicket or Shrub-carr	Groundwater	0.38
923	Wet meadow	Groundwater	0.69
942	Deep marsh	Groundwater	2.96
943	Deep marsh	Groundwater	14.03
944	Hardwood swamp	Groundwater	2.61
945	Alder thicket or Shrub-carr	Groundwater	2.32
950	Alder thicket or Shrub-carr	Groundwater	3.13
978	Hardwood swamp	Groundwater	2.80
980	Alder thicket or Shrub-carr	Groundwater	2.82
996	Alder thicket or Shrub-carr	Groundwater	4.10
1025	Hardwood swamp	Groundwater	1.55
1070	Alder thicket or Shrub-carr	Groundwater	3.80
1071	Alder thicket or Shrub-carr	Groundwater	29.18
1072	Alder thicket or Shrub-carr	Groundwater	8.62
1073	Alder thicket or Shrub-carr	Groundwater	3.57
1129	Coniferous swamp	Groundwater	9.79
1147	Alder thicket or Shrub-carr	Groundwater	13.46
1156	Shallow marsh	Groundwater	4.08
NA	Hardwood swamp	Groundwater	16.51
NA	Coniferous swamp	Groundwater	30.02
NA	Shallow marsh	Groundwater	7.36
NA	Coniferous swamp	Groundwater	2.99
NA	Coniferous bog	Precipitation	6.23
NA	Coniferous bog	Precipitation	1.14
Trimble Creek			
252	Coniferous swamp	Groundwater	45.74
253	Deep marsh	Groundwater	5.89
254	Shallow marsh	Groundwater	36.71
256	Alder thicket or Shrub-carr	Groundwater	21.23
259	Alder thicket or Shrub-carr	Groundwater	0.34
260	Shallow marsh	Groundwater	114.62
261	Alder thicket or Shrub-carr	Groundwater	0.84
262	Shallow marsh	Groundwater	1.86

Wetland ID	Eggers and Reed Wetland Community	Dominant Source of Hydrology	Area (acres)
267	Alder thicket or Shrub-carr	Groundwater	1.09
312	Shrub-carr	Groundwater	0.65
476	Alder thicket or Shrub-carr	Groundwater	0.82
529	Wet meadow	Groundwater	0.30
549	Alder thicket or Shrub-carr	Groundwater	1.89
578	Deep marsh	Groundwater	0.69
579	Deep marsh	Groundwater	2.14
580	Alder thicket or Shrub-carr	Groundwater	1.72
581	Coniferous swamp	Groundwater	20.62
582	Deep marsh	Groundwater	18.39
582A	Deep marsh	Groundwater	19.84
584	Alder thicket or Shrub-carr	Groundwater	53.00
585	Alder thicket	Groundwater	1.58
585A	Alder thicket or Shrub-carr	Groundwater	2.78
586	Deep marsh	Groundwater	0.36
587	Shallow marsh	Groundwater	0.81
588	Alder thicket or Shrub-carr	Groundwater	18.22
589	Deep marsh	Groundwater	40.05
590	Shallow marsh	Groundwater	0.05
591	Deep marsh	Groundwater	1.65
591A	Deep marsh	Groundwater	2.60
609	Coniferous swamp	Groundwater	0.33
610	Shallow marsh	Groundwater	0.09
611	Coniferous bog	Precipitation	0.23
612	Coniferous bog	Precipitation	2.19
613	Alder thicket or Shrub-carr	Groundwater	1.59
614	Shallow marsh	Groundwater	1.23
615	Shallow marsh	Groundwater	0.44
616	Deep marsh	Groundwater	5.98
617	Shallow marsh	Groundwater	2.08
618	Alder thicket	Groundwater	1.46
619	Alder thicket or Shrub-carr	Groundwater	0.88
620	Shallow marsh	Groundwater	0.28
621	Alder thicket or Shrub-carr	Groundwater	0.52
622	Alder thicket or Shrub-carr	Groundwater	0.37

Wetland ID	Eggers and Reed Wetland Community	Dominant Source of Hydrology	Area (acres)
623	Alder thicket or Shrub-carr	Groundwater	0.89
643	Alder thicket or Shrub-carr	Groundwater	1.59
670	Coniferous swamp	Groundwater	29.76
672	Coniferous swamp	Groundwater	9.05
673	Coniferous swamp	Groundwater	110.07
810	Alder thicket or Shrub-carr	Groundwater	11.40
869	Alder thicket or Shrub-carr	Groundwater	16.50
870	Coniferous bog	Precipitation	8.60
915	Alder thicket	Groundwater	5.48
946	Alder thicket or Shrub-carr	Groundwater	0.12
947	Alder thicket or Shrub-carr	Groundwater	0.76
951	Coniferous bog	Precipitation	116.45
954	Coniferous swamp	Groundwater	39.29
956	Wet meadow	Groundwater	17.40
957	Coniferous swamp	Groundwater	6.88
958	Alder thicket or Shrub-carr	Groundwater	3.58
974	Coniferous bog	Precipitation	69.16
975	Coniferous swamp	Groundwater	26.33
979	Alder thicket or Shrub-carr	Groundwater	5.75
981	Alder thicket	Groundwater	0.38
990	Alder thicket or Shrub-carr	Groundwater	42.22
991	Coniferous swamp	Groundwater	55.70
995	Coniferous swamp	Groundwater	3.82
1139	Shallow marsh	Groundwater	17.70
1139A	Shallow marsh	Groundwater	5.31
1139B	Shallow marsh	Groundwater	44.61
Mud Lake Creek			
260	Shallow marsh	Groundwater	34.98
285	Coniferous swamp	Groundwater	243.19
286	Shallow, open water	Groundwater	7.44
288	Deep marsh	Groundwater	4.51
290	Coniferous swamp	Groundwater	0.25
292	Deep marsh	Groundwater	0.41
292A	Deep marsh	Groundwater	0.07
308	Deep marsh	Groundwater	5.22

Wetland ID	Eggers and Reed Wetland Community	Dominant Source of Hydrology	Area (acres)
308A	Deep marsh	Groundwater	75.57
314	Shallow marsh	Groundwater	19.17
314A	Shallow marsh	Groundwater	20.92
572	Deep marsh	Groundwater	7.34
573	Shallow marsh	Groundwater	0.12
573A	Shallow marsh	Groundwater	11.33
574	Deep marsh	Groundwater	6.59
575	Alder thicket or Shrub-carr	Groundwater	0.49
576	Sedge meadow or Wet meadow	Groundwater	0.35
577	Alder thicket or Shrub-carr	Groundwater	2.26
578	Deep marsh	Groundwater	16.81
582	Deep marsh	Groundwater	0.99
582A	Deep marsh	Groundwater	0.90
652	Coniferous swamp	Groundwater	109.44
669	Shallow marsh	Groundwater	21.39
810	Alder thicket or Shrub-carr	Groundwater	0.35
866	Hardwood swamp	Groundwater	31.04
867	Alder thicket or Shrub-carr	Groundwater	64.89
868	Hardwood swamp	Groundwater	9.87
870	Coniferous bog	Precipitation	58.14
908	Shallow marsh	Groundwater	8.70
947	Alder thicket or Shrub-carr	Groundwater	19.62
963	Alder thicket or Shrub-carr	Groundwater	26.88
964	Coniferous swamp	Groundwater	42.88
965	Coniferous swamp	Groundwater	11.22
966	Alder thicket or Shrub-carr	Groundwater	8.15
968	Coniferous swamp	Groundwater	3.49
986	Alder thicket or Shrub-carr	Groundwater	22.21
1130	Coniferous swamp	Groundwater	32.29
1133	Coniferous swamp	Groundwater	70.54
1134	Shallow marsh	Groundwater	5.71
1134A	Shallow marsh	Groundwater	1.82
1135	Deep marsh	Groundwater	0.51
1135A	Deep marsh	Groundwater	6.91
1151	Coniferous swamp	Groundwater	117.31

Large Table 17 **Summary of wetlands abutting the railroad corridor - Mine Site to Plant Site**

Wetland ID	Eggers and Reed Wetland Community	Wetland Size (acres)
9	Shallow marsh	1.80
13	Deep marsh	5.03
16	Shallow marsh	0.31
53	Alder thicket	18.59
53B	Coniferous swamp	0.43
53C	Coniferous swamp	2.88
53D	Alder thicket	241.16
81	Coniferous swamp	1.68
390A	Alder thicket or Shrub-carr	13.54
391	Coniferous swamp	22.32
556	Alder thicket or Shrub-carr	1.84
565	Alder thicket or Shrub-carr	1.92
568	Deep marsh	0.42
570	Alder thicket or Shrub-carr	31.69
571	Coniferous swamp	44.05
583	Alder thicket or Shrub-carr	0.13
595	Deep marsh	1.06
716A	Alder thicket	1.04
903	Shallow marsh	9.71
1037	Shallow, open water	6.59
1038A	Coniferous swamp	1.68
1041	Alder thicket or Shrub-carr	81.52
1042	Sedge meadow or Wet meadow	0.69
1119	Coniferous swamp	7.93
1137	Alder thicket or Shrub-carr	8.92
1160	Shallow, open water	0.85
R-1	Alder thicket or Shrub-carr	1.05
R-2	Alder thicket or Shrub-carr	1.65
R-3A	Alder thicket or Shrub-carr	0.53
R-4A	Alder thicket	3.31
R-5A	Shallow marsh	16.30
R-7A	Shallow marsh	12.05
Total acres of wetland		542.67

Large Table 18 **Total Wetland Area (Acres) for Pre-settlement, Existing, and Future Conditions**

Watershed	Total Land Area (acres)	Pre-settlement Conditions		Existing Conditions		Foreseeable Future Conditions without the Project (No Action Alternative)		Foreseeable Future Conditions without the Project (No Action Alternative)	
		Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed
Partridge River	101,812	33,601	33.0%	31,318	30.8%	30,937	30.4%	31,044	30.5%
Embarrass River	116,797	34,650	29.7%	34,249	29.3%	34,074	29.2%	34,248	29.3%

Large Table 19 **Total Lake Area (Acres) for Pre-settlement, Existing, and Future Conditions**

Watershed	Total Land Area (acres)	Pre-settlement Conditions		Existing Conditions		Foreseeable Future Conditions without the Project (No Action Alternative)		Foreseeable Future Conditions without the Project (No Action Alternative)	
		Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed
Partridge River	101,812	2,688	2.6%	3,194	3.1%	3,194	3.1%	3,194	3.1%
Embarrass River	116,797	3,121	2.7%	2,904	2.5%	2,904	2.5%	2,904	2.5%

Large Table 20 **Total Deepwater Habitat Area (Acres) for Pre-settlement, Existing, and Future Conditions**

Watershed	Total Land Area (acres)	Pre-settlement Conditions		Existing Conditions		Foreseeable Future Conditions without the Project (No Action Alternative)		Foreseeable Future Conditions without the Project (No Action Alternative)	
		Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed	Area (acres)	% of Watershed
Partridge River	101,812	0	0.0%	3,146	3.1%	3,516	3.5%	3,195	3.1%
Embarrass River	116,797	0	0.0%	977	0.8%	977	0.8%	977	0.8%

Large Table 21 Summary of Future Known Changes in Wetland Resources for the Study Area(1)

Watershed	Total Land Area (acres)	Pre-settlement Conditions (acres)	Existing Conditions (acres)	% Change from Pre-settlement to Existing Conditions	Forseeable Future Conditions with the Project (acres)	% Change from Pre-settlement to Future Conditions with the Project	% Change from Existing to Future Conditions with the Project	Forseeable Future Conditions with the No Action Alternative (acres)	% Change from Pre-settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
Partridge River	101,812	33,601	31,318	-6.8%	30,937	-7.9%	-1.2%	31,044	-7.6%	-0.9%
Embarrass River	116,797	34,650	34,249	-1.2%	34,074	-1.7%	-0.5%	34,248	-1.2%	-0.003%

(1) The (-) represents a loss of wetland acres and the (+) represents a gain of wetland acres.

Large Table 22 Summary of Future Known Changes in Lake Resources for the Study Area(1)

Watershed	Total Land Area (acres)	Pre-settlement Conditions (acres)	Existing Conditions (acres)	% Change from Pre-settlement to Existing Conditions	Forseeable Future Conditions with the Project (acres)	% Change from Pre-settlement to Future Conditions with the Project	% Change from Existing to Future Conditions with the Project	Forseeable Future Conditions with the No Action Alternative (acres)	% Change from Pre-settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
Partridge River	101,812	2,688	3,194	18.8%	3,194	18.8%	0.0%	3,194	18.8%	0%
Embarrass River	116,797	3,121	2,904	-7.0%	2,904	-7.0%	0.0%	2,904	-7.0%	0%

(1) The (-) represents a loss of lake acres and the (+) represents a gain of lake acres.

Large Table 23 Summary of Future Known Changes in Deepwater Habitat Resources for the Study Area

Watershed	Total Land Area (acres)	Pre-settlement Conditions (acres)	Existing Conditions (acres)	% Change from Pre-settlement to Existing Conditions	Forseeable Future Conditions with the Project (acres)	% Change from Pre-settlement to Future Conditions with the Project	% Change from Existing to Future Conditions with the Project	Forseeable Future Conditions with the No Action Alternative (acres)	% Change from Pre-settlement to Future Conditions with the No Action Alternative	% Change from Existing to Future Conditions with the No Action Alternative
Partridge River	101,812	0	3,146	100%	3,516	100%	11.8%	3,195	100%	1.6%
Embarrass River	116,797	0	977	100%	977	100%	0%	977	100%	0%

(1) The (-) represents a loss of deepwater acres and the (+) represents a gain of deepwater acres.

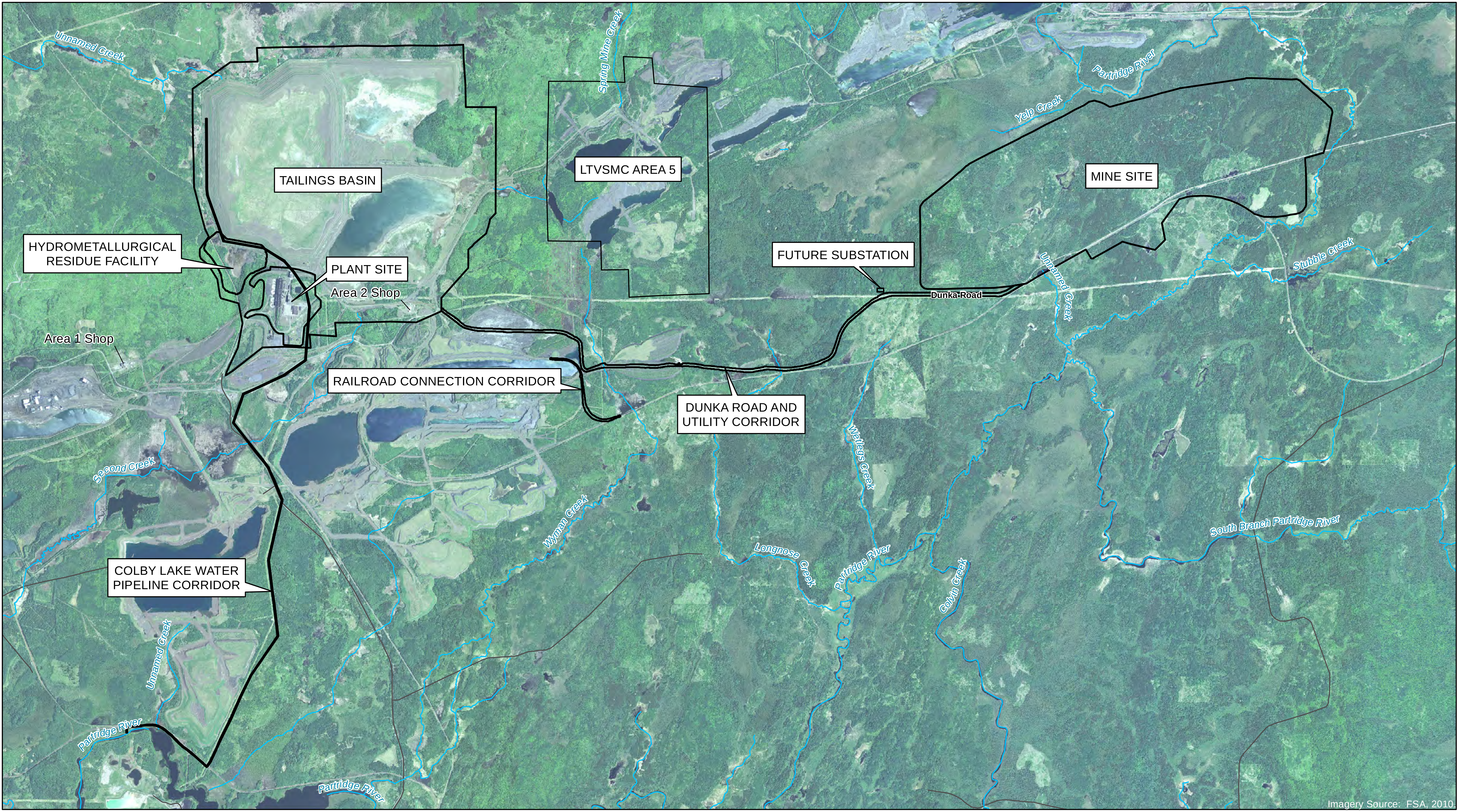
Large Table 24 Comparison of Future Conditions for Wetland and Deepwater Habitat Resources(1)

Project Name	Watershed	Wetland Impact (acres)	Proposed Wetland Mitigation (acres)	Net Change in Wetlands (acres)	Existing Deepwater Habitat (acres)	Future Deepwater Habitat (acres)	Net Change in Deepwater (acres)
PolyMet Mining Company	Partridge River	-767.6	661.0	-106.6	0	321.0	321.0
Mesabi Nugget Phase II	Partridge River	-266.8	0	-266.8	1552.0	1601.0	49.0
Laskin Energy Park - worst case scenario	Partridge River	-6.8	0	-6.8	0	0	0
St. Louis County Public Works Bridge Replacement	Partridge River	-0.9	0	-0.9	0	0	0
Total - Partridge River Watershed with Project		**-1042.1**	**-1042.1**	**661.0**	**-381.1**	**1552.0**	**1922.0**
Total - Partridge River Watershed without Project		**-275.4**	**-274.5**	**0**	**-274.5**	**1552.0**	**1601.0**
PolyMet Mining Company	Embarrass River	-144.85	0	-144.9	0	0	0
PolyMet Mining Company	Embarrass River	-28.59	NA(2)	-28.6	0	0	0
St. Louis County Public Works Bridge Replacement	Embarrass River	-0.9	0	-0.9	0	0	0
Total - Embarrass River Watershed with Project		**-145.8**	**-174.3**	**0**	**-174.3**	**0**	**0**
Total - Embarrass River Watershed without Project		**-0.9**	**-0.9**	**0**	**-0.9**	**0**	**0**

(1) The (-) represents a loss of water resources acres and the (+) represents a gain of water resources acres.

(2) These wetlands as exempt because the wetlands are located within the Cliffs Erie LLC (formerly LTVSMC) Permit To Mine Ultimate Tailings Basin Limit boundary and are not regulated by state and federal wetland regulations (see Section 5.1).

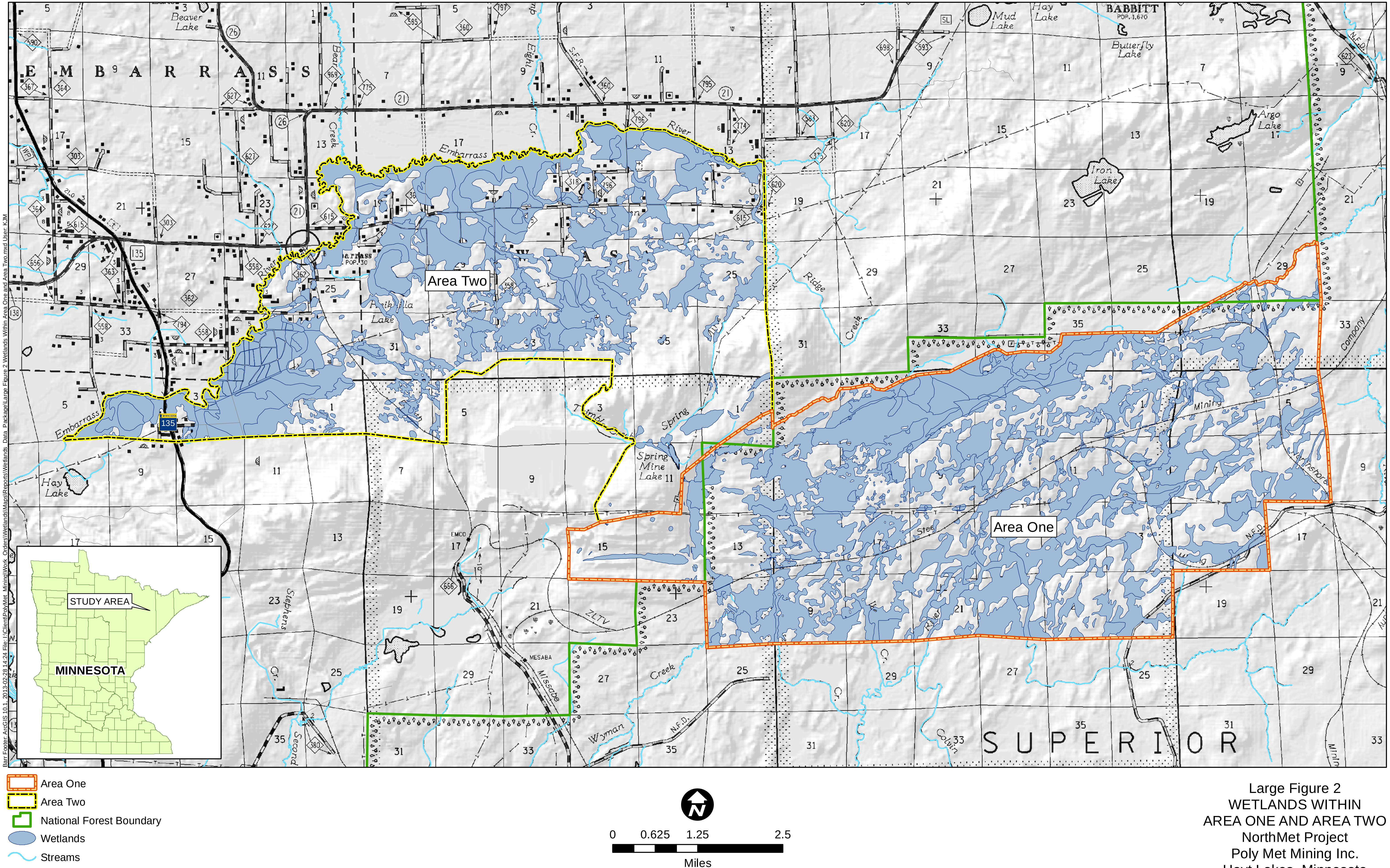
Large Figures



▭ Project Areas

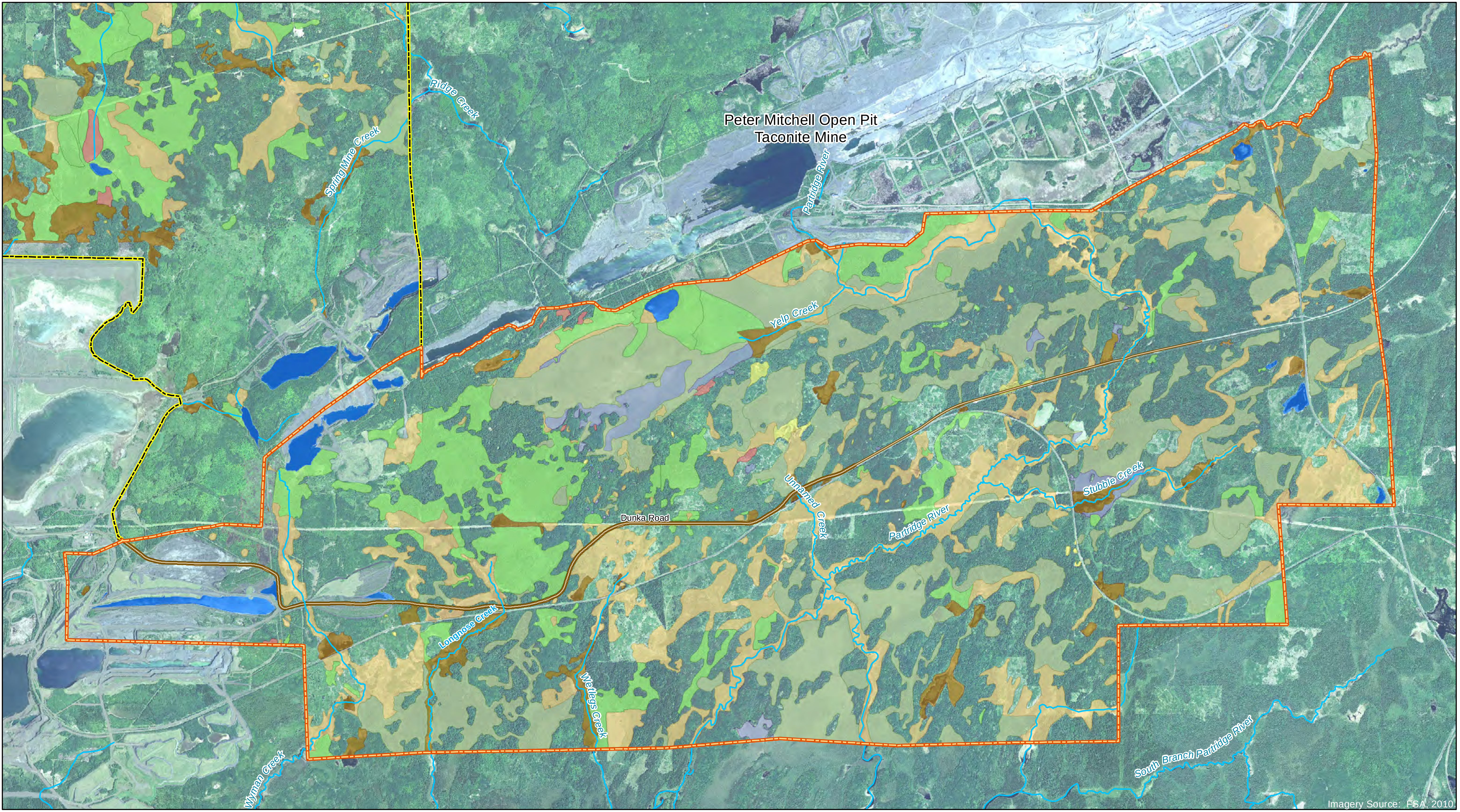
〜 Rivers & Streams

Large Figure 1
PROJECT AREAS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



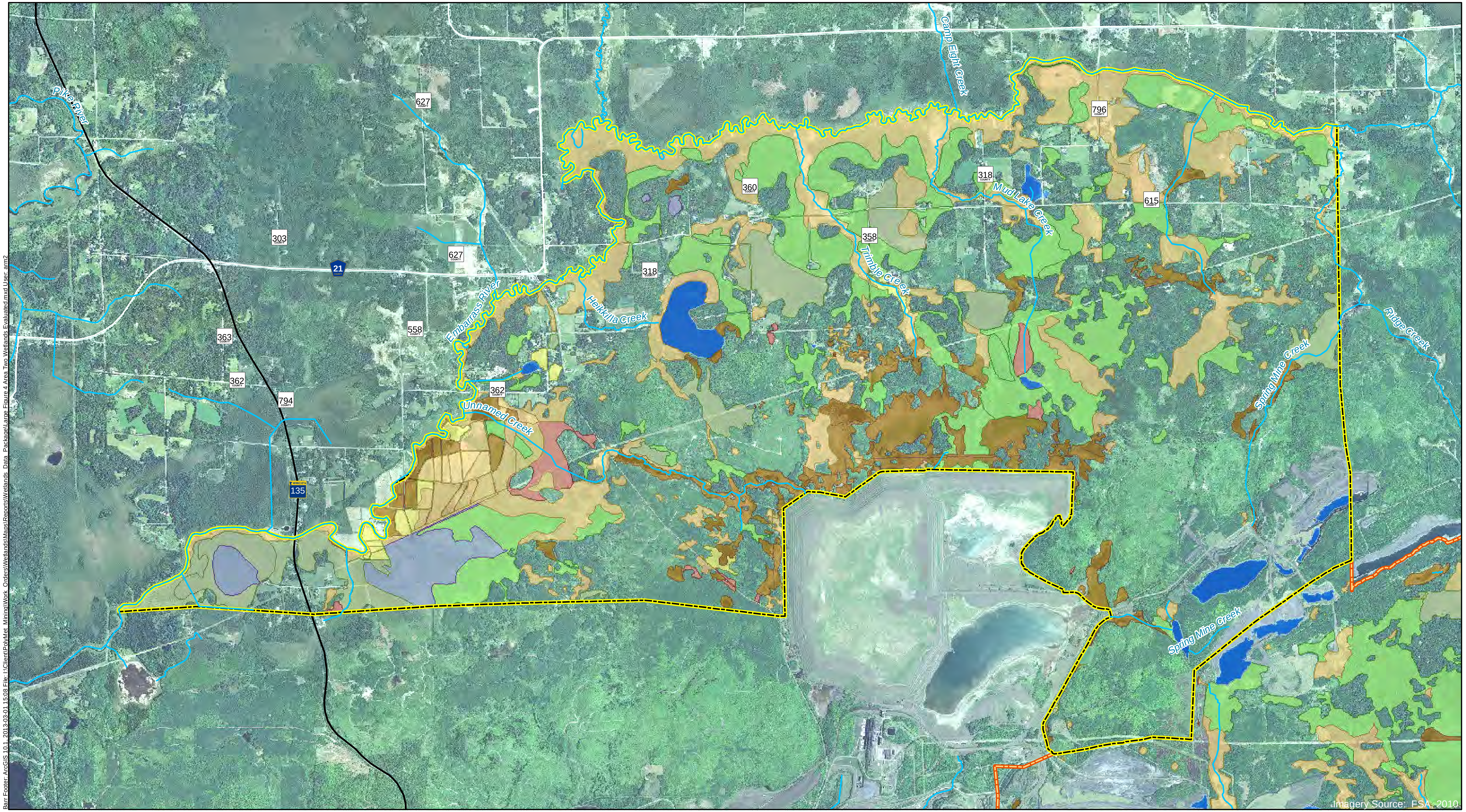
- 🟧 Area One
- 🟨 Area Two
- 🟩 National Forest Boundary
- ● Wetlands
- ~ Streams

Large Figure 2
WETLANDS WITHIN
AREA ONE AND AREA TWO
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 3
AREA ONE -
WETLANDS EVALUATED
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Barr Footer: ArcGIS 10.1, 2013-02-28 14:25 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure 3 Area One Wetlands Evaluated.mxd User: KJM



▭ Area Two
▭ Area One
〰 Rivers & Streams

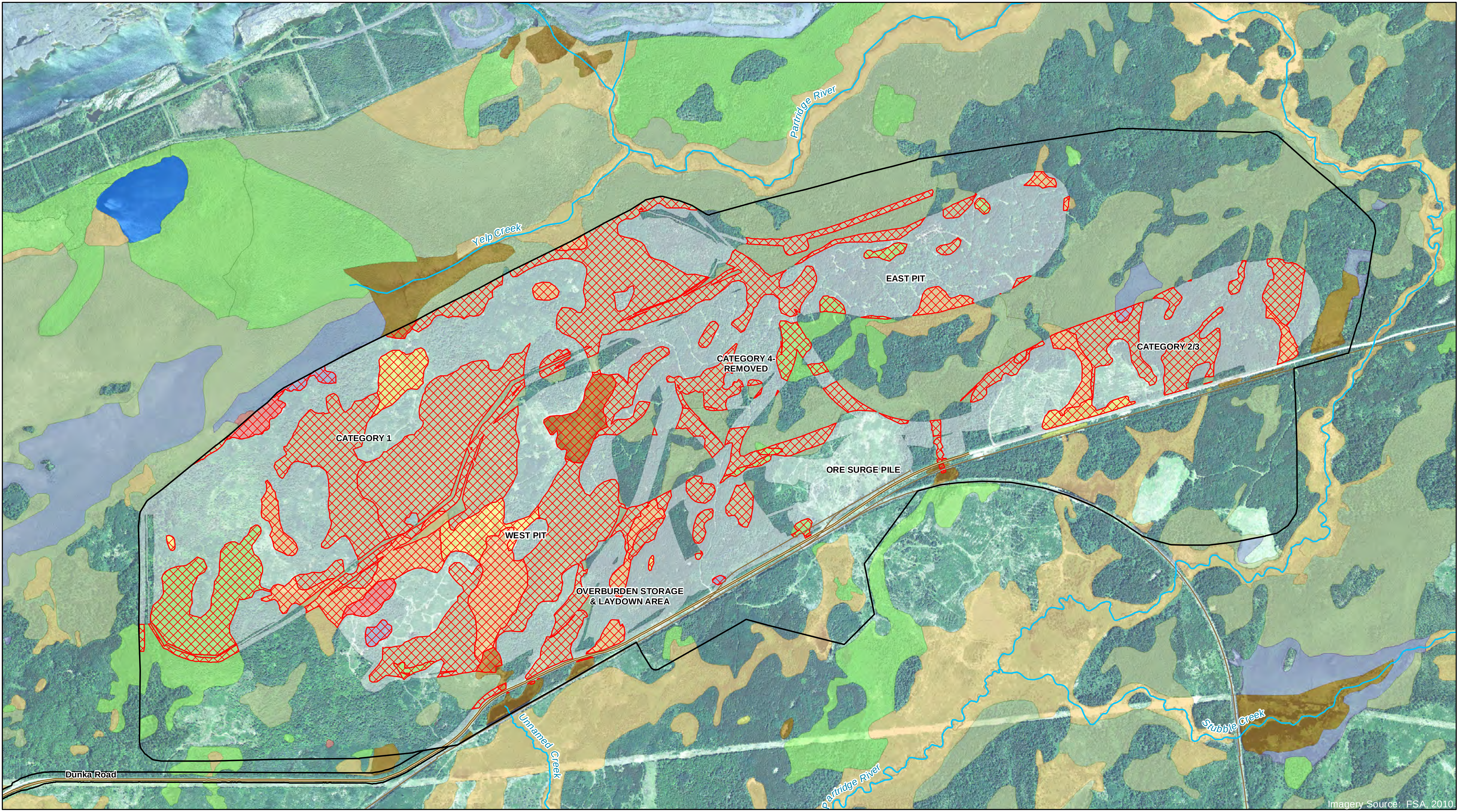
Eggers & Reed Wetland Types

🟧 Shrub Swamps (Alder thickets & Shrub-carrs)
🟩 Coniferous bog
🟩 Coniferous swamp
🟫 Deep marsh; Shallow marsh
🟥 Hardwood swamp
🟦 Open water (Shallow, open water & lakes)
🟪 Open bog
🟨 Sedge meadow; Wet meadow

N

0 2,000 4,000 8,000
Feet

Large Figure 4
AREA TWO -
WETLANDS EVALUATED
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



▭ Mine Site

═ Dunka Road

☐ Areas Disturbed by
Proposed Project Features

▨ Direct Wetland Impacts

Eggers & Reed Wetland Types

● Shrub Swamps (Alder thickets & Shrub-carrs)

● Coniferous bog

● Coniferous swamp

● Deep marsh; Shallow marsh

● Hardwood swamp

● Open water (Shallow, open water & lakes)

● Open bog

● Sedge meadow; Wet meadow

Large Figure 5
MINE SITE AREA WETLANDS AND DIRECT WETLAND IMPACTS

NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Barr Footer: ArcGIS 10.1, 2013-02-28 14:30 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure 5 Mine Site Area Wetlands and Direct Wetland Impacts.mxd User: KJM

Imagery Source: FSA, 2010.

- ▭ Railroad Connection Corridor
- ─┼─ Proposed Track
- ─┼─ Existing Railroad
- ═ Dunka Road
- ▭ Areas Disturbed by Proposed Project Features
- ▨ Direct Wetland Impacts

Eggers & Reed Wetland Types

- ● Shrub Swamps (Alder thickets & Shrub-carrs)
- ● Coniferous bog
- ● Coniferous swamp
- ● Deep marsh; Shallow marsh
- ● Hardwood swamp
- ● Open water (Shallow, open water & lakes)
- ● Open bog
- ● Sedge meadow; Wet meadow

N

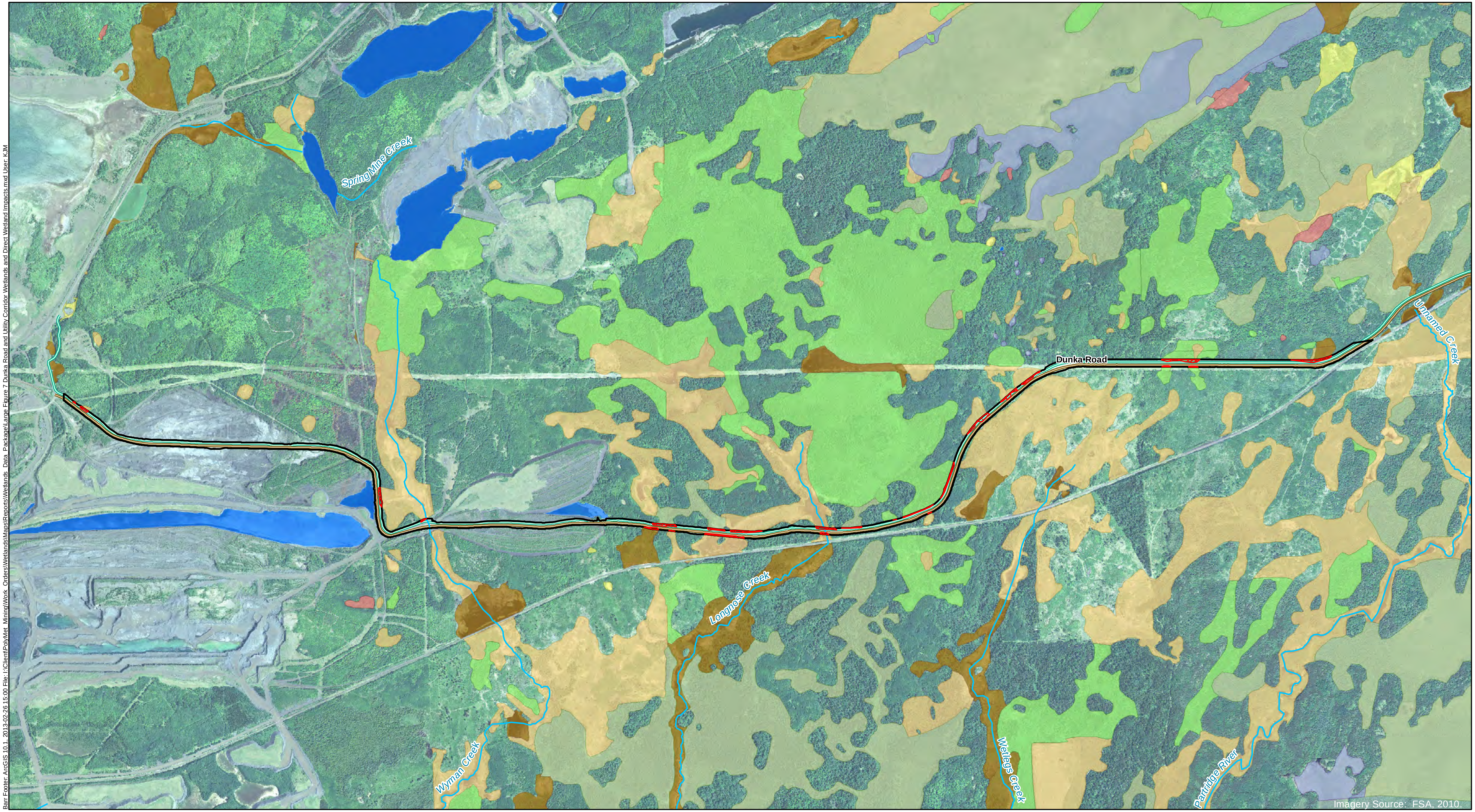
0 250 500 1,000

Feet

Large Figure 6

RAILROAD CONNECTION CORRIDOR WETLANDS AND DIRECT WETLAND IMPACTS

NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- ▭ Dunka Road and Utility Corridor
- ═ Dunka Road
- ═ Treated Water Pipeline
- ☐ Areas Disturbed by Proposed Project Features
- ▨ Direct Wetland Impacts

Eggers & Reed Wetland Types

- ● Shrub Swamps (Alder thickets & Shrub-carrs)
- ● Coniferous bog
- ● Coniferous swamp
- ● Deep marsh; Shallow marsh
- ● Hardwood swamp
- ● Open water (Shallow, open water & lakes)
- ● Open bog
- ● Sedge meadow; Wet meadow

N

0 1,000 2,000 4,000

Feet

Large Figure 7

DUNKA ROAD AND UTILITY CORRIDOR WETLANDS AND DIRECT WETLAND IMPACTS

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota

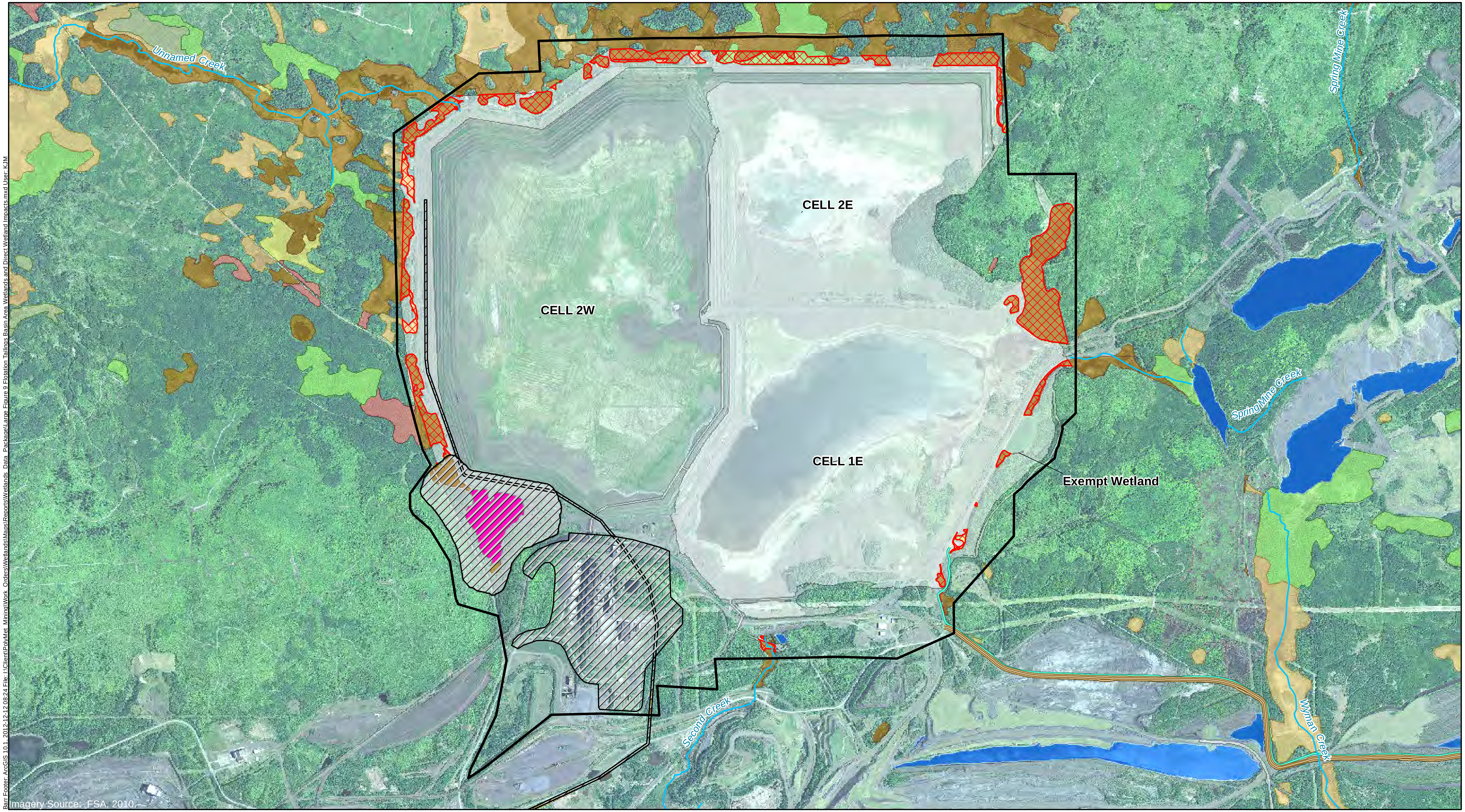
▭ Plant Site
〜 Rivers & Streams

Eggers & Reed Wetland Types
- ● Shrub Swamps (Alder thickets & Shrub-carrs)
- ● Coniferous bog
- ● Coniferous swamp
- ● Deep marsh; Shallow marsh
- ● Hardwood swamp
- ● Open water (Shallow, open water & lakes)
- ● Open bog
- ● Sedge meadow; Wet meadow

N

0 250 500 1,000
Feet

Large Figure 8
PLANT SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- ☐ Tailings Basin
- ▨ Areas Excluded from Tailings Basin Boundary
- ― Dunka Road
- ― Treated Water Pipeline
- ☐ Areas Disturbed by Proposed Project Features
- ▨ Direct Wetland Impacts
- ● Exempt Wetlands

Eggers & Reed Wetland Types

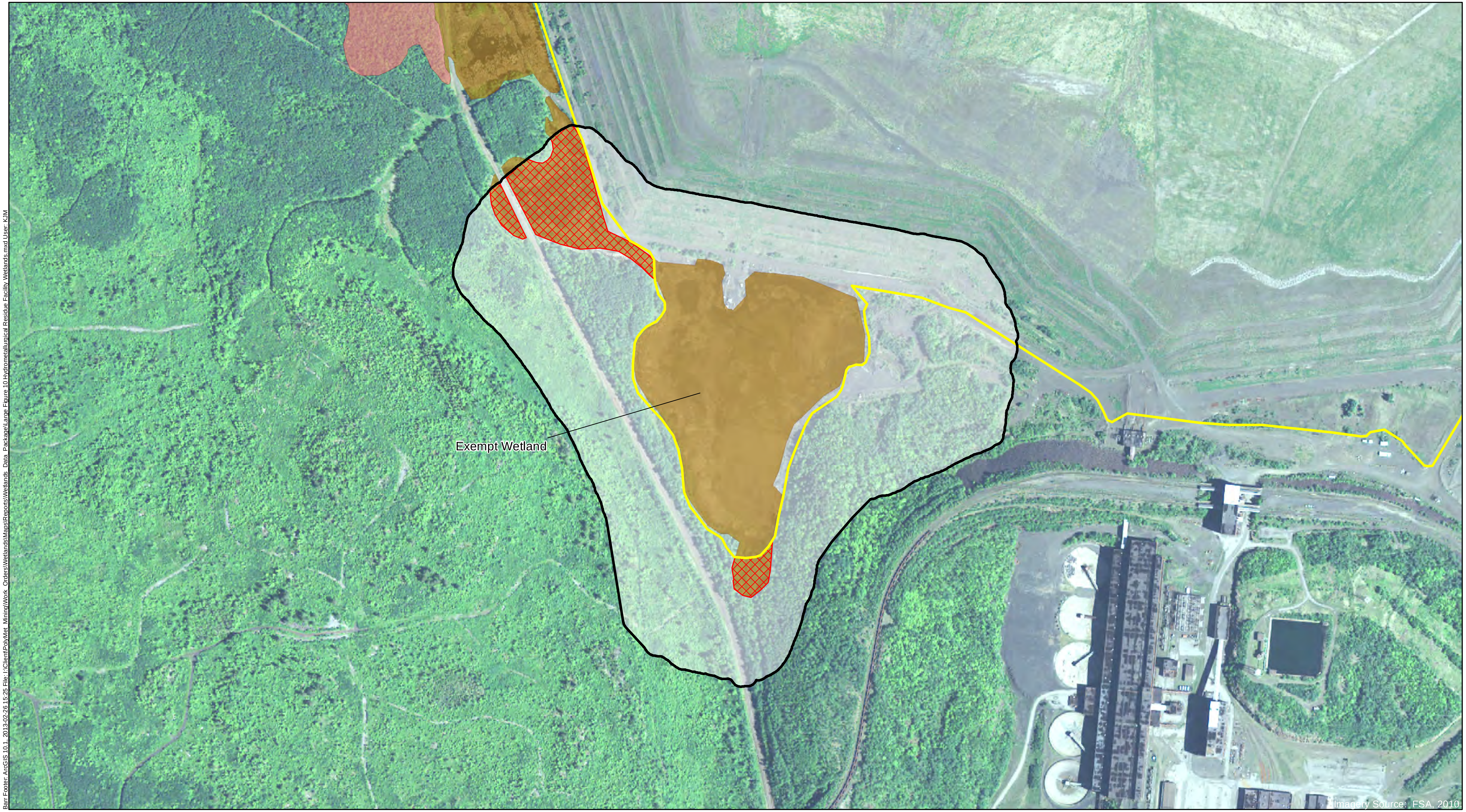
- ● Shrub Swamps (Alder thickets & Shrub-carrs)
- ● Coniferous bog
- ● Coniferous swamp
- ● Deep marsh; Shallow marsh
- ● Hardwood swamp
- ● Open water (Shallow, open water & lakes)
- ● Open bog
- ● Sedge meadow; Wet meadow

N

0 1,000 2,000 4,000

Feet

Large Figure 9
FLOTATION TAILINGS BASIN AREA WETLANDS AND DIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- ⬜ Hydrometallurgical Residue Facility
- 🟨 Cliffs Erie, LLC Permit to Mine Ultimate Tailings Basin Limit
- ⬜ Areas Disturbed by Proposed Project Features
- ▨ Direct Wetland Impacts

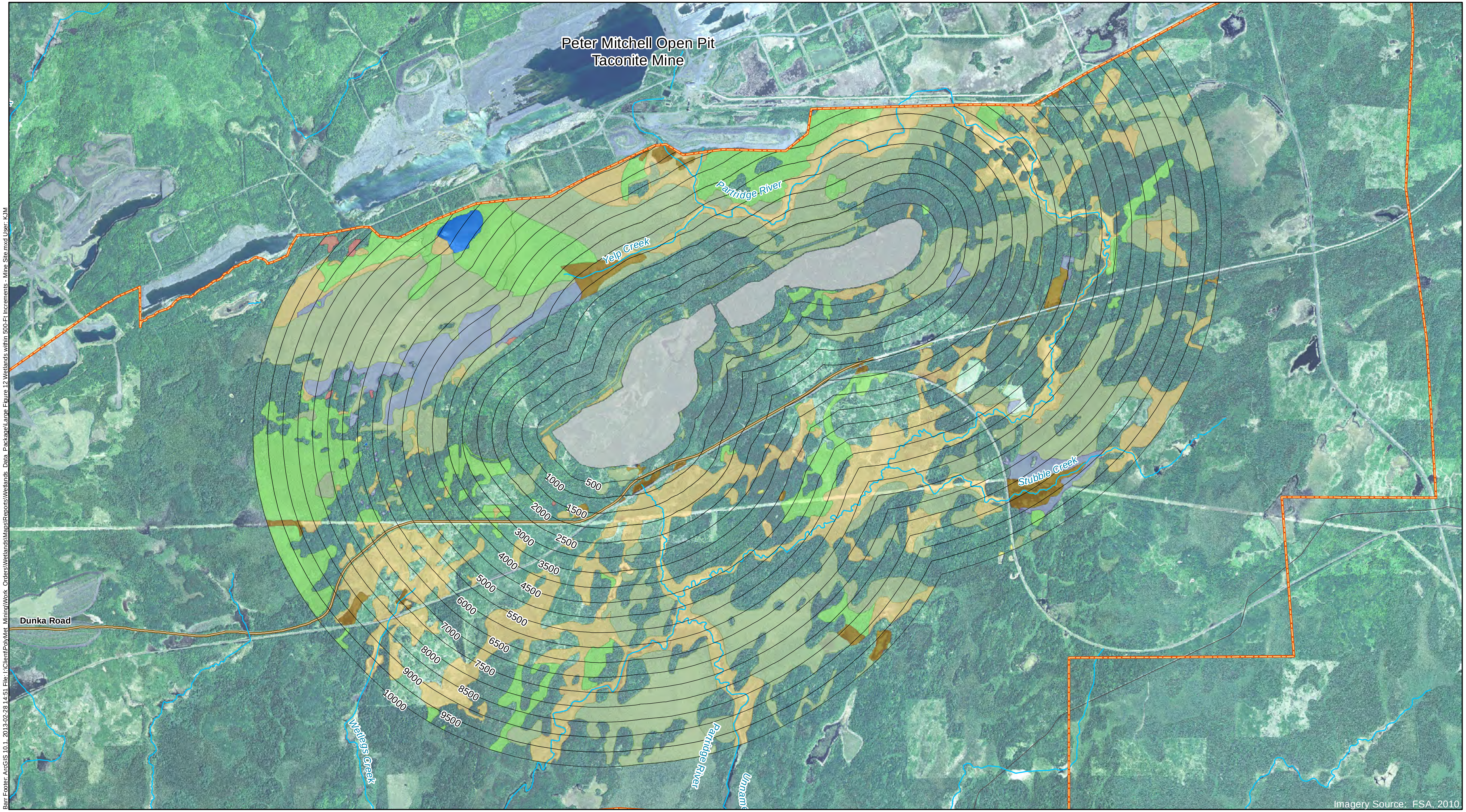
Eggers & Reed Wetland Types

- ● Shrub Swamps (Alder thickets & Shrub-carrs)
- ● Coniferous bog
- ● Coniferous swamp
- ● Deep marsh; Shallow marsh
- ● Hardwood swamp
- ● Open water (Shallow, open water & lakes)
- ● Open bog
- ● Sedge meadow; Wet meadow

0 250 500 1,000
Feet

Large Figure 10
HYDROMETALLURGICAL RESIDUE FACILITY
WETLANDS AND DIRECT WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Large Figure 11
COLBY LAKE WATER PIPELINE
CORRIDOR WETLANDS
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, MInnesota



◯ 500-Ft Increments

Baseline Type Evaluation Study Areas

▭ Area One

Eggers & Reed Wetland Types

● Shrub Swamps (Alder thickets & Shrub-carrs)

● Coniferous bog

● Coniferous swamp

● Deep marsh; Shallow marsh

● Hardwood swamp

● Open water (Shallow, open water & lakes)

● Open bog

● Sedge meadow; Wet meadow

— Dunka Road

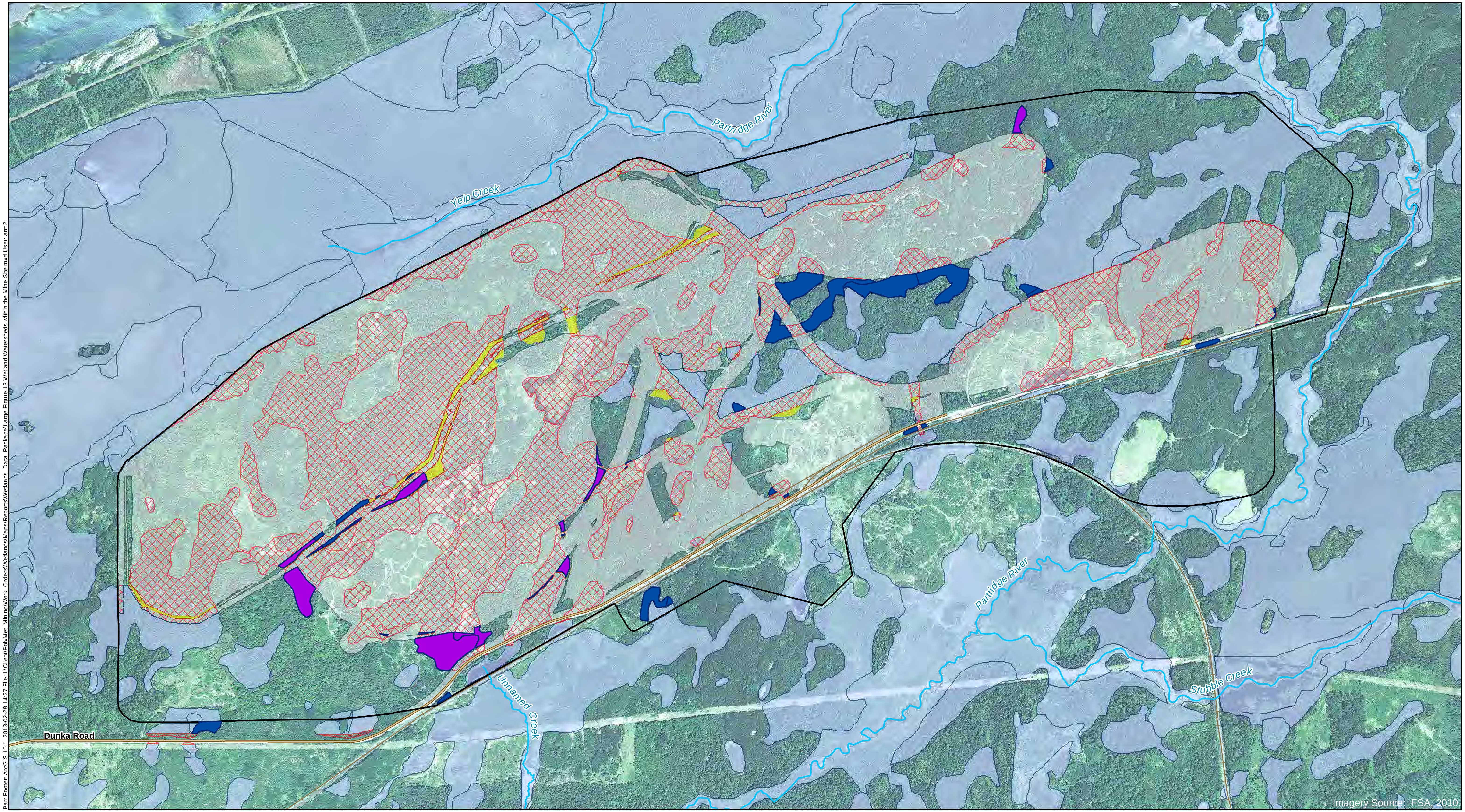
~ Rivers & Streams

N

0 2,000 4,000 8,000

Feet

Large Figure 12
WETLANDS WITHIN 500-FT
INCREMENTS - MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



▭ Mine Site

▭ Areas Disturbed by Proposed Project Features

═ Dunka Road

▨ Direct Wetland Impact

● Fragmented Wetland

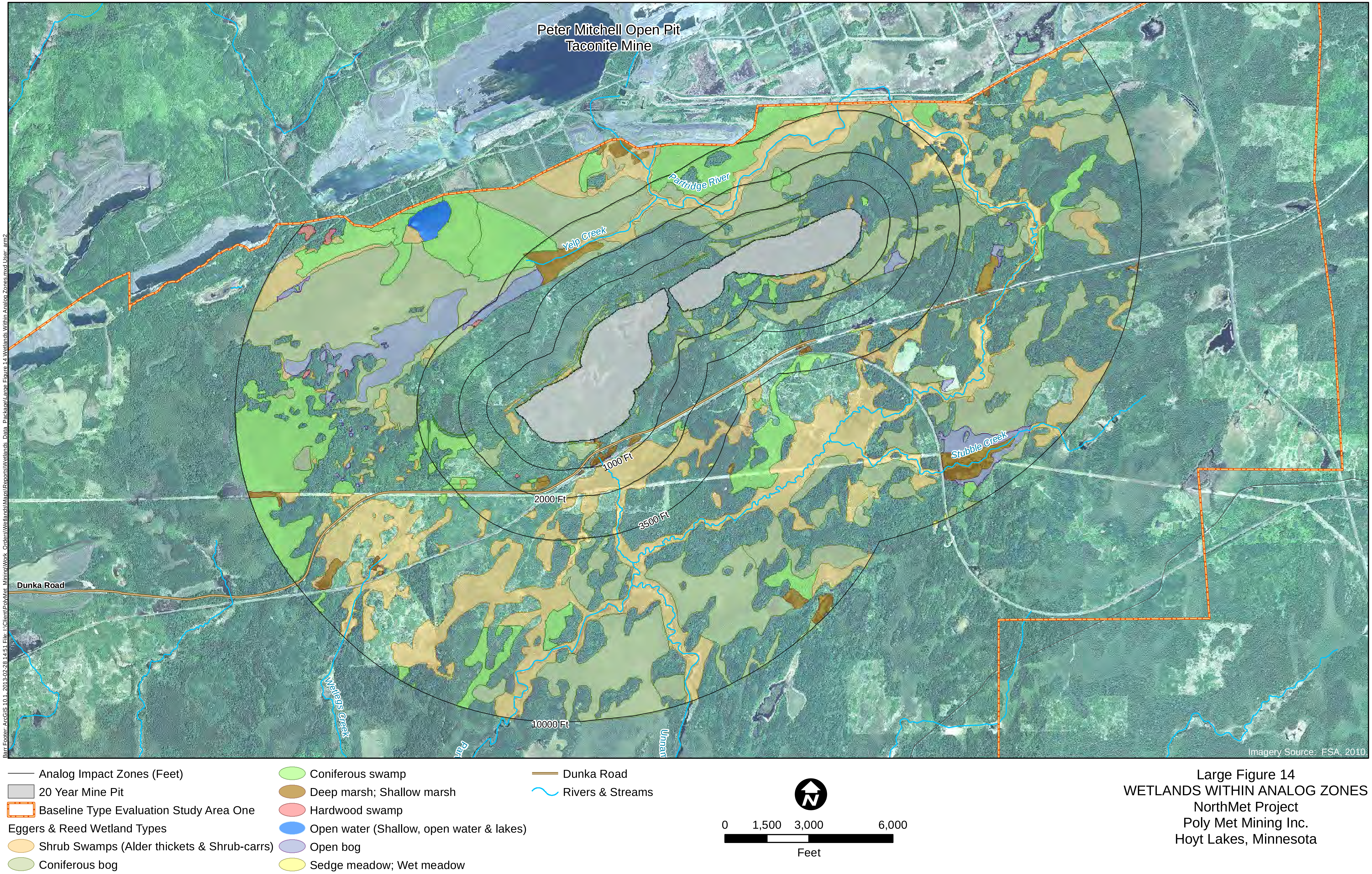
○ Wetland

Potential Indirect Wetland Impacts

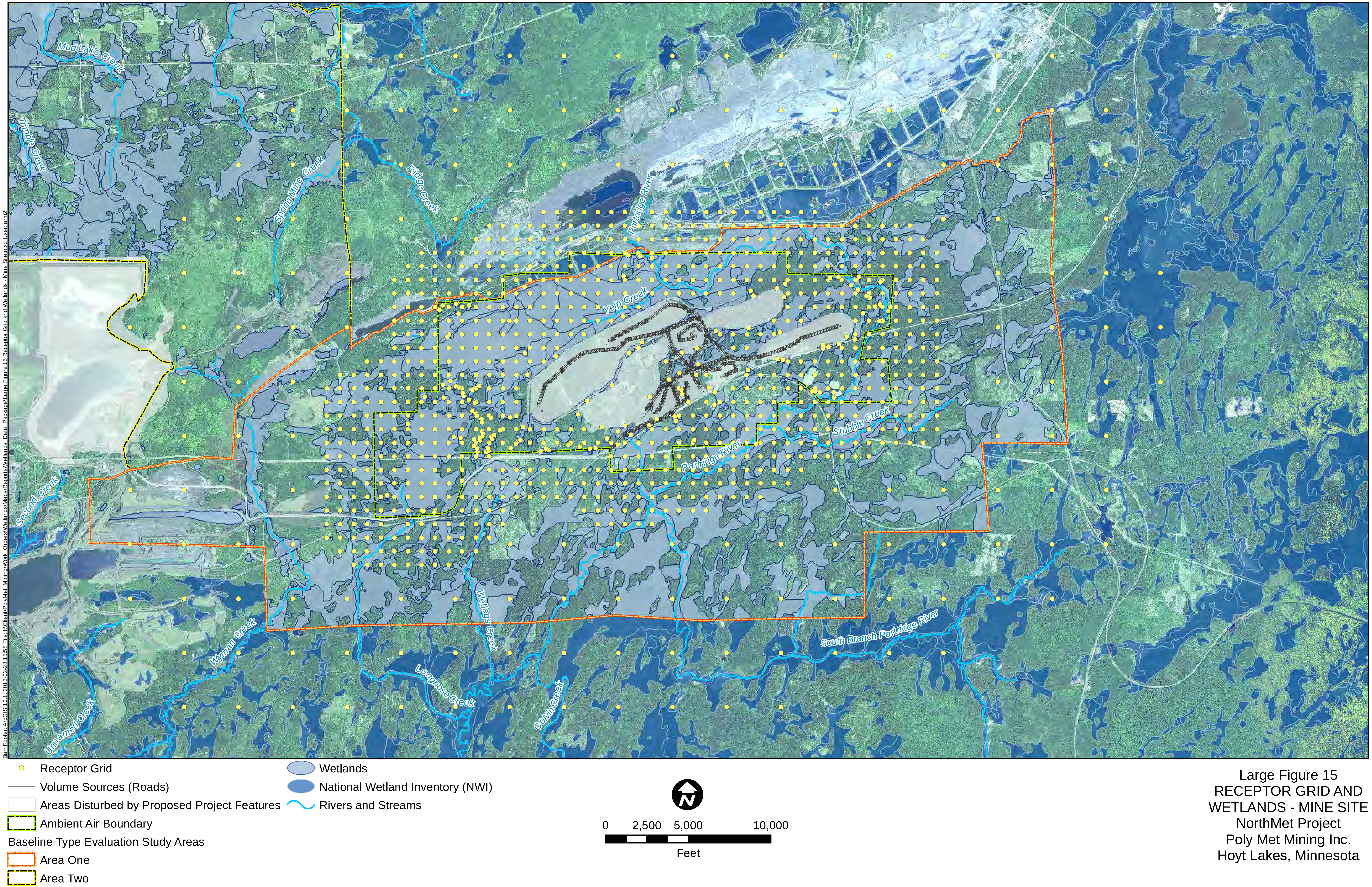
● Decrease in Yield per Wetland Acre of Greater Than 20%

● Increase in Yield per Wetland Acre of Greater Than 20%

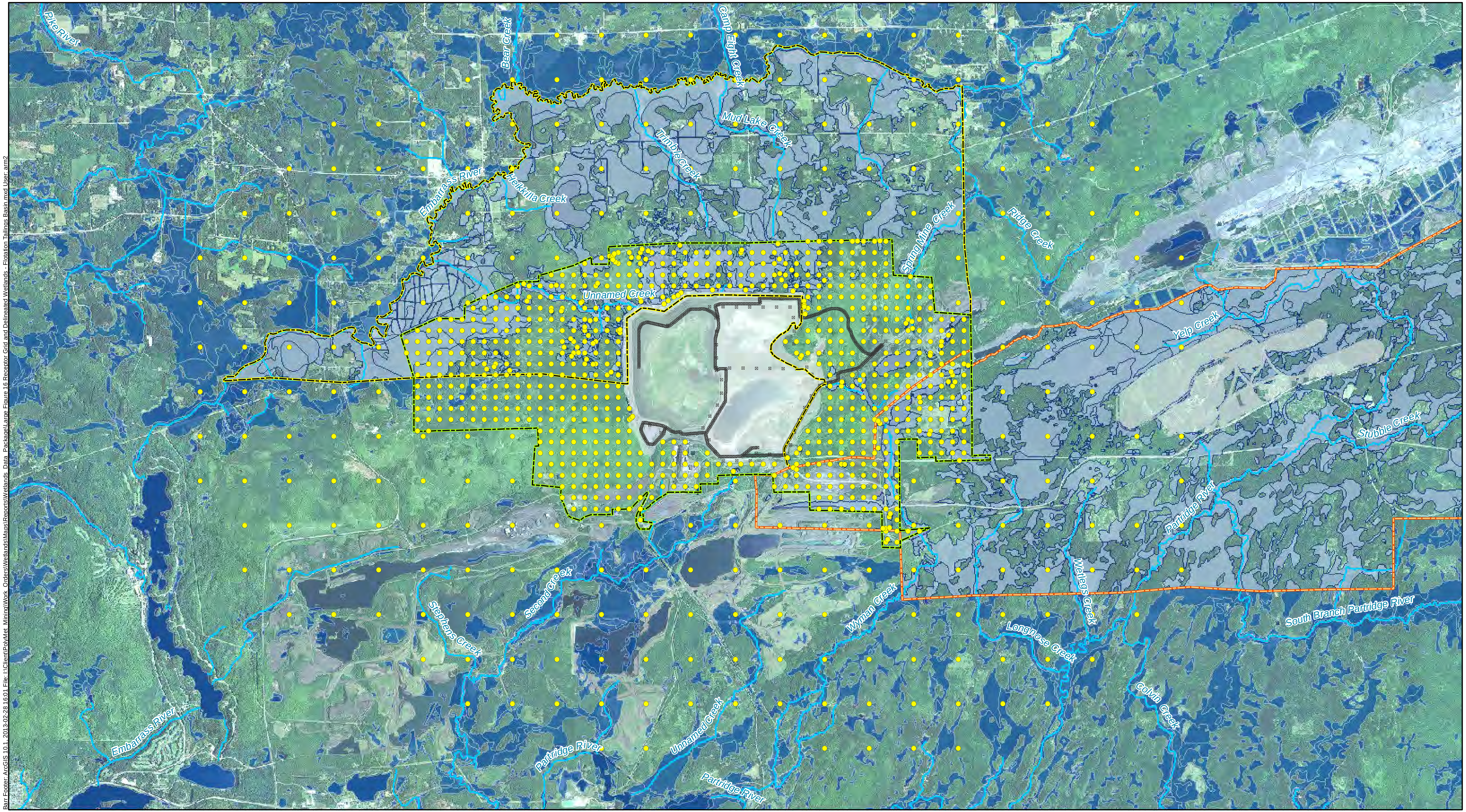
Large Figure 13
WETLANDS POTENTIALLY INDIRECTLY IMPACTED
BY CHANGE IN WATERSHED AREA
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 14
WETLANDS WITHIN ANALOG ZONES
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 15
RECEPTOR GRID AND
WETLANDS - MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



●	Receptor Grid
—	Volume Sources (Roads)
☐	Areas Disturbed by Proposed Project Features
☐	Ambient Air Boundary
⬭	Wetlands
⬬	National Wetland Inventory (NWI)
~	Rivers and Streams

Baseline Type Evaluation Study Areas

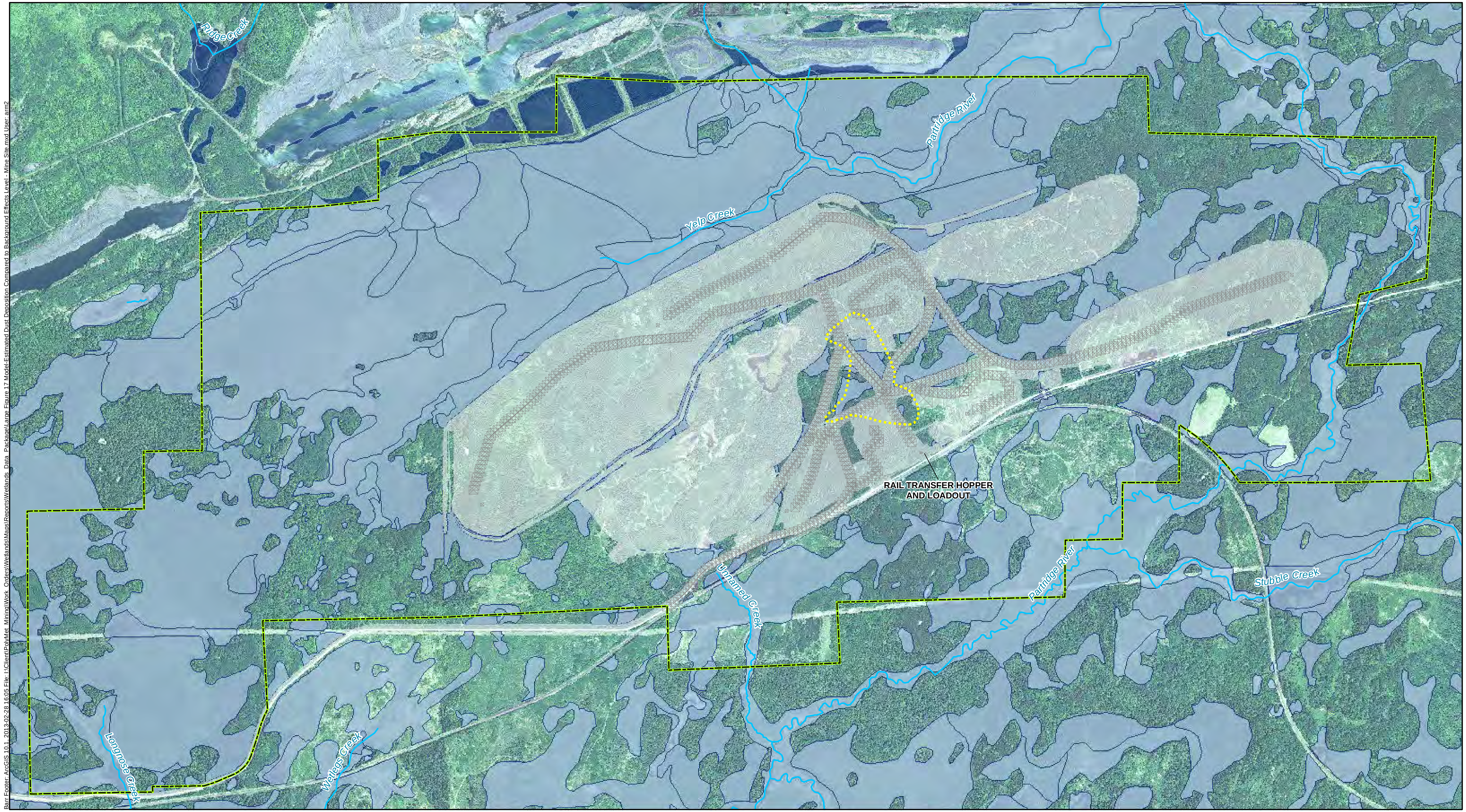
🟧	Area One
☐	Area Two

0 0.625 1.25 2.5

Miles

Large Figure 16
RECEPTOR GRID AND WETLANDS - FLOTATION TAILINGS BASIN

NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Extent of Highest Estimated Deposition Receptors with Deposition of 25% of Background

Rivers and Streams

Volume Sources (Roads)

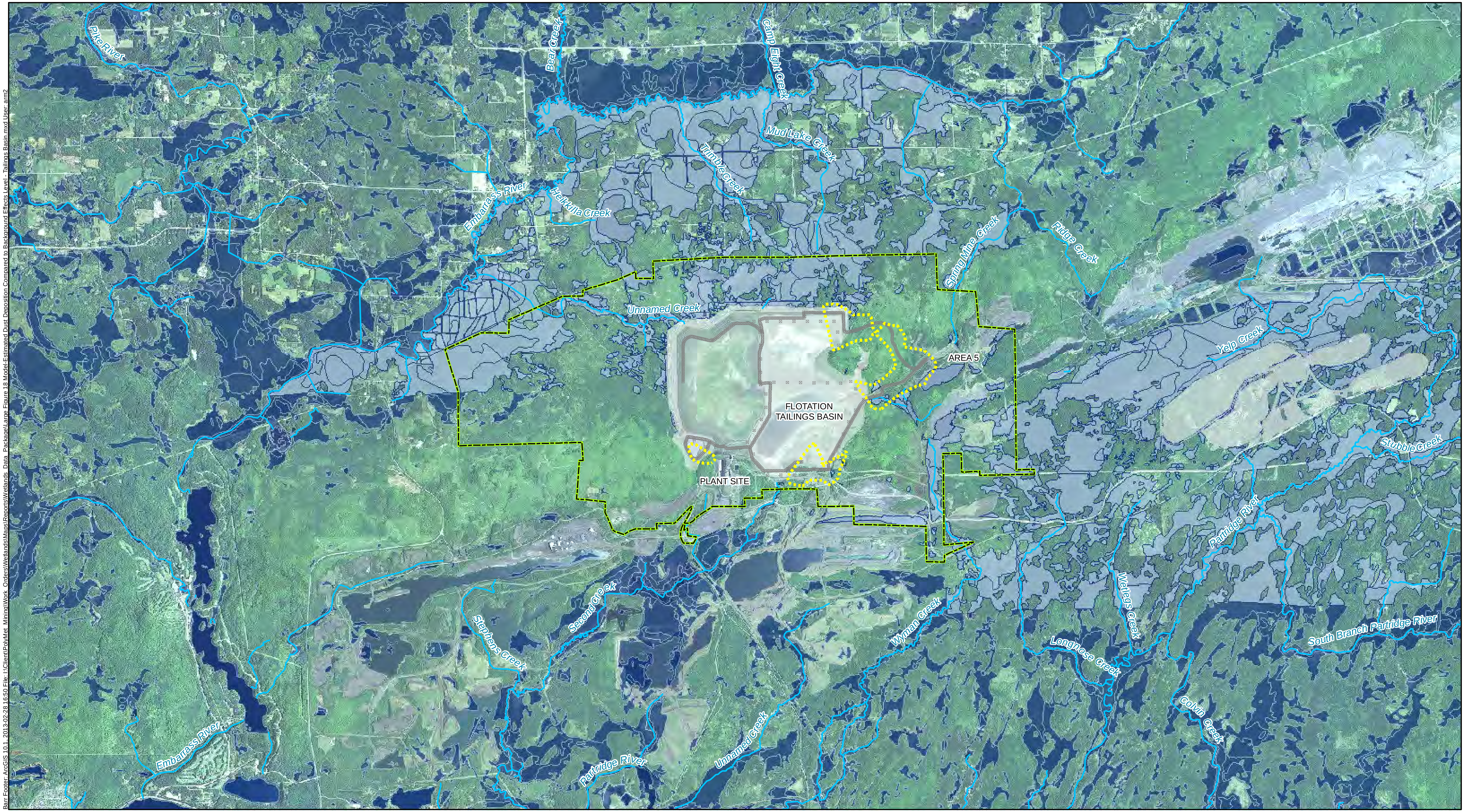
Areas Disturbed by Proposed Project Features

Ambient Air Boundary

Wetlands

National Wetland Inventory (NWI)

Large Figure 17
MODEL-ESTIMATED DUST DEPOSITION
COMPARED TO BACKGROUND
EFFECTS LEVEL - MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



⋯	Extent of Highest Estimated Deposition Receptors with Deposition of 50% of Background
—	Volume Sources (Roads)
☐	Areas Disturbed by Proposed Project Features
▭	Ambient Air Boundary
⬭	Wetlands
⬬	National Wetland Inventory (NWI)
∼	Rivers and Streams

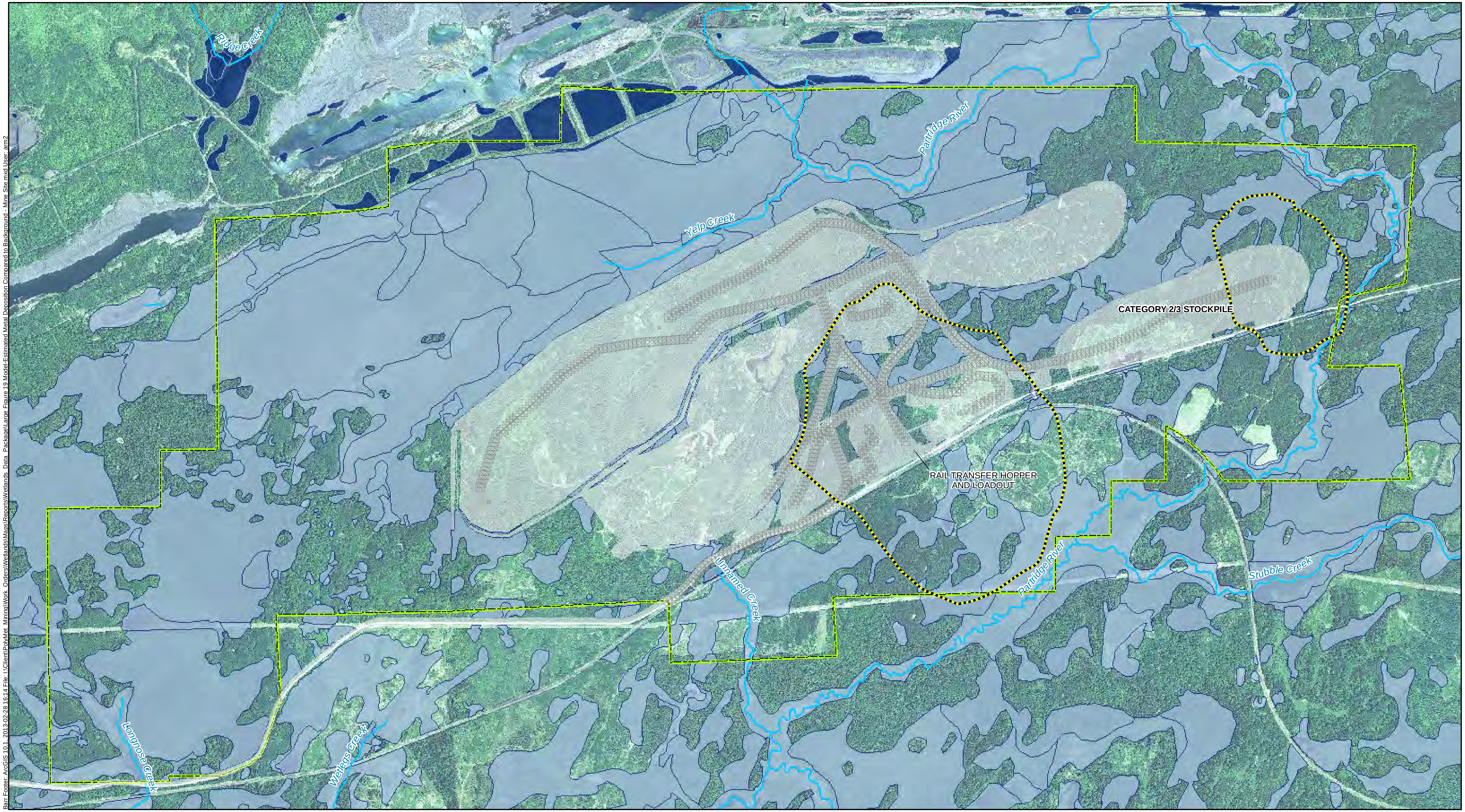
0 0.625 1.25 2.5

Miles

Large Figure 18

MODEL-ESTIMATED DUST DEPOSITION
COMPARED TO BACKGROUND
EFFECTS LEVEL - FLOTATION TAILINGS BASIN

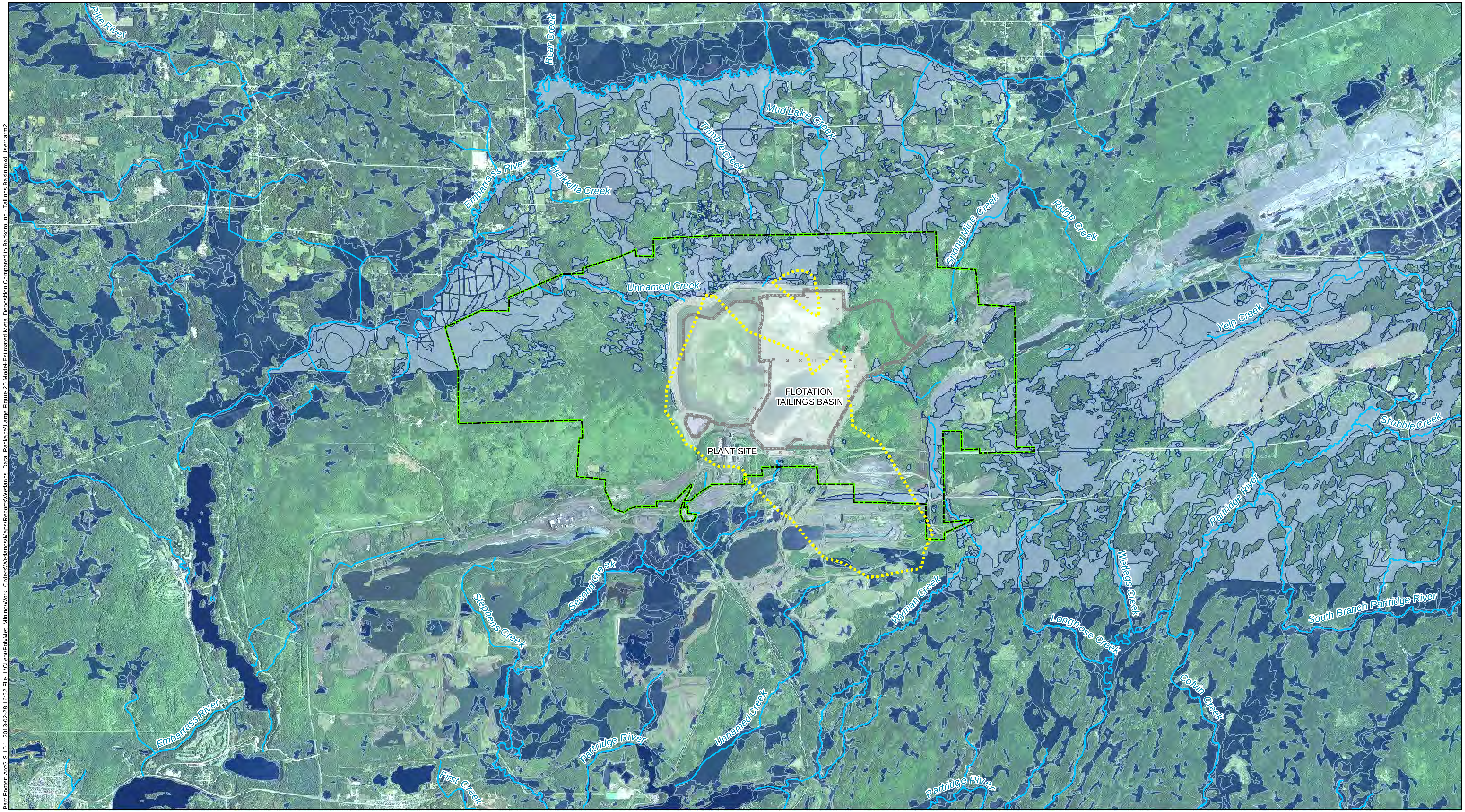
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- Extent of Highest Estimated Deposition Receptors with Deposition of 100% of Background
- Volume Sources (Roads)
- Areas Disturbed by Proposed Project Features
- Ambient Air Boundary
- Wetlands
- National Wetland Inventory (NWI)
- Rivers and Streams

0 1,000 2,000 4,000
Feet

Large Figure 19
MODEL - ESTIMATED METAL DEPOSITION
COMPARED TO BACKGROUND
EFFECTS LEVEL - MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



▪▪▪▪	Extent of Highest Estimated Deposition Receptors with Deposition of 100% of Background
—	Volume Sources (Roads)
☐	Areas Disturbed by Proposed Project Features
▭	Ambient Air Boundary
⬭	Wetlands
⬬	National Wetland Inventory (NWI)
～	Rivers and Streams

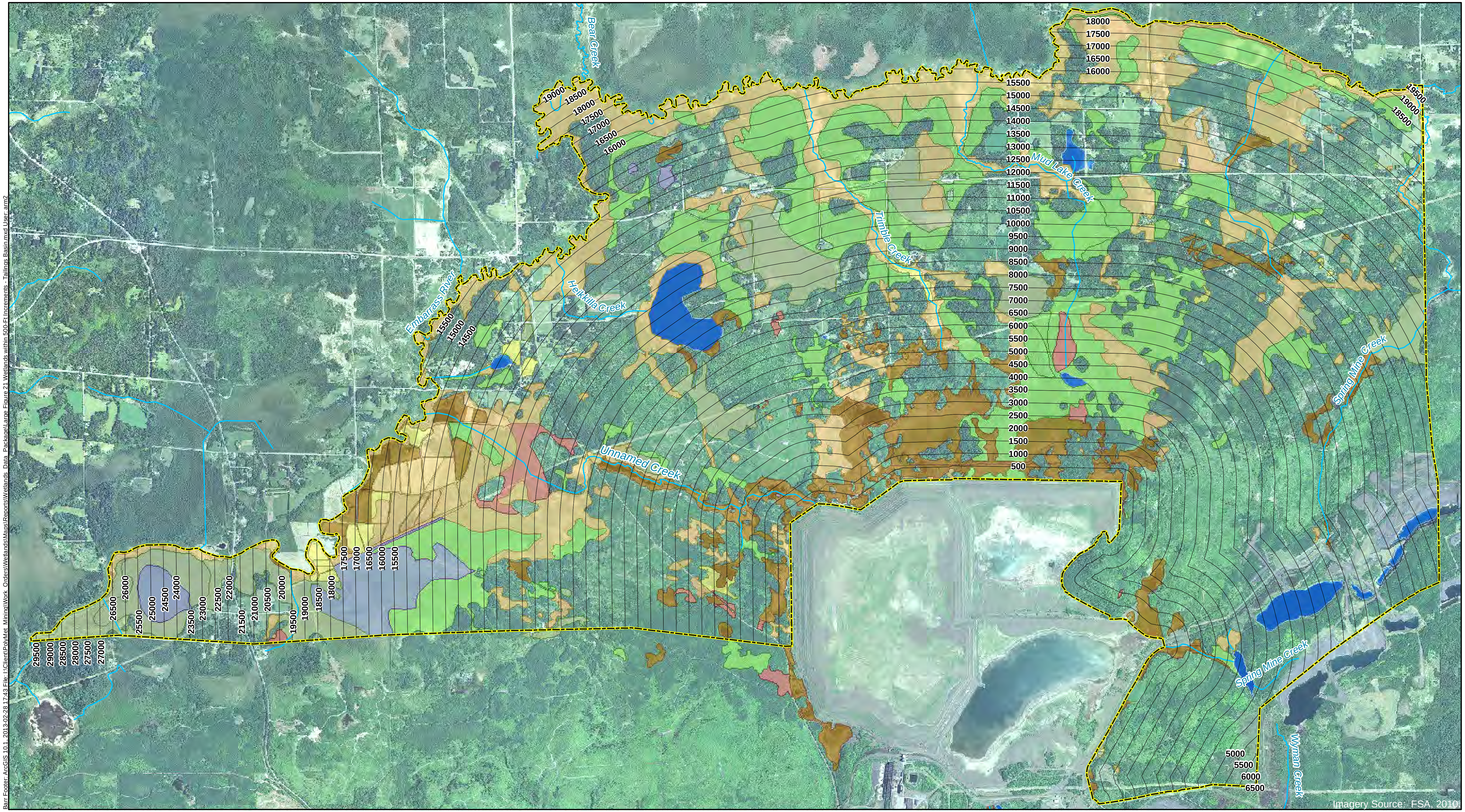
N

0 0.625 1.25 2.5

Miles

Large Figure 20
MODEL - ESTIMATED METAL DEPOSITION
COMPAREDTO BACKGROUND EFFECTS LEVEL -
FLOTATION TAILINGS BASIN
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Barr Footer: ArcGIS 10.1, 2013-02-28 17:43 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Maps\Reports\Wetlands Data Package\Large Figure 21 Wetlands within 500-Ft Increments - Tailings Basin.mxd User: arm2



○ 500-Ft Increments

Baseline Type Evaluation Study Area Two

▭ Area Two

Eggers & Reed Wetland Types

🟧 Shrub Swamps (Alder thickets & Shrub-carrs)

🟩 Coniferous bog

🟩 Coniferous swamp

🟫 Deep marsh; Shallow marsh

🟥 Hardwood swamp

🟦 Open water (Shallow, open water & lakes)

🟪 Open bog

🟨 Sedge meadow; Wet meadow

~ Rivers & Streams

0 1,750 3,500 7,000

Feet

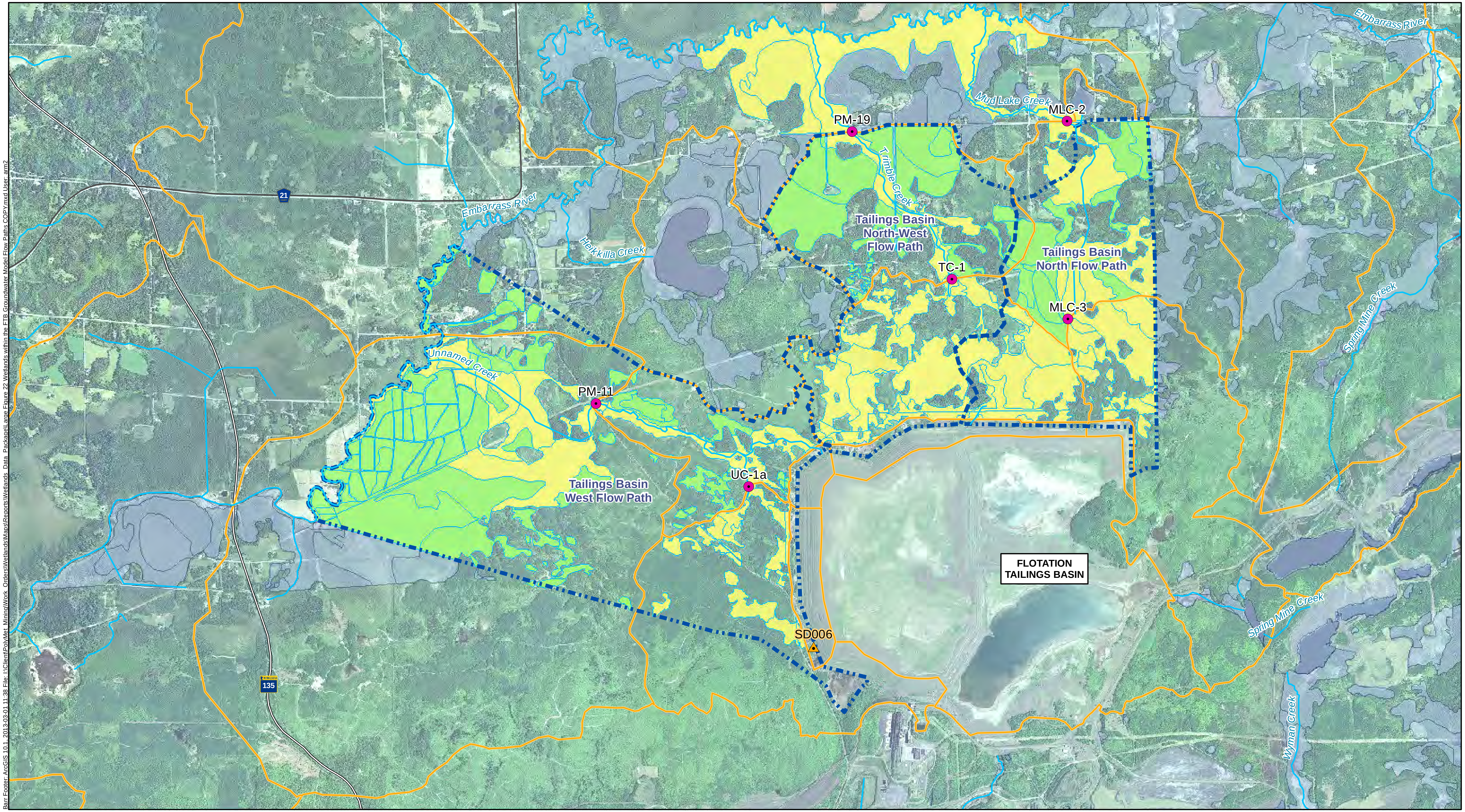
Large Figure 21

WETLANDS WITHIN 500-FT INCREMENTS -
FLOTATION TAILINGS BASIN

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.1, 2013-03-01 11:38 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Maps\Reports\Wetlands Data Package\Large Figure 22 Wetlands within the FTB Groundwater Model Flow Paths COPY.mxd User: arm2

● Surface Water Model Evaluation Location

▲ Approximate Location of Project Surface Water Discharge

— Rivers and Streams

▭ Subwatersheds with Project

▭ Groundwater Flow Path

○ Wetlands

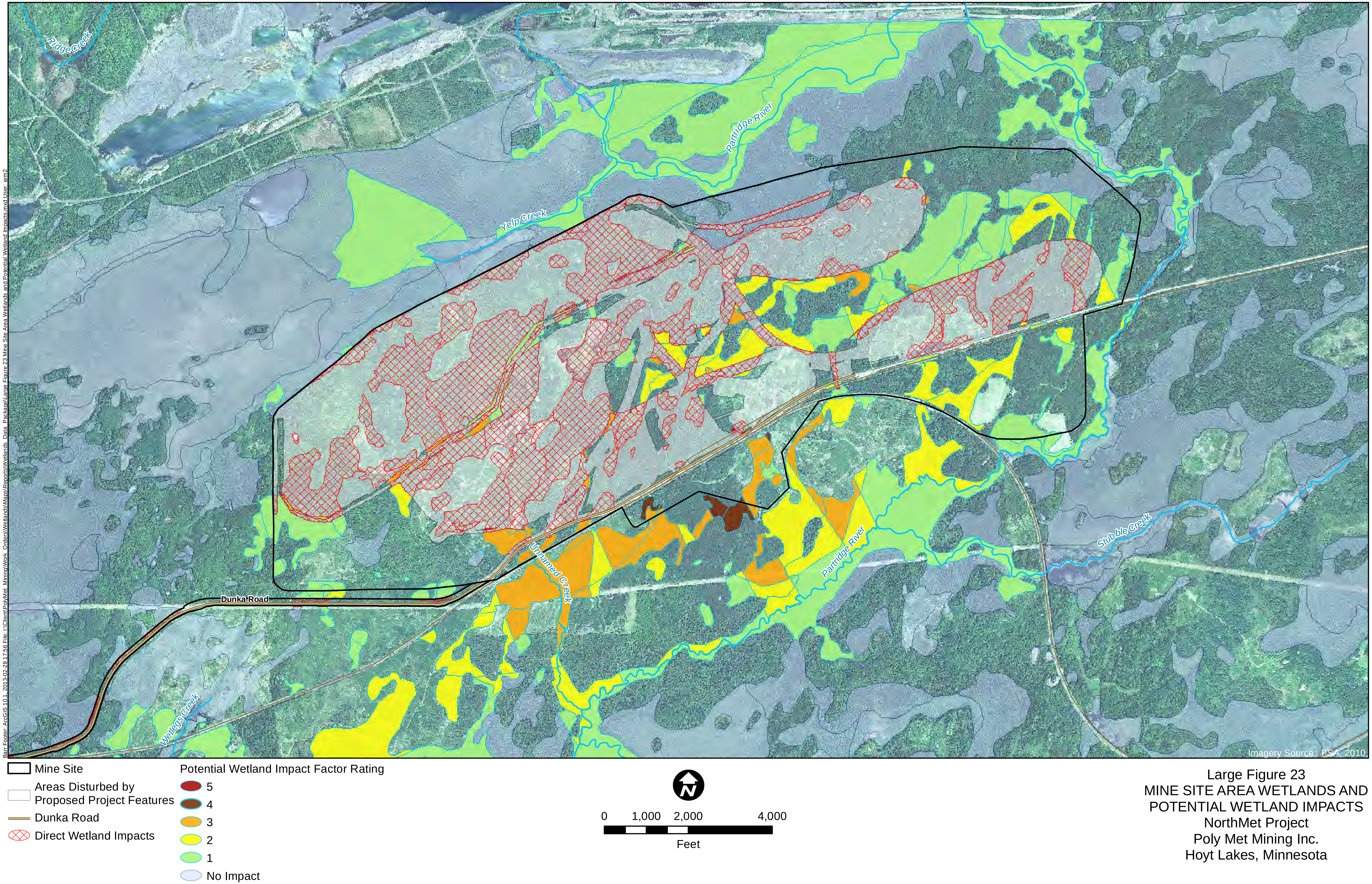
Wetlands with Potential for Indirect Impacts

○ Surface Water and Groundwater

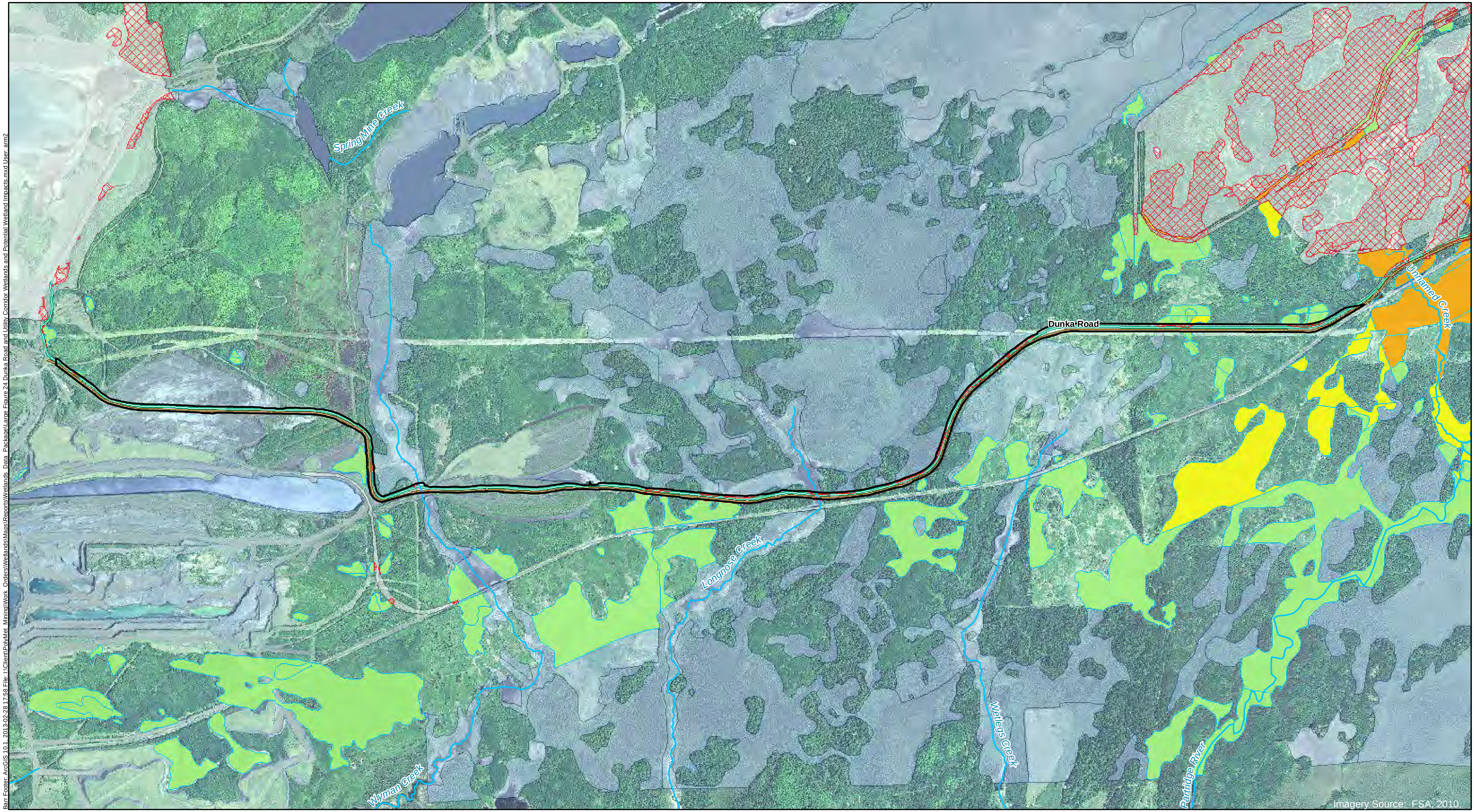
○ Groundwater Only

0 1,500 3,000 6,000
Feet

Large Figure 22
WETLANDS WITHIN THE FTB
GROUNDWATER MODEL FLOW PATHS
NorthMet Project
Poly Met Mining, Inc.
Hoyt Lakes, MN



Large Figure 23
MINE SITE AREA WETLANDS AND POTENTIAL WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- ▭ Dunka Road and Utility Corridor
- ◻ Areas Disturbed by Proposed Project Features
- ═ Dunka Road
- ═ Treated Water Pipeline
- ▨ Direct Wetland Impacts

Potential Wetland Impact Factor Rating

- ● 4
- ● 3
- ● 2
- ● 1
- ● No Impact

0 1,000 2,000 4,000

Feet

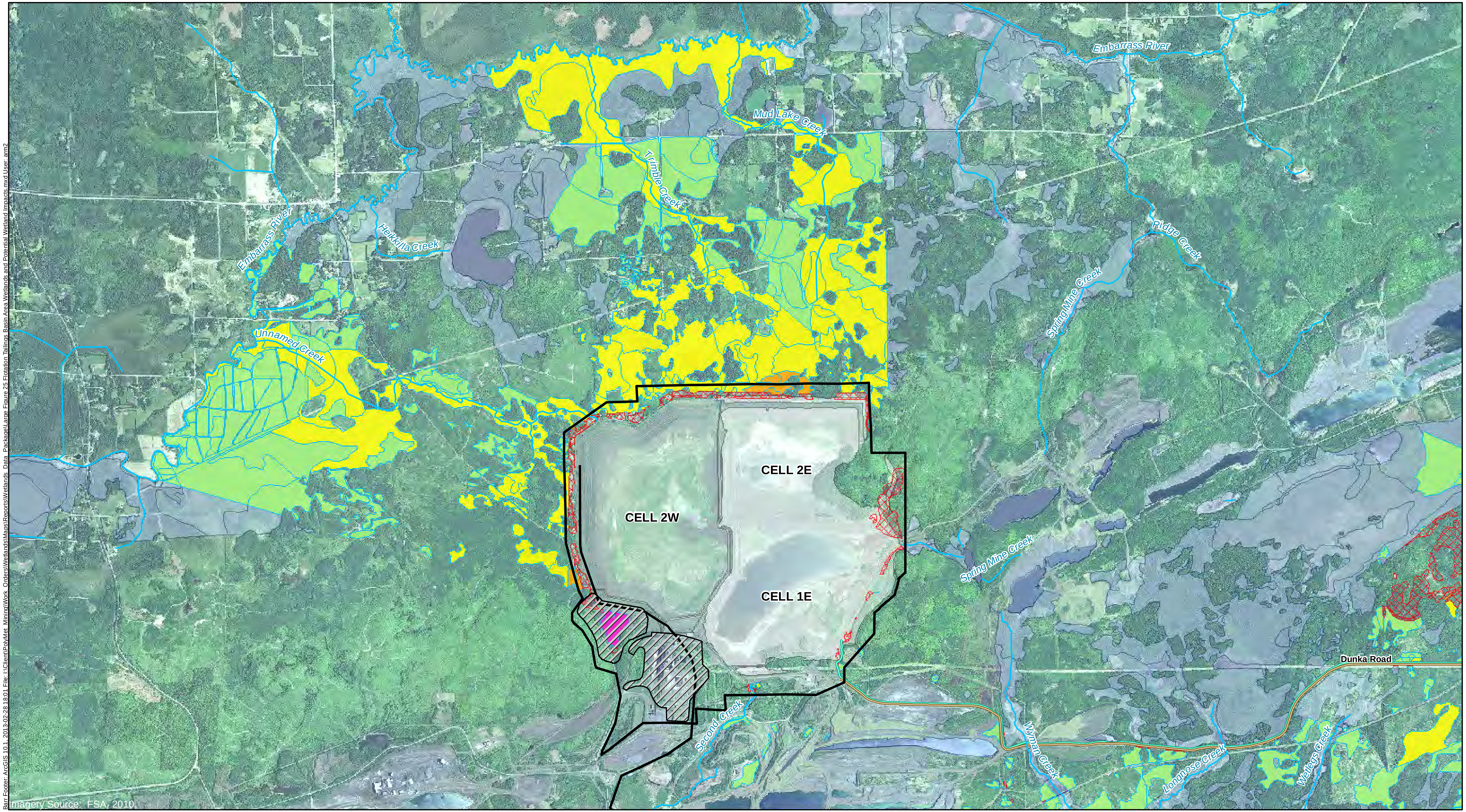
Large Figure 24

DUNKA ROAD AND UTILITY CORRIDOR WETLANDS AND POTENTIAL WETLAND IMPACTS

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.1, 2013-02-28 18:01 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Maps\Reports\Wetlands Data Package\Large Figure 25 Flotation Tailings Basin Area Wetlands and Potential Wetland Impacts.mxd User: arm2

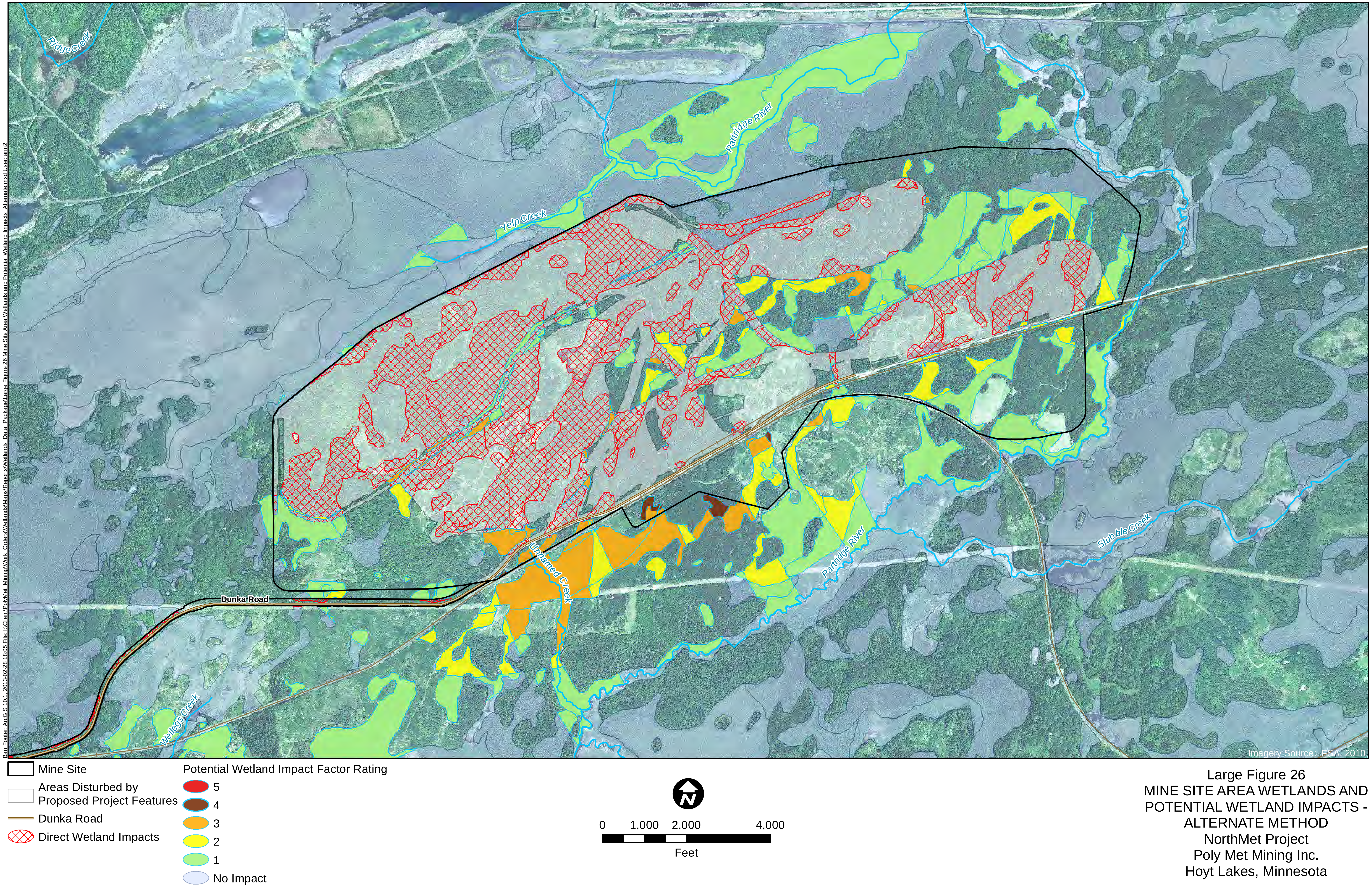
▭ Tailings Basin
▨ Areas Excluded from Tailings Basin Boundary
▭ Areas Disturbed by Proposed Project Features
— Dunka Road
— Treated Water Pipeline
▨ Direct Wetland Impacts

Potential Wetland Impact Factor Rating
- ● 4
- ● 3
- ● 2
- ● 1
- ● No Impact
- ● Exempt

N

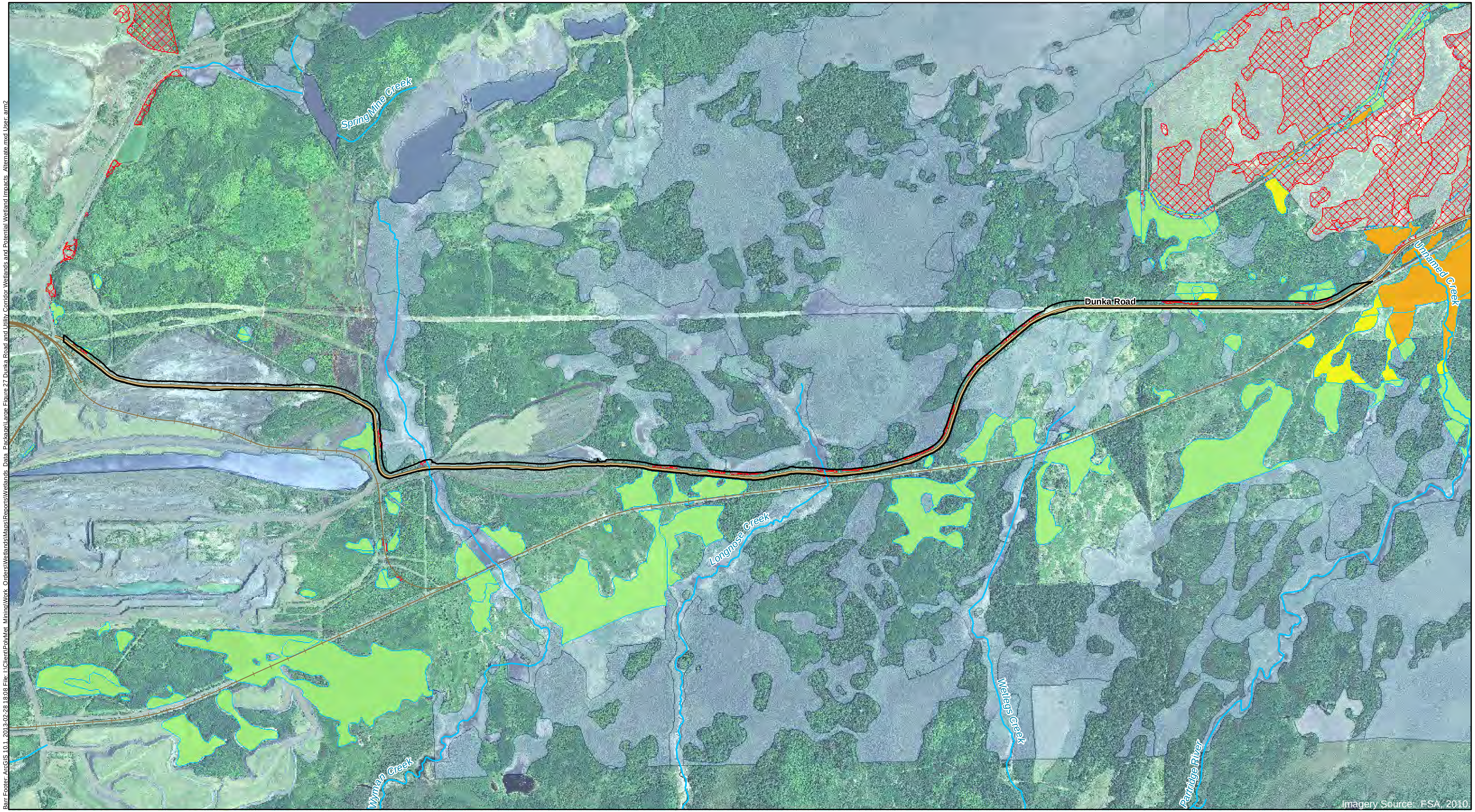
0 2,000 4,000 8,000
Feet

Large Figure 25
FLOTATION TAILINGS BASIN AREA WETLANDS AND POTENTIAL WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.1, 2013-02-28 18:05 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure 26 Mine Site Area Wetlands and Potential Wetland Impacts_Alternate.mxd User: arm2

Large Figure 26
MINE SITE AREA WETLANDS AND POTENTIAL WETLAND IMPACTS - ALTERNATE METHOD
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.1, 2013-02-28 18:08 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure 27 Dunka Road and Utility Corridor Wetlands and Potential Wetland Impacts_Alternate.mxd User: arm2

- ▭ Dunka Road and Utility Corridor
- ▭ Areas Disturbed by Proposed Project Features
- ═ Dunka Road
- ▨ Direct Wetland Impacts

Potential Wetland Impact Factor Rating

- ● 4
- ● 3
- ● 2
- ● 1
- ● No Impact

N

0 1,000 2,000 4,000

Feet

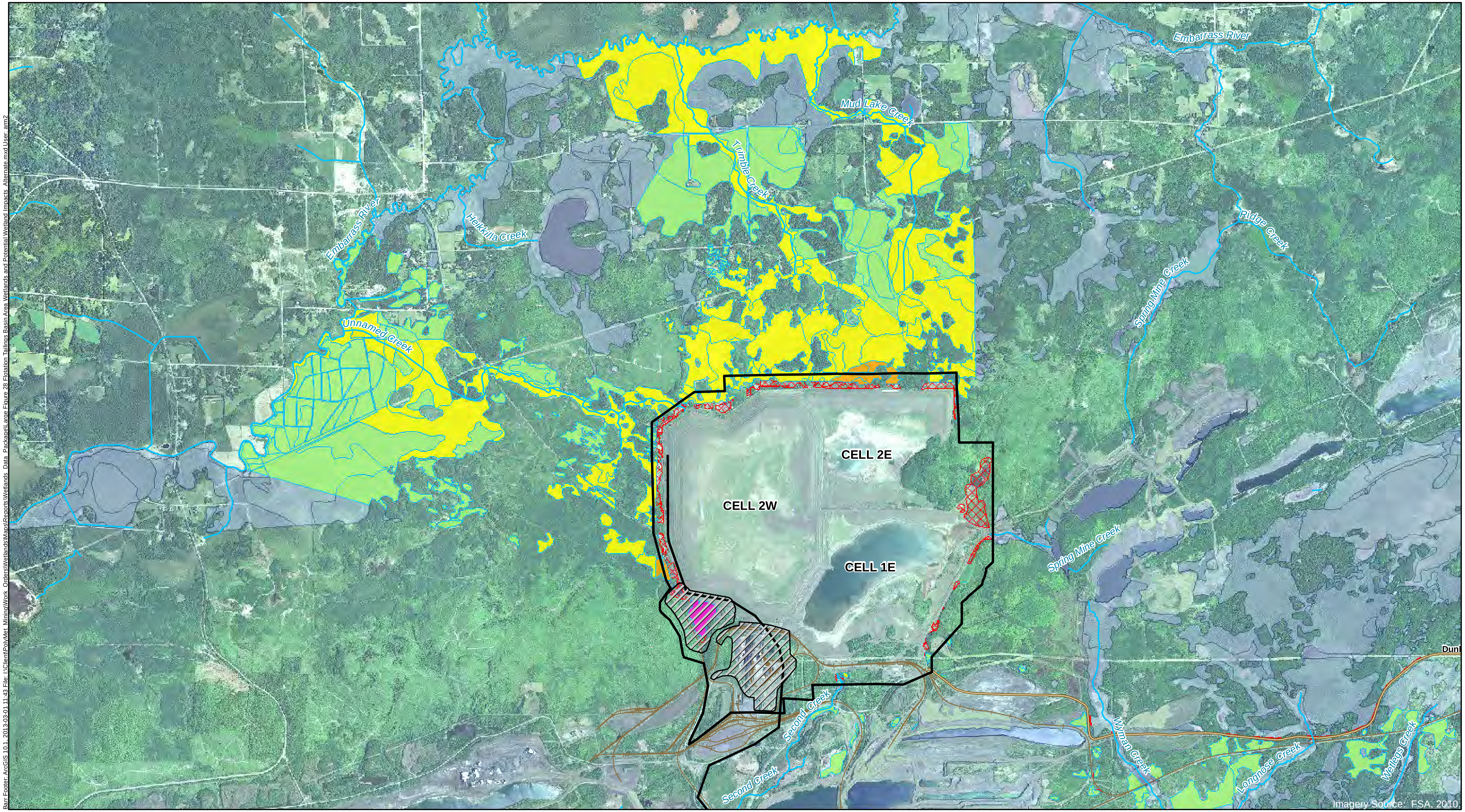
Large Figure 27

DUNKA ROAD AND UTILITY CORRIDOR WETLANDS AND POTENTIAL WETLAND IMPACTS - ALTERNATE METHOD

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota



▭ Tailings Basin
▨ Areas Excluded from Tailings Basin Boundary
☐ Areas Disturbed by Proposed Project Features
— Dunka Road
▩ Direct Wetland Impacts

Potential Wetland Impact Factor Rating
- ● 4
- ● 3
- ● 2
- ● 1
- ○ No Impact
- ● Exempt

N

0 2,000 4,000 8,000

Feet

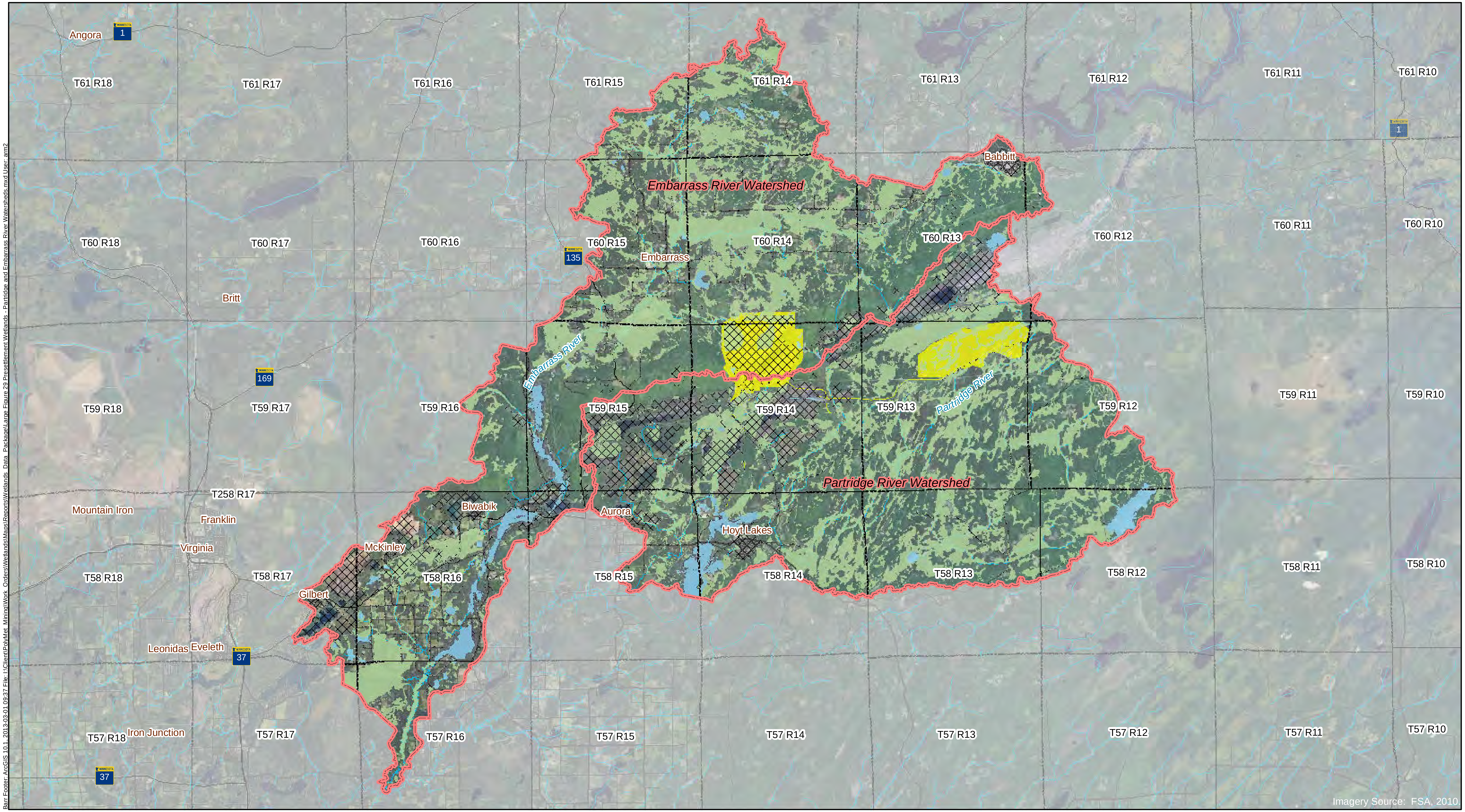
Large Figure 28

FLOTATION TAILINGS BASIN AREA WETLANDS AND POTENTIAL WETLAND IMPACTS - ALTERNATE METHOD

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota



🟩 Pre-settlement Wetland

🟦 Pre-settlement Lake

🟥 Study Area

🟨 Project Boundaries

▨ Disturbance Areas

⬚ Township Boundary

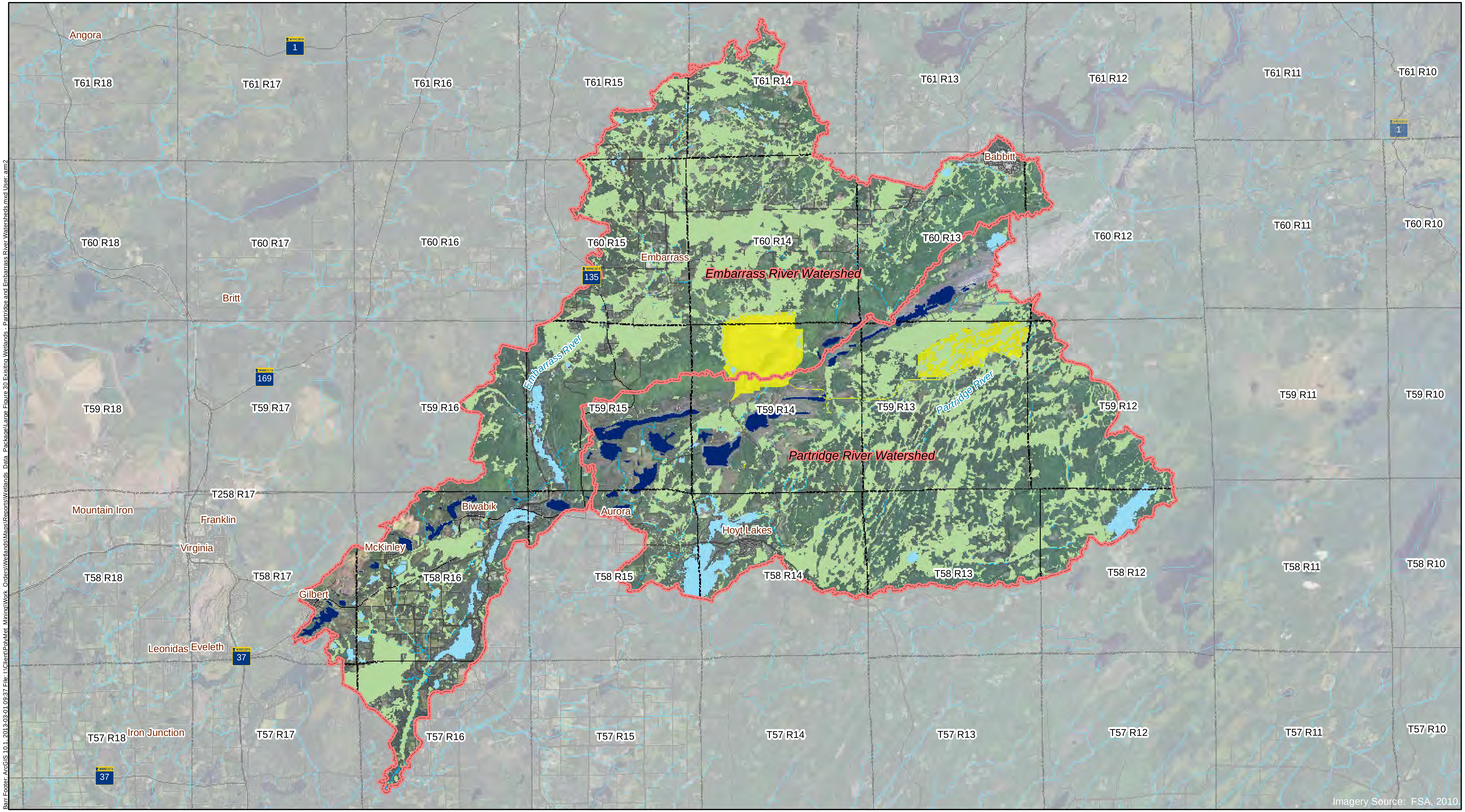
〜 Rivers & Streams

N

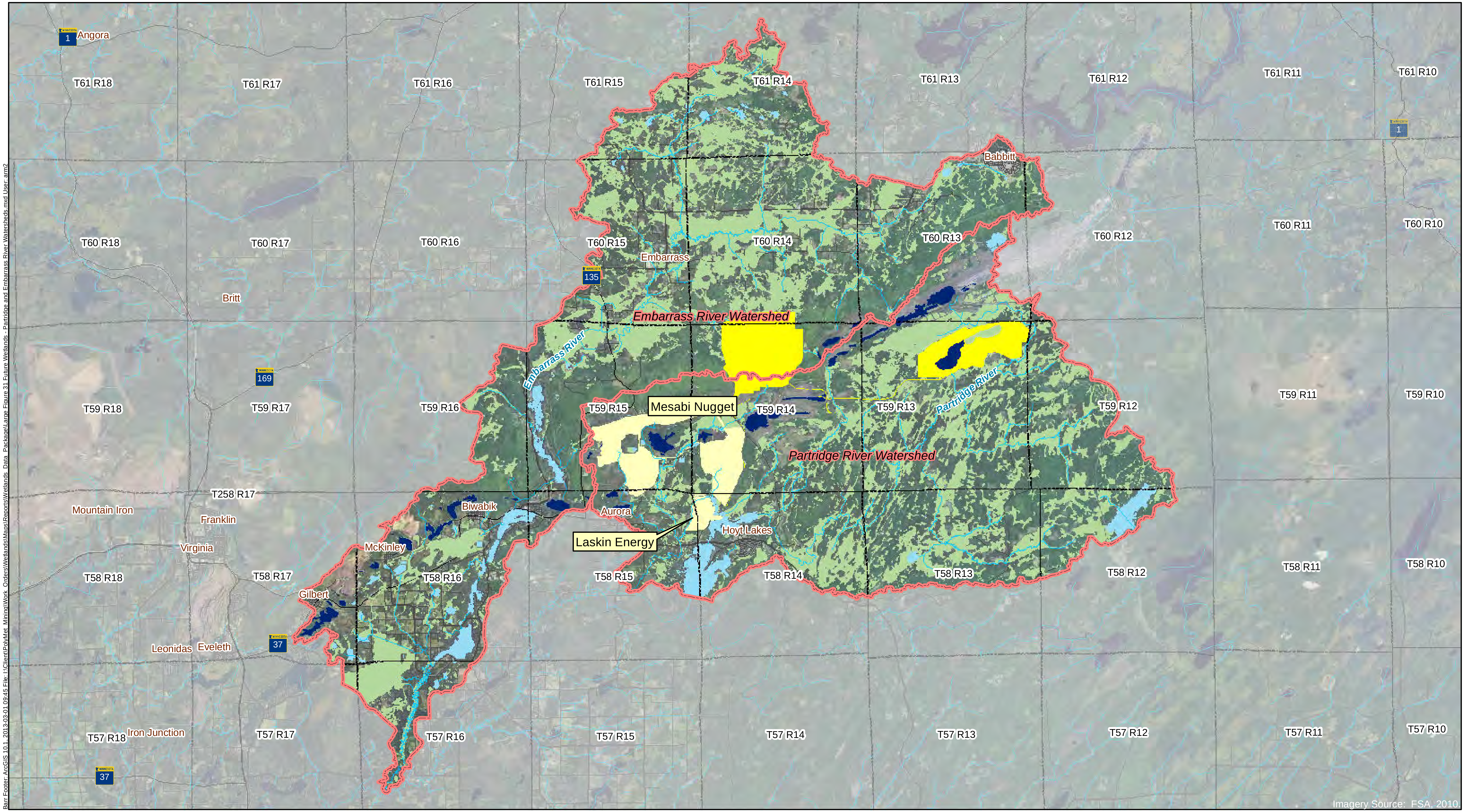
0 1.5 3 6

Miles

Large Figure 29
PRE-SETTLEMENT WETLANDS - PARTRIDGE
AND EMBARRASS RIVER WATERSHEDS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure 30
EXISTING WETLANDS - PARTRIDGE
AND EMBARRASS RIVER WATERSHEDS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.1, 2013-03-01 09:45 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure 31 Future Wetlands - Partridge and Embarrass River Watersheds.mxd User: arm2

🟩 Future Wetland
🟦 Future Lake
● Future Deepwater Habitat
🟥 Study Area
🟨 Project Boundaries
🟨 Other Project Areas
▭ Township Boundary
~ Rivers & Streams

0 1.5 3 6
Miles

Large Figure 31
FUTURE WETLANDS - PARTRIDGE
AND EMBARRASS RIVER WATERSHEDS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Attachments

Attachment A

NorthMet Wetland Analysis Work Plan v3

NorthMet Project

Wetland Analysis Work Plan

Version 3

October 13, 2011

NorthMet Project
Wetland Analysis Work Plan
Version 3

Table of Contents

1. Project

This document is the Work Plan for wetland analysis for the NorthMet Project (Project) as specified in Wetland Resources IAP Final Summary Memo and Co-lead Agency Final Work Plan Preparation Guidance of July 1, 2011 (Guidance Document) and the Wetland IAP Work Plan Compiled Comments dated August 30, 2011.

The project that will be modeled is the project described in the Co-lead Agency Draft Alternative Summary as amended in September, 2011. The Project Footprint that will be used for this analysis has been defined and detailed in the NorthMet Project Project Description (Reference 1).

2. Background

Wetland impacts for the Project were previously evaluated for the DEIS and included direct, potential indirect, and cumulative impacts. Using the wetland types and acreages identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), direct, potential indirect, and cumulative impacts will be evaluated as described in the following sections. The results of the wetland analysis in this Work Plan will be presented in the Wetland Data Package.

3. Direct Wetland Impacts

Direct wetland impacts will result from filling and excavation. The analysis performed for the SDEIS will duplicate the analysis performed for the DEIS (Section 4.2 of Reference 2) using the current Project Footprint described in Reference 1.

Wetlands within the Project Footprint will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for each wetland were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The analysis output for the direct wetland impact will include:

1. A summary table will provide information for each wetland within the Project Footprint and include:
    a. The wetland type, wetland acreage, and direct impact will be calculated using GIS.
    b. The type of direct impact (fill, excavation, etc.) will be identified.
    c. The quality of each wetland will be identified.
2. For each Eggers and Reed (1997) wetland type, a summary table will provide the total acreage and total acres of direct impact for the following Project Areas - Mine Site, railroad corridor, Dunka Road and utility corridor, Plant Site, Flotation Tailings Basin, Hydrometallurgical Residue Facility, and the Colby Lake water pipeline corridor.
    a. Figures for each of the Project Areas will be created that show the areas with direct wetland impacts.
3. The total direct wetland impact acreage for the Project Footprint will be provided.

4. Potential Indirect Wetland Impacts

The analysis of potential indirect wetland impacts will be completed using the Guidance Document. The purpose of this analysis is to provide an estimate of potential indirect wetland impacts.

Potential indirect wetland impacts will be assessed based on: changes in wetland watershed areas (during operation and post-closure); groundwater drawdown resulting from open pit mine dewatering; groundwater mounding/drawdown resulting from operation of the Flotation Tailings Basin including groundwater seepage interception wells; changes in stream flow near the Mine Site and Flotation Tailings

Basin and associated impacts to wetlands abutting the streams (during operation and post-closure); wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.; and changes in wetland water quality. If/when the Project is permitted, an indirect wetland impact monitoring plan will be implemented as part of the Section 404 permit conditions.

The analysis will be completed for the Mine Site, the Flotation Tailings Basin, and the transportation corridors (railroad and Dunka Road).

4.1 Mine Site

4.1.1 Wetland Identification

Wetlands within the Mine Site will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area One (which includes the Mine Site) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

Wetland acreage by wetland type will be calculated using GIS within 500-foot radius increments beginning at the mine pits and continuing out to a total radius of 10,000 feet (for a total of 20 increments). The area of evaluation will only include wetlands within Area One where wetland type information has been developed and it will not include wetlands identified as directly impacted in Section 3.0. In addition, wetlands in the Peter Mitchell open pit taconite mine and areas north of this mine will be excluded from evaluation as described in the Guidance Document.

1. A detailed table will be provided for each increment identifying the wetland type and acreage for each wetland.
2. A summary table will be provided for each increment identifying the total acreage and total acres of direct impact for each Eggers and Reed (1997) wetland type.
3. For each wetland that will be directly impacted, the acreage for the portion of the remaining wetland will be calculated and included in a table.
4. A figure will be provided showing the increments and identifying the Eggers and Reed (1997) wetland types within each increment.

4.1.2 Potential Indirect Wetland Impacts Resulting from a Change in Watershed Area

For each wetland that will not be directly impacted by fill or excavation, but will have Project elements impacting its watershed, an estimate of the change in watershed area (acreage and percent gain or loss) will be calculated.

The change (acreage and percent gain or loss) in watershed areas and the wetland area found within each watershed will be identified for the following conditions: pre-Project, during operation when the maximum amount of watershed has been removed, and at closure.

An estimate of potential indirect wetland impacts (wetland acres by wetland type and type of indirect impact) will be calculated for non-directly impacted wetlands that will have changed watershed areas (during operation and post-closure) for each watershed that was identified as changed in the previous paragraph, using the following steps:

1. Determine the tributary acres per wetland acre for the pre-Project, during operation, and after closure conditions.
2. Determine the equivalent watershed yield (ac-ft/yr) for the pre-Project, during operation, and after closure conditions. The existing watershed yield will be calculated based on available gage data from Section 4.4.1 of Reference 3. This rate would be applied to each watershed to

convert the tributary ratio in Step 1 to an equivalent yield (or equivalent average contributing net precipitation), expressed as acre-feet/year (ac-ft/yr) per acre of wetland.

3. The range in the equivalent yield (inches/year) estimated over the life of the Project will be evaluated relative to pre-Project yield to calculate a maximum percent change in yield. The estimated relative change in yield will be evaluated on a case-by-case basis, taking into account factors such as wetland type, to determine the potential for indirect impacts (e.g., groundwater fed wetlands may be less susceptible to changes in surface watershed).

4.1.3 Potential Indirect Wetland Impacts Resulting from Wetland Fragmentation

For remaining wetlands not directly impacted or indirectly impacted by watershed area changes, an estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) from wetland fragmentation by Project features (open pits, stockpiles, haul roads, etc) will be determined, using the following steps:.

1. For each portion of a remaining wetland, excluding indirect impacts from watershed changes, the potential area of indirect impacts will be determined based on an analysis of the various factors that may contribute to potential fragmentation. Based on this analysis, the identifying factor(s) contributing to potential fragmentation (change in size of wetland, surrounded by Project features, change in function and values of wetland e.g. wildlife habitat, etc.) will be identified. [Note: noise and dust do not cause fragmentation impacts according to the U.S. Army Corps of Engineers, May 16, 2011 conference call.]

4.1.4 Potential Indirect Wetland Impacts Resulting from Changes in Hydrology

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of indirect impact) due to groundwater drawdown from open pit mine dewatering, based on the Co-lead Agency guidance for estimating potential indirect wetland impacts from groundwater drawdown near open pit mines as provided on July 1, 2011 will be determined, using the following steps.

1. Use the information provided by the Groundwater IAP Group and other available and relevant hydrogeologic data to justify whether to use or modify the provided analogue information which is based upon comparisons of the existing regional and site specific geologic data (such as bedrock faults, bedrock joint systems, bedrock topography, glacial till hydraulic conductivities, etc.), site specific engineering controls such as the Category 1 Waste Rock Stockpile seepage containment system, and the geologic settings of the analogue information sites and the Mine Site.
2. Use the guidelines provided by the Corps Memorandum (CEMVP-OP-R) Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff to identify minerotrophic and ombrotrophic coniferous and open bogs.

The potential indirect wetland impact from glacial aquifer drawdown will be based on the analogue impact zone with the greater potential drawdown (zone closer to the open pit mine) for wetlands that lie on both sides of the analogue distance boundary. The analogue distances are described below in steps 1, 2, 3 and 4.

1. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within 0 feet to 1,000 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
    a. High Likelihood – includes coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket

    b. Moderate Likelihood – deep marsh, shallow marsh, and shallow open water
    c. Low Likelihood – minerotrophic coniferous bog and open bog
    d. No Impact anticipated as identified in Guidance Document – ombrotrophic coniferous bog and open bog
2. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >1,000 feet to 2,000 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
    a. Moderate Likelihood – coniferous swamps, hardwood swamps, sedge/wet meadow, shrub-carr, and alder thicket
    b. Low Likelihood – deep marsh; shallow marsh, and shallow open water
    c. No Impact anticipated as identified in Guidance Document – minerotrophic and ombrotrophic coniferous bog and open bog
3. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >2,000 feet to 3,500 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
    a. Low Likelihood – coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, alder thicket
    b. No Impact anticipated as identified in Guidance Document – deep marsh, shallow marsh, shallow open water, coniferous bog, open bog
4. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >3,500 feet to 10,000 feet from the pit edge (within the wetland evaluation area). The table will also identify the type of indirect wetland impact for each indirectly impacted wetland.
    a. No Impact anticipated as identified in Guidance Document – all wetland types

A general discussion will be provided regarding the potential indirect wetland hydrology drawdown impacts to each wetland type based on the wetland sensitivity class tables for falling groundwater tables found in the Crandon mine project document titled *Wetland Impact Assessment Technical Memorandum – Appendix B* (Peterson Environmental Consulting, Inc. 2002).

1. A qualitative discussion of the types of potential indirect wetland impacts that might occur will be provided based on hypothetical hydrologic drawdown levels. Potential indirect wetland impacts might include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts, which will be categorized using the Eggers and Reed (1997) wetland classification system.

4.1.5 Potential Indirect Wetland Impacts for Wetlands Abutting the Partridge River

Estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands abutting the Partridge River as a result of changes in river flow resulting from the Project (during operation and post-closure), using the following steps.

1. Identify in GIS the wetlands abutting the Partridge River within Area One. A table will identify the wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands).

2. Provide the change in flow and water levels in the Partridge River using the model developed in Section 5.6 of Reference 3.
3. Identify whether the changes in flow (and therefore stage) resulting from the Project are within the observed natural variation for the Partridge River (Section 4.4.1 of Reference 3).
4. If the changes in flow and water levels are not within the observed natural variation for the Partridge River, identify the potential indirect impacts for the wetlands abutting the Partridge River.

4.1.6 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for remaining wetlands not directly impacted or indirectly impacted by previously evaluated causes in Sections 4.1.2 through 4.1.5 that would be impacted by water quality changes (such as from sulfide-bearing dust deposition, ore spillage, seepage from stockpiles, etc.) will be completed using the following steps:

1. Fugitive Dust Emissions
    a. The air emissions from all surface fugitive dust sources at the Mine Site will be modeled using an EPA approved air dispersion model with a deposition algorithm (AERMOD version 11103). This is the same model that has been proposed to be used for assessing air impacts in Class II areas in the draft NorthMet Air Modeling Work Plan (version 1, May 9, 2011) which was developed in response to the Air Impacts Assessment Planning Summary Memo dated May 6, 2011. Comments have been received on this draft Work Plan, with no objections to the proposed model, so this model is expected to be specified in the final Work Plan. Emission rates and particle size distributions will be based on total particulate matter. Receptors will be placed on all delineated wetlands within the Project ambient air boundaries that have not been identified as directly impacted. The receptor grid will also initially extend 5 kilometers beyond the ambient air boundaries with a grid spacing of 500 meters. The receptor grid may be adjusted based on preliminary modeling results. Other modeling details would generally follow those specified in the Class II modeling protocols for the Mine Site as defined by the Air IAP and/or generally excepted modeling practice.
    b. The modeled dust sources at the Mine Site will include ore and waste rock truck loading and unloading outside of the pits, railcar loading, dust generation from traffic on unpaved roads on the surface (i.e. not in the pits), and overburden and other construction rock screening and/or crushing as defined by the Air IAP.
    c. Rock handling and roads within the pits will not be included in the analysis because: a) “pit-trapping” would greatly reduce the potential for dust to impact areas outside of the pits and b) Barr’s past experience which indicates that the AERMOD “open pit” algorithm is incompatible with the AERMOD deposition algorithm.
    d. The output of the model will be deposition rate (grams per square meter) on an annual basis. The model results will be compared to background values such that contours where the modeled deposition is small relative to the background value can be developed. This can be considered a conservative assessment of how far away potential impacts to wetlands from dust may occur from fugitive dust sources. This should be considered a screening level analysis such that it would identify an upper bound for the potential range of distances at which impacts might occur, but the results will not identify actual impacts. This range of distances could be used to

estimate the extent of potential indirect impacts to guide development of monitoring plans to document actual indirect impacts. Based on the results of the screening analysis, PolyMet may propose a more refined approach to assess the distance at which potential impacts may occur.

2. Metals and Sulfide Dust Emissions

    a. The potential for sulfur deposition was evaluated for the DEIS Mine Plan in Screening Analysis of the Potential for Fugitive Dust Emissions Associated with Sulfide Rock Handling at the NorthMet Project Mine Site to Increase Sulfur Deposition to Nearby Wetlands (Barr, January 28, 2010). This analysis included dust emissions from the handling of Category 2, 3, and 4 waste rock and ore. Lean ore handling emissions were also modeled, but lean ore has been eliminated as a rock classification in the updated Mine Plan.

    b. The handling activities associated with Category 2, 3 and 4 waste rock and ore located outside of the pits will be included in the metals and sulfur analysis for the Mine Site. This includes truck loading and unloading with waste rock and ore and railcar loading with ore. Note: the potential for wind erosion from the stockpiles has been evaluated, and it has been determined that wind erosion would not occur through the use of EPA approved wind erosion calculations procedures in Section 13.2.5 of Reference 4. The calculations are described in the Mine Site Emission Inventory Spreadsheet (Version 2 Submitted August 1, 2011). This spreadsheet references the detailed calculations based on five years of meteorological data provided to MPCA via FTP site on May 9, 2011.

    c. Modeling will be conducted for the included sources in the same manner as described for dust modeling. The dust modeling and metals and sulfide modeling may be conducted in separate model runs or in the same run utilizing the model's source grouping capabilities.

    d. For air dispersion/deposition modeling, the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. Metals for evaluation, associated with rock and soils, would be: arsenic, cadmium, chromium, lead, manganese, nickel and selenium.

    e. Mercury will not be evaluated at the Mine Site for dust deposition because the concentration of mercury in the rock to be mined is very low (Sections 5.0 and 5.8 of Reference 3) and not considered to be environmentally significant in this medium.

    f. The model-estimated sulfur and metals deposition rates (grams per square meter) will be compared to background values to determine distance contours beyond which the deposition rate is insignificant compared to background. As with the dust analysis, this would be a screening level evaluation that could be used to identify a range of distances from a source beyond which impacts would be unlikely to occur. This range of distances could be used to estimate the extent of potential indirect wetland impacts to guide development of monitoring plans to document actual indirect impacts. PolyMet may choose to propose a more refined approach depending on the results of the screening level analysis. A more refined approach could take into account such factors as the potential for metals and/or sulfur to be liberated from the rock particles depending on the rock chemistry, environmental chemistry and general conditions in the ecosystem where the deposition is predicted to occur.

3. Ore spillage – see the Section 4.3.2.

4. Leakage from stockpile will be evaluated using the following steps:
    a. Quantify the amount of stockpile leakage water that discharges to surface water and wetlands, down gradient of the stockpiles based on the results of the water quality modeling.
    b. Identify the wetlands (type, acreage) within the surficial aquifer groundwater flowpaths from mine features using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).
    c. Categorize the wetlands within the flowpaths in Step ii into groundwater-fed and precipitation-fed wetlands using guidance from the Corps "Bog Memo" and evaluate the potential for indirect impacts based on potential water quality changes from the mine features.

4.1.7 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

4.2 Flotation Tailings Basin

4.2.1 Wetland Identification

Wetlands around the Flotation Tailings Basin will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area Two (which includes the Flotation Tailings Basin) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

Wetland acreage by wetland type will be calculated using GIS within 500-foot radius increments beginning at the Flotation Tailings Basin and continuing out to the Embarrass River. The area of evaluation will only include wetlands within Area Two where wetland type information has been developed and it will not include wetlands identified as directly impacted in Section 3.0.

1. A detailed table will be provided for each increment identifying the wetland type and acreage for each wetland.
2. A summary table will be provided for each increment identifying the total acreage and total acres of direct impact for each Eggers and Reed (1997) wetland type.
3. For each wetland that will be directly impacted, the acreage for the portion of the remaining wetland will be calculated and included in a table.
4. A figure will be provided showing the increments and identifying the Eggers and Reed (1997) wetland types within each increment.

4.2.2 Potential Indirect Wetland Impacts Resulting from Changes in Hydrology

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) from hydrologic changes (groundwater upwelling and resulting surface water flow in wetlands and/or groundwater drawdown near the groundwater seepage interception wells) resulting from groundwater seepage and/or interception well pumping will be determined.

1. Quantify the amount of Flotation Tailings Basin groundwater seepage water that discharges to surface water features, including wetlands, down gradient of the Flotation Tailings Basin. A MODFLOW model developed for the Flotation Tailings Basin will be used in conjunction with a GoldSim probabilistic model to estimate the quantity of seepage that discharges to surface water features.
2. Identify all the wetlands (type, acreage) within the surficial aquifer groundwater flowpaths downgradient of the Flotation Tailings Basin using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).
3. Using the wetlands identified in step 2, categorize the wetlands into groundwater-fed and precipitation-fed wetlands using guidance in the Corps Memorandum (CEMVP-OP-R) *Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff* and evaluate the potential for indirect impacts resulting from groundwater seepage and/or interception well pumping.

Provide a general discussion regarding the potential indirect wetland hydrology impacts to each wetland type based on the wetland sensitivity class tables for rising groundwater tables found in the Crandon mine project document titled *Wetland Impact Assessment Technical Memorandum – Appendix B* (Peterson Environmental Consulting, Inc. 2002).

1. A qualitative discussion of the types of potential indirect wetland impacts that might occur will be provided based on hypothetical hydrologic drawdown or surchage levels. Potential indirect wetland impacts might include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts, which will be categorized using the Eggers and Reed (1997) wetland classification system.

4.2.3 Potential Indirect Wetland Impacts for Wetlands Abutting Trimble Creek and the Two Unnamed Creeks

An estimate of potential indirect wetland impacts (wetland acres by wetland type) in wetlands abutting the three streams north and west of the Flotation Tailings Basin (Trimble Creek and the two unnamed creeks as shown in Figure 3 of the Water Resources IAP – Surface Water Summary Memo) as a result of changes in stream flow resulting from operation of the Flotation Tailings Basin will be determined using the following steps:

1. Identify in GIS the wetlands abutting the west Unnamed Creek (Mud Lake Creek), Trimble Creek, and the east Unnamed Creek within Area Two. A table will identify the wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands).
2. Provide the change in flow in the three streams using the GoldSim probabilistic model developed in Reference 6 and the method described in Section 4.4 of Reference 2. Estimate a corresponding change in stage based on available rating curves or simple hydraulic equations (e.g. Manning's equation).

3. Identify whether the changes in flow (and by extension, stage) are within the estimated natural variation for the three streams based on observed data or unit-area relationships extrapolated from gage data (Section 4.4.1 of Reference 5 and Page 3 of Reference 6).
4. If the changes in flow and water levels are not within the observed natural variation for the three streams, identify the potential indirect impacts for the wetlands abutting the three streams.

4.2.4 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands that would be impacted by water quality changes (such as from sulfide-bearing dust deposition from the Flotation Tailings Basin, Flotation Tailings Basin groundwater seepage, etc.) will be completed using the following steps:

1. Fugitive Dust Emissions
    a. The air emissions from all surface fugitive dust sources at the Flotation Tailings Basin site will be modeled using an EPA approved air dispersion model with a deposition algorithm (AERMOD version 11103). This is the same model that has been proposed to be used for assessing air impacts in Class II areas in the draft NorthMet Air Modeling Work Plan (version 1, May 9, 2011) which was developed in response to the Air Impacts Assessment Planning Summary Memo dated May 6, 2011. Comments have been received on this draft Work Plan, with no objections to the proposed model, so this model is expected to be specified in the final Work Plan. Emission rates and particle size distributions will be based on total particulate matter. Receptors will be placed on all delineated wetlands within the Project ambient air boundaries that have not been identified as directly impacted. The receptor grid will also initially extend 5 kilometers beyond the ambient air boundaries with a grid spacing of 500 meters. The receptor grid may be adjusted based on preliminary modeling results. Other modeling details would generally follow those specified in the Class II modeling protocols for the Plant Site as defined by the Air IAP and/or generally excepted modeling practice.
    b. The modeled dust sources at the Flotation Tailings Basin will include LTV Steel Mining Company (LTVSMC) tailings loading and unloading, unpaved road traffic, and wind erosion from dams constructed of LTVSMC tailings and beaches composed of NorthMet tailings.
    c. The output of the model will be deposition rate (grams per square meter) on an annual basis. The model results will be compared to background values such that contours where the modeled deposition is small relative to the background value can be developed. This can be considered a conservative assessment of how far away potential impacts to wetlands from dust may occur from fugitive dust sources. This should be considered a screening level analysis such that it would identify an upper bound for the potential range of distances at which impacts might occur, but the results will not identify actual impacts. This range of distances could be used to estimate the extent of potential indirect impacts to guide development of monitoring plans to document actual indirect impacts. Based on the results of the screening analysis, if model-estimated particle deposition is equal to current background deposition (i.e., 100 percent of current background; i.e., a potential doubling of deposition), PolyMet may propose a more refined approach to assess the distance at which potential impacts may occur.
2. Metals and Sulfide Dust Emission

a. At the Flotation Tailings Basin wind erosion from the embankment and beaches as well as truck traffic on roads composed of LTVSMC tailings will be included in the analysis.

b. Modeling will be conducted for the included sources in the same manner as described for dust modeling. The dust modeling and metals and sulfide modeling may be conducted in separate model runs or in the same run utilizing the model's source grouping capabilities.

c. For air dispersion/deposition modeling, the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. Proposed metals for evaluation, associated with rock and soils, will include: arsenic, cadmium, chromium, lead, manganese, nickel, and selenium.

d. Because the NorthMet ore is low in mercury, the tailings, which includes roughly 98 percent of the ore, will also be low in mercury, and in fact pilot study data shows that the mercury preferentially goes to the flotation concentrate. The mercury in the tailings is also expected to be strongly bound within the mineral matrix. This is also true of the LTVSMC tailings that will be used to construct the Flotation Tailings Basin dams and that may be present on some road surfaces. Therefore, any mercury present in dust from the Flotation Tailings Basin would not be biologically available and we are not proposing to consider mercury in the deposition analysis at the Flotation Tailings Basin. When metal ores are concentrated and heated, such as in taconite mining or in smelting processes, then mercury becomes a metal of interest for air emissions and deposition. For the Project, potential mercury air emissions from ore processing (i.e., potential emissions from the autoclave) are being evaluated for potential local deposition impacts.

e. The model-estimated sulfur and metals deposition rates (grams per square meter) will be compared to background values to determine distance contours beyond which the deposition rate is insignificant compared to background. As with the dust analysis, this will be a screening level evaluation that could be used to identify a range of distances from a source beyond which impacts would be unlikely to occur. This range of distances could be used to estimate the extent of potential indirect wetland impacts to guide development of monitoring plans to document actual indirect impacts. If model-estimated sulfur or individual metal deposition is equal to current background deposition (i.e., 100% of current background; i.e., a potential doubling of deposition), PolyMet may propose a more refined approach depending on the results of the screening level analysis. A more refined approach could take into account such factors as the potential for metals and/or sulfur to be liberated from the rock particles depending on the rock chemistry, environmental chemistry and general conditions in the ecosystem where the deposition is predicted to occur.

3. Flotation Tailings Basin Groundwater Seepage

    a. Identify the chemistry from the Flotation Tailings Basin groundwater seepage based on the results of the water quality modeling (Reference 6).

    b. Identify the wetlands (type, acreage) within the down gradient zone using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).

    c. Categorize the wetlands within the flowpaths in Step ii into groundwater-fed and precipitation-fed wetlands using guidance from the Corps Memorandum (CEMVP-

OP-R) *Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff* and evaluate the potential for indirect impacts based on potential water quality changes from the Flotation Tailings Basin.

4.2.5 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

4.3 Transportation Corridors

4.3.1 Wetland Identification

Wetlands around the Flotation Tailings Basin will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area Two (which includes the Flotation Tailings Basin) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The wetlands abutting the Dunka Road and the railroad corridor within Area One and Area Two will be identified using GIS. The wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands) will be identified in a table.

4.3.2 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands that will be impacted by water quality changes (such as from sulfide-bearing dust deposition, ore spillage, etc.) will be completed using the following steps:

Mine to Plant Rail

The potential release of dust from railcars transporting ore from the Mine Site to the Plant Site was addressed in the May 6, 2011 Air Impact Assessment Planning Summary Memo, "The air IAP group concluded that there would be minimal air impacts from any dust generated from ore hauled in the railcars due to the coarse nature of the ore. " Based on this conclusion, air modeling of potential release of dust from railcars will not be performed because the potential wetland impacts will not be significant.

The air IAP group concluded that any dust generated from ore hauled in railcars would be coarse in nature (i.e., relatively large particles). These larger particles would tend to deposit near the railcar and not be dispersed to any great extent. An estimate of the spillage of ore fines along the rail corridor is shown in Section 8.5.3 of Reference 7. Assuming that all spillage of the coarse material would occur in a 2 meter wide strip on both sides of the centerline of the railway (total width = 4 meters) over the entire haul distance after loading (~ 8 miles; ~13,000 meters), results in approximately 0.11 Kg/square meter of ore fines annually or 2.14 Kg/square meter for the 20 year Project. This equates to 0.002 inch of depth annually or 0.05 inches for the 20 year Project.

Using the geochemical modeling methods described in Reference 7 for the Ore Surge Pile, the quality of water infiltrating through this material will be estimated on a per-unit area basis which will also be on a per unit length of the rail corridor. If the water quality is found to have a greater than 10 percent likelihood of exceeding water quality standards as defined in Table 1-3 of Reference 8, the unit area required to provide sufficient precipitation to dilute the water to meet standards will be calculated and converted to a distance to be added to the 2 meters from the centerline of the rail corridor that will be a potential dust impact corridor. Any wetlands identified in the above paragraph of this section that are within the potential dust impact corridor will be considered to be potentially indirectly impacted.

Dunka Road

Loaded mine haul trucks will not travel on the Dunka Road. Empty mine haul trucks will only travel on the Dunka Road when they are in need of maintenance at the Area 1 Shop. It is estimated that each truck will travel to Area 1 twice per year. The total one-way trips per year are estimated at 44. Given the low traffic volumes (< 1 trip per week on average) a quantitative assessment of impacts from ore particle discharge from haul trucks travelling down the Dunka Road is not warranted.

Product Shipping

Products produced in the hydrometallurgical plant (AU/PGM concentrate, mixed hydroxide precipitate) will be loaded into super sacks (i.e. large industrial sacks used to transport solid material) and then loaded onto trucks or railcars. There is little or no potential for spillage with this method of shipping. With respect to flotation concentrate, as stated in the project description (Reference 1) "Each filtered concentrate would be conveyed to separate stockpiles within an enclosed 10,000 ton storage facility for loading into covered rail cars. The storage facility would store about 7 to 10 days of production capacity when flotation concentrate would be directed to Concentrate Dewatering/Storage. The storage facility would have a concrete floor and provisions to wash wheeled equipment leaving the facility to prevent concentrates from being tracked out of the facility." The flotation concentrate is similar material to that which caused issues at the Red Dog Mine in Alaska (zinc concentrate transported in truck trailers), which has been cited as an example of potential consequences of product transport at mining operations. Some issues at Red Dog were driven by road dust and port activities which do not apply to the Project. Best Management Practices adopted at Red Dog - enclosed storage and loading, covered cars, and vehicle wash facilities - are proposed for use at the NorthMet project. Because the common carrier route (i.e. the rail line used to transport products) is not known (ultimate customer not known and could change), there is no way to assess impacts along the common carrier route. PolyMet will be paid on tons received by customers so it has a vested interest in not losing any concentrate. The covered rail cars will be inspected for holes and any holes repaired before concentrate loading.

4.3.3 Potential Indirect Wetland Impacts Resulting from Wetland Fragmentation

For remaining wetlands not directly impacted or identified in 4.3.2, an estimate of potential indirect wetlands (wetland acres by wetland type, and type of indirect impact) from wetland fragmentation by Project features will be completed using the following steps:

1. For each portion of a remaining wetland, excluding indirect impacts identified in 4.2.3, the potential area of indirect impacts would be determined based on an analysis of the various factors that may contribute to potential fragmentation. Based on the analysis, the identifying factor(s) contributing to potential fragmentation (change in size of wetland, surrounded by Project features, change in function and values of wetland e.g. wildlife habitat, etc.) would be identified. [Note: noise and dust do not cause fragmentation impacts according to the U.S. Army Corps of Engineers, May 16, 2011 conference call.]

4.3.4 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

5. Cumulative Wetland Impacts

Analysis of cumulative wetland impacts will be done using accepted tools and protocols. The analysis performed for the DEIS is described and summarized in Section 4.3 of Reference 1. The analysis performed for the SDEIS will generally duplicate that effort using the revised direct and potential indirect wetland impact acreage, along with updated watershed information. The assessment will be conducted for both the Partridge River watershed and the Embarrass River watershed. The following steps will provide acreage for wetland and water resources for the pre-settlement, existing and foreseeable future conditions. Tables and figures will be developed to present the information.

5.1 Presettlement Wetland and Water Resources

The pre-settlement conditions time period represents wetlands, lakes, and deepwater resources as they existed prior to mining and urban development in the late 1800s to early 1900s. An estimate of pre-settlement wetland, lakes, and deepwater acreage within the Partridge River and Embarrass River watersheds will be developed in GIS using the following steps:

1. The acreage of wetland and water resources estimated for the pre-settlement period will be developed using the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) and the original survey maps developed using data from the original Government Land Surveys along with other historical surveys and sources, generally from the late 1800s.
2. The NWI mapping efforts were generated from interpretations of black-and-white aerial photographs completed in the late 1970s to early 1980s. The NWI is a more accurate depiction of historic wetland resources where human disturbance has been limited. Therefore, the NWI will be used as a base wetland map and available delineation data will be substituted to improve the accuracy of the wetland mapping.
3. The original survey maps will be obtained from the MDNR GIS Data Deli maps at http://deli.dnr.state.mn.us/. The original survey maps identify water resources as marshes, bottoms, swamps, lakes, ponds, and rivers, as documented in early land surveys. The original survey maps are a more accurate depiction of historic wetland resources where human disturbance is present. The water resources within the areas of human disturbance in each watershed will be digitized and presented on a figure.
4. The wetland and water resources mapped on the original survey maps will be digitized for one township, with minimal disturbance (roads, railroads, mining areas, etc.) located within and adjacent to the Partridge River watershed and for one township located within the Embarrass River watershed. It is assumed that if there is a minimal amount of disturbance in a township, the NWI mapping would be representative of pre-settlement wetland and water resources conditions. Therefore the data from each township will be used to develop a relationship between the NWI and original survey data.

5. The total wetland and water resources acreage for the two data sets will be compiled and the ratio of NWI to original survey map wetland and water resources will be calculated for each township. This ratio will indicate the percent of wetland and water resources identified on the NWI maps compared the original survey maps. This ratio will be used as an adjustment factor to conform the original survey data to the standards and scales of the NWI data for estimating the pre-settlement wetland resources within the disturbed areas of the watershed. The selected townships and data used to determine the adjustment factor will be presented in a table.
6. For the human disturbance areas, the NWI wetlands and water resources located within the human disturbance polygon boundaries will be removed using a GIS clipping tool. The NWI within these disturbance areas do not accurately reflect pre-settlement conditions because the NWI either included wetlands that have since been eliminated because of disturbance activities or did not include wetlands that had already been eliminated when the NWI was completed (e.g., reservoir development permanently flooded the wetlands). Because the NWI does not accurately map these types of areas, it does not accurately represent pre-settlement conditions; therefore the NWI wetlands in the disturbed areas will be replaced with wetlands mapped on the original survey maps. The total area of wetland and water resources within those polygons will be corrected using the adjustment factor. The total acreage of pre-settlement wetlands and water resources will be estimated for the two watersheds.

5.2 Existing Wetland and Water Resources

The existing conditions time period represents wetland, lake, and deepwater resources as they exist today, prior to the development of the Project. An estimate of existing wetland, lake, and deepwater acreage within the Partridge River and Embarrass River watersheds will be developed in GIS using the following steps:

1. Existing wetland, lake, and deepwater resources will be estimated using: wetland delineations completed in the area (as available); lake or lacustrine water body acreages will be estimated using the USGS National Hydrograph Dataset and the NWI datasets; deepwater or mine pit water body acreages will be estimated using a combination of the MDNR Mesabi Mining Features (2008) and interpretation of 2003, 2008, 2009, and 2010 FSA aerial photographs; and NWI mapping.
2. A “composite” wetland and water resources layer will be developed by deleting all of the NWI polygons from areas in which more detailed mapping had been completed and replacing them with the delineated wetland, lake, and deepwater resources.

5.3 Projected Future Wetland and Water Resources

An estimate of future wetland acreage within the Partridge River and Embarrass River watersheds will be completed considering reasonably foreseeable future project wetland impacts, both direct and potential indirect. Reasonably foreseeable future projects are defined as those that have been permitted and those that have had permit applications submitted and/or are undergoing environmental review by regulatory agencies.

The future conditions time period represents wetland, lake, and deepwater resources expected to be present following conclusion and reclamation of the Project. It is assumed that the future conditions follows some time after conclusion of the future projects such that the mine pit will have filled with water.

Relevant public officials from city, county, state and federal agencies will be contacted to identify reasonably foreseeable future actions within the study area. Agency officials will be asked to identify reasonably foreseeable future projects that may occur during the life of the Project. Contacts will include the City of Babbitt, St. Louis County, MDNR, Minnesota Board of Water and Soil Resources, the U.S. Forest Service, and the Iron Range Resources and Rehabilitation Board (IRRRB).

Future projects will be identified in the Partridge River watershed and the Embarrass River watershed that may impact wetland, lake, and deepwater resources. For the projected future conditions, the acreage of wetland, lake, and deepwater resources will be estimated by subtracting the future projected wetland impacts and adding the future projected development of wetland, lake, and deepwater resources to the existing resource totals. This information will be provided as a table.

5.4 Qualitative Analysis of Cumulative Wetland Impacts for the St. Louis River below the Ordinary High Water Mark From Its Confluence with the Embarrass River to Lake Superior

A qualitative analysis of cumulative wetland impacts for the St. Louis River below the ordinary high water mark from its confluence with the Embarrass River to Lake Superior will be developed based on a qualitative estimate of flow changes in the river.

A qualitative estimate of flow changes in the St. Louis River will be developed from the results of the Partridge River hydrologic modeling described in Section 7.1.1 of Reference 3. The estimated flow changes in the St. Louis River will be evaluated relative to gage data to determine if the changes are expected to be within the natural variation of flow within the St. Louis River will be developed using the following steps:

1. If the evaluation of the estimated flow changes in the St. Louis River is within the natural variation of average annual flow in within the St. Louis River observed at USGS gage 04016500 (St. Louis River near Aurora), no further analysis will be conducted. This location is the most upstream location of the St. Louis River affected by the NorthMet Project, and will therefore show the greatest impact.
2. If the evaluation of the estimated flow changes in the St. Louis River is not within the natural variation of flow in within the St. Louis River, the following analysis will be conducted.
    a. An estimate of existing wetland acreage and wetland types below the ordinary high water mark of the St. Louis River from its confluence with the Embarrass River to Lake Superior will be made using the National Wetland Inventory.
    b. An estimate of future wetland acreage and wetland types below the ordinary high water mark of the St. Louis River will be made from its confluence with the Embarrass River to Lake Superior.

5.5 Quantitative Analysis of Cumulative Wetland Impacts

5.5.1 Partridge River and Embarrass River Watersheds

A quantitative analysis of cumulative impacts for the Partridge River and Embarrass River watersheds will be developed using the following steps:

1. The acreage of wetland, lake, and deepwater resources for the pre-settlement, existing and reasonably foreseeable future conditions will be provided as a table. The foreseeable future conditions will include evaluation of a No Action Alternative and the Proposed Action.
    a. The acreage of wetland, lake, and deepwater resources will be compared and discussed for the pre-settlement, existing and reasonably foreseeable future conditions.
    b. The project's effect on the wetland, lake, and deepwater resources will be discussed and compared for the study area. This includes a discussion of changes in acreage,

water quality, unique habitat, adjacency to stream resources, and cumulative effects of projects within each watershed.

5.5.2 The St. Louis River below the Ordinary High Water Mark From Its Confluence with the Embarrass River to Lake Superior

A quantitative analysis of cumulative impacts for wetlands located below the ordinary high water mark of the of the St. Louis River from its confluence with the Embarrass River to Lake Superior will be developed using the following steps:

1. If the evaluation of the estimated flow changes in the St. Louis River is within the natural variation of flow in within the St. Louis River, no further analysis will be conducted.
2. If the evaluation of the estimated flow changes in the St. Louis River is not within the natural variation of flow in within the St. Louis River, determine the change in wetland acreage from existing to future conditions based on a qualitative estimate of flow changes in the St. Louis River.

5.6 Climate Change

A qualitative analysis of estimated climate change impacts (to be coordinated with the climate change evaluation being conducted for the air impacts chapter of the SDEIS) on cumulative wetland impacts in the Partridge River Watershed, the Embarrass River Watershed, and below the ordinary high water mark of the of the St. Louis River from its confluence with the Embarrass River to Lake Superior.

The qualitative assessment of the potential impacts of climate change on wetlands will be included in the Climate Change Evaluation Report developed by the Air IAP. No additional assessment will be conducted.

6. References

Reference 1 NorthMet Project Project Description, Version 3, September 13, 2011

Reference 2 NorthMet Project Draft Environmental Impact Statement. U.S. Army Corps of Engineers and Minnesota Department of Natural Resources. October 2009.

Reference 3 NorthMet Project Water Modeling Data Package – Volume 1 (Mine Site) Version 5

Reference 4 Compilation of Air Pollutant Emission Factors, AP-42 5th edit. Volume I Stationary Point and Area Sources, Section 13.2.5. Updated November 2006. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

Reference 5 NorthMet Project Water Modeling Data Package – Volume 2 (Plant Site) Version 2

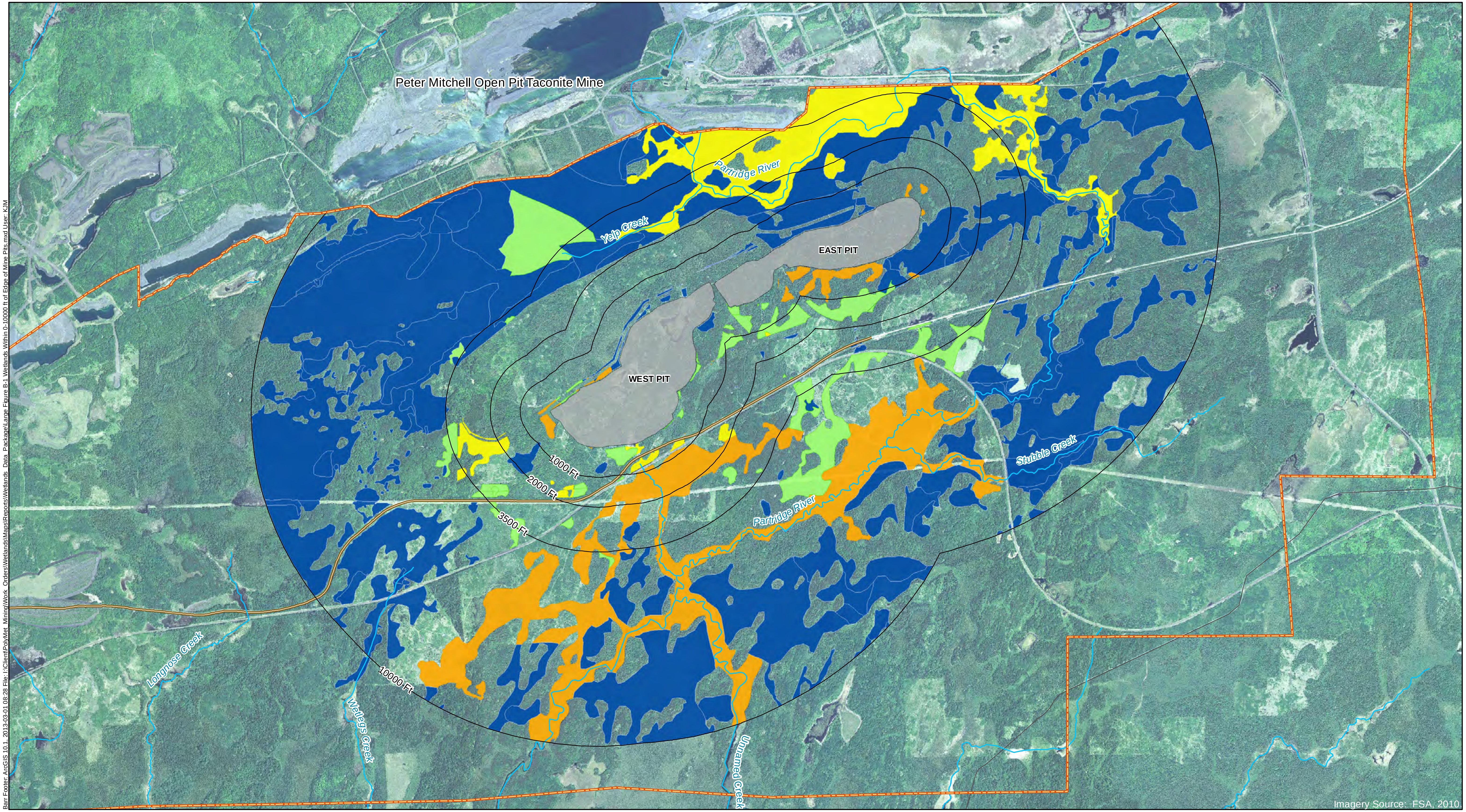
Reference 6 Surface Water IAP Group Summary Document, Date: May 20, 2011.

Reference 7 NorthMet Project Waste Characterization Data Package Version 5

Reference 8 NorthMet Mine Site Water Modeling Work Plan Version 2

Attachment B

Wetlands within Analogue Zones – Mine Site



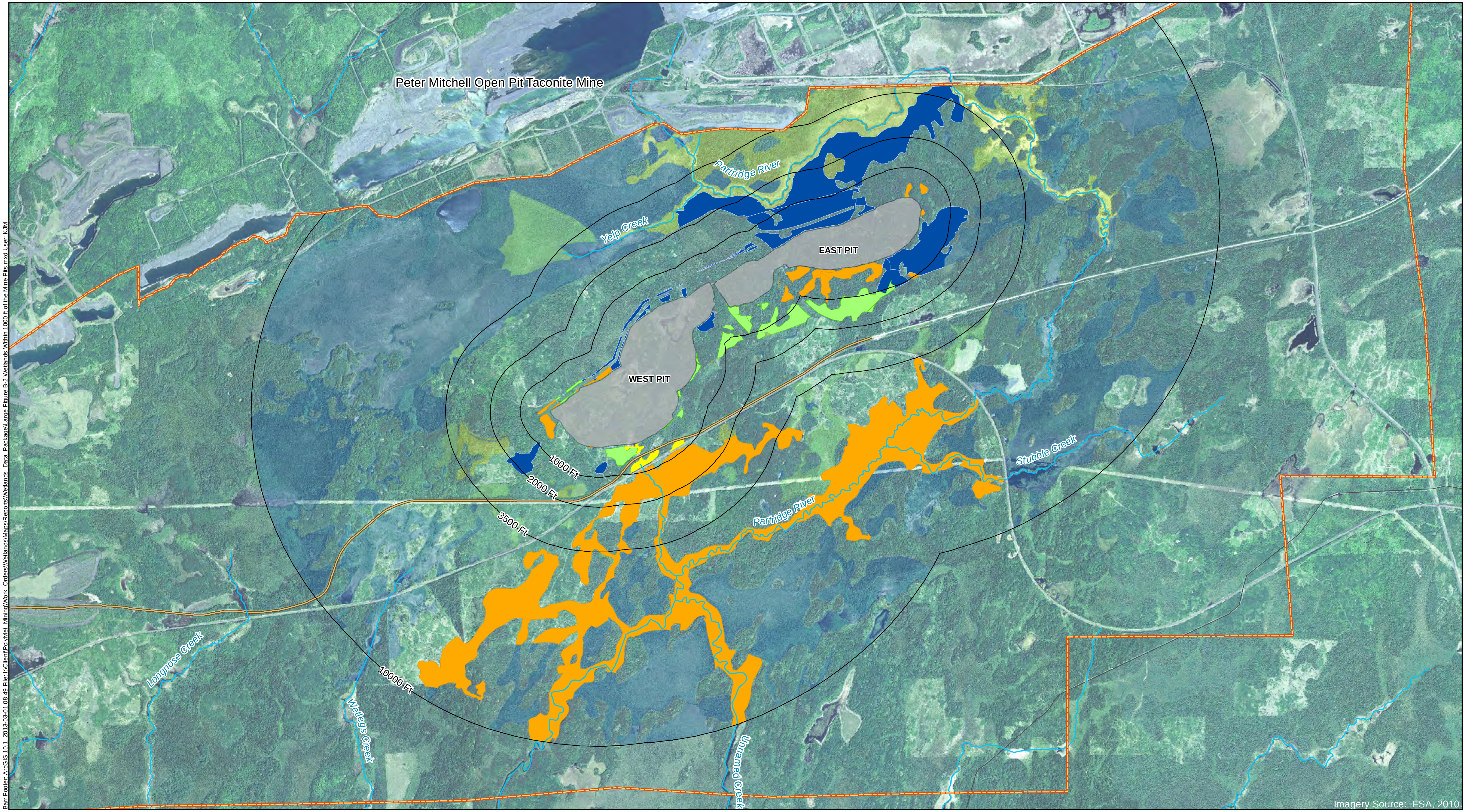
▭ 20 Year Mine Pit
▭ Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
● High Likelihood
● Moderate Likelihood
● Low Likelihood
● No Impact

N

0 1,500 3,000 6,000
Feet

Large Figure B-1
WETLANDS WITHIN 0 - 10,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



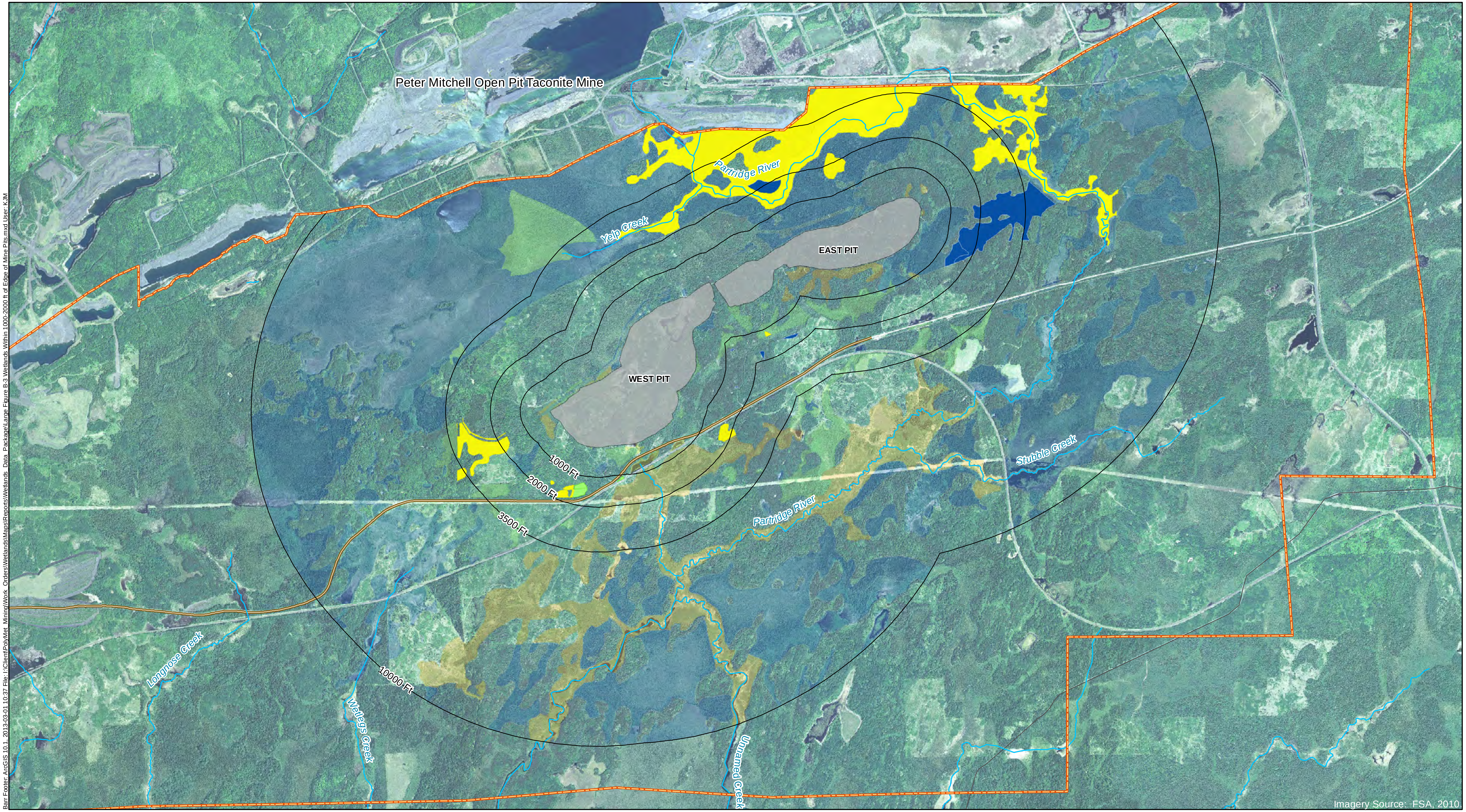
▨ 20 Year Mine Pit
▭ Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
● High Likelihood
● Moderate Likelihood
● Low Likelihood
● No Impact

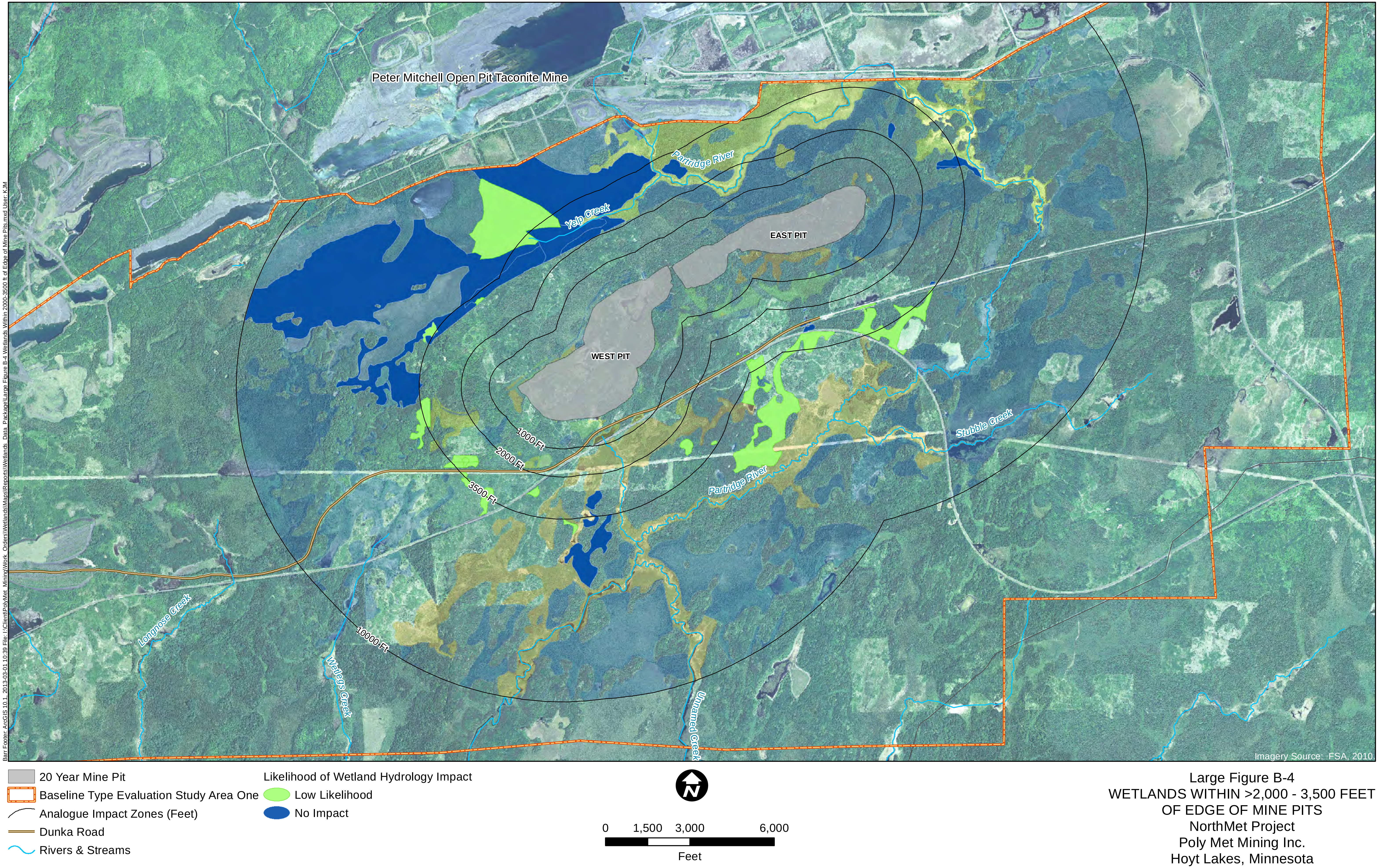
N

0 1,500 3,000 6,000
Feet

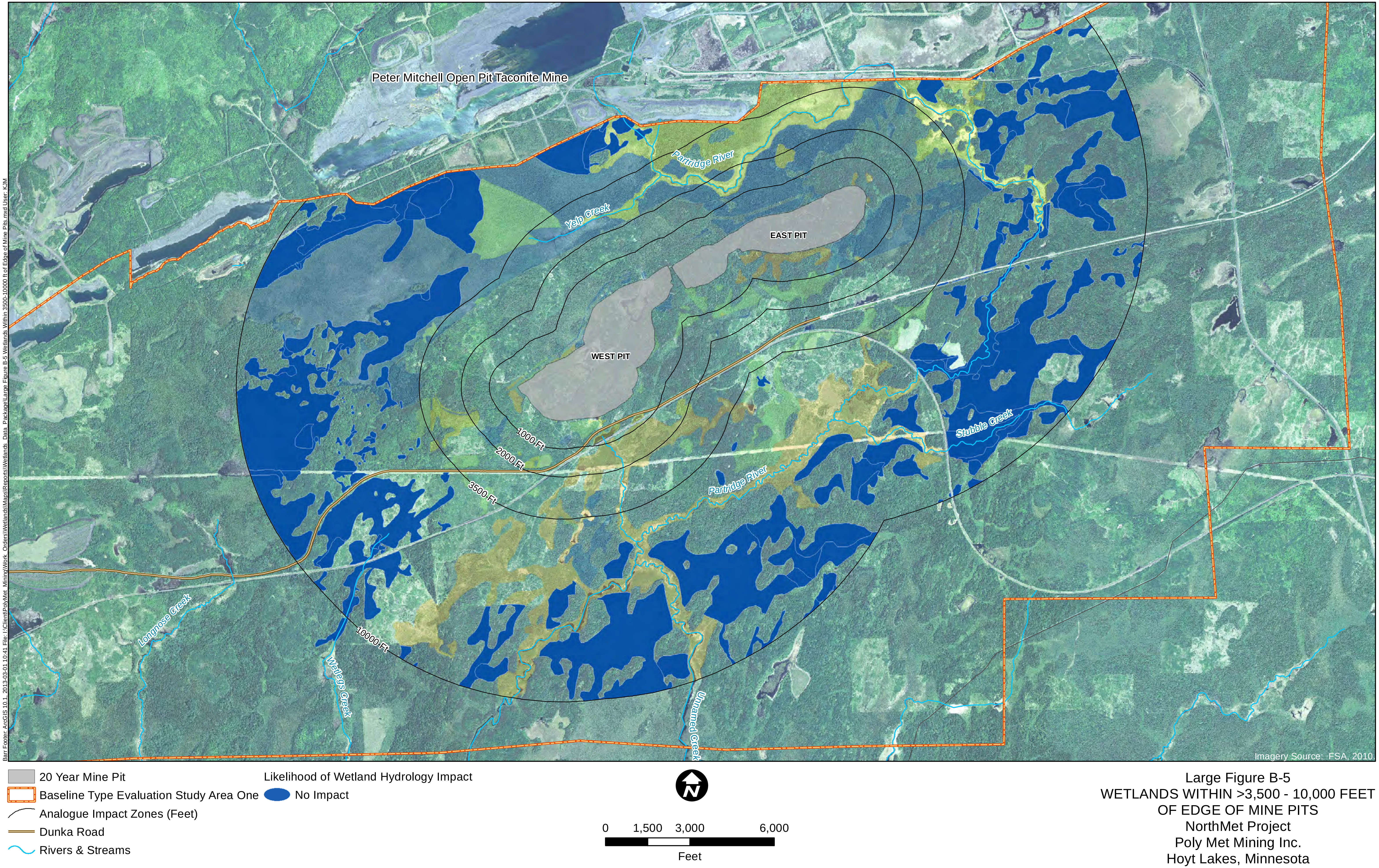
Large Figure B-2
WETLANDS WITHIN 0 - 1,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure B-3
WETLANDS WITHIN >1,000 - 2,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure B-4
WETLANDS WITHIN >2,000 - 3,500 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

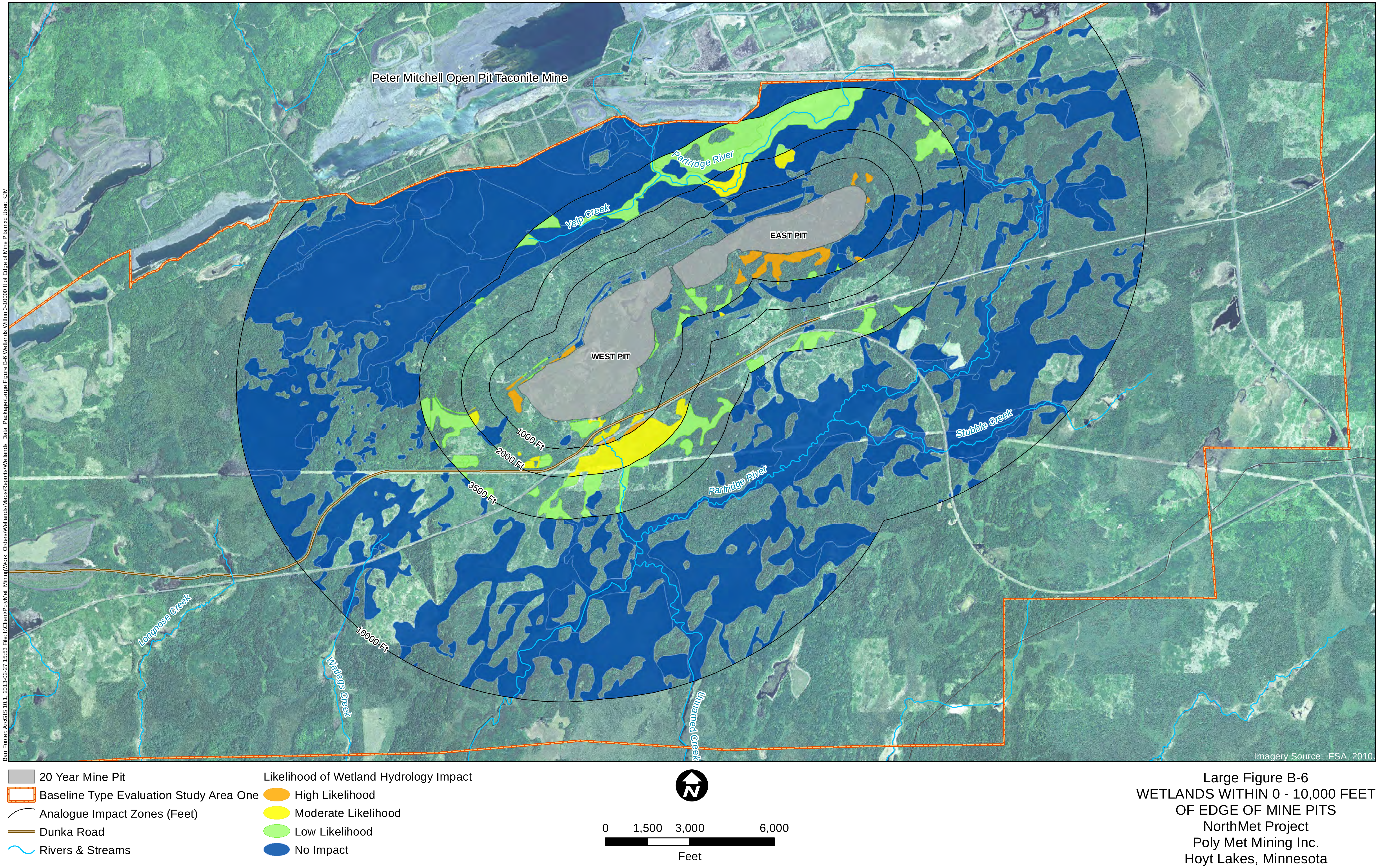


Barr Footer: ArcGIS 10.1, 2013-03-01 10:41 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Maps\Reports\Wetlands Data Package\Large Figure B-5 Wetlands Within 3500-10000 ft of Edge of Mine Pits.mxd User: KJM

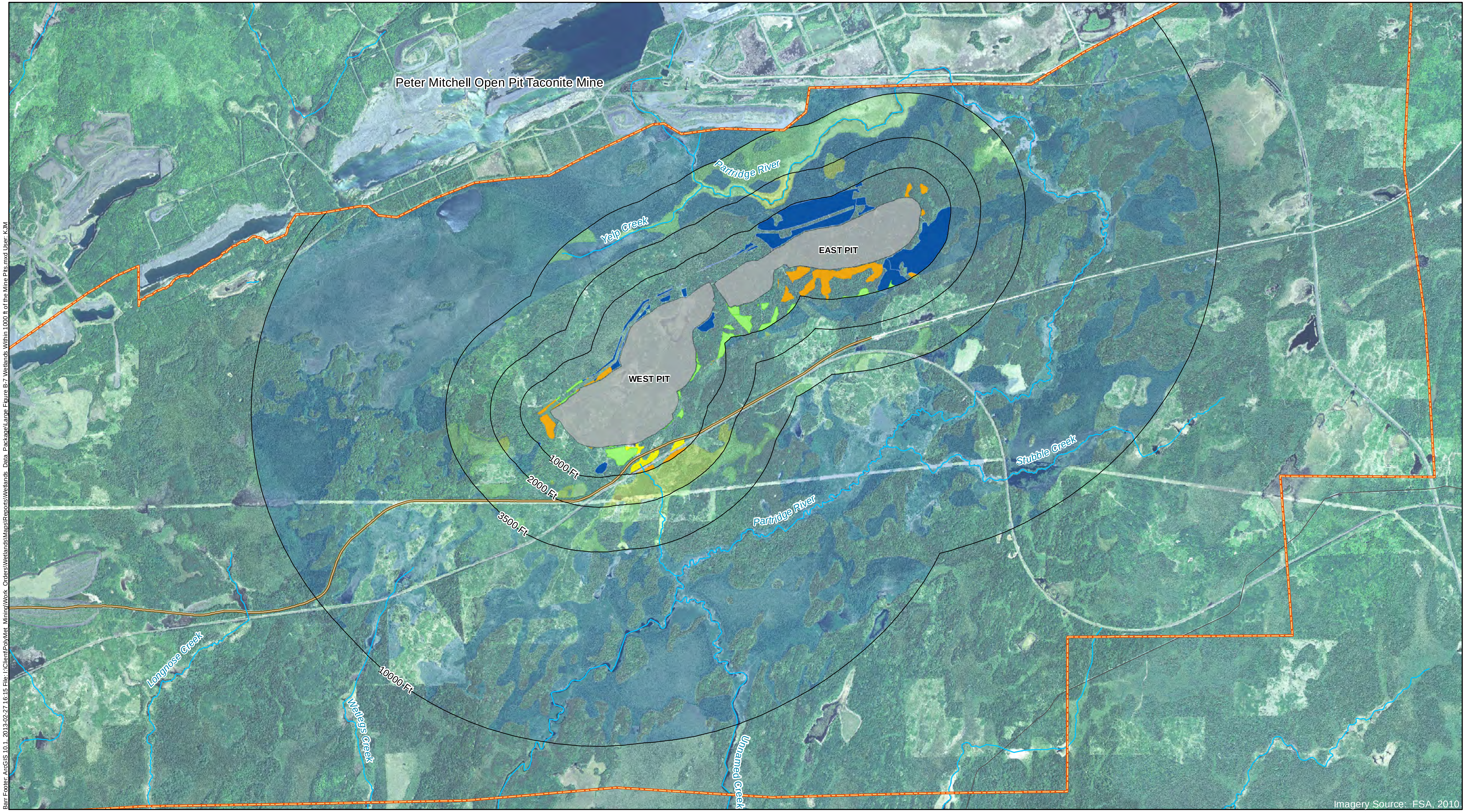
▭ 20 Year Mine Pit
▭ Baseline Type Evaluation Study Area One
Analogue Impact Zones (Feet)
Dunka Road
Rivers & Streams

Likelihood of Wetland Hydrology Impact
● No Impact

Large Figure B-5
WETLANDS WITHIN >3,500 - 10,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure B-6
WETLANDS WITHIN 0 - 10,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



- ⬜ 20 Year Mine Pit
- ▭ Baseline Type Evaluation Study Area One
- ⌒ Analogue Impact Zones (Feet)
- ═ Dunka Road
- ∼ Rivers & Streams

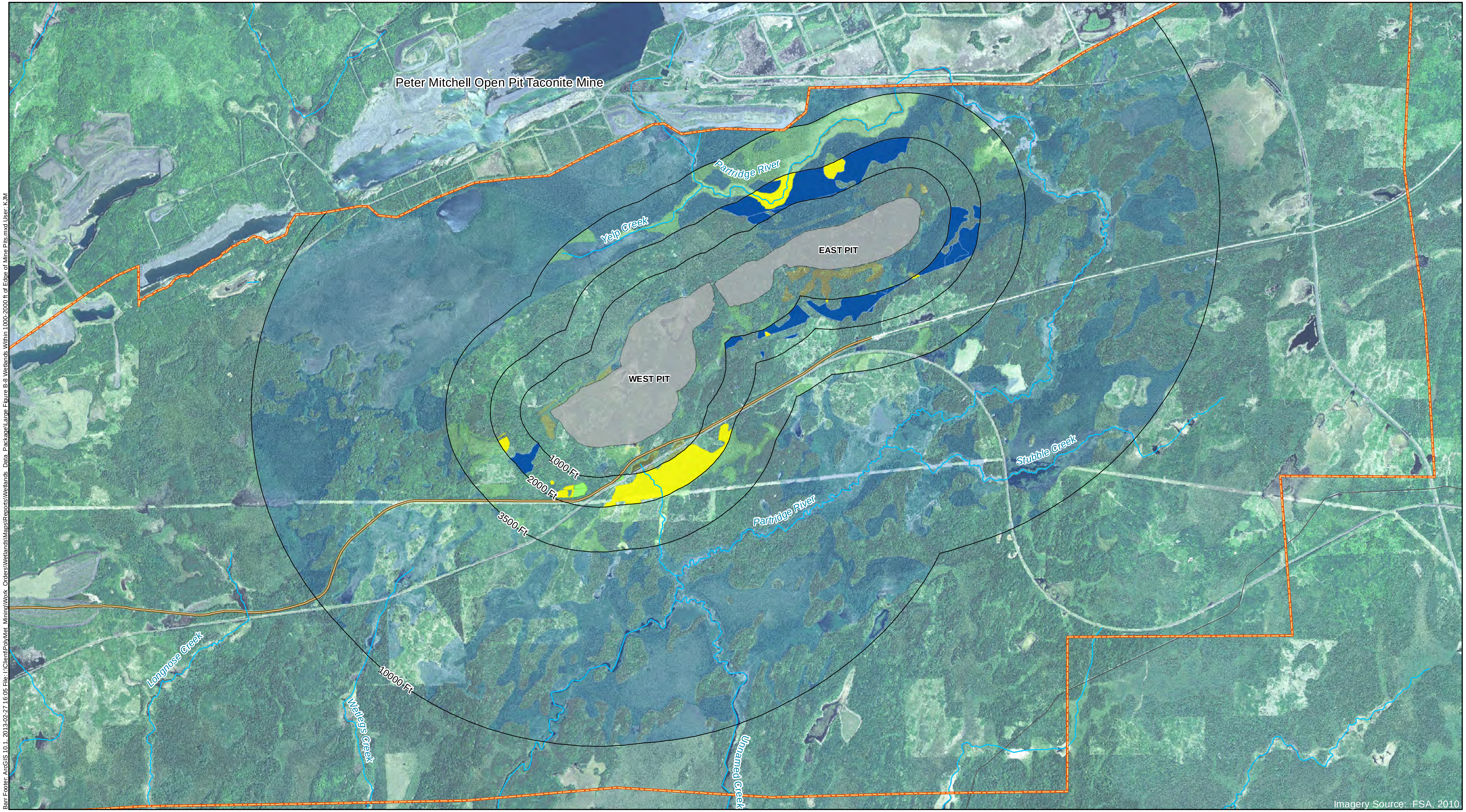
Likelihood of Wetland Hydrology Impact

- 🟧 High Likelihood
- 🟨 Moderate Likelihood
- 🟩 Low Likelihood
- 🟦 No Impact

0 1,500 3,000 6,000

Feet

Large Figure B-7
WETLANDS WITHIN 0 - 1,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



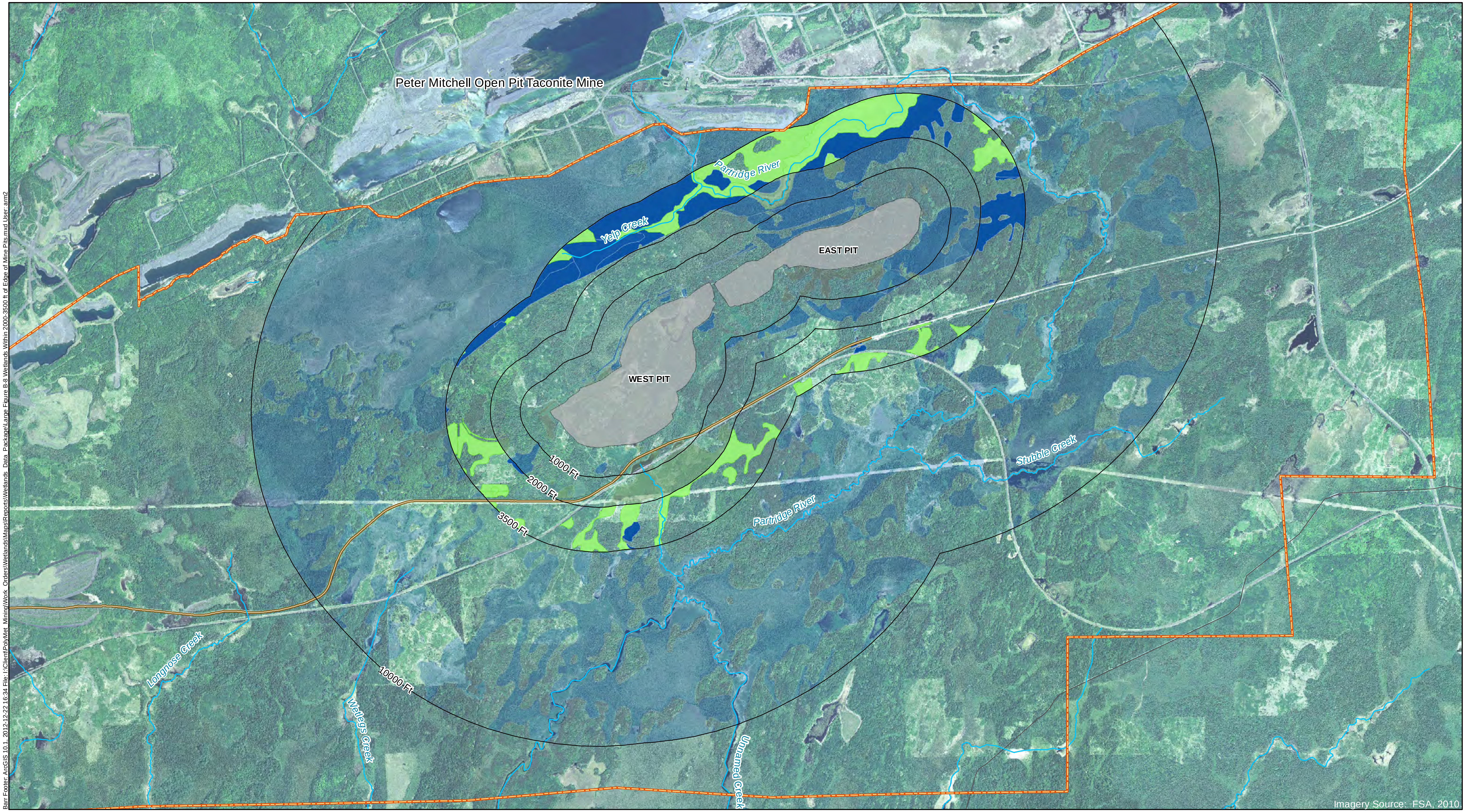
Barr Footer: ArcGIS 10.1, 2013-02-27 16:05 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Maps\Reports\Wetlands Data Package\Large Figure B-8 Wetlands Within 1000-2000 ft of Edge of Mine Pits.mxd User: KJM

▭ 20 Year Mine Pit
▭ Baseline Type Evaluation Study Area One
⁀ Analogue Impact Zones (Feet)
═ Dunka Road
～ Rivers & Streams

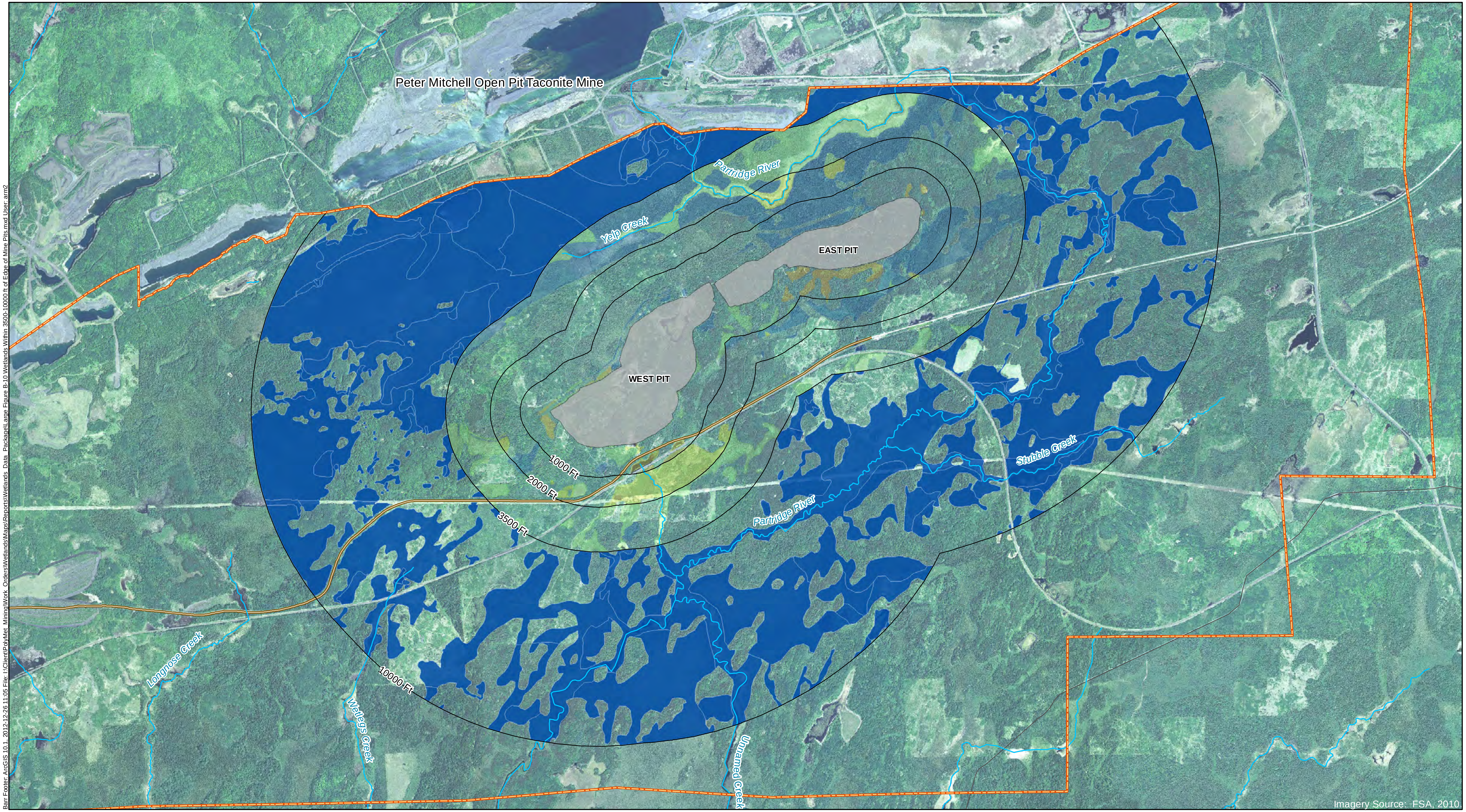
Likelihood of Wetland Hydrology Impact
● Moderate Likelihood
● Low Likelihood
● No Impact

0 1,500 3,000 6,000
Feet

Large Figure B-8
WETLANDS WITHIN >1,000 - 2,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Large Figure B-9
WETLANDS WITHIN >2,000 - 3,500 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



▭ 20 Year Mine Pit

▭ Baseline Type Evaluation Study Area One

Analogue Impact Zones (Feet)

Dunka Road

Rivers & Streams

Likelihood of Wetland Hydrology Impact

● No Impact

0 1,500 3,000 6,000

Feet

Large Figure B-10
WETLANDS WITHIN >3,500 - 10,000 FEET
OF EDGE OF MINE PITS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Barr Footer: ArcGIS 10.1, 2012-12-26 11:05 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\Large Figure B-10 Wetlands Within 3500-10000 ft of Edge of Mine Pits.mxd User: arm2

Attachment C

Chemistry of NorthMet Ore, NorthMet Tailings, and LTVSMC Tailings

Table C1-1 Ore and Waste Rock Chemistry Data Used Speciate Dust Depostion

Ore[1]							Category 1 Waste Rock				
	Center	East	West	Max			Center	East	West	Max	
Constituent	95% UCL	95% UCL	95% UCL	95% UCL	99th Percentile		95% UCL	95% UCL	95% UCL	95% UCL	99th Percentile
AS_PPM	18.8	7.84	9.51	18.83	28.1		6.18	5.82	8.48	8.48	13.2
CD_PPM	0.838	0.923	0.814	0.92	2.50		0.513	0.609	0.576	0.61	1.30
CR_PPM	119	124	208	208.46	559		160	178	182	181.85	286
Cu_D	0.286	0.363	0.312	0.36	0.594		0.032	0.0394	0.046	0.0460	0.082
MN_PPM	970	956	911	970.41	1279		846	989	1004	1004.10	1363
Ni_D	0.106	0.0976	0.082	0.11	0.153		0.032	0.0305	0.0343	0.0343	0.056
PB_PPM	9.11	10.6	7.81	10.58	16.8		3.74	5.65	5.33	5.65	12.1
SE_PPM				5.5						8.4	
Sulfur_PPM				9,588.6						n/a	
V_PPM	106	126	96.5	126.29	259		63.8	117	98.2	117.00	168
ZN_PPM	100	104	92.3	104.12	138		80.4	110	86.4	110.17	116
Category 2/3 Waste Rock							Category 4 Waste Rock[2]				
	Center	East	West	Max							
Constituent	95% UCL	95% UCL	95% UCL	95% UCL	99th Percentile		95% UCL	99th Percentile	Max		
AS_PPM	7.15	7.10	9.32	9.32	20.8		33.8	86.7			
CD_PPM	0.555	0.708	0.721	0.72	1.60		1.80	3.40			
CR_PPM	130	225	219	224.69	474		159	325			
Cu_D	0.068	0.072	0.100	0.10	0.130		0.0369	0.1290			
MN_PPM	713	1026	964	1025.74	1300		529	1758			
Ni_D	0.033	0.035	0.0362	0.04	0.051		0.0191	0.0470			
PB_PPM	3.25	6.77	6.81	6.81	13.7		12.4	25.1			
SE_PPM				8.38					8.38		
Sulfur_PPM				3,476.5					34,540.0		
V_PPM	49.9	119	124	123.94	280		143	256			
ZN_PPM	73.2	110	83.7	110.08	147		273	555			

PPM = part per million concentration
General Notes:
Values listed are the 95% upper confidence limit (UCL) for the mean for the maximum year in the 20-year projected life of the mine.

Columns labeled "Max Avg." contain the value used in the previous emission inventory submittals for comparison.
95% UCL Values are in PPM except for Cu and Ni which are expressed as percents. Maximum averages are all expresses as PPM (divide by 10,000 to convert PPM to %).

Footnotes:

[1] Ore data used in the previous emission inventory submittals was not separated into East and Central pit values.

[2] Because of the relatively small volume of Category 4 Waste Rock, the statistical analysis was conducted for all data independent of year and pit.

References:

Geerts, S.D., 1994, Petrography and geochemistry of a platinum group element-bearing mineralized horizon in the Dunka Road prospect (Keweenawan) Duluth Complex northeastern Minnesota: Unpublished M.S. Thesis. University of Minnesota Duluth. 155 p., 8 plates.

Severson, M.J., 1988. Geology and structure of a portion of the Partridge River intrusion: A progress report: Natural Resources Research Institute, University of Minnesota Duluth, Technical Report, NRRI/GMIN-TR-88-08. Duluth, Minnesota. 78 p., 5 plates.

Severson, M.J., and Hauck, S.A. 1990. Geology, geochemistry, and stratigraphy of a portion of the Partridge River intrusion: Natural Resources Research Institute, University of Minnesota Duluth, Technical Report, NRRI/GMIN-TR-89-11. 235 p. 4 plates, 1 diskette.

Table C1-2 Tailings Chemistry Data Used to Speciate Dust Deposition

Metal	Conc. (ppm)	Source	Comments
NorthMet Tailings			
Arsenic	81	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be conservative.
Cadmium	0.08	2005/2006 Pilot Study [1]	Emission factor calculated from data obtained during 2005 and 2006 pilot studies. Average value for all parcels calculated. Values below the detection limit assumed to be at the detection limit.
Chromium	310	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be conservative.
Copper	547		
Lead	383		
Manganese	1400		
Nickel	510	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be conservative.
Selenium	1.2	2005/2006 Pilot Study [1]	Emission factor calculated from data obtained during 2005 and 2006 pilot studies. Average value for all parcels calculated. Values below the detection limit assumed to be at the detection limit.
Sulfur	1,210	Water Modeling Data Package; as of Sept. 04, 2012	1,210 mg S / kg tailings is ~ 0.12% sulfur content.
Zinc	548	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be

Metal	Conc. (ppm)	Source	Comments
			conservative.
Vanadium	210	2000 Pilot Study [2]	Emission factors calculated from trace metal analysis completed on tailings produced during the pilot study. The results from the -38um fraction was used because this would approximate TSP except when the -10um fraction appeared to produce higher quality data (e.g. lower detection limits). Data for the analysis of the entire tailings size range was also evaluated, but these values were lower, with the exception of boron, and the smaller particle sizes would represent those most likely to become airborne. The data for the entire tailings size range was used for boron, because the size specific data were below the detection limit. With the exception of vanadium, analysis for all of these elements was also performed during the 2005 pilot study. However, the results from 2000 were higher for all elements. 2000 data was used for all elements to be conservative.
LTVSMC Tailings Chemistry			
Arsenic	24.6	Waste water modeling report [3]	
Cadmium	0.25	Waste water modeling report [3]	Result reports as < 0.5
Chromium	66.8	Waste water modeling report [3]	
Copper	12.6	Waste water modeling report [3]	
Lead	5.6	Waste water modeling report [3]	
Manganese	4880	Waste water modeling report [3]	
Nickel	4	Waste water modeling report [3]	
Selenium	1.2	NorthMet Data	Data not available for LTVSMC tailings.
Sulfur	1,210	Water Modeling Data Package; as of Sept. 04, 2012	1,210 mg S / kg tailings is ~ 0.12% sulfur content. Sulfur content of NorthMet tailings assumed to the sulfur content of the LTVSMC tailings.
Zinc	15.8	Waste water modeling report [3]	
Vanadium	10.4	LTVSMC tailings data (Aqua Regia tests)	Data submitted to the MDNR in June 2011 via email from P.Hinck (Barr) to M.Olson (MDNR).

[1] Barr Engineering Co. May 2006. Environmental Sampling and Analysis Flotation Process Liquids and Solids Sampling Results Pilot Test – NorthMet Deposit PolyMet Mining, Inc. Table 9 and Barr Engineering Co. July 2006. Draft - Environmental Sampling and Analysis Flotation Process Optimization Test. Table 5.

[2] SGS Lakefield Research Limited. Flotation Pilot Plant Products Environmental Investigation and Air Testing from NorthMet Samples. June 30, 2004. LR10054-003 Progress Report No. 6, Tables B-6 and B-1.

[3] Barr Engineering Co. July 20, 2007. Waste Water Modeling – Tailings; NorthMet Project. Table 5-1 and supporting data set.'

Attachment D

Adjustment of Background Metal Deposition

ATTACHMENT D

Adjustment of Background Metal Deposition

The authors estimated that precipitation was under-estimated by 45% to 70%. An initial review of data (comparison of dry deposition and wet deposition as a percent of total deposition) indicates wet deposition is less than 50% of total deposition for the metals, except selenium (Table C2-1). Wet deposition in rural areas should account for 50% or more of the total deposition. For the Eagle Harbor data, the deposition estimates are considered to be skewed toward dry deposition (except for selenium)

Table D2-1 Comparing Wet Deposition and Dry Deposition to Total Deposition for the Eagle Harbor, Michigan Monitoring Site (Data as reported from Sweet et al. (1998).

Metal	Dry Deposition	Wet Deposition	Total (wet+dry)	Dry Deposition as a % of Total	Wet Deposition as a % of Total	Comments
	µg/m2/yr	µg/m2/yr	µg/m2/yr			
Vanadium	260	78	338	77%	23%	Wet dep % is low
Chromium	130	78	208	63%	38%	Wet dep % is low
Manganese	1,900	2,300	4,200	45%	55%	
Nickel	570	230	800	71%	29%	Wet dep % is low
Copper	2,400	700	3,100	77%	23%	Wet dep % is low
Zinc	5,300	3,500	8,800	60%	40%	Wet dep % is low
Arsenic	91	78	169	54%	46%	Wet dep % is low
Selenium	52	520	572	9%	91%	
Cadmium	380	78	458	83%	17%	Wet dep % is low
Lead (Pb)	920	550	1,470	63%	37%	Wet dep % is low

µg/m2/yr = micrograms per square meter per year

Because Sweet et al. (1998) indicated that precipitation was under-collected by 45% to 70%, the wet deposition component of t heir data was adjusted. The mid-range of the under-collection (60%) was used to adjust estimated wet deposition. A factor of 1.6 was applied to the wet deposition reported by Sweet et al. (1998). The adjusted wet deposition was added to the estimated dry deposition reported by Sweet et al. (1998) to derive an “adjusted total deposition” (Table C2-2). The adjusted total deposition from Table C2-2 was used for comparison to the respective modeled metal deposition rates for the Mine Site and Flotation Tailings Basin.

However, no adjustment to the selenium wet deposition was made because wet deposition was already accounting for 91% of the total deposition.

Even with the adjustment in wet deposition by a factor of 1.6, the adjusted wet deposition for most metals is less than 50% of total deposition.

Table D2-2 Summary Table of Adjustments in Background Metal Deposition Due to the Under-Collection of Precipitation at the Eagle Harbor, Michigan Monitoring Site (reported data from Sweet et al. 1998.)

Metal	Reported Dry Deposition [1]	Reported Wet Deposition [1]	Adjusted Wet Deposition [2]	Adjusted Total (Dry + Adjusted Wet) [3]	Dry Deposition as a % of Adjusted Total	Adjusted Wet Deposition as a % of Adjusted Total
	µg/m2/yr	µg/m2/yr	µg/m2/yr	µg/m2/yr		
Vanadium	260	78	125	385	68%	32%
Chromium	130	78	125	255	51%	49%
Manganese	1,900	2,300	3,680	5,580	34%	66%
Nickel	570	230	368	938	61%	39%
Copper	2,400	700	1,120	3,520	68%	32%
Zinc	5,300	3,500	5,600	10,900	49%	51%
Arsenic	91	78	125	216	42%	58%
Selenium	52	520	520 [4]	572 [4]	91% [4]	9% [4]
Cadmium	380	78	125	505	75%	25%
Lead (Pb)	920	550	880	1,800	51%	49%

µg/m2/yr = micrograms per square meter per year

[1] Deposition as reported by Sweet et al. (1998).

[2] Adjusted Wet Deposition = Reported Deposition x 1.6

[3] Adjusted Total Deposition = Reported Dry Deposition + Adjusted Wet Deposition

[4] Selenium wet deposition and total deposition were not adjusted for under-collection of precipitation.

Adjustment in total deposition compared to the deposition reported by Sweet et al. (1998) is summarized in Table C2-3. Overall, the adjustment in wet deposition by a factor of 1.6 (60% increase) results in relatively small increases in total deposition. Because dry deposition is the major component of the total deposition, the adjustment in the wet deposition for under-collection of precipitation does not change the total deposition appreciably and for most of the metals wet deposition is still the smaller component of the total deposition (Table C2-2).

Table D2-3. Change in estimated total deposition from the values originally reported by Sweet et al (1998)

	Initial Data: From Sweet et al. (1998)					
Metal	**Reported Dry Deposition**	**Reported Wet Deposition**	**Reported Total Deposition (wet + dry)**	**Adjusted Wet Deposition**	**Adjusted Total Deposition (adjusted wet + dry)**	**% Change in Total Deposition (Adjusted Total - Reported Total)/Reported Total**
	µg/m2/yr	µg/m2/yr	µg/m2/yr	µg/m2/yr	µg/m2/yr	%
Vanadium	260	78	338	125	385	14%
Chromium	130	78	208	125	255	23%
Manganese	1,900	2,300	4,200	3,680	5,580	33%
Nickel	570	230	800	368	938	17%
Copper	2,400	700	3,100	1,120	3,520	14%
Zinc	5,300	3,500	8,800	5,600	10,900	24%
Arsenic	91	78	169	125	216	28%
Selenium	52	520	572			
Cadmium	380	78	458	125	505	10%
Lead (Pb)	920	550	1,470	880	1,800	22%

Attachment E

Technical Memorandum: NorthMet Mine Site to Plant Site Rail Impacts Modeling, December 21, 2012

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BARR

Memorandum

To: Project File
From: Peter Hinck
Subject: NorthMet Mine Site to Plant Site rail impacts modeling
Date: December 21, 2012
Project: 23690862.00

This memorandum documents the water quality modeling assumptions and methods used to estimate the potential indirect impacts to wetlands along the Mine Site to Plant Site rail corridor. The basis for this analysis is described in the Wetland Analysis Work Plan (Reference [1], Section 4.3.2).

Conceptual model

As discussed in Reference [1], the goal of this analysis is to estimate the quality of water contacting spilled ore material along the rail corridor. If the resulting water quality (at Point 1 in Figure 1 below) is found to have a greater than 10 percent likelihood of exceeding surface water quality standards, this analysis seeks to determine the unit area needed (dimension *X* in Figure 1) to provide sufficient precipitation to dilute the water to meet water quality standards (at Point 2 in Figure 1).

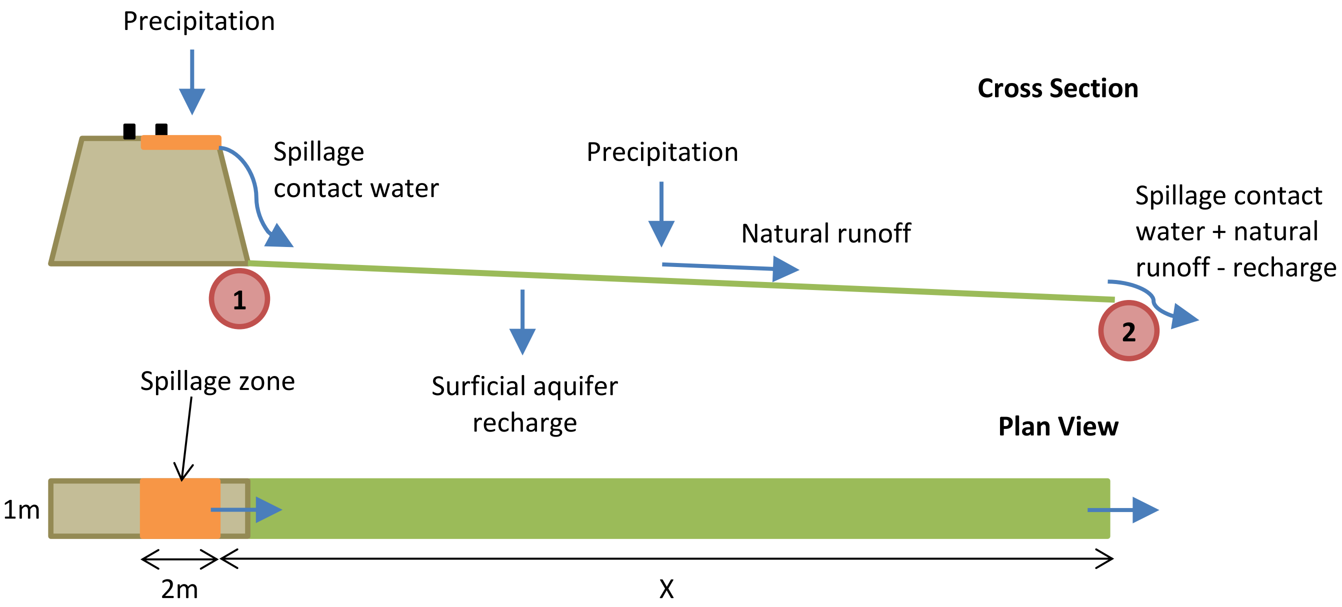

Figure 1 Rail spillage conceptual model schematic

This modeling was performed using a probabilistic simulation in the GoldSim software, similar to the water quality modeling for the Mine Site. The model was run at a monthly timestep for 100 years, with 500 realizations performed using the GoldSim Monte Carlo simulation package.

Model input parameters

The list below includes all of the input parameters used in this modeling and their references. Any adjustments from the referenced methods or values are documented here.

Geochemical Parameters

- Width of spillage zone: 2 meters on both sides of the centerline of the railway (total width = 4 meters) (Reference [1], Section 4.3.2)
- Mass of spilled ore: 2.14 kg/m^2 at the end of 20 years, assumed to accumulate linearly from zero mass at time zero (Reference [1], Section 4.3.2)
- Humidity cell release rates: As defined for "ore composites" (Reference [2], Section 8.1)
- Water contact factor: 1.0, assumed complete rinsing (Reference [2], Section 8.4.3)
- Particle size factor: 1.0, assumed particle size distribution identical to humidity cells (Reference [2], Section 8.4.3)
- Temperature factor: uncertainty in annual field temperature and activation energy (Reference [2], Section 8.2.4)
- Acidification: uncertainty in acidification factor and time to acidification, time to acidification assumed to be scaled by the temperature factor (Reference [2], Sections 8.2.5 and 9.4)
- Concentration caps: uncertainty in nonacidic and acidic concentration caps for Duluth Complex Category 2/3/4 waste rock and ore (Reference [2], Sections 8.3.1.6 and 8.3.3)
- Depletion: mass of constituents per unit ore (Reference [2], Sections 8.4.1)

Hydrology Parameters

- Annual and monthly precipitation: uncertainty in annual precipitation (Reference [3], Section 5.2)
- Contact water from spilled ore: uniform range from 40% to 60% of annual precipitation (Reference [3], Section 6.1.3.4.2)
- Runoff from natural areas: uncertainty in summer and winter runoff as a percent of precipitation (Reference [3], Section 6.1.3.3.2)
- Annual surficial aquifer recharge: uniform range from 0.36 to 1.8 inches per year (Reference [3], Section 5.4.1.2)

Water Quality Parameters

- Background runoff water quality: uncertainty in mean runoff concentrations, calibrated to the Partridge River watershed (Reference [3], Section 5.3.2)
- Surface water quality standards: standards applicable to the Partridge River, 100 mg/L hardness assumed for hardness-based standards (Reference [3], Section 2.2)

Additional modeling assumptions and methods

Constituent release from the spilled ore was modeled using release rates derived from ore composite humidity cells as well as from total metal content to total sulfur ratios from tests on core samples of ore rock (Reference [2], Section 8.1). Sulfate release was modeled using the linear regression to sulfur content developed from humidity cells at a range of sulfur contents (Reference [2], Section 8.1.1). The sulfur content used in this calculation was the currently-modeled sulfur content, with the result that sulfate release rates decrease as the remaining sulfur content decreases in the model. For metals with release rates based on metal to sulfur ratios, this method results in a corresponding decrease in metal release rates.

The water balance for the both the spillage zone and the natural runoff zone was modeled with consideration of the effects of snowmelt. Precipitation during the months of November through March is assumed to be stored on the landscape as snow. The accumulated snow is released as a one-month flow during the month of April. This method reduces the potential for unrealistically high concentrations due to low flows in the winter months, when in reality any water will be frozen in ice and snow.

The defined runoff or contact water from the spillage zone is assumed to be completely mixed with the runoff from natural areas. The only loss of water (and dissolved constituent mass) from this system prior to evaluation of standards compliance is due to recharge into the surficial aquifer. The recharge lost from the system is assumed to flow at the same rate both beneath the ore spillage zone (contact water concentration) and within the natural areas (mixed contact and natural runoff water concentration).

The modeled concentrations of all constituents were compared to surface water quality standards at each timestep during the 100-year simulation at both the edge of the spillage zone (Point 1 in Figure 1) and at the downstream edge of the mixing zone (Point 2 in Figure 1). For every timestep the fraction of the 500 realizations with recorded exceedances of the water quality standards was computed and compared to the stated goal of a less than 10% likelihood of exceeding a standard. For example, if at model time 20.5 years the concentration of copper was above the water quality standard in 75 of the 500 realizations, the simulation would have a 15% (75/500) likelihood of an exceedance and would fail the 10% goal. The model was run multiple times with varying lengths of the dilution zone (dimension *X* in Figure 1) until the 10% goal was met for all constituents in all timesteps.

Results

For the majority of the modeled constituents, concentrations are expected to be well below the applicable surface water quality standards at the edge of the spillage zone. No additional dilution from unimpacted surface runoff is necessary, and there is little or no potential for indirect impacts to adjacent wetlands.

Four constituents have modeled concentrations at the edge of the spillage zone that have a greater than 10% likelihood of exceeding surface water quality standards: aluminum, cobalt, copper and nickel. The modeled water quality in the spillage contact water is shown for each of these constituents in Figure 2 through Figure 5; sulfate concentrations are also included for reference in Figure 6.

Background surface runoff has an approximately 20% likelihood of exceeding the water quality standard for aluminum, so no amount of dilution is possible to meet the goal of less than 10% likelihood of exceeding the standard. Therefore aluminum was not carried forward for additional analysis.

For cobalt, the likelihood of exceeding the surface water quality standard at the edge of the seepage zone is a maximum of approximately 90%. Using successive runs of the water quality model it was estimated that 2.5 meters (perpendicular to the rail line) of additional natural background runoff is necessary to reduce the likelihood of exceeding the standard to below 10%. Figure 7 shows the modeled cobalt concentrations at the downstream edge of a 2.5-meter buffer. Figure 8 shows the likelihood of exceedance for cobalt through time for both the edge of the seepage zone (purple line) and at the edge of a 2.5-meter buffer (green line).

For nickel, exceedances of the surface water quality standard at the edge of the seepage zone occurred in all model realizations for a period of about 30 years. Compared to cobalt, a longer buffer of an unimpacted runoff zone is necessary in order to dilute nickel concentrations to below the standard; the required distance is estimated as 30 meters (perpendicular to the rail line) for nickel. Figure 9 shows the modeled nickel concentrations at the downstream edge of a 30-meter buffer. Figure 10 shows the likelihood of exceedance for nickel through time for both the edge of the seepage zone (purple line) and at the edge of a 30-meter buffer (green line).

For copper, the modeled water quality at the edge of the seepage zone is consistently above the surface water quality standard until copper depletion begins to occur after about 40 years. Copper requires the longest buffer of an unimpacted runoff zone in order to have a less than 10% likelihood of exceeding the standard; the required distance is estimated as 675 meters (perpendicular to the rail line). Figure 11 shows the modeled copper concentrations at the downstream edge of a 675-meter buffer. Figure 12 shows the likelihood of exceedance for copper through time for both the edge of the seepage zone (purple line) and at the edge of a 30-meter buffer (green line).

Recommendations

Based on this analysis, it is recommended that wetlands with watersheds that contain less than 675 m^2 of unimpacted areas per meter of rail (one-sided) within the watershed be identified as potentially indirectly impacted due to water quality changes. Wetlands that are physically near the rail corridor but are not hydraulically connected to the rail line (i.e. no rail spillage areas are within the wetland's watershed) should not be considered to be indirectly impacted due to rail spillage effects.

References

[1] NorthMet Project Wetland Analysis Work Plan. Version 3, October 2011.

[2] NorthMet Project Waste Characterization Data Package. Version 9, July 2012.

[3] NorthMet Project Water Modeling Data Package – Volume 1 (Mine Site). Version 10, July 2012.

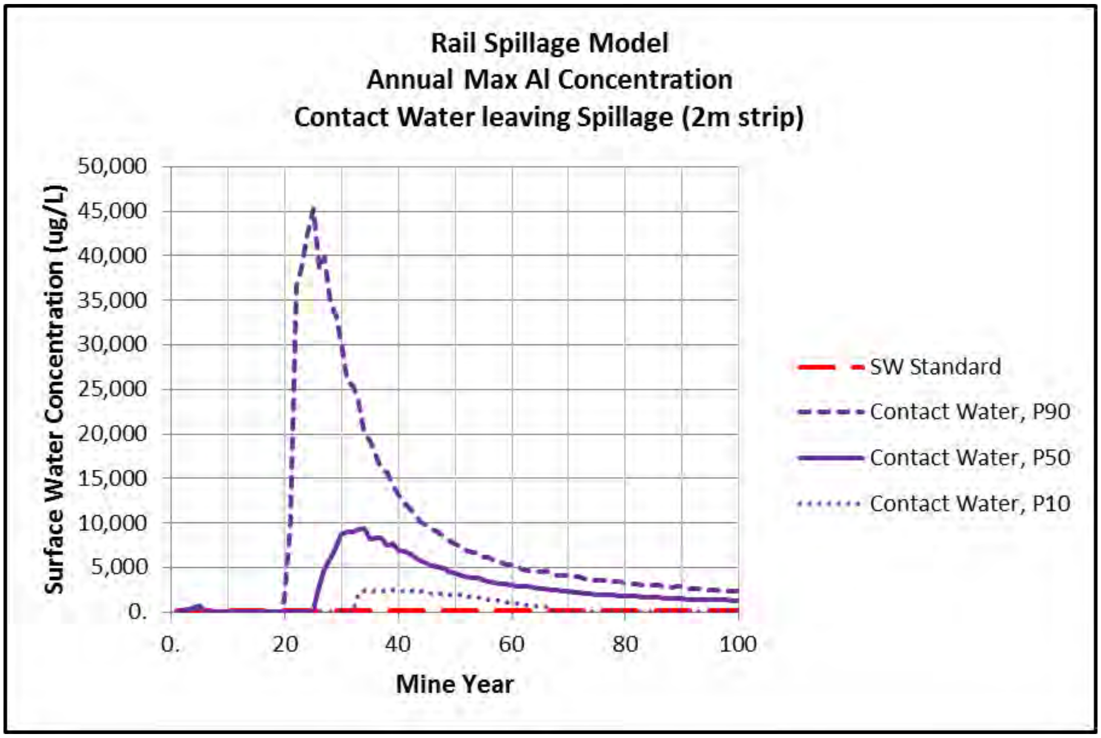

Figure 2 Aluminum concentrations at the edge of the spillage zone

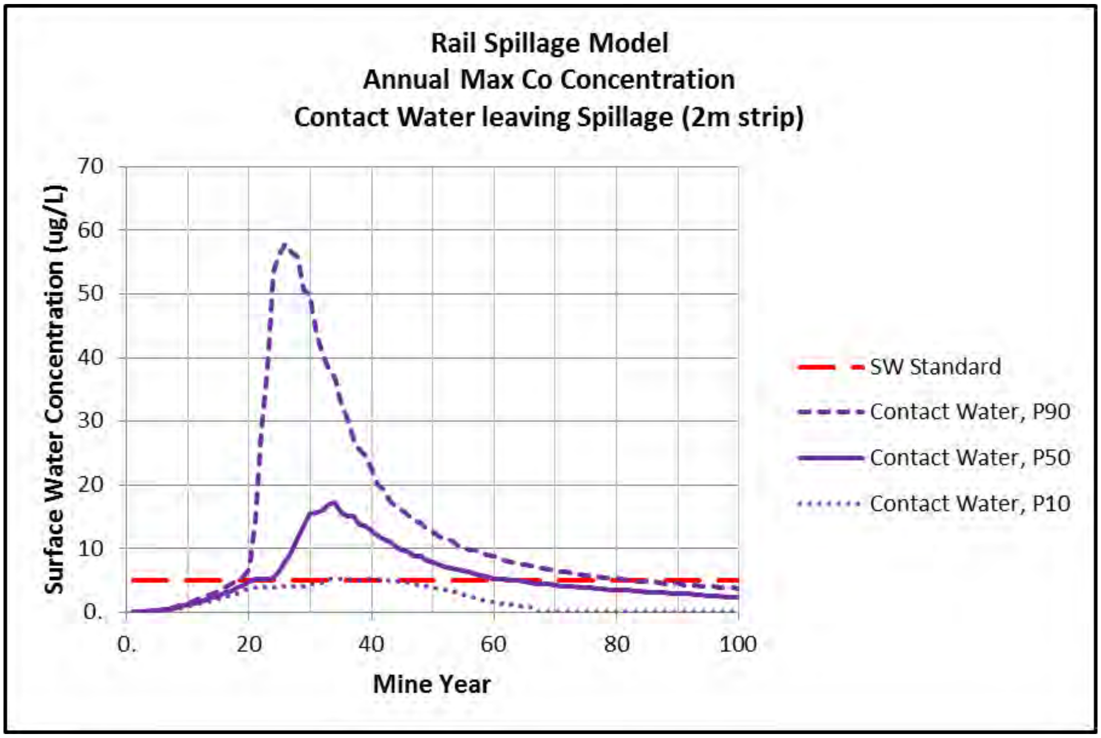

Figure 3 Cobalt concentrations at the edge of the spillage zone

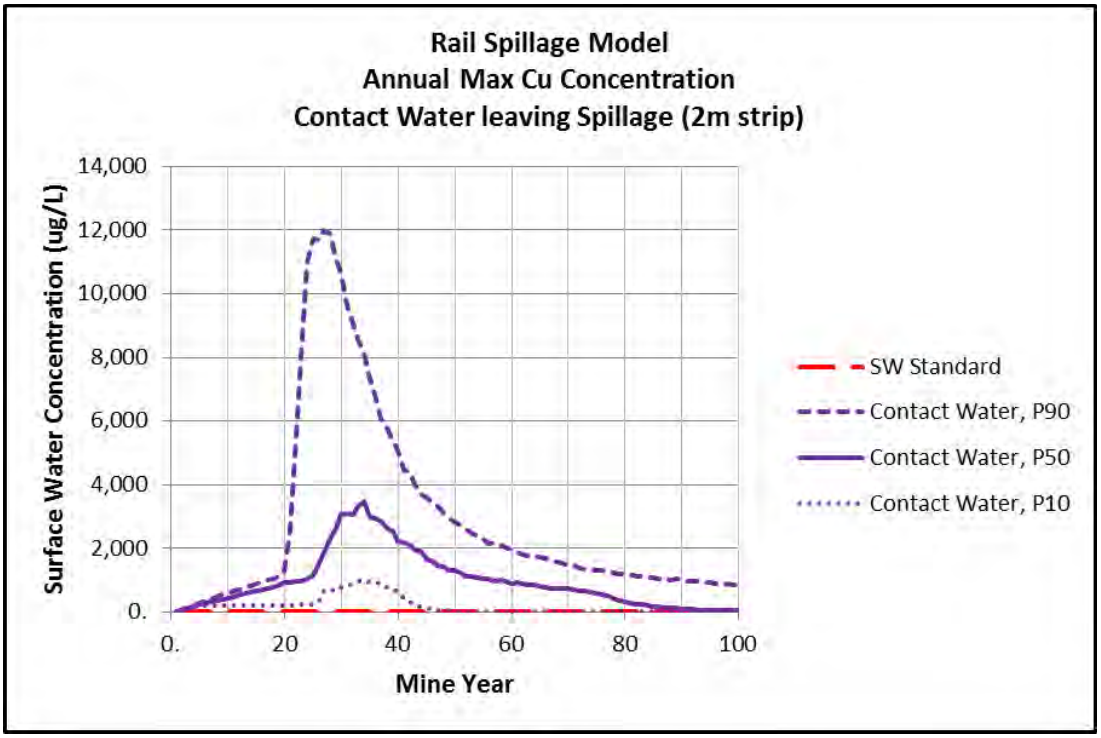

Figure 4 Copper concentrations at the edge of the spillage zone

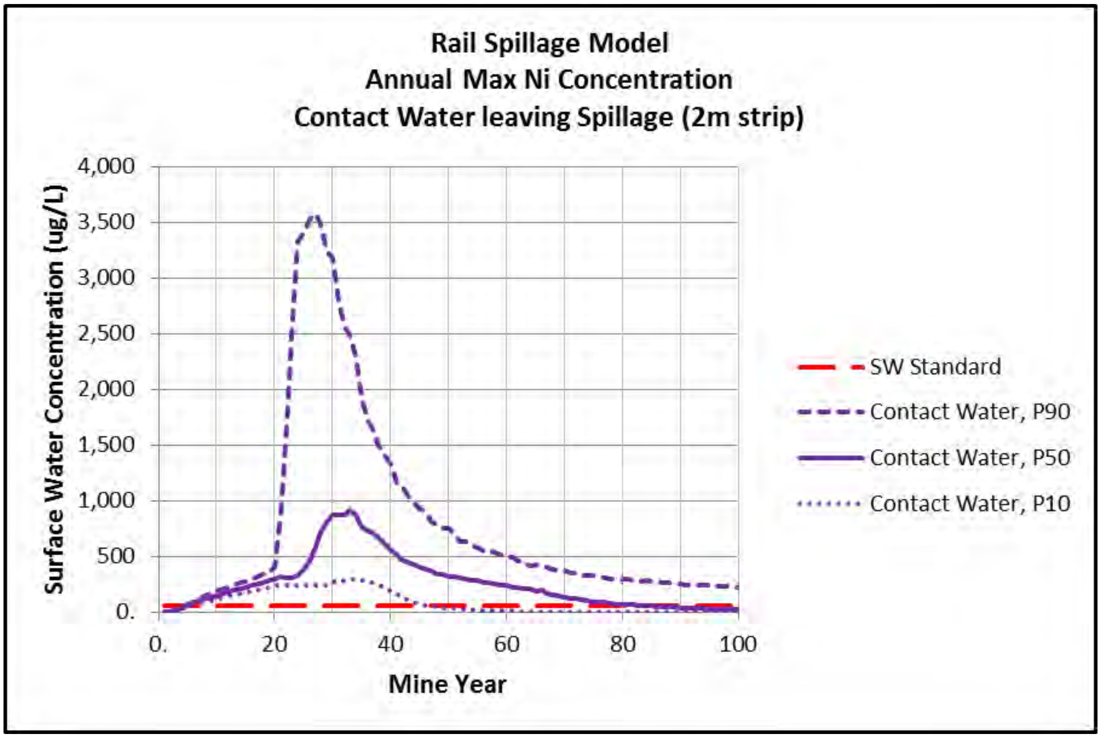

Figure 5 Nickel concentrations at the edge of the spillage zone

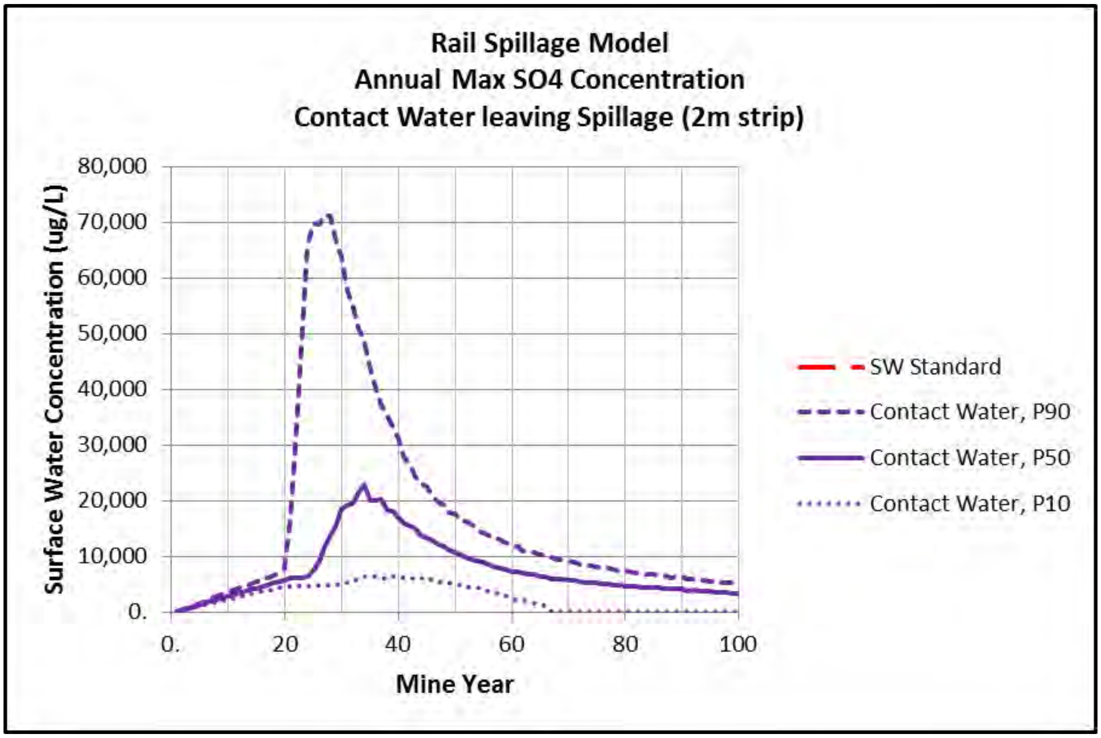

Figure 6 Sulfate concentrations at the edge of the spillage zone

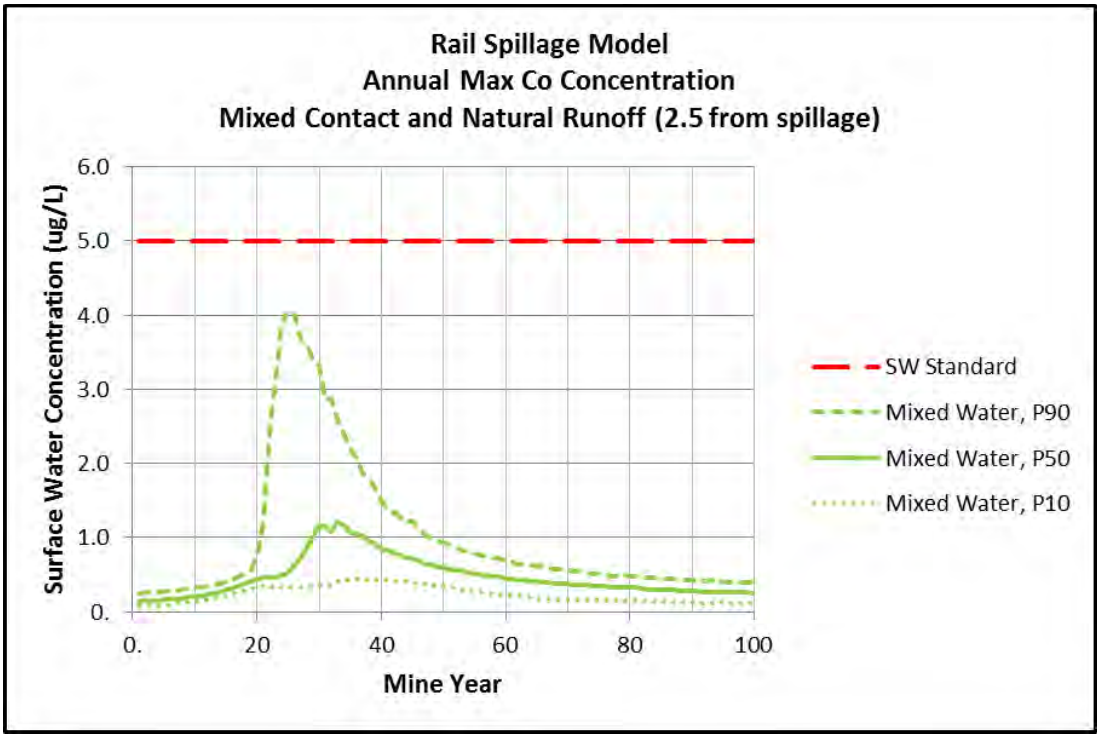

Figure 7 Cobalt concentrations at the edge of a 2.5-m buffer

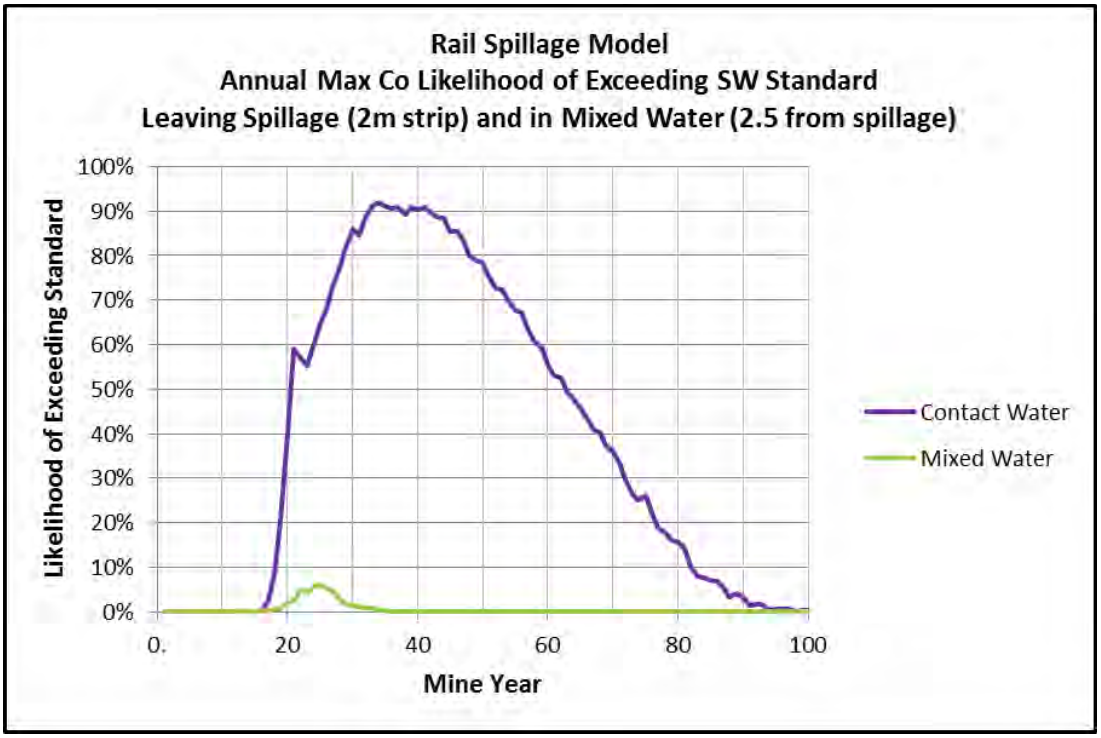

Figure 8 Cobalt likelihood of exceedance

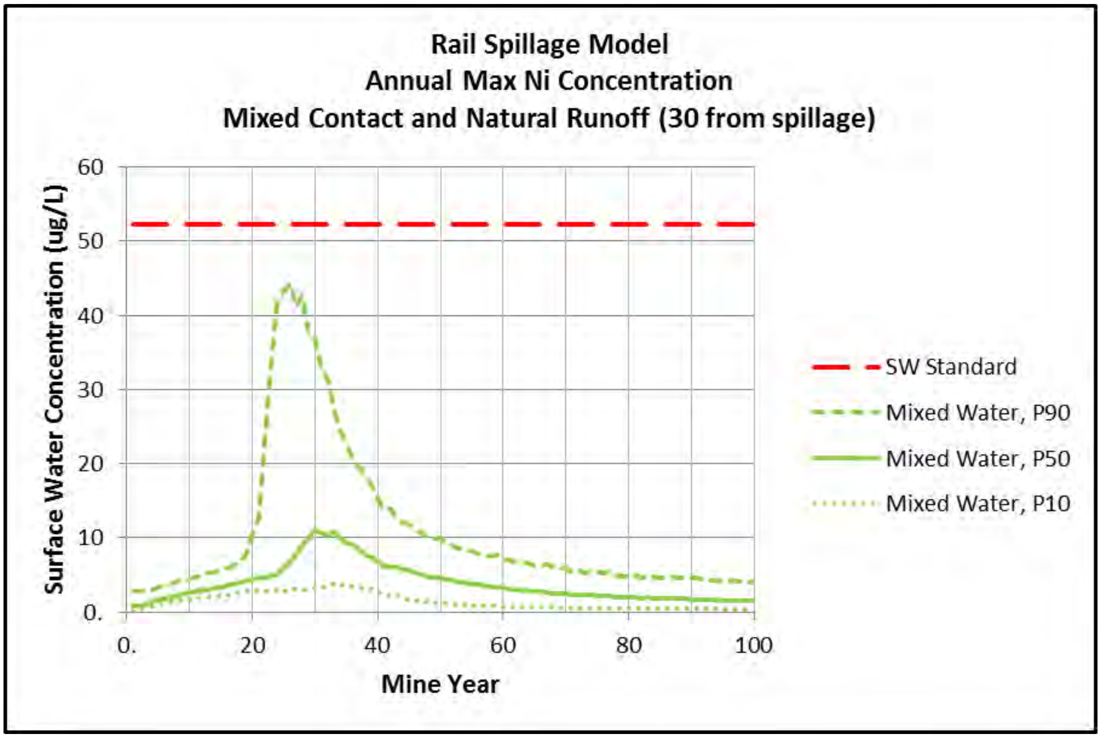

Figure 9 Nickel concentrations at the edge of a 30-m buffer

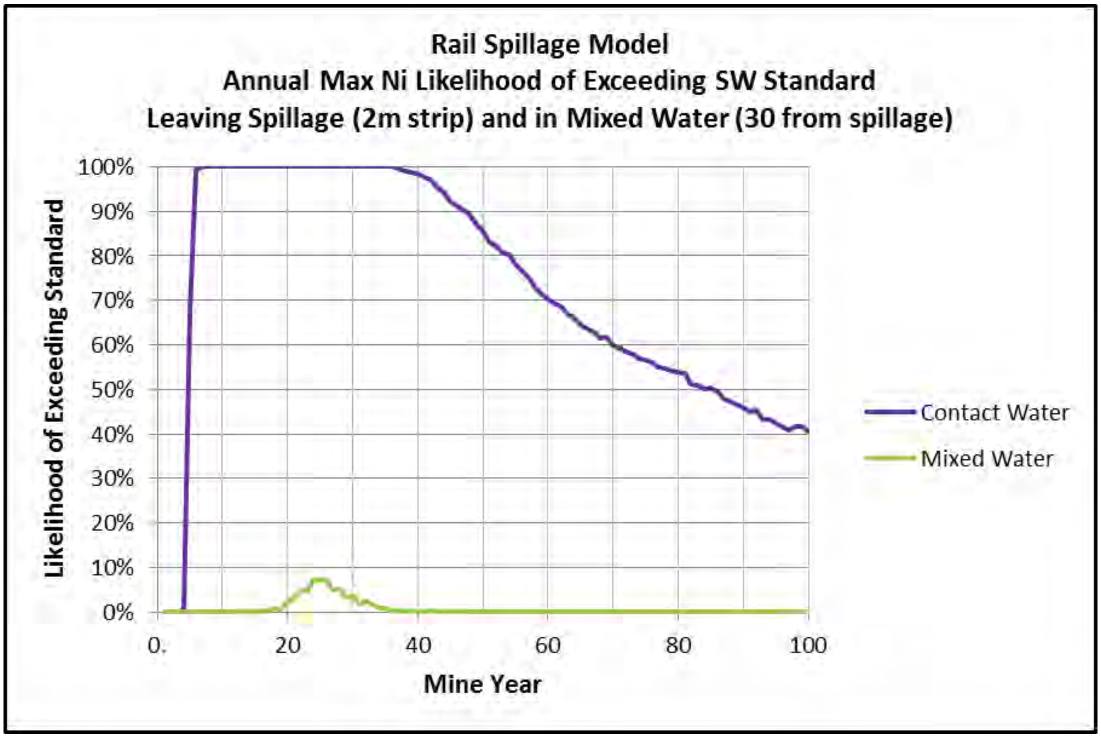

Figure 10 Nickel likelihood of exceedance

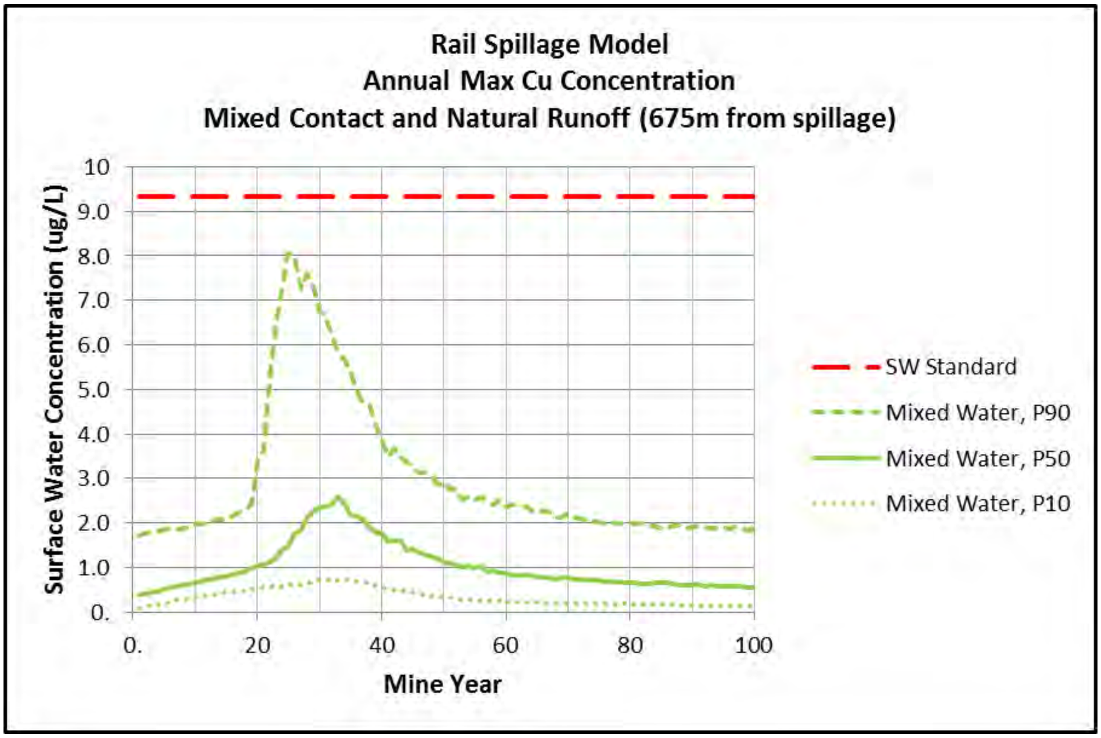

Figure 11 Copper concentrations at the edge of a 675-m buffer

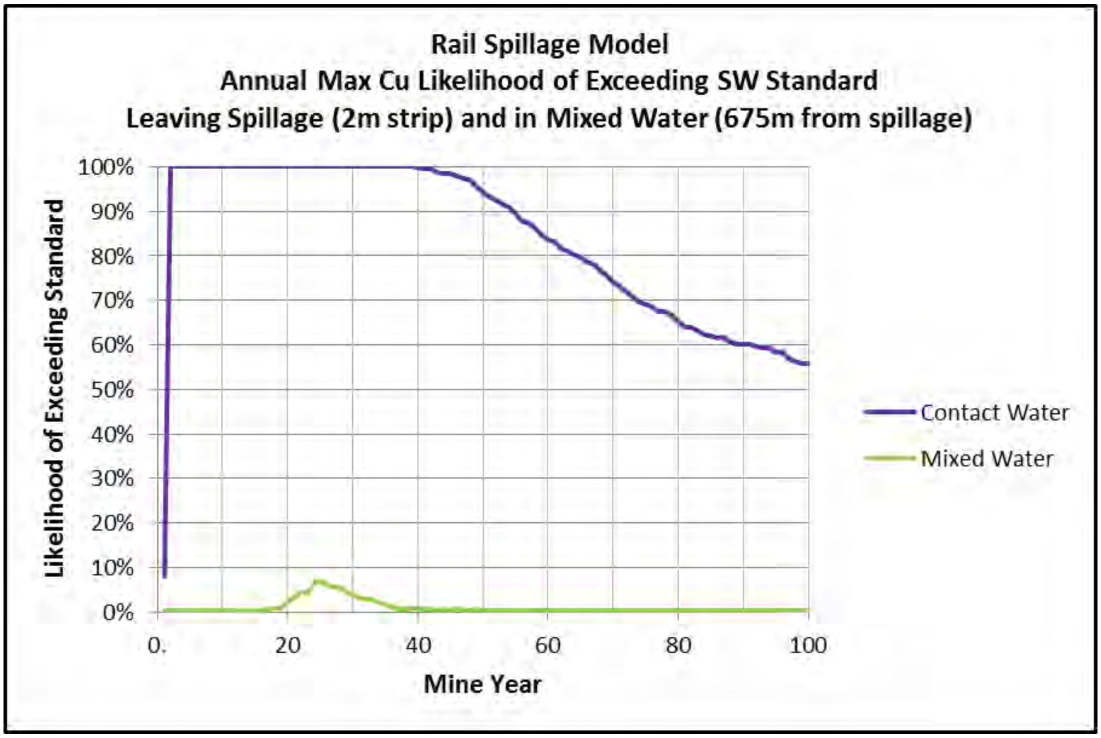

Figure 12 Copper likelihood of exceedance

Attachment F

Foreseeable Future Actions within the Partridge River and Embarrass River Watersheds

1. U.S. Forest Service
    a. Superior National Forest: Marty Rye
        i. The Eastern States BLM office has received 33 federal hardrock mineral prospecting permit applications and 21 operating plan proposals for mineral explorations in Superior National Forest. An EIS for the prospecting permits is currently under draft revision to determine where and under what circumstances the lands may be explored. The scope of the DEIS covers 1.7 million acres of land in Superior National Forest. Wetland impacts are unknown at this time but may occur if mineral prospecting permits are accepted.
2. Minnesota DNR
    a. Lands and Minerals: Anne Jagunich
        i. The Mesabi Nugget project at the old LTV site will impact wetlands and the Partridge River. No other projects were identified.
    b. Forestry: Mike Magnuson
        i. Future wetland impacts are not known at this time.
    c. Waters: Amy Loiselle
        i. She referred to St. Louis County planning, MN BWSR, MN DNR staff, USFS staff, the Duluth EPA, MPCA, and Iron Range Resources for information on specific projects in the future.
3. Minnesota DOT
    a. Website
        i. The website lists upcoming projects on Highways 135 and 37, which cross the Partridge River watershed. However, project locations are outside the watershed boundaries. No wetland impacts are expected.
    b. Duluth office: Howard Mackey
        i. Highway projects are planned no more than 3 years in advance, but long range road plans do not show any highway projects in the watersheds for the next 20 years. Routine culvert replacements will be conducted on highways 135 and 37, but any wetland impacts will be temporary.
4. Minnesota Board of Soil and Water Resources
    a. Joan Weyandt
        i. She referred to St. Louis County Landuse and Planning and had no information on projects impacting wetlands.
5. St. Louis County
    a. Landuse Planning and Zoning, Duluth office: Mark Lindhorst

        i. The Embarrass River watershed has little development, and no major projects are planned which will affect wetlands. The only foreseeable development in the watersheds includes homeowners adding decks, garages, or driveways to their properties. No wetland impacts are known at this time.

    b. Land Department, Pike Lake office: Mark Pannkuk

        i. The Land department only manages tax forfeit lands, most of which is forestland. Foreseeable wetland impacts from the Land department may include logging bridges "under the silviculture exemption" over the next 5 years. He referred to Planning and Zoning department for specific permitting information and other projects in the county.

    c. Public Works Department, Duluth office: Inga Foster

        i. The 10 year plan for St. Louis County road projects was provided: http://www.stlouiscountymn.gov/Portals/0/Library/Land-Property/Maps/Map%20Gallery/Transportation/Road-Construction-10YearPlan-2011-2020.pdf and is subject to change based on funding.

        ii. Projects in the study watersheds in the 10 year plan include: 8 bridge replacements and 1 complete road re-build (also mentioned by the City of Biwabik contact as a 3.5 mile road replacement project). Bridge replacements should impact no greater than 10,000 sq. feet per bridge – for a maximum wetland impact of 80,000 sq. ft. (1.8 acres). Wetland impacts associated with the road replacement are unknown at this time.

6. North St. Louis County Soil and Water Conservation District

    a. Virginia Office: Paul Ojanen

        i. He referred to Inga Foster for county public works roads projects. Cliffs-Eerie is expanding a road near Babbitt for a mining project that will result in wetland impacts. There may also be an unknown number of smaller-scale projects which may impact wetlands. He also referred to St. Louis County Land Department for forestry impacts and the MNDOT in Duluth for highway impacts.

7. City of Babbitt

    a. Public Works: Rich Posie

        i. The City of Babbitt is planning road building and storm sewer maintenance in the western portion of the municipality. Wetland impacts are unknown at this time.

8. City of Biwabik

    a. City Administrator: Jeff Jacobsen

        i. Two projects may impact wetlands in the Partridge River watershed. First, County Highway 4, just north of Biwabik, is being extended, and the project will create 3.5 miles of new roadway; this is the same project described by St. Louis County Public Works.

9. City of Embarrass
    a. Town Clerk: Diane Nelmark
        i. Future wetland impacts are not known at this time.
10. City of Gilbert
    a. Public Works: Ken Kuitunen
        i. Future wetland impacts are not known at this time.
11. City of Aurora
    a. Public Works
        i. Future wetland impacts are not known at this time.
12. City of Mckinley
    a. Public Works
        i. Future wetland impacts are not known at this time.
13. City of Hoyt Lakes
    a. Public Works
        i. Future wetland impacts are not known at this time.
14. Iron Range Resources and Rehabilitation Board (IRRRB)
    a. Mining and Mine land Reclamation: Dan Jordan
        i. A number of mining projects may impacts wetlands within the Partridge and Embarrass River watersheds. Pending approval, Mesabi Nugget, Twin Metals, Arcelor Mittal, Northshore Mining Company, Encampment Resources, and Teck Resources plan to pursue underground copper-nickel mining operations. All projects are currently in the exploratory and/or permitting phase.
        ii. Cardero Resource Corp. is currently in an "advanced" exploratory phase of an iron-titanium (Ilmenite) mining project just south of Hoyt Lakes at the Longnose property. The plant for this mining operation will likely be located within or adjacent to Hoyt Lakes. See the project summary dated April 12, 2011 at: http://www.cardero.com/s/minnesota_ferro.asp?ReportID=459547

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Technical Memorandum

To: Tom Hingsberger, USACE; Tom Hale, USFS; Bill Johnson, MDNR
From: PolyMet
Subject: Addendum to Poly Met Mining Inc. *Wetland Data Package V7*
Date: March 22, 2013
Project: NorthMet Project
c: Kevin Pylka, Jim Scott, John Borovsky

The purpose of this addendum is to provide data regarding potential indirect wetland impacts associated with stream flow augmentation activities for Second Creek. Potential indirect wetland impacts were identified based on changes in hydrology due to drawdown, groundwater flow and seepage, surface water quantity, surface water quality, and metals deposition from the augmentation of Second Creek. There are no potential indirect impacts as a result of wetland fragmentation, changes in watershed areas or dust deposition. The results of these respective analyses and assessments identify areas to be monitored for potential wetland impacts as part of the monitoring plan that is expected to be implemented as part of the Section 404 permit conditions for the Project.

Area of Analysis

The area of analysis for Second Creek begins at its origin, at the south end of Tailings Basin Cell 1E, and ends at the east edge of County Highway 666 (Large Figure 1). The majority of this area of analysis is located outside of the Project Areas (see Large Figure 1 in Reference (1)). Exceptions include a portion within the Flotation Tailings Basin (FTB) Area at its origin and narrow portions on the west and northwest sides of the area which are within the Colby Lake Pipeline Corridor.

Wetlands Located in the Area of Analysis

A total of 30 wetlands covering 298.91 acres were identified within the area of analysis for Second Creek (Large Figure 1, Table 1). The wetlands included alder thicket or shrub-carr (44%), shallow marsh (35%), hardwood swamp (7%), deep marsh (7%), coniferous swamp (6%), wet meadow (less than 1%), and shallow, open water (less than 1%). One wetland is located in the FTB Area, 7 wetlands are located in the

Colby Lake Pipeline Corridor, and 22 wetlands are not in a Project Area. All wetlands for this addendum, shown in Table 1, were classified by Eggers and Reed Wetland Community (Reference (2)) type.

Table 1 Wetlands Located in the Area of Analysis

Project Area(1)	Wetland ID	Dominant Eggers and Reed Wetland Community	Total Wetland Area (acres)
Tailings Basin	595	Deep marsh	2.14
NA	595A	Deep marsh	3.06
NA	1161	Deep marsh	9.41
NA	1162	Shallow marsh	40.84
NA	1163	Hardwood swamp	14.80
NA	1164	Alder thicket or Shrub-carr	8.23
NA	1165	Hardwood swamp	6.25
NA	1166	Shallow marsh	28.04
NA	1167	Shallow marsh	2.88
NA	1168	Shallow, open water	0.36
NA	1169	Shallow marsh	4.92
NA	1170	Deep marsh	3.32
NA	1171	Alder thicket or Shrub-carr	3.87
NA	1172	Shallow marsh	1.96
NA	1173	Shallow, open water	0.93
NA	1174	Alder thicket or Shrub-carr	118.75
NA	1175	Coniferous swamp	16.82
Colby Lake Water Pipeline Corridor	P1	Deep marsh	0.23
NA	P1A	Deep marsh	0.61
Colby Lake Water Pipeline Corridor	P2	Shrub-carr	0.03
NA	P2A	Shrub-carr	0.43
Colby Lake Water Pipeline Corridor	P3	Shallow marsh	0.25
NA	P3A	Shallow marsh	24.24

Project Area(1)	Wetland ID	Dominant Eggers and Reed Wetland Community	Total Wetland Area (acres)
Colby Lake Water Pipeline Corridor	P4	Shrub-carr	1.28
NA	P4A	Shrub-carr	0.29
Colby Lake Water Pipeline Corridor	P5-1	Deep marsh	0.77
NA	P5-1A	Deep marsh	0.03
Colby Lake Water Pipeline Corridor	P5-2	Shallow marsh	0.14
NA	P5-2A	Shallow marsh	2.75
Colby Lake Water Pipeline Corridor	P9	Wet meadow	1.28
Total acres of wetland			298.91

(1) The wetland is not located in a Project area (NA)

Potential Indirect Wetland Impacts

The methods used to identify the potential indirect impacts are described in Section 5.2 of Reference (1) for the NorthMet Project (Project). The potential indirect wetland impacts were assessed based on changes to hydrology due to groundwater flow or seepage, drawdown or surface water quantity, or changes in surface water quality or metals deposition. There are no potential indirect wetland impacts due to wetland fragmentation, changes in watershed area, or dust deposition.

Groundwater Flow or Seepage

Seepage from the south side of the FTB is generally restricted by bedrock outcrops and does not contribute to the groundwater flow south of the FTB. All seepage from the south side of the FTB is surface water, forming the headwaters of Second Creek (see Sections 4.3.2.2.1 and 5.1.1.2 of Reference (3)). There are no potential indirect impacts to wetlands as a result of changes in groundwater flow in the area of analysis.

Drawdown or Changes in Surface Water Quantity

Wetlands abutting Second Creek are identified by wetland ID, wetland type using Eggers and Reed (Reference (2)), and acreage in Table 2 and Large Figure 1. There are 8 wetlands covering approximately 179 acres which include alder thicket or shrub-carr (66%), shallow marsh (26%), and deep marsh (8%).

Table 2 Wetlands Abutting Second Creek

Wetland ID	Dominant Eggers and Reed Wetland Community	Total Wetland Area (acres)
595(1)	Deep marsh	1.05
595A	Deep marsh	3.06
1161	Deep marsh	9.41
1162	Shallow marsh	40.84
1174	Alder thicket or Shrub-carr	118.75
1176	Shallow marsh	4.92
P5-1	Deep marsh	0.77
P5-1A	Deep marsh	0.03
Total acres of wetland		178.83

(1) Wetland 595 includes 3 separate areas.

Flow augmentation at the south toe of the Tailings Basin is designed such that the average annual discharge to that location is within +/- 20% of the No Action condition (see Section 5.2.2.8.1 of Reference (3)). Plus or minus 20% is within the range of annual variability in precipitation, as well as streamflow, in the Partridge and Embarrass watersheds (see Section 5.2.2.8.1 of Reference (3)). Therefore, anticipated changes to downstream hydrology, including adjacent wetlands, is expected to be within the range of that typically observed due to natural variability. Therefore, no potential indirect wetland impacts are identified for the wetlands abutting Second Creek.

Changes in Surface Water Quality

The Project will impact water quality in Second Creek by altering the chemistry of surface water discharges to the headwaters of Second Creek (see Sections 5.2.2.8.1 and Section 6.6 of Reference (3)). The collection of seepage by the South Seepage Management System and augmentation with Colby Lake and Waste Water Treatment Plan (WWTP) effluent water will generally improve downstream water quality relative to current conditions. Even if water quality is improved, there is potential for indirect impacts to wetlands due to changes in water quality.

Potential indirect wetland impacts due to changes in water quality will be limited to wetlands abutting Second Creek. Potential indirect impacts due to changes in surface water quality are expected to diminish as the distance from the Tailings Basin increases. Upstream of County Road 666, there are approximately 179 acres of wetlands abutting Second Creek (Table 2) that have the potential to be indirectly impacted by the change in water quality due to stream flow augmentation of Second Creek.

Metals Deposition

The deposition modeling results (see Section 5.2.1.4.1 in Reference (1)) indicate there are 7 wetlands covering approximately 44 acres that are potentially indirectly impacted (modeled metal deposition greater than 100% of background), with 1.05 acres located within the FTB ambient air boundary (Large Figure 2). The wetlands are identified by wetland ID, wetland type using Eggers and Reed (Reference (2)), and acreage in Table 3. Wetland IDs 1161, 1166, and 1167 were previously identified as potentially indirectly impacted in Reference (1), however the boundaries were reviewed and modified as part of the analysis for this addendum. Revised acreages for the wetlands are identified in Table 3.

Table 3 Wetlands Potential Indirectly Impacted by Metals Deposition

Wetland ID	Dominant Eggers and Reed Wetland Community	Revised Total Wetland Area (acres)(1)	Reference (1) Total Wetland Area (acres)
595(2)	Deep marsh	1.05	1.05
595A	Deep marsh	3.06	3.06
1161(3)	Deep marsh	9.41	6.34
1166(3)	Shallow marsh	28.04	15.03
1167(3)	Shallow marsh	2.88	2.40
Total acres of wetland		44.44	

(1) Acreage for wetland IDs 595 and 595A did not change.
(2) Wetland 595 includes 3 separate areas.
(3) Previously identified in Reference (1) using the NWI.

Table 3 identifies the 3 wetlands that were previously included in the wetland analysis in Reference (1) and identified using the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI). For this addendum, the wetland boundaries were reviewed and modified using the same methods as described in Section 3.0 of Reference (1).

Summary of Potential Indirect Wetland Impacts

A summary of potential indirect wetland impacts was completed using the same method as described in Section 5.2.4 of Reference (1). Large Figures 2-7 show the ratings for the wetlands in the Project area.

Table 4 identifies the rating for the wetlands in the Second Creek area. Of the 209.75 acres of potentially indirectly impacted wetlands in the Second Creek area, approximately 94% of wetlands received a rating of 1, with one factor potentially indirectly impacting the wetland; 6% of wetlands received a rating of 2, with two factors potentially indirectly impacting the wetland; 0.4% of wetlands received a rating of 3, with three factors potentially indirectly impacting the wetland; 0.1% of wetlands received a rating of 4, with four factors potentially indirectly impacting the wetland; and less than 0.1% of wetlands received a rating of 5, with five factors potentially indirectly impacting the wetland. Large Figure 2 shows the rating for wetlands in the Second Creek area.

Table 4 Rating for Wetlands Potentially Indirectly Impacted in the Second Creek Area

Rating	Wetlands (acres)	Wetlands (% of total acres)
1	196.23	93.6%
2	12.47	5.9%
3	0.79	0.4%
4	0.25	0.1%
5	0.01	<0.01%
Total acres of wetland	209.75	

Table 5 provides an update to Table 5-13 in Reference (1) and includes the wetlands in the Second Creek Area using the method identified in Attachment A of Reference (1). Of the 7,413.02 acres of potentially indirectly impacted wetlands in the Project area, approximately 55% of wetlands received a rating of 1, with one factor potentially indirectly impacting the wetland; 41% of wetlands received a rating of 2, with two factors potentially indirectly impacting the wetland; 3% of wetlands received a rating of 3, with three factors potentially indirectly impacting the wetland; 0.2% of wetlands received a rating of 4, with four factors potentially indirectly impacting the wetland; and less than 0.1% of wetlands received a rating of 5, with five factors potentially indirectly impacting the wetland. Large Figure 3 through Large Figure 5 shows the rating for wetlands in the Project area.

Table 5 Rating for Wetlands Potentially Indirectly Impacted in the Project Area

Rating	Attachment A of Reference (1) Method		Alternate Method	
	Wetlands (acres)	Wetlands (% of total acres)	Wetlands (acres)	Wetlands (% of total acres)
1	4,108.66	55.4%	3,470.64	53.4%
2	3,042.91	41.0%	2,813.05	43.3%
3	245.31	3.3%	205.97	3.2%
4	15.89	0.2%	8.11	0.1%
5	0.25	<0.1%	0.25	<0.1%
Total acres of wetland	7,413.02		6,498.02	

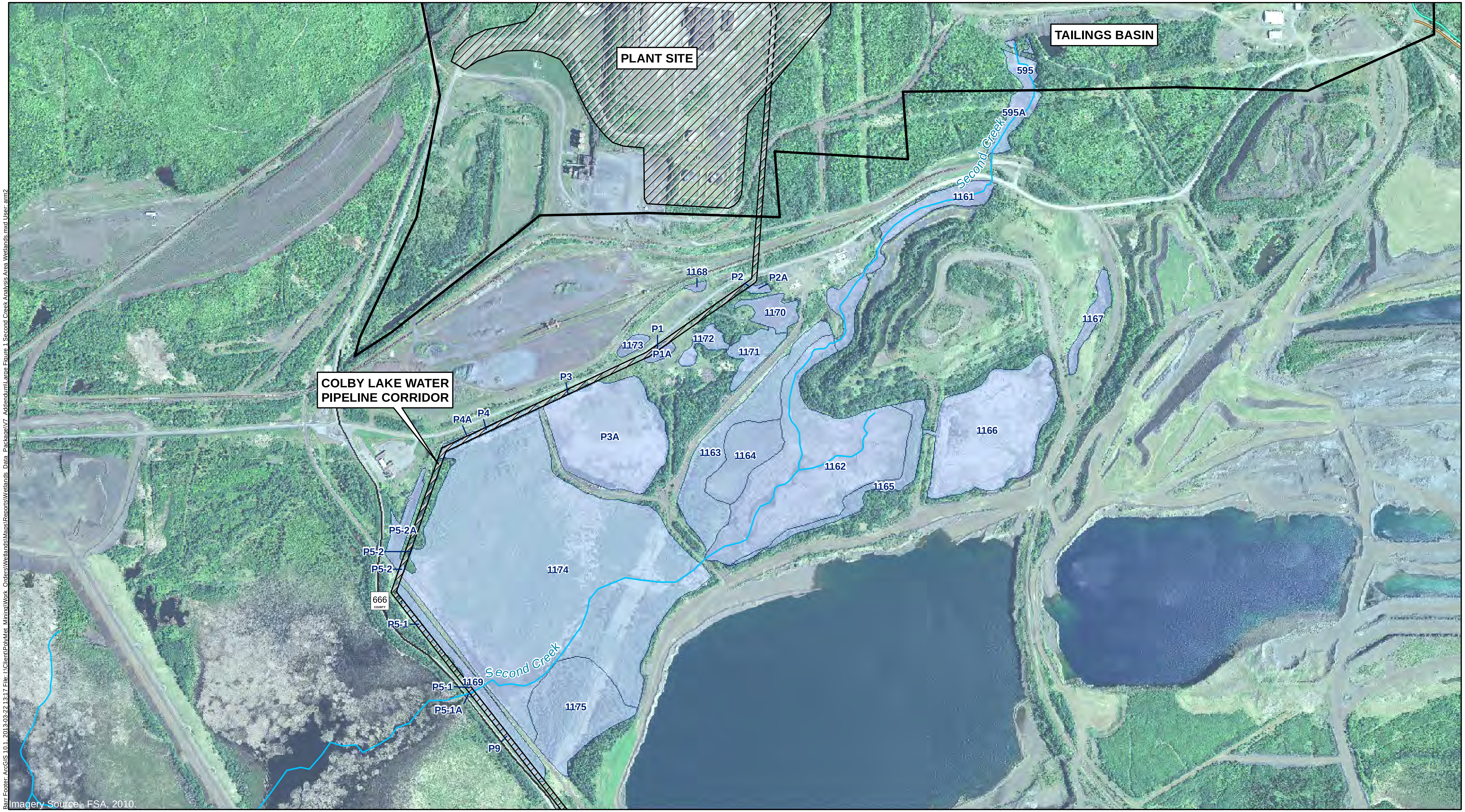
Table 5 provides an update to Table 5-13 in Reference (1) and includes the wetlands in the Second Creek Area using the alternative method to identify potential indirect wetland impacts from drawdown (Section 5.2.1.2.2 of Reference (1)). Of the 6,498.02 acres of potentially indirectly impacted wetlands in the Project area, approximately 53% of wetlands received a rating of 1, with one factor potentially indirectly impacting the wetland; 43% of wetlands received a rating of 2, with two factors potentially indirectly impacting the wetland; 3% of wetlands received a rating of 3, with three factors potentially indirectly impacting the wetland; less than 1% of wetlands received a rating of 4, with four factors potentially indirectly impacting the wetland; and less than 0.1% of wetlands received a rating of 5, with five factors potentially indirectly impacting the wetland. Large Figure 6 through Large Figure 8 show the rating for wetlands in the Project area.

References

1. **Poly Met Mining Inc.** NorthMet Project Wetland Data Package (v7). March 2013.

2. **Eggers, S.D. and D.M. Reed.** Wetland Plants and Communities of Minnesota and Wisconsin: Second Edition. U.S. Army Corps of Engineers, St. Paul District. 1997.

3. **Poly Met Mining Inc.** NorthMet Project Water Modeling Data Package Volume 2 - Plant Site (v9). March 2013.



Imagery Source: FSA, 2010.

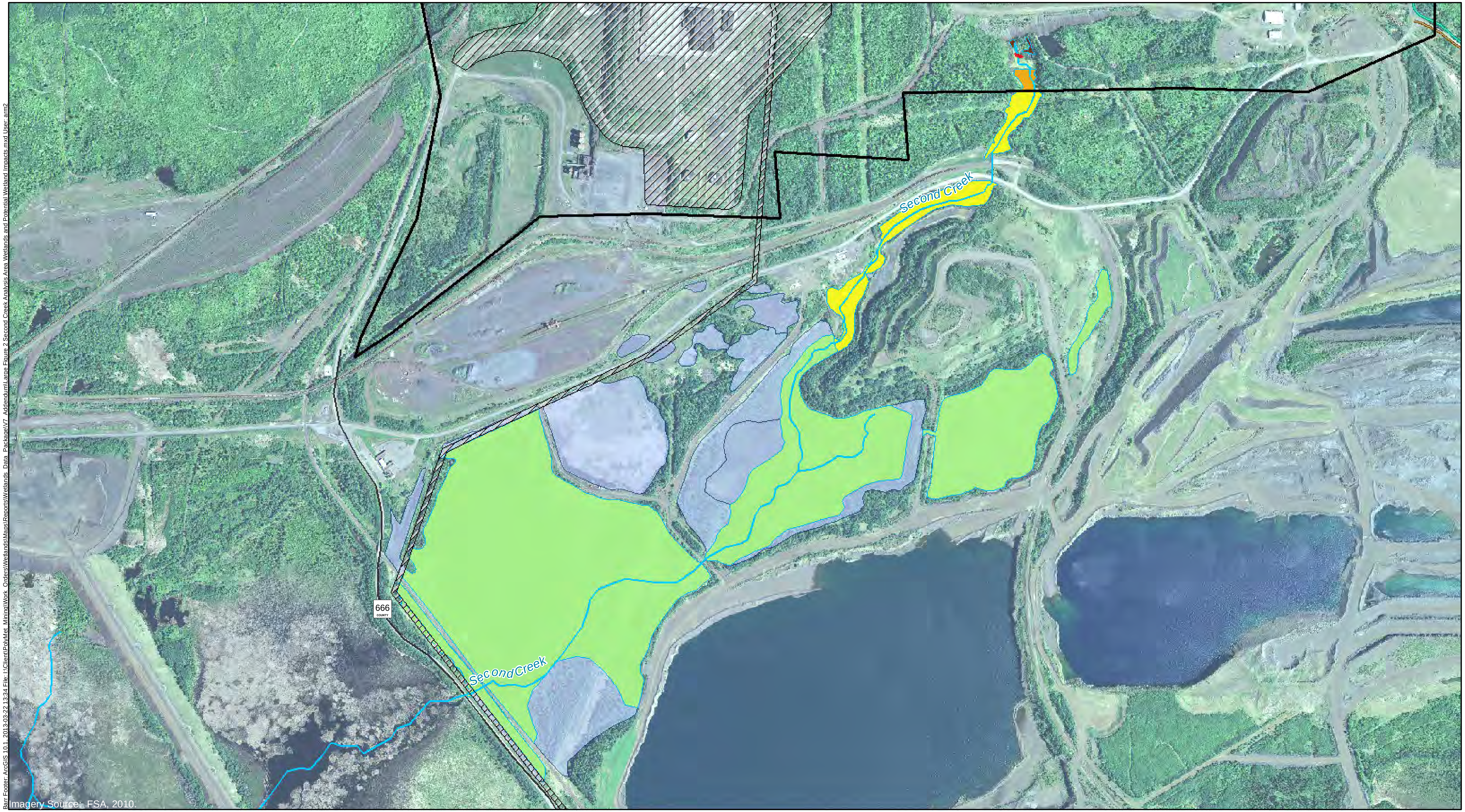
Barr Footer: ArcGIS 10.1, 2013-03-22 13:17 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\V7_Addendum\Large Figure 1 Second Creek Analysis Area Wetlands.mxd User: arm2

☐ Tailings Basin
▨ Areas Excluded from Tailings Basin Boundary
⬭ Wetlands
— Dunka Road
— Treated Water Pipeline

N

0 450 900 1,800
Feet

Large Figure 1
SECOND CREEK ANALYSIS AREA WETLANDS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Imagery Source: FSA, 2010.

▭ Tailings Basin

▨ Areas Excluded from Tailings Basin Boundary

═ Dunka Road

═ Treated Water Pipeline

Potential Wetland Impact Factor Rating

- 🟥 5
- 🟫 4
- 🟧 3
- 🟨 2
- 🟩 1
- ○ No Impact

N

0 450 900 1,800

Feet

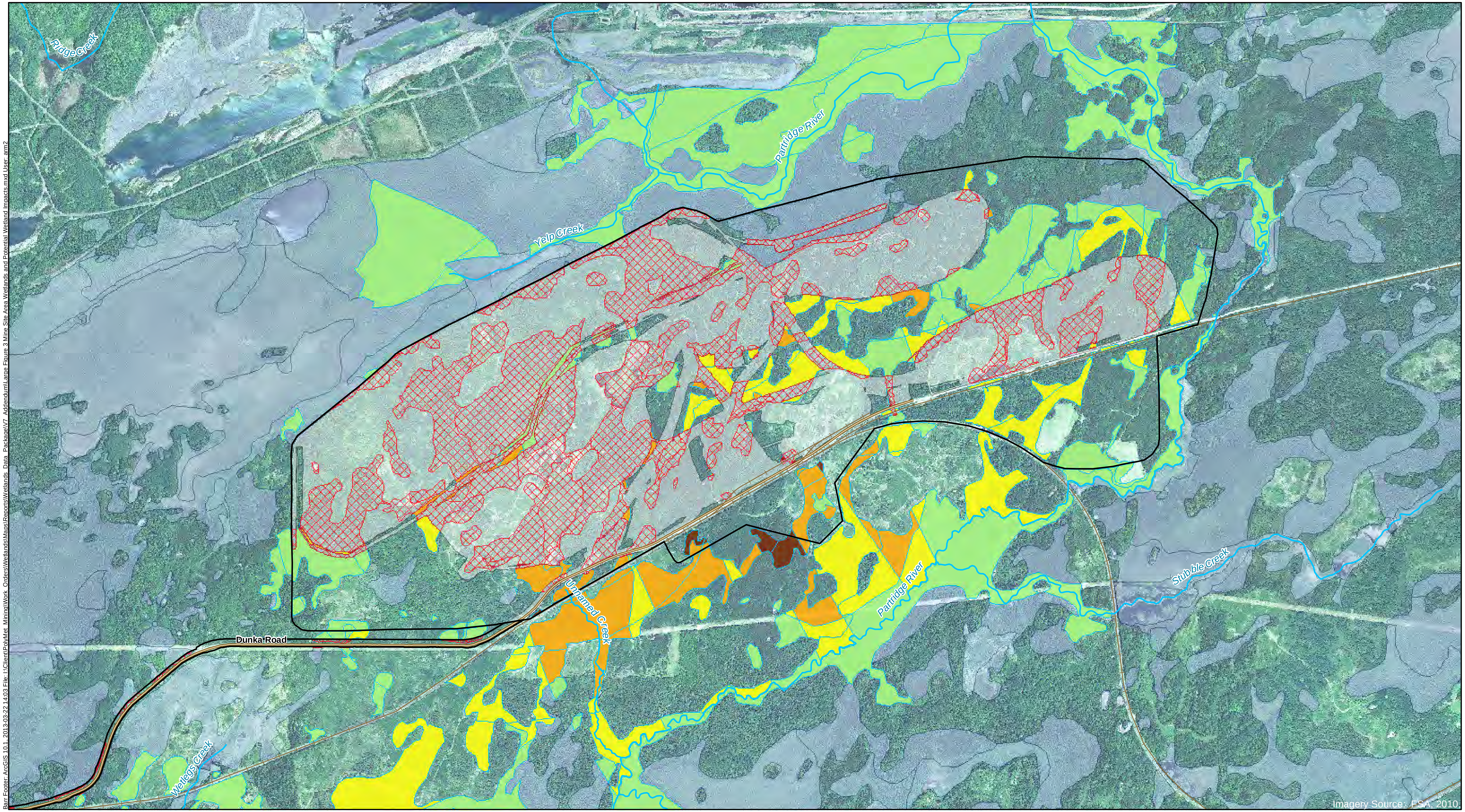
Large Figure 2

SECOND CREEK ANALYSIS AREA WETLANDS AND POTENTIAL WETLAND IMPACTS

NorthMet Project

Poly Met Mining Inc.

Hoyt Lakes, Minnesota



▭ Mine Site

▭ Areas Disturbed by Proposed Project Features

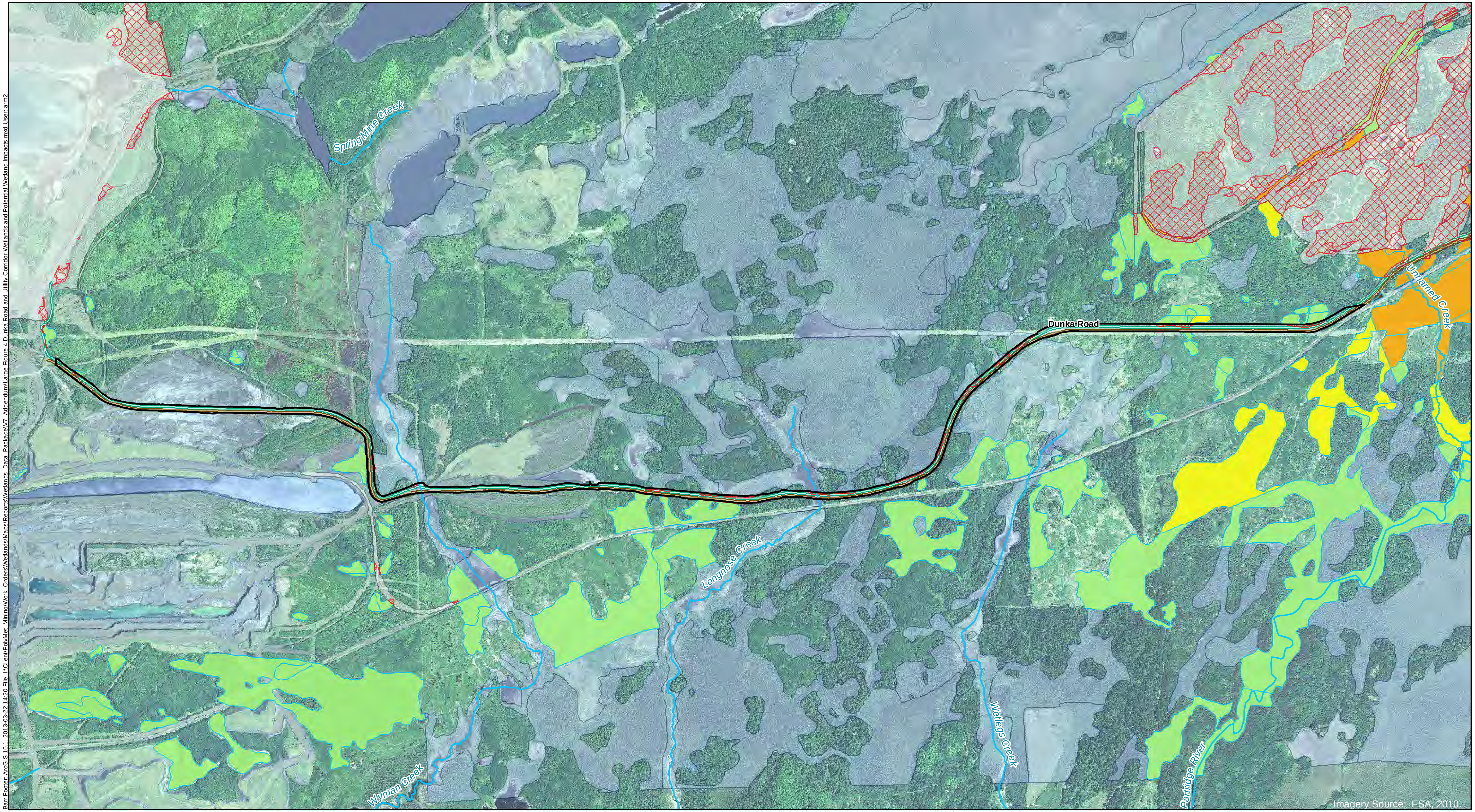
═ Dunka Road

▨ Direct Wetland Impacts

Potential Wetland Impact Factor Rating

- ● 5
- ● 4
- ● 3
- ● 2
- ● 1
- ○ No Impact

Large Figure 3
MINE SITE AREA WETLANDS AND
POTENTIAL WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.1, 2013-03-22 14:20 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Maps\Reports\Wetlands Data Package\V7 Addendum\Large Figure 4 Dunka Road and Utility Corridor Wetlands and Potential Wetland Impacts.mxd User: arm2

▭ Dunka Road and Utility Corridor

▭ Areas Disturbed by Proposed Project Features

— Dunka Road

— Treated Water Pipeline

▨ Direct Wetland Impacts

Potential Wetland Impact Factor Rating

- ● 4
- ● 3
- ● 2
- ● 1
- ● No Impact

0 1,000 2,000 4,000

Feet

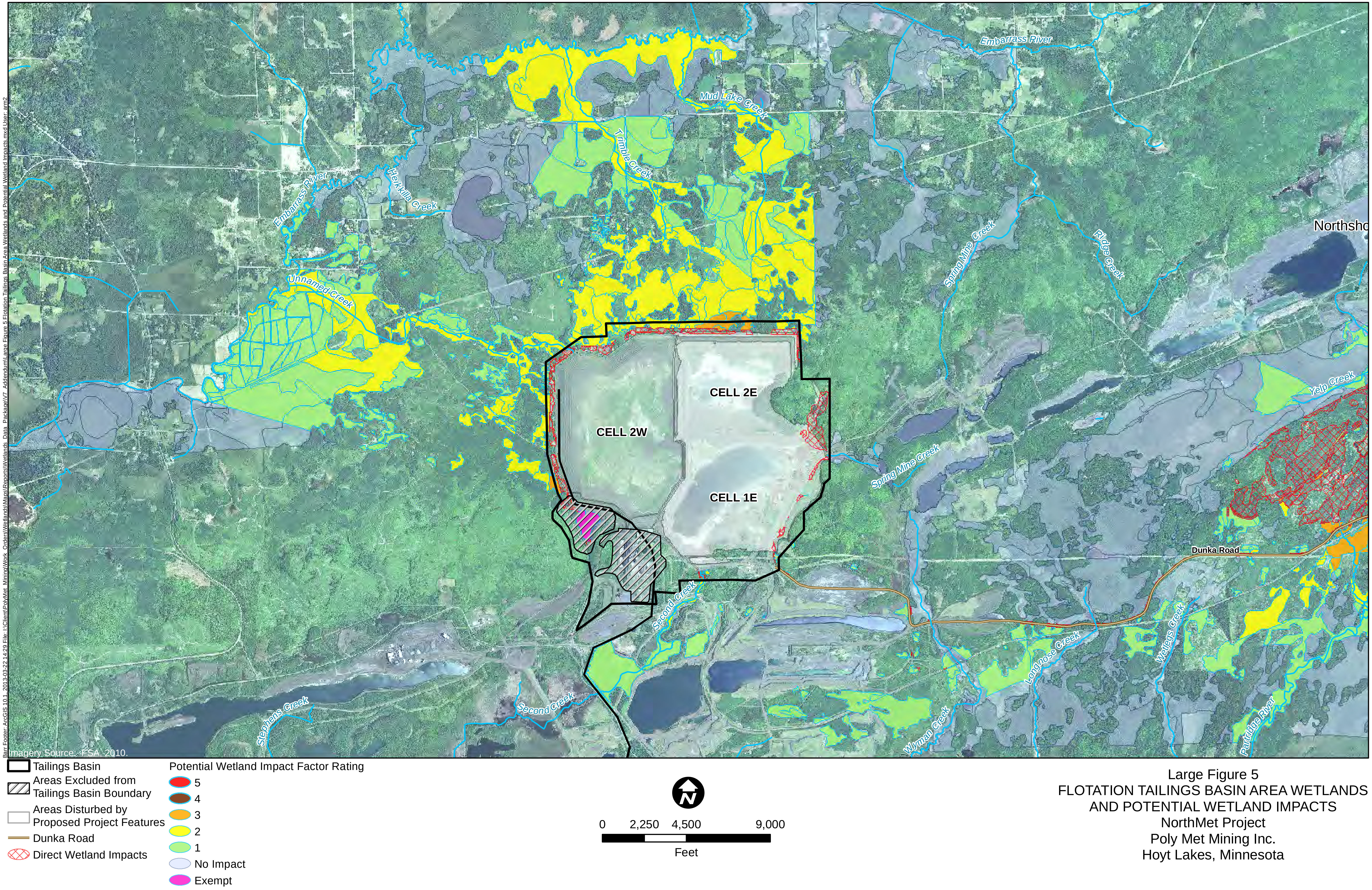
Large Figure 4

DUNKA ROAD AND UTILITY CORRIDOR WETLANDS
AND POTENTIAL WETLAND IMPACTS

NorthMet Project

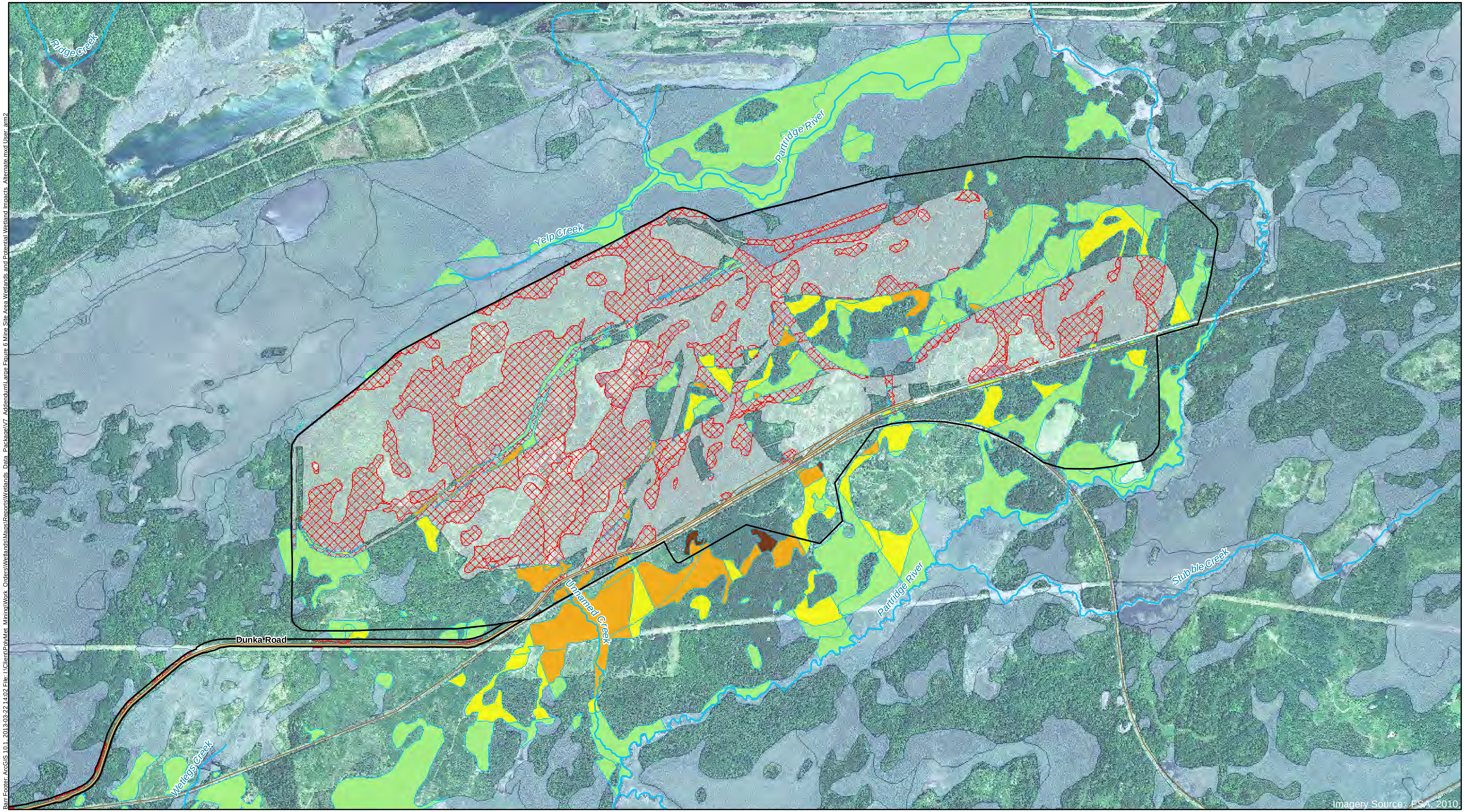
Poly Met Mining Inc.

Hoyt Lakes, Minnesota



Barr Footer: ArcGIS 10.1, 2013-03-22 14:29 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\Wetlands_Data_Package\V7_Addendum\Large Figure 5 Flotation Tailings Basin Area Wetlands and Potential Wetland Impacts.mxd User: arm2

Large Figure 5
FLOTATION TAILINGS BASIN AREA WETLANDS AND POTENTIAL WETLAND IMPACTS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



▭ Mine Site

▭ Areas Disturbed by Proposed Project Features

═ Dunka Road

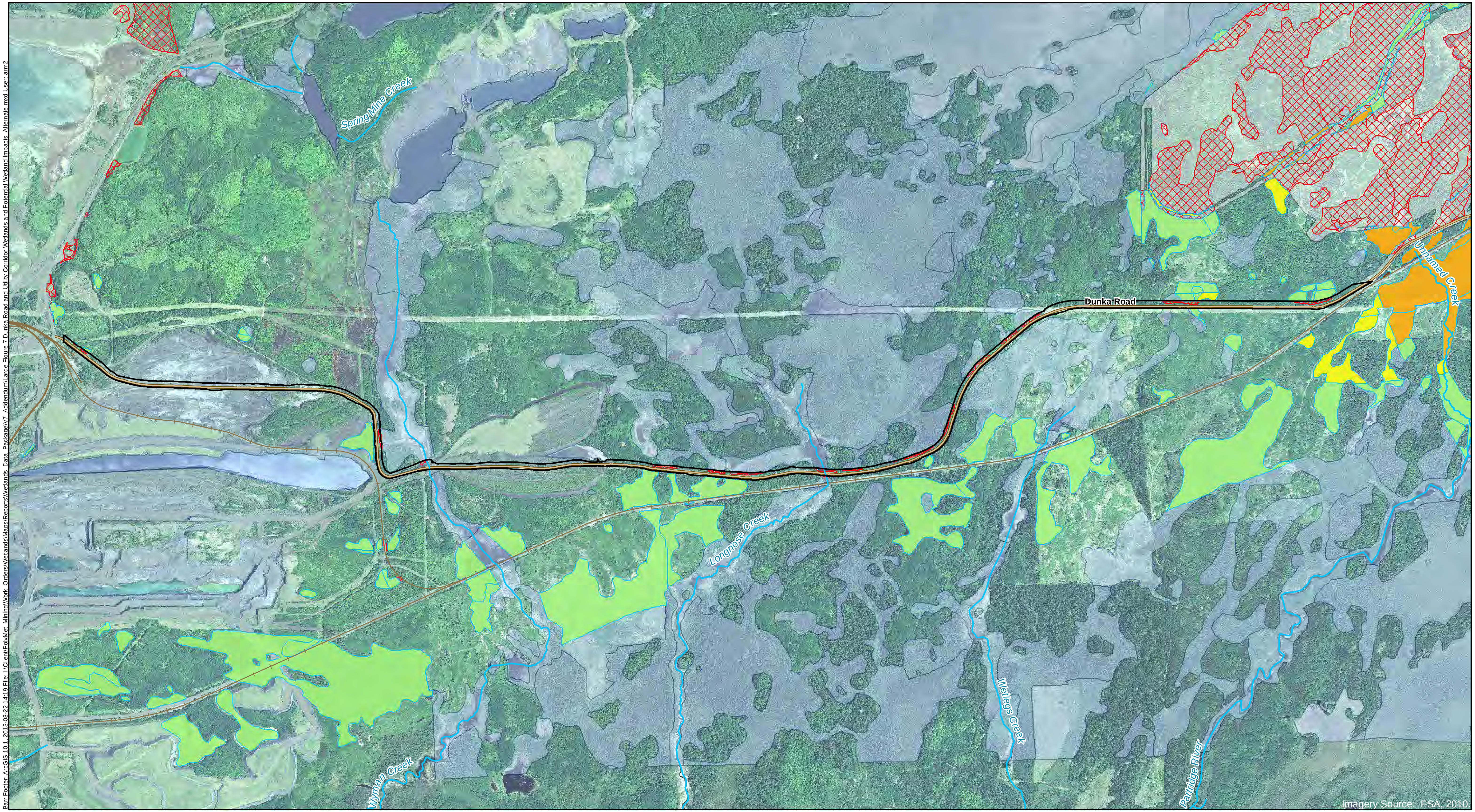
▨ Direct Wetland Impacts

Potential Wetland Impact Factor Rating

- 🟥 5
- 🟫 4
- 🟧 3
- 🟨 2
- 🟩 1
- ⬜ No Impact

Large Figure 6
MINE SITE AREA WETLANDS AND POTENTIAL WETLAND IMPACTS - ALTERNATE METHOD

NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



☐ Dunka Road and Utility Corridor

☐ Areas Disturbed by Proposed Project Features

— Dunka Road

▨ Direct Wetland Impacts

Potential Wetland Impact Factor Rating

● 4

● 3

● 2

● 1

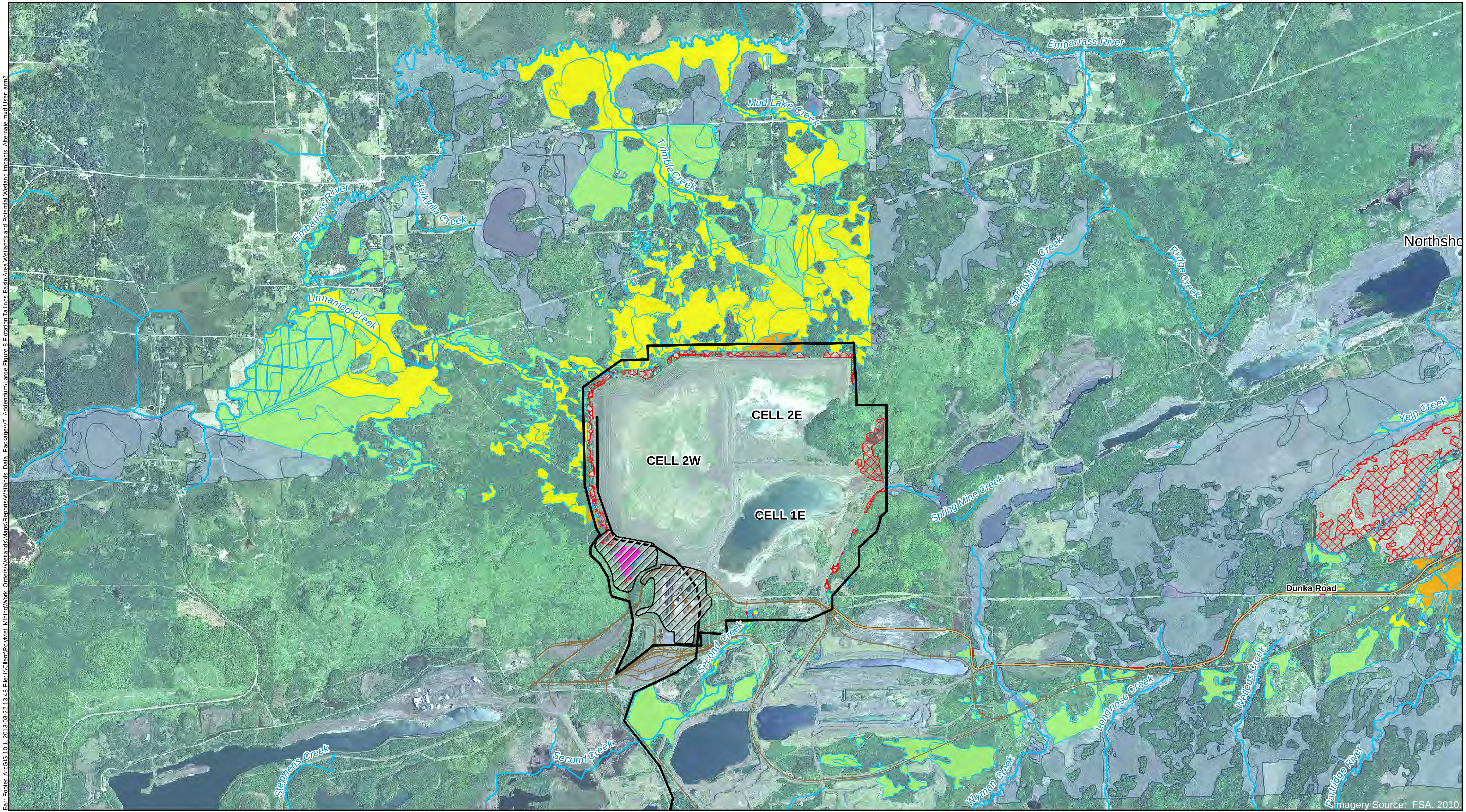
● No Impact

0 1,000 2,000 4,000

Feet

Large Figure 7

DUNKA ROAD AND UTILITY CORRIDOR WETLANDS
AND POTENTIAL WETLAND IMPACTS -
ALTERNATE METHOD
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



▭ Tailings Basin
▨ Areas Excluded from Tailings Basin Boundary
▭ Areas Disturbed by Proposed Project Features
═ Dunka Road
▨ Direct Wetland Impacts

Potential Wetland Impact Factor Rating
● 5
● 4
● 3
● 2
● 1
○ No Impact
● Exempt

0 2,250 4,500 9,000
Feet

Large Figure 8
FLOTATION TAILINGS BASIN AREA WETLANDS AND POTENTIAL WETLAND IMPACTS - ALTERNATE METHOD
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota

Attachment B

NorthMet Project Wetland Analysis Work Plan v3

POLYMET
MINING

NorthMet Project

Wetland Analysis Work Plan

Version 3

October 13, 2011

NorthMet Project
Wetland Analysis Work Plan
Version 3

Table of Contents

1. Project

This document is the Work Plan for wetland analysis for the NorthMet Project (Project) as specified in Wetland Resources IAP Final Summary Memo and Co-lead Agency Final Work Plan Preparation Guidance of July 1, 2011 (Guidance Document) and the Wetland IAP Work Plan Compiled Comments dated August 30, 2011.

The project that will be modeled is the project described in the Co-lead Agency Draft Alternative Summary as amended in September, 2011. The Project Footprint that will be used for this analysis has been defined and detailed in the NorthMet Project Project Description (Reference 1).

2. Background

Wetland impacts for the Project were previously evaluated for the DEIS and included direct, potential indirect, and cumulative impacts. Using the wetland types and acreages identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), direct, potential indirect, and cumulative impacts will be evaluated as described in the following sections. The results of the wetland analysis in this Work Plan will be presented in the Wetland Data Package.

3. Direct Wetland Impacts

Direct wetland impacts will result from filling and excavation. The analysis performed for the SDEIS will duplicate the analysis performed for the DEIS (Section 4.2 of Reference 2) using the current Project Footprint described in Reference 1.

Wetlands within the Project Footprint will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for each wetland were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The analysis output for the direct wetland impact will include:

1. A summary table will provide information for each wetland within the Project Footprint and include:
    a. The wetland type, wetland acreage, and direct impact will be calculated using GIS.
    b. The type of direct impact (fill, excavation, etc.) will be identified.
    c. The quality of each wetland will be identified.
2. For each Eggers and Reed (1997) wetland type, a summary table will provide the total acreage and total acres of direct impact for the following Project Areas - Mine Site, railroad corridor, Dunka Road and utility corridor, Plant Site, Flotation Tailings Basin, Hydrometallurgical Residue Facility, and the Colby Lake water pipeline corridor.
    a. Figures for each of the Project Areas will be created that show the areas with direct wetland impacts.
3. The total direct wetland impact acreage for the Project Footprint will be provided.

4. Potential Indirect Wetland Impacts

The analysis of potential indirect wetland impacts will be completed using the Guidance Document. The purpose of this analysis is to provide an estimate of potential indirect wetland impacts.

Potential indirect wetland impacts will be assessed based on: changes in wetland watershed areas (during operation and post-closure); groundwater drawdown resulting from open pit mine dewatering; groundwater mounding/drawdown resulting from operation of the Flotation Tailings Basin including groundwater seepage interception wells; changes in stream flow near the Mine Site and Flotation Tailings

Basin and associated impacts to wetlands abutting the streams (during operation and post-closure); wetland fragmentation from Project elements such as open pits, stockpiles, haul roads, etc.; and changes in wetland water quality. If/when the Project is permitted, an indirect wetland impact monitoring plan will be implemented as part of the Section 404 permit conditions.

The analysis will be completed for the Mine Site, the Flotation Tailings Basin, and the transportation corridors (railroad and Dunka Road).

4.1 Mine Site

4.1.1 Wetland Identification

Wetlands within the Mine Site will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area One (which includes the Mine Site) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

Wetland acreage by wetland type will be calculated using GIS within 500-foot radius increments beginning at the mine pits and continuing out to a total radius of 10,000 feet (for a total of 20 increments). The area of evaluation will only include wetlands within Area One where wetland type information has been developed and it will not include wetlands identified as directly impacted in Section 3.0. In addition, wetlands in the Peter Mitchell open pit taconite mine and areas north of this mine will be excluded from evaluation as described in the Guidance Document.

1. A detailed table will be provided for each increment identifying the wetland type and acreage for each wetland.
2. A summary table will be provided for each increment identifying the total acreage and total acres of direct impact for each Eggers and Reed (1997) wetland type.
3. For each wetland that will be directly impacted, the acreage for the portion of the remaining wetland will be calculated and included in a table.
4. A figure will be provided showing the increments and identifying the Eggers and Reed (1997) wetland types within each increment.

4.1.2 Potential Indirect Wetland Impacts Resulting from a Change in Watershed Area

For each wetland that will not be directly impacted by fill or excavation, but will have Project elements impacting its watershed, an estimate of the change in watershed area (acreage and percent gain or loss) will be calculated.

The change (acreage and percent gain or loss) in watershed areas and the wetland area found within each watershed will be identified for the following conditions: pre-Project, during operation when the maximum amount of watershed has been removed, and at closure.

An estimate of potential indirect wetland impacts (wetland acres by wetland type and type of indirect impact) will be calculated for non-directly impacted wetlands that will have changed watershed areas (during operation and post-closure) for each watershed that was identified as changed in the previous paragraph, using the following steps:

1. Determine the tributary acres per wetland acre for the pre-Project, during operation, and after closure conditions.
2. Determine the equivalent watershed yield (ac-ft/yr) for the pre-Project, during operation, and after closure conditions. The existing watershed yield will be calculated based on available gage data from Section 4.4.1 of Reference 3. This rate would be applied to each watershed to

convert the tributary ratio in Step 1 to an equivalent yield (or equivalent average contributing net precipitation), expressed as acre-feet/year (ac-ft/yr) per acre of wetland.

3. The range in the equivalent yield (inches/year) estimated over the life of the Project will be evaluated relative to pre-Project yield to calculate a maximum percent change in yield. The estimated relative change in yield will be evaluated on a case-by-case basis, taking into account factors such as wetland type, to determine the potential for indirect impacts (e.g., groundwater fed wetlands may be less susceptible to changes in surface watershed).

4.1.3 Potential Indirect Wetland Impacts Resulting from Wetland Fragmentation

For remaining wetlands not directly impacted or indirectly impacted by watershed area changes, an estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) from wetland fragmentation by Project features (open pits, stockpiles, haul roads, etc) will be determined, using the following steps:.

1. For each portion of a remaining wetland, excluding indirect impacts from watershed changes, the potential area of indirect impacts will be determined based on an analysis of the various factors that may contribute to potential fragmentation. Based on this analysis, the identifying factor(s) contributing to potential fragmentation (change in size of wetland, surrounded by Project features, change in function and values of wetland e.g. wildlife habitat, etc.) will be identified. [Note: noise and dust do not cause fragmentation impacts according to the U.S. Army Corps of Engineers, May 16, 2011 conference call.]

4.1.4 Potential Indirect Wetland Impacts Resulting from Changes in Hydrology

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of indirect impact) due to groundwater drawdown from open pit mine dewatering, based on the Co-lead Agency guidance for estimating potential indirect wetland impacts from groundwater drawdown near open pit mines as provided on July 1, 2011 will be determined, using the following steps.

1. Use the information provided by the Groundwater IAP Group and other available and relevant hydrogeologic data to justify whether to use or modify the provided analogue information which is based upon comparisons of the existing regional and site specific geologic data (such as bedrock faults, bedrock joint systems, bedrock topography, glacial till hydraulic conductivities, etc.), site specific engineering controls such as the Category 1 Waste Rock Stockpile seepage containment system, and the geologic settings of the analogue information sites and the Mine Site.
2. Use the guidelines provided by the Corps Memorandum (CEMVP-OP-R) Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff to identify minerotrophic and ombrotrophic coniferous and open bogs.

The potential indirect wetland impact from glacial aquifer drawdown will be based on the analogue impact zone with the greater potential drawdown (zone closer to the open pit mine) for wetlands that lie on both sides of the analogue distance boundary. The analogue distances are described below in steps 1, 2, 3 and 4.

1. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within 0 feet to 1,000 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
    a. High Likelihood – includes coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, and alder thicket

    b. Moderate Likelihood – deep marsh, shallow marsh, and shallow open water
    c. Low Likelihood – minerotrophic coniferous bog and open bog
    d. No Impact anticipated as identified in Guidance Document – ombrotrophic coniferous bog and open bog

2. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >1,000 feet to 2,000 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
    a. Moderate Likelihood – coniferous swamps, hardwood swamps, sedge/wet meadow, shrub-carr, and alder thicket
    b. Low Likelihood – deep marsh; shallow marsh, and shallow open water
    c. No Impact anticipated as identified in Guidance Document – minerotrophic and ombrotrophic coniferous bog and open bog
3. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >2,000 feet to 3,500 feet from the pit edge. The table will also identify the type of indirect wetland impact for each indirectly impacted wetland. Identify the likelihood of wetland hydrology impact based on wetland type.
    a. Low Likelihood – coniferous swamp, hardwood swamp, sedge/wet meadow, shrub-carr, alder thicket
    b. No Impact anticipated as identified in Guidance Document – deep marsh, shallow marsh, shallow open water, coniferous bog, open bog
4. For all wetlands, provide a table and figure identifying type and acreage of wetlands located within >3,500 feet to 10,000 feet from the pit edge (within the wetland evaluation area). The table will also identify the type of indirect wetland impact for each indirectly impacted wetland.
    a. No Impact anticipated as identified in Guidance Document – all wetland types

A general discussion will be provided regarding the potential indirect wetland hydrology drawdown impacts to each wetland type based on the wetland sensitivity class tables for falling groundwater tables found in the Crandon mine project document titled *Wetland Impact Assessment Technical Memorandum – Appendix B* (Peterson Environmental Consulting, Inc. 2002).

1. A qualitative discussion of the types of potential indirect wetland impacts that might occur will be provided based on hypothetical hydrologic drawdown levels. Potential indirect wetland impacts might include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts, which will be categorized using the Eggers and Reed (1997) wetland classification system.

4.1.5 Potential Indirect Wetland Impacts for Wetlands Abutting the Partridge River

Estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands abutting the Partridge River as a result of changes in river flow resulting from the Project (during operation and post-closure), using the following steps.

1. Identify in GIS the wetlands abutting the Partridge River within Area One. A table will identify the wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands).

2. Provide the change in flow and water levels in the Partridge River using the model developed in Section 5.6 of Reference 3.
3. Identify whether the changes in flow (and therefore stage) resulting from the Project are within the observed natural variation for the Partridge River (Section 4.4.1 of Reference 3).
4. If the changes in flow and water levels are not within the observed natural variation for the Partridge River, identify the potential indirect impacts for the wetlands abutting the Partridge River.

4.1.6 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for remaining wetlands not directly impacted or indirectly impacted by previously evaluated causes in Sections 4.1.2 through 4.1.5 that would be impacted by water quality changes (such as from sulfide-bearing dust deposition, ore spillage, seepage from stockpiles, etc.) will be completed using the following steps:

1. Fugitive Dust Emissions
    a. The air emissions from all surface fugitive dust sources at the Mine Site will be modeled using an EPA approved air dispersion model with a deposition algorithm (AERMOD version 11103). This is the same model that has been proposed to be used for assessing air impacts in Class II areas in the draft NorthMet Air Modeling Work Plan (version 1, May 9, 2011) which was developed in response to the Air Impacts Assessment Planning Summary Memo dated May 6, 2011. Comments have been received on this draft Work Plan, with no objections to the proposed model, so this model is expected to be specified in the final Work Plan. Emission rates and particle size distributions will be based on total particulate matter. Receptors will be placed on all delineated wetlands within the Project ambient air boundaries that have not been identified as directly impacted. The receptor grid will also initially extend 5 kilometers beyond the ambient air boundaries with a grid spacing of 500 meters. The receptor grid may be adjusted based on preliminary modeling results. Other modeling details would generally follow those specified in the Class II modeling protocols for the Mine Site as defined by the Air IAP and/or generally excepted modeling practice.
    b. The modeled dust sources at the Mine Site will include ore and waste rock truck loading and unloading outside of the pits, railcar loading, dust generation from traffic on unpaved roads on the surface (i.e. not in the pits), and overburden and other construction rock screening and/or crushing as defined by the Air IAP.
    c. Rock handling and roads within the pits will not be included in the analysis because: a) “pit-trapping” would greatly reduce the potential for dust to impact areas outside of the pits and b) Barr’s past experience which indicates that the AERMOD “open pit” algorithm is incompatible with the AERMOD deposition algorithm.
    d. The output of the model will be deposition rate (grams per square meter) on an annual basis. The model results will be compared to background values such that contours where the modeled deposition is small relative to the background value can be developed. This can be considered a conservative assessment of how far away potential impacts to wetlands from dust may occur from fugitive dust sources. This should be considered a screening level analysis such that it would identify an upper bound for the potential range of distances at which impacts might occur, but the results will not identify actual impacts. This range of distances could be used to

estimate the extent of potential indirect impacts to guide development of monitoring plans to document actual indirect impacts. Based on the results of the screening analysis, PolyMet may propose a more refined approach to assess the distance at which potential impacts may occur.

2. Metals and Sulfide Dust Emissions
    a. The potential for sulfur deposition was evaluated for the DEIS Mine Plan in Screening Analysis of the Potential for Fugitive Dust Emissions Associated with Sulfide Rock Handling at the NorthMet Project Mine Site to Increase Sulfur Deposition to Nearby Wetlands (Barr, January 28, 2010). This analysis included dust emissions from the handling of Category 2, 3, and 4 waste rock and ore. Lean ore handling emissions were also modeled, but lean ore has been eliminated as a rock classification in the updated Mine Plan.
    b. The handling activities associated with Category 2, 3 and 4 waste rock and ore located outside of the pits will be included in the metals and sulfur analysis for the Mine Site. This includes truck loading and unloading with waste rock and ore and railcar loading with ore. Note: the potential for wind erosion from the stockpiles has been evaluated, and it has been determined that wind erosion would not occur through the use of EPA approved wind erosion calculations procedures in Section 13.2.5 of Reference 4. The calculations are described in the Mine Site Emission Inventory Spreadsheet (Version 2 Submitted August 1, 2011). This spreadsheet references the detailed calculations based on five years of meteorological data provided to MPCA via FTP site on May 9, 2011.
    c. Modeling will be conducted for the included sources in the same manner as described for dust modeling. The dust modeling and metals and sulfide modeling may be conducted in separate model runs or in the same run utilizing the model's source grouping capabilities.
    d. For air dispersion/deposition modeling, the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. Metals for evaluation, associated with rock and soils, would be: arsenic, cadmium, chromium, lead, manganese, nickel and selenium.
    e. Mercury will not be evaluated at the Mine Site for dust deposition because the concentration of mercury in the rock to be mined is very low (Sections 5.0 and 5.8 of Reference 3) and not considered to be environmentally significant in this medium.
    f. The model-estimated sulfur and metals deposition rates (grams per square meter) will be compared to background values to determine distance contours beyond which the deposition rate is insignificant compared to background. As with the dust analysis, this would be a screening level evaluation that could be used to identify a range of distances from a source beyond which impacts would be unlikely to occur. This range of distances could be used to estimate the extent of potential indirect wetland impacts to guide development of monitoring plans to document actual indirect impacts. PolyMet may choose to propose a more refined approach depending on the results of the screening level analysis. A more refined approach could take into account such factors as the potential for metals and/or sulfur to be liberated from the rock particles depending on the rock chemistry, environmental chemistry and general conditions in the ecosystem where the deposition is predicted to occur.
3. Ore spillage – see the Section 4.3.2.

4. Leakage from stockpile will be evaluated using the following steps:
    a. Quantify the amount of stockpile leakage water that discharges to surface water and wetlands, down gradient of the stockpiles based on the results of the water quality modeling.
    b. Identify the wetlands (type, acreage) within the surficial aquifer groundwater flowpaths from mine features using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).
    c. Categorize the wetlands within the flowpaths in Step ii into groundwater-fed and precipitation-fed wetlands using guidance from the Corps "Bog Memo" and evaluate the potential for indirect impacts based on potential water quality changes from the mine features.

4.1.7 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

4.2 Flotation Tailings Basin

4.2.1 Wetland Identification

Wetlands around the Flotation Tailings Basin will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area Two (which includes the Flotation Tailings Basin) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

Wetland acreage by wetland type will be calculated using GIS within 500-foot radius increments beginning at the Flotation Tailings Basin and continuing out to the Embarrass River. The area of evaluation will only include wetlands within Area Two where wetland type information has been developed and it will not include wetlands identified as directly impacted in Section 3.0.

1. A detailed table will be provided for each increment identifying the wetland type and acreage for each wetland.
2. A summary table will be provided for each increment identifying the total acreage and total acres of direct impact for each Eggers and Reed (1997) wetland type.
3. For each wetland that will be directly impacted, the acreage for the portion of the remaining wetland will be calculated and included in a table.
4. A figure will be provided showing the increments and identifying the Eggers and Reed (1997) wetland types within each increment.

4.2.2 Potential Indirect Wetland Impacts Resulting from Changes in Hydrology

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) from hydrologic changes (groundwater upwelling and resulting surface water flow in wetlands and/or groundwater drawdown near the groundwater seepage interception wells) resulting from groundwater seepage and/or interception well pumping will be determined.

1. Quantify the amount of Flotation Tailings Basin groundwater seepage water that discharges to surface water features, including wetlands, down gradient of the Flotation Tailings Basin. A MODFLOW model developed for the Flotation Tailings Basin will be used in conjunction with a GoldSim probabilistic model to estimate the quantity of seepage that discharges to surface water features.
2. Identify all the wetlands (type, acreage) within the surficial aquifer groundwater flowpaths downgradient of the Flotation Tailings Basin using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).
3. Using the wetlands identified in step 2, categorize the wetlands into groundwater-fed and precipitation-fed wetlands using guidance in the Corps Memorandum (CEMVP-OP-R) *Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff* and evaluate the potential for indirect impacts resulting from groundwater seepage and/or interception well pumping.

Provide a general discussion regarding the potential indirect wetland hydrology impacts to each wetland type based on the wetland sensitivity class tables for rising groundwater tables found in the Crandon mine project document titled *Wetland Impact Assessment Technical Memorandum – Appendix B* (Peterson Environmental Consulting, Inc. 2002).

1. A qualitative discussion of the types of potential indirect wetland impacts that might occur will be provided based on hypothetical hydrologic drawdown or surchage levels. Potential indirect wetland impacts might include: conversion to other wetland community types, a change in vegetation without a change in community type, conversion to uplands, or other impacts, which will be categorized using the Eggers and Reed (1997) wetland classification system.

4.2.3 Potential Indirect Wetland Impacts for Wetlands Abutting Trimble Creek and the Two Unnamed Creeks

An estimate of potential indirect wetland impacts (wetland acres by wetland type) in wetlands abutting the three streams north and west of the Flotation Tailings Basin (Trimble Creek and the two unnamed creeks as shown in Figure 3 of the Water Resources IAP – Surface Water Summary Memo) as a result of changes in stream flow resulting from operation of the Flotation Tailings Basin will be determined using the following steps:

1. Identify in GIS the wetlands abutting the west Unnamed Creek (Mud Lake Creek), Trimble Creek, and the east Unnamed Creek within Area Two. A table will identify the wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands).
2. Provide the change in flow in the three streams using the GoldSim probabilistic model developed in Reference 6 and the method described in Section 4.4 of Reference 2. Estimate a corresponding change in stage based on available rating curves or simple hydraulic equations (e.g. Manning's equation).

3. Identify whether the changes in flow (and by extension, stage) are within the estimated natural variation for the three streams based on observed data or unit-area relationships extrapolated from gage data (Section 4.4.1 of Reference 5 and Page 3 of Reference 6).
4. If the changes in flow and water levels are not within the observed natural variation for the three streams, identify the potential indirect impacts for the wetlands abutting the three streams.

4.2.4 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands that would be impacted by water quality changes (such as from sulfide-bearing dust deposition from the Flotation Tailings Basin, Flotation Tailings Basin groundwater seepage, etc.) will be completed using the following steps:

1. Fugitive Dust Emissions
    a. The air emissions from all surface fugitive dust sources at the Flotation Tailings Basin site will be modeled using an EPA approved air dispersion model with a deposition algorithm (AERMOD version 11103). This is the same model that has been proposed to be used for assessing air impacts in Class II areas in the draft NorthMet Air Modeling Work Plan (version 1, May 9, 2011) which was developed in response to the Air Impacts Assessment Planning Summary Memo dated May 6, 2011. Comments have been received on this draft Work Plan, with no objections to the proposed model, so this model is expected to be specified in the final Work Plan. Emission rates and particle size distributions will be based on total particulate matter. Receptors will be placed on all delineated wetlands within the Project ambient air boundaries that have not been identified as directly impacted. The receptor grid will also initially extend 5 kilometers beyond the ambient air boundaries with a grid spacing of 500 meters. The receptor grid may be adjusted based on preliminary modeling results. Other modeling details would generally follow those specified in the Class II modeling protocols for the Plant Site as defined by the Air IAP and/or generally excepted modeling practice.
    b. The modeled dust sources at the Flotation Tailings Basin will include LTV Steel Mining Company (LTVSMC) tailings loading and unloading, unpaved road traffic, and wind erosion from dams constructed of LTVSMC tailings and beaches composed of NorthMet tailings.
    c. The output of the model will be deposition rate (grams per square meter) on an annual basis. The model results will be compared to background values such that contours where the modeled deposition is small relative to the background value can be developed. This can be considered a conservative assessment of how far away potential impacts to wetlands from dust may occur from fugitive dust sources. This should be considered a screening level analysis such that it would identify an upper bound for the potential range of distances at which impacts might occur, but the results will not identify actual impacts. This range of distances could be used to estimate the extent of potential indirect impacts to guide development of monitoring plans to document actual indirect impacts. Based on the results of the screening analysis, if model-estimated particle deposition is equal to current background deposition (i.e., 100 percent of current background; i.e., a potential doubling of deposition), PolyMet may propose a more refined approach to assess the distance at which potential impacts may occur.
2. Metals and Sulfide Dust Emission

  a. At the Flotation Tailings Basin wind erosion from the embankment and beaches as well as truck traffic on roads composed of LTVSMC tailings will be included in the analysis.

  b. Modeling will be conducted for the included sources in the same manner as described for dust modeling. The dust modeling and metals and sulfide modeling may be conducted in separate model runs or in the same run utilizing the model's source grouping capabilities.

  c. For air dispersion/deposition modeling, the total particulate emission rates (grams per second) will be speciated and converted to metals and sulfur emission rates based on data on the chemical composition of each material generating dust. Proposed metals for evaluation, associated with rock and soils, will include: arsenic, cadmium, chromium, lead, manganese, nickel, and selenium.

  d. Because the NorthMet ore is low in mercury, the tailings, which includes roughly 98 percent of the ore, will also be low in mercury, and in fact pilot study data shows that the mercury preferentially goes to the flotation concentrate. The mercury in the tailings is also expected to be strongly bound within the mineral matrix. This is also true of the LTVSMC tailings that will be used to construct the Flotation Tailings Basin dams and that may be present on some road surfaces. Therefore, any mercury present in dust from the Flotation Tailings Basin would not be biologically available and we are not proposing to consider mercury in the deposition analysis at the Flotation Tailings Basin. When metal ores are concentrated and heated, such as in taconite mining or in smelting processes, then mercury becomes a metal of interest for air emissions and deposition. For the Project, potential mercury air emissions from ore processing (i.e., potential emissions from the autoclave) are being evaluated for potential local deposition impacts.

  e. The model-estimated sulfur and metals deposition rates (grams per square meter) will be compared to background values to determine distance contours beyond which the deposition rate is insignificant compared to background. As with the dust analysis, this will be a screening level evaluation that could be used to identify a range of distances from a source beyond which impacts would be unlikely to occur. This range of distances could be used to estimate the extent of potential indirect wetland impacts to guide development of monitoring plans to document actual indirect impacts. If model-estimated sulfur or individual metal deposition is equal to current background deposition (i.e., 100% of current background; i.e., a potential doubling of deposition), PolyMet may propose a more refined approach depending on the results of the screening level analysis. A more refined approach could take into account such factors as the potential for metals and/or sulfur to be liberated from the rock particles depending on the rock chemistry, environmental chemistry and general conditions in the ecosystem where the deposition is predicted to occur.

3. Flotation Tailings Basin Groundwater Seepage

  a. Identify the chemistry from the Flotation Tailings Basin groundwater seepage based on the results of the water quality modeling (Reference 6).

  b. Identify the wetlands (type, acreage) within the down gradient zone using boundaries used in the water quality modeling (as shown in the Groundwater IAP Summary document).

  c. Categorize the wetlands within the flowpaths in Step ii into groundwater-fed and precipitation-fed wetlands using guidance from the Corps Memorandum (CEMVP-

OP-R) *Distinguishing Between Bogs That Are Entirely Precipitation Driven Versus Those with Some Degree of Mineral Inputs from Groundwater and/or Surface Water Runoff* and evaluate the potential for indirect impacts based on potential water quality changes from the Flotation Tailings Basin.

4.2.5 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

4.3 Transportation Corridors

4.3.1 Wetland Identification

Wetlands around the Flotation Tailings Basin will be identified using the Eggers and Reed (1997) community classification system. The wetland types and acreages for Area Two (which includes the Flotation Tailings Basin) were identified in the report entitled: *NorthMet Project Baseline Wetland Typing Evaluation* (Barr 2011), which was discussed with the Wetland IAP Workgroup and approved by the Co-lead Agencies on March 30, 2011.

The wetlands abutting the Dunka Road and the railroad corridor within Area One and Area Two will be identified using GIS. The wetland ID, type and acreage for each wetland (only within the area previously characterized for wetlands) will be identified in a table.

4.3.2 Potential Indirect Wetland Impacts Resulting from Water Quality Changes

An estimate of potential indirect wetland impacts (wetland acres by wetland type, and type of impact) for wetlands that will be impacted by water quality changes (such as from sulfide-bearing dust deposition, ore spillage, etc.) will be completed using the following steps:

<u>Mine to Plant Rail</u>

The potential release of dust from railcars transporting ore from the Mine Site to the Plant Site was addressed in the May 6, 2011 Air Impact Assessment Planning Summary Memo, "The air IAP group concluded that there would be minimal air impacts from any dust generated from ore hauled in the railcars due to the coarse nature of the ore. " Based on this conclusion, air modeling of potential release of dust from railcars will not be performed because the potential wetland impacts will not be significant.

The air IAP group concluded that any dust generated from ore hauled in railcars would be coarse in nature (i.e., relatively large particles). These larger particles would tend to deposit near the railcar and not be dispersed to any great extent. An estimate of the spillage of ore fines along the rail corridor is shown in Section 8.5.3 of Reference 7. Assuming that all spillage of the coarse material would occur in a 2 meter wide strip on both sides of the centerline of the railway (total width = 4 meters) over the entire haul distance after loading (~ 8 miles; ~13,000 meters), results in approximately 0.11 Kg/square meter of ore fines annually or 2.14 Kg/square meter for the 20 year Project. This equates to 0.002 inch of depth annually or 0.05 inches for the 20 year Project.

Using the geochemical modeling methods described in Reference 7 for the Ore Surge Pile, the quality of water infiltrating through this material will be estimated on a per-unit area basis which will also be on a per unit length of the rail corridor. If the water quality is found to have a greater than 10 percent likelihood of exceeding water quality standards as defined in Table 1-3 of Reference 8, the unit area required to provide sufficient precipitation to dilute the water to meet standards will be calculated and converted to a distance to be added to the 2 meters from the centerline of the rail corridor that will be a potential dust impact corridor. Any wetlands identified in the above paragraph of this section that are within the potential dust impact corridor will be considered to be potentially indirectly impacted.

Dunka Road

Loaded mine haul trucks will not travel on the Dunka Road. Empty mine haul trucks will only travel on the Dunka Road when they are in need of maintenance at the Area 1 Shop. It is estimated that each truck will travel to Area 1 twice per year. The total one-way trips per year are estimated at 44. Given the low traffic volumes (< 1 trip per week on average) a quantitative assessment of impacts from ore particle discharge from haul trucks travelling down the Dunka Road is not warranted.

Product Shipping

Products produced in the hydrometallurgical plant (AU/PGM concentrate, mixed hydroxide precipitate) will be loaded into super sacks (i.e. large industrial sacks used to transport solid material) and then loaded onto trucks or railcars. There is little or no potential for spillage with this method of shipping. With respect to flotation concentrate, as stated in the project description (Reference 1) "Each filtered concentrate would be conveyed to separate stockpiles within an enclosed 10,000 ton storage facility for loading into covered rail cars. The storage facility would store about 7 to 10 days of production capacity when flotation concentrate would be directed to Concentrate Dewatering/Storage. The storage facility would have a concrete floor and provisions to wash wheeled equipment leaving the facility to prevent concentrates from being tracked out of the facility." The flotation concentrate is similar material to that which caused issues at the Red Dog Mine in Alaska (zinc concentrate transported in truck trailers), which has been cited as an example of potential consequences of product transport at mining operations. Some issues at Red Dog were driven by road dust and port activities which do not apply to the Project. Best Management Practices adopted at Red Dog - enclosed storage and loading, covered cars, and vehicle wash facilities - are proposed for use at the NorthMet project. Because the common carrier route (i.e. the rail line used to transport products) is not known (ultimate customer not known and could change), there is no way to assess impacts along the common carrier route. PolyMet will be paid on tons received by customers so it has a vested interest in not losing any concentrate. The covered rail cars will be inspected for holes and any holes repaired before concentrate loading.

4.3.3 Potential Indirect Wetland Impacts Resulting from Wetland Fragmentation

For remaining wetlands not directly impacted or identified in 4.3.2, an estimate of potential indirect wetlands (wetland acres by wetland type, and type of indirect impact) from wetland fragmentation by Project features will be completed using the following steps:

1. For each portion of a remaining wetland, excluding indirect impacts identified in 4.2.3, the potential area of indirect impacts would be determined based on an analysis of the various factors that may contribute to potential fragmentation. Based on the analysis, the identifying factor(s) contributing to potential fragmentation (change in size of wetland, surrounded by Project features, change in function and values of wetland e.g. wildlife habitat, etc.) would be identified. [Note: noise and dust do not cause fragmentation impacts according to the U.S. Army Corps of Engineers, May 16, 2011 conference call.]

4.3.4 Potential Indirect Wetland Impacts to Wildlife Utilization of Nearby Habitats From Project Noise

Provide a general discussion regarding the potential indirect wetland impact to wildlife utilization of nearby habitats from project noise using the following steps:

1. Identify the potential sources of project noise and the range of emitted noise levels.
2. Identify wildlife species that are found within the area, as well as their preferred habitats using wildlife surveys previously conducted for the NorthMet Project (Section 4.4 of Reference 2).
3. Qualitatively discuss the potential impacts and possible short- and long-term reactions of wildlife species to the potential project noise levels.

5. Cumulative Wetland Impacts

Analysis of cumulative wetland impacts will be done using accepted tools and protocols. The analysis performed for the DEIS is described and summarized in Section 4.3 of Reference 1. The analysis performed for the SDEIS will generally duplicate that effort using the revised direct and potential indirect wetland impact acreage, along with updated watershed information. The assessment will be conducted for both the Partridge River watershed and the Embarrass River watershed. The following steps will provide acreage for wetland and water resources for the pre-settlement, existing and foreseeable future conditions. Tables and figures will be developed to present the information.

5.1 Presettlement Wetland and Water Resources

The pre-settlement conditions time period represents wetlands, lakes, and deepwater resources as they existed prior to mining and urban development in the late 1800s to early 1900s. An estimate of pre-settlement wetland, lakes, and deepwater acreage within the Partridge River and Embarrass River watersheds will be developed in GIS using the following steps:

1. The acreage of wetland and water resources estimated for the pre-settlement period will be developed using the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) and the original survey maps developed using data from the original Government Land Surveys along with other historical surveys and sources, generally from the late 1800s.
2. The NWI mapping efforts were generated from interpretations of black-and-white aerial photographs completed in the late 1970s to early 1980s. The NWI is a more accurate depiction of historic wetland resources where human disturbance has been limited. Therefore, the NWI will be used as a base wetland map and available delineation data will be substituted to improve the accuracy of the wetland mapping.
3. The original survey maps will be obtained from the MDNR GIS Data Deli maps at http://deli.dnr.state.mn.us/. The original survey maps identify water resources as marshes, bottoms, swamps, lakes, ponds, and rivers, as documented in early land surveys. The original survey maps are a more accurate depiction of historic wetland resources where human disturbance is present. The water resources within the areas of human disturbance in each watershed will be digitized and presented on a figure.
4. The wetland and water resources mapped on the original survey maps will be digitized for one township, with minimal disturbance (roads, railroads, mining areas, etc.) located within and adjacent to the Partridge River watershed and for one township located within the Embarrass River watershed. It is assumed that if there is a minimal amount of disturbance in a township, the NWI mapping would be representative of pre-settlement wetland and water resources conditions. Therefore the data from each township will be used to develop a relationship between the NWI and original survey data.

5. The total wetland and water resources acreage for the two data sets will be compiled and the ratio of NWI to original survey map wetland and water resources will be calculated for each township. This ratio will indicate the percent of wetland and water resources identified on the NWI maps compared the original survey maps. This ratio will be used as an adjustment factor to conform the original survey data to the standards and scales of the NWI data for estimating the pre-settlement wetland resources within the disturbed areas of the watershed. The selected townships and data used to determine the adjustment factor will be presented in a table.
6. For the human disturbance areas, the NWI wetlands and water resources located within the human disturbance polygon boundaries will be removed using a GIS clipping tool. The NWI within these disturbance areas do not accurately reflect pre-settlement conditions because the NWI either included wetlands that have since been eliminated because of disturbance activities or did not include wetlands that had already been eliminated when the NWI was completed (e.g., reservoir development permanently flooded the wetlands). Because the NWI does not accurately map these types of areas, it does not accurately represent pre-settlement conditions; therefore the NWI wetlands in the disturbed areas will be replaced with wetlands mapped on the original survey maps. The total area of wetland and water resources within those polygons will be corrected using the adjustment factor. The total acreage of pre-settlement wetlands and water resources will be estimated for the two watersheds.

5.2 Existing Wetland and Water Resources

The existing conditions time period represents wetland, lake, and deepwater resources as they exist today, prior to the development of the Project. An estimate of existing wetland, lake, and deepwater acreage within the Partridge River and Embarrass River watersheds will be developed in GIS using the following steps:

1. Existing wetland, lake, and deepwater resources will be estimated using: wetland delineations completed in the area (as available); lake or lacustrine water body acreages will be estimated using the USGS National Hydrograph Dataset and the NWI datasets; deepwater or mine pit water body acreages will be estimated using a combination of the MDNR Mesabi Mining Features (2008) and interpretation of 2003, 2008, 2009, and 2010 FSA aerial photographs; and NWI mapping.
2. A "composite" wetland and water resources layer will be developed by deleting all of the NWI polygons from areas in which more detailed mapping had been completed and replacing them with the delineated wetland, lake, and deepwater resources.

5.3 Projected Future Wetland and Water Resources

An estimate of future wetland acreage within the Partridge River and Embarrass River watersheds will be completed considering reasonably foreseeable future project wetland impacts, both direct and potential indirect. Reasonably foreseeable future projects are defined as those that have been permitted and those that have had permit applications submitted and/or are undergoing environmental review by regulatory agencies.

The future conditions time period represents wetland, lake, and deepwater resources expected to be present following conclusion and reclamation of the Project. It is assumed that the future conditions follows some time after conclusion of the future projects such that the mine pit will have filled with water.

Relevant public officials from city, county, state and federal agencies will be contacted to identify reasonably foreseeable future actions within the study area. Agency officials will be asked to identify reasonably foreseeable future projects that may occur during the life of the Project. Contacts will include the City of Babbitt, St. Louis County, MDNR, Minnesota Board of Water and Soil Resources, the U.S. Forest Service, and the Iron Range Resources and Rehabilitation Board (IRRRB).

Future projects will be identified in the Partridge River watershed and the Embarrass River watershed that may impact wetland, lake, and deepwater resources. For the projected future conditions, the acreage of wetland, lake, and deepwater resources will be estimated by subtracting the future projected wetland impacts and adding the future projected development of wetland, lake, and deepwater resources to the existing resource totals. This information will be provided as a table.

5.4 Qualitative Analysis of Cumulative Wetland Impacts for the St. Louis River below the Ordinary High Water Mark From Its Confluence with the Embarrass River to Lake Superior

A qualitative analysis of cumulative wetland impacts for the St. Louis River below the ordinary high water mark from its confluence with the Embarrass River to Lake Superior will be developed based on a qualitative estimate of flow changes in the river.

A qualitative estimate of flow changes in the St. Louis River will be developed from the results of the Partridge River hydrologic modeling described in Section 7.1.1 of Reference 3. The estimated flow changes in the St. Louis River will be evaluated relative to gage data to determine if the changes are expected to be within the natural variation of flow within the St. Louis River will be developed using the following steps:

1. If the evaluation of the estimated flow changes in the St. Louis River is within the natural variation of average annual flow in within the St. Louis River observed at USGS gage 04016500 (St. Louis River near Aurora), no further analysis will be conducted. This location is the most upstream location of the St. Louis River affected by the NorthMet Project, and will therefore show the greatest impact.
2. If the evaluation of the estimated flow changes in the St. Louis River is not within the natural variation of flow in within the St. Louis River, the following analysis will be conducted.
    a. An estimate of existing wetland acreage and wetland types below the ordinary high water mark of the St. Louis River from its confluence with the Embarrass River to Lake Superior will be made using the National Wetland Inventory.
    b. An estimate of future wetland acreage and wetland types below the ordinary high water mark of the St. Louis River will be made from its confluence with the Embarrass River to Lake Superior.

5.5 Quantitative Analysis of Cumulative Wetland Impacts

5.5.1 Partridge River and Embarrass River Watersheds

A quantitative analysis of cumulative impacts for the Partridge River and Embarrass River watersheds will be developed using the following steps:

1. The acreage of wetland, lake, and deepwater resources for the pre-settlement, existing and reasonably foreseeable future conditions will be provided as a table. The foreseeable future conditions will include evaluation of a No Action Alternative and the Proposed Action.
    a. The acreage of wetland, lake, and deepwater resources will be compared and discussed for the pre-settlement, existing and reasonably foreseeable future conditions.
    b. The project's effect on the wetland, lake, and deepwater resources will be discussed and compared for the study area. This includes a discussion of changes in acreage,

water quality, unique habitat, adjacency to stream resources, and cumulative effects of projects within each watershed.

5.5.2 The St. Louis River below the Ordinary High Water Mark From Its Confluence with the Embarrass River to Lake Superior

A quantitative analysis of cumulative impacts for wetlands located below the ordinary high water mark of the of the St. Louis River from its confluence with the Embarrass River to Lake Superior will be developed using the following steps:

1. If the evaluation of the estimated flow changes in the St. Louis River is within the natural variation of flow in within the St. Louis River, no further analysis will be conducted.
2. If the evaluation of the estimated flow changes in the St. Louis River is not within the natural variation of flow in within the St. Louis River, determine the change in wetland acreage from existing to future conditions based on a qualitative estimate of flow changes in the St. Louis River.

5.6 Climate Change

A qualitative analysis of estimated climate change impacts (to be coordinated with the climate change evaluation being conducted for the air impacts chapter of the SDEIS) on cumulative wetland impacts in the Partridge River Watershed, the Embarrass River Watershed, and below the ordinary high water mark of the of the St. Louis River from its confluence with the Embarrass River to Lake Superior.

The qualitative assessment of the potential impacts of climate change on wetlands will be included in the Climate Change Evaluation Report developed by the Air IAP. No additional assessment will be conducted.

6. References

Reference 1 NorthMet Project Project Description, Version 3, September 13, 2011

Reference 2 NorthMet Project Draft Environmental Impact Statement. U.S. Army Corps of Engineers and Minnesota Department of Natural Resources. October 2009.

Reference 3 NorthMet Project Water Modeling Data Package – Volume 1 (Mine Site) Version 5

Reference 4 Compilation of Air Pollutant Emission Factors, AP-42 5th edit. Volume I Stationary Point and Area Sources, Section 13.2.5. Updated November 2006. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

Reference 5 NorthMet Project Water Modeling Data Package – Volume 2 (Plant Site) Version 2

Reference 6 Surface Water IAP Group Summary Document, Date: May 20, 2011.

Reference 7 NorthMet Project Waste Characterization Data Package Version 5

Reference 8 NorthMet Mine Site Water Modeling Work Plan Version 2

Attachment C

Wetland Mitigation Plan (RS20T)

RS-20T - Wetland Mitigation Plan
Wetland Mitigation Plan
PolyMet Mining

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1.0 Introduction

On behalf of PolyMet Mining, Inc. (PolyMet), Barr Engineering Co. has prepared this wetland restoration plan to provide compensatory wetland mitigation to replace unavoidable wetland impacts associated with PolyMet's NorthMet Project. The project site is located in the St. Louis River #3 major watershed and a total of 854 acres of wetland impacts are proposed. The compensatory mitigation activities described in this report include those planned within one property located near Hinckley, Minnesota in Pine County, one property located near Aitkin, Minnesota in Aitkin County, and several on-site mitigation projects planned during closure. This compensatory wetland mitigation plan includes the restoration of 1,123 acres of wetlands and the establishment and preservation of 202 acres of upland buffer within the two properties along with 175 acres of wetland establishment at the project site.

The Hinckley location is the site of an active sod production facility that encompasses approximately 511 acres of land, on which, 313 acres of wetland restoration and 79 acres of upland buffer preservation is proposed (Figure 6). The Hinckley site is located in the Snake River #36 major watershed. PolyMet has entered into an option agreement with the landowner formalizing the landowner's intent to allow the restoration activities.

The Aitkin location is the site of an active sod production facility that encompasses approximately 1,070 acres of land, on which, 810 acres of wetland restoration and 123 acres of upland buffer preservation is proposed (Figure 9). The Aitkin site is located in the Mississippi River-Brainerd #10 major watershed. PolyMet has entered into an option agreement with the landowner formalizing the intent to conduct wetland restoration activities.

At the project site, four distinct efforts are planned to establish wetlands. The establishment of wetlands is planned in the emergency basin, on the closed tailings basin, in the area of the surge stockpile and around the perimeter of the east mine pit. These activities are generally planned during closure activities within the different areas.

This report includes discussions of the restoration sites, construction activities, vegetation establishment and management activities, wetland restoration goals, performance standards, schedules, and monitoring plans. Preliminary wetland restoration plans were most recently submitted to the U.S. Army Corps of Engineers (Corps) and Minnesota Department of Natural Resources (MDNR) Division of Lands and Minerals in August 2007. This plan was developed to comply with

Wetland Conservation Act rules (Minnesota Rules Chapter 8420) as administered by the Minnesota Department of Natural Resources – Division of Lands and Minerals, Section 404 of the Clean Water Act as administered by the U.S. Army Corps of Engineers, and Minnesota Rules 7050.0186 (wetland mitigation) as administered by the Minnesota Pollution Control Agency.

Permanent Conservation Easements similar to the example provided in Appendix F will be prepared and recorded to cover the wetland restoration and associated upland buffer areas within one year after starting the restoration activities at each site.

2.0 Wetland Mitigation Planning

The wetland mitigation planning efforts have proceeded in general accordance with the Wetland Conservation Act wetland replacement siting rules and the Corps guidelines to first replace on-site, then within the same watershed or county, and finally, within adjacent watersheds as described in the following sections. Additional, comprehensive wetland mitigation planning information will be submitted under separate cover.

2.1 Wetland Mitigation Study Limits

The PolyMet project lies within the headwaters of the St. Louis River major watershed in St. Louis County (Figure 1). At the time the wetland mitigation study was commenced, the Corps had distributed a draft “Ecological Rationale for St. Paul District’s Compensatory Mitigation Ratios in Minnesota” (Corps, 2004). The Corps (2004) had identified preliminary Bank Service Areas (BSA) to assist in evaluating acceptable compensatory mitigation opportunities for unavoidable wetland losses. The PolyMet project lies within Bank Service Area #1, which encompasses the watersheds tributary to Lake Superior (Figure 1). Given the difficulty in finding suitable compensation sites in the Lake Superior watershed, the St. Paul District considered accepting banking credits from within the Rainy River watershed, defined as Bank Service Area #2. The wetland replacement siting rules within the Wetland Conservation Act (WCA) give preference to adjacent Bank Service Areas. The other Bank Service Areas that are adjacent to the St. Louis River watershed are Bank Service Areas #5 and #6. These watersheds encompass the upper Mississippi River and St. Croix watersheds. Therefore, the initial wetland mitigation study scope was identified as Bank Service Areas 1, 2, 5, and 6, focused on the areas containing greater than 80 percent of their historic wetland resources as defined in the WCA (Figure 1).

2.2 Wetland Mitigation Opportunity Analysis

A survey of wetland mitigation banking credits available within the study area was conducted initially to determine if suitable credits were available for purchase. It was determined that insufficient credits were available to satisfy the compensatory mitigation requirements for the project. Next, on-site wetland mitigation potential was considered. It was determined that there will be potential for developing wetland resources during the later stages of the project and during reclamation, however, given the 20-year schedule for the project and the current stage of mine planning, a specific plan for on-site mitigation could not be developed at this time. On-site mitigation activities are discussed in Section 3. Finally, the potential for developing compensatory wetland mitigation was evaluated within the study area.

A Geographic Information System (GIS) analysis was performed to identify potential wetland mitigation sites within the defined study area. The primary goal of this analysis was to identify large, potentially drained wetlands located primarily on private or tax-forfeit land within the study area so that more detailed ground investigations could proceed. The identification of sites was established by overlaying and evaluating numerous existing spatial data sources (primarily from public domain sources) to identify those sites with the greatest potential. Some of the data sources utilized include:

1. Geomorphology/soil types (Loesch, 1997),
2. Land ownership (separated by county/state/federal and private ownership) (MLMIC, 1983),
3. Land slope/Digital Elevation Model (MLMIC, 1999),
4. Streams/Ditches (MNDNR 1980),
5. Major watersheds
6. Land Cover (Loesch, 1998)

The geomorphology data is 1:100,000 scale data describing a wide variety of conditions related to surficial geology within a hierarchical classification scheme that was devised for use within Minnesota (Loesch, 1997). The geology data include geomorphic association, glacial phase, topographic expression, and sedimentary association/rock type. The land ownership data includes federal, state, county, city, tax-forfeited, and private land, by 40-acre parcels (MLMIC, 1983). The digital elevation model was split into three slope classes: 0-1 percent (high likelihood of wetlands), 1-3 percent (moderate likelihood of wetlands), and >3 percent (diminished likelihood of wetlands) (MLMIC, 1999). The stream data is a mapping of natural watercourses and ditches by the MDNR at a 1:24,000 scale (MNDNR 1980). The land cover data consists of land use – land cover mapping divided into 16 classes based on 30-meter resolution satellite imagery from June 1995 to June 1996 (Loesch, 1998).

The analysis was conducted by establishing specific filtering criteria to identify potential wetland mitigation sites. The general filtering criteria included the following:

1. Land slopes of ≤ 1 percent slope based on an analysis of the USGS 30-meter digital elevation model,
2. Areas mapped as peat or lacustrine geomorphology,
3. Private or county tax-forfeit property,

4. Areas within 1.1 miles of a ditch, and ultimately
5. Areas meeting all of the above criteria with at least 100 contiguous acres.

The analysis was initially limited to sites with more than 100 acres of wetland mitigation potential due to the anticipated difficulties in planning numerous, small wetland mitigation projects and the desire to identify opportunities that were realistically feasible. In addition, it was felt that the PolyMet project represented an opportunity to restore large wetland systems that may provide greater public and ecological benefit that are typically not available to smaller projects.

This GIS analysis resulted in the development of a polygon data layer which contained nearly 900 areas with the highest potential for mitigation in the study area. This analysis resulted in several significant findings. First, a large proportion of the study area is in State, Federal, or tribal ownership, and therefore was determined to represent minimal potential for a private enterprise to conduct compensatory wetland mitigation. Second, many of the large wetland systems within the study area have not been affected by historic drainage or other significant alteration. Third, much of the study area is characterized by surface geology that is not indicative of large wetland systems prone to be easily drained. The majority of the Arrowhead region, including Cook, Lake, and much of St. Louis Counties, is mapped with surface geology typified by steep, igneous bedrock terranes; rolling till plains; and rolling to undulating areas of supraglacial drift (Loesch, 1997). These geomorphological associations are also typically associated with steeper land slopes containing few drained wetlands.

2.3 Bank Service Area #1

The potential wetland mitigation areas identified within the St. Louis River watershed (Figure 2) were then evaluated in more detail by reviewing National Wetland Inventory maps, plat maps, recent aerial photographs, USGS topography, and subwatershed divides to find the sites with the highest potential. One general area appeared to have the most suitable characteristics; the area around Meadowlands and Floodwood (Figure 2). Two contiguous areas in this region, covering approximately 270 square miles are mapped as level peat.

A total of 27 potential wetland mitigation sites were identified in the study area (Figures 2 and 3) with a high likelihood of feasibility, including 10 within Bank Service Area #1. The sites with high potential identified in Bank Service Area #1 were then evaluated further by conducting site visits and meetings with various regulatory agencies. All of the sites except one were determined to not be feasible and prudent due to many different factors including: private property, public roads, and active gravel operations that could be hydrologically impacted by wetland restoration; insufficient wetland drainage; existing public ditches that could not be abandoned; potentially contaminated soils; and/or unwilling landowners.

The primary, preferred wetland mitigation site, Site 8362 (Figure 4), was chosen for several reasons, including:

1. Limited private land ownership within and adjacent to the primary area with wetland mitigation potential,
2. The lack of roads or other public infrastructure that could be affected by wetland mitigation,
3. The presence of multiple outlets from the wetland to the St. Louis River and the close proximity of the river,
4. The density of ditching within the wetland, and
5. The apparent lack of flow through the wetland from upstream.

2.4 Bank Service Area #5

In addition to the potential sites in Bank Service Area #1, 17 potential wetland mitigation sites located in Bank Service Area #5 (Figure 3) were evaluated to determine the relative potential for mitigation, the level of risk and uncertainty, and the likely costs. The majority of the sites in Bank Service Area #5 were located in the northern part of Aitkin County with a few in Itasca, Pine, and Carlton Counties. Most of the 17 priority sites in BSA #5 were evaluated in more detail and many did not appear to have significant potential for several reasons including: unwilling landowners, significant adjacent private properties that would be hydrologically impacted by wetland restoration, insufficient agricultural history, insufficient wetland drainage, considerable existing upstream drainage through the site, or active pursuit of the properties by others.

2.5 Site 8362

Since Site 8362 was located within the same watershed as the project, had the greatest potential for wetland restoration with apparently limited peripheral issues, and contained the potential to restore bog wetlands similar to those proposed for impact; this site was selected for further study. Site 8362 is an approximately 3,900 acre, partially drained wetland site containing a combination of raised open bog and raised black spruce bog wetlands. The site is located northeast of the Town of Floodwood and west of the Town of Meadowlands in St. Louis County. Approximately 640 acres of the site are owned by the State of Minnesota with the remainder designated as tax-forfeit land.

In 2005-2006, PolyMet structured an agreement with St. Louis County as the first step in pursuing a wetland mitigation project at the site. Discussions were started with the State of Minnesota in 2006 to advance efforts to secure the rights to conduct wetland restoration activities on the State-owned portion of the site. PolyMet conducted studies of the site from 2005 to 2006 as part of the 20-year wetland mitigation planning efforts for the project.

There are 12 outlets from the site that are either natural streams or ditches. In addition, the site has a pattern of ditches that are located one-half mile to one mile apart within the interior of the bog. It was determined that hydrologic restoration of this site would require blocking and filling ditches, logging of trees along the ditches and restoration of bog vegetation. The restoration potential of the site was discussed with Federal, State and local authorities on several occasions during the study. Numerous site visits, town meetings, and agency meetings were held in order to better understand potential conflicts associated with the development of a restoration plan. The site has been utilized by local residents for hunting, tree-topping and recreation. Several potential issues were raised by local residents and peatland hydrology experts during these meetings and discussions. The agencies requested a more detailed study plan to better document the hydrology of the site, the specific extent of hydrologic drainage, the extent of soil subsidence along the ditches, the presence of demonstrable threats to support wetland preservation credits, and other issues raised by the agencies and the public.

The site was chosen as a high priority because it presented an opportunity to restore primarily Type 8, bog wetlands, which are the primary type of wetland that will be impacted by the project and it is located in the same watershed as the project site. Before implementation of a plan to restore wetlands at the site, the agreement with St. Louis County required the completion of several actions:

1. The public ditch system would have to be abandoned through the ditch abandonment process,
2. The State Legislature would have to pass special legislation allowing a permanent conservation easement to be placed over the restored and protected wetland area, and
3. The State would have to enter into an agreement allowing wetland restoration activities to be conducted on the State-owned land.

However, these required actions could not be undertaken until a wetland restoration plan was approved by State and Federal regulatory agencies. In order to complete sufficient planning to support the development of a wetland restoration plan suitable for regulatory approval, a 1-2 year study was going to be needed to develop the information requested by the regulatory authorities.

Further pursuit of wetland restoration activities at Site 8362 was halted for a number of reasons that rendered the site impracticable:

1. District Court nullified PolyMet's agreement with St. Louis County in April 2007, thereby not allowing any further study of the site.
2. Lack of local support, in fact, broad opposition from local residents.
3. Extensive hydrologic monitoring and evaluation to document the degree of drainage at the site to support the proposed mitigation credits. This would have required long-term monitoring to adequately demonstrate the drainage and there was uncertainty regarding the outcome of such monitoring. Such monitoring activities were no longer allowed after April 2007 due to the District Court action.
4. Preservation credits would only be allowed where there is a demonstrable threat that could be eliminated, i.e., peat mining, tree-topping, ATV activity. There is only about 400 acres of documented minable peat and the County had indicated they were unlikely to agree to limit tree-topping activities. Therefore, the ability to show a demonstrable threat that would meet regulatory criteria appeared unlikely.
5. Even if the agreement with the County were reestablished, that agreement still required that PolyMet go through ditch abandonment proceedings in District Court with public hearings that would likely be opposed by local residents.
6. The agreement with the County (were it to be reinstated) also required receiving legislative authorization to place a permanent conservation easement over the restoration area. The likelihood of that was uncertain.

With Site 8362 no longer a feasible mitigation option, pursuit of the high priority sites identified in Bank Service Area #5 was initiated along with the continued search for existing bank credits, wetland banks in various stages of planning, and various other potential wetland mitigation opportunities located in central and northwestern parts of Minnesota. During these efforts, two properties were identified with willing landowners that had the potential to accomplish compensatory wetland mitigation for nearly the entire project. One site is located in Aitkin County and one site in Pine County. These sites are described in more detail in the remainder of this report.

3.0 Wetland Impact and Mitigation Summary

The NorthMet Project is expected to result in unavoidable impacts to 854 acres of wetlands during the life of the project (Table 1). Detailed wetland impacts proposed for the various activities associated with the project are provided in Table 2. A summary of wetland impacts proposed within various portions of the project classified by Eggers and Reed (1997) wetland types is provided in Table 3. Approximately 40 acres of impact have been avoided by combining the Overburden and Category 1/2 Waste Rock Stockpiles. A total of 550 acres of impacts are proposed in coniferous bogs and 76 acres in open bogs. A total of 76 acres of impacts are proposed in Type 6 wetlands, including 67 acres in alder thicket communities and 9 acres in shrub carr communities. Type 7 forested wetlands represent the wetland type with the next most abundant impacts, including 63 acres of coniferous swamp and 20 acres of hardwood swamp. Type 2 wetlands are expected to result in 43 acres of impacts including 28 acres in sedge meadow communities and 15 acres in wet meadow communities. Type 3, shallow marsh wetlands comprise 26 acres of impact. Impacts to Type 4 deep marsh and Type 5 open water wetland communities along with deepwater habitats each comprise less than 1 acre. No direct wetland impacts are anticipated associated with the tailings basin drain system since the drains and pump station are planned to be constructed on the lower, existing tailings dam bench.

The unavoidable wetland impacts projected during the first five years total 702 acres (Table 4). A summary of wetland impacts proposed during the first 5 years within various portions of the project are classified by Eggers and Reed (1997) wetland types in Table 5. A total of 445 acres of impacts are proposed in coniferous bogs and 46 acres in open bogs. A total of 70 acres of impacts are proposed in Type 6 wetlands, including 61 acres in alder thicket communities and 9 acres in shrub carr communities. Type 7 forested wetlands represent the wetland type with the next most abundant impacts, including 63 acres of coniferous swamp and 15 acres of hardwood swamp. Type 2 wetlands are expected to result in 41 acres of impacts including 27 acres in sedge meadow communities and 15 acres in wet meadow communities. Impacts to shallow marsh wetlands represent 21 acres during the first 5 years.

The overall wetland mitigation strategy for the project is to replace unavoidable wetland impacts in-kind where possible and ahead of the impacts when feasible. The compensatory wetland mitigation for the project includes the restoration of 1,123 acres of wetland and preservation of 202 acres of upland buffer on two sod farms, one located in Aitkin County and one in Pine County; along with the creation and restoration of approximately 175 acres of wetland at the project site during closure (Table 1).

Because the two primary wetland mitigation sites included in this plan are located outside of the project watershed and the on-site mitigation is planned for completion at the end of the project, all mitigation associated with this plan will be conducted at a ratio of 1.25:1 or 1.5:1 in accordance with Corps guidance. Assuming the restoration is successfully conducted one full growing season ahead of the impacts, replacement in-kind will be credited at a 1.25:1 ratio and replacement out-of-kind will be credited at a 1.5:1 ratio. Should in-kind compensatory mitigation be deemed unsuccessful such that an equal area of in-kind replacement is not provided for the impacts, those impacts will be replaced at a 1.5:1 ratio.

The tabulation of total project wetland impacts compensated by the proposed wetland mitigation is provided in Table 1 and the tabulation of impacts compensated during the first 5-years of the project is provided in Table 4. The 1,123 acres of off-site wetland restoration proposed in the mitigation plan (Tables 1 and 6) are expected to provide direct compensatory wetland mitigation for 834 acres of projected impacts, an average replacement ratio of 1.35:1 excluding consideration of upland buffer (Table 6). A total of 202 acres of upland buffer areas are proposed to be established with native vegetation around the wetland restoration areas. In accordance with Corps guidelines, credit for the upland buffer areas is proposed at a 1:4 ratio, resulting in 51 acres of wetland credit (Table 1). Including the proposed upland buffer, the proposed off-site wetland mitigation is expected to compensate for 885 acres of proposed wetland impacts, which exceeds the 854 acres of planned impacts by 31 acres (Table 6). It is planned that the additional compensatory wetland mitigation would be held in reserve for use in the event: additional wetland impacts result from changes during the project life, to compensate for mitigation that may not develop as planned, to compensate for mitigation not conducted in advance, or as banked credits for future use.

The closure plan for the site was designed to create and restore 175 acres of wetlands that would function as a reserve. The closure plan includes:

- 30 acres of created wetlands at the emergency basin
- 75 acres of created wetlands in the tailings basin at closure
- 30 acres of created wetlands at the mine stockpile areas after removal of the temporarily stored lean ore surge stockpile and overburden processing area
- 40 acres of wetland development within the east and central pits after backfilling

In order to adequately track the timing of wetland mitigation construction and wetland impacts, a structured accounting system may be needed to determine the required mitigation ratios. This information could be provided in the MDNR Permit to Mine annual report. The annual report could include a tabulation of wetland mitigation that was constructed, including the dates when construction was completed and wetland impacts that occurred by December 31 of each year. This information would be submitted using the schedule for the Permit to Mine annual report, typically within one month after the end of the year.

4.0 Wetland Mitigation Goals

To the degree feasible, the primary goal of the wetland mitigation plan for PolyMet is to restore high quality wetland communities (Eggers and Reed, 1997) of the same types as those impacted by the project. While it is not practicable to replace all impacted wetland types with an equivalent area of in-kind wetland due to site limitations, technical feasibility, and other considerations; the goal of the mitigation plan is to replace the wetland types in-kind to the degree practicable in order to replace lost wetland functions and values. A summary of the acreage of each targeted wetland restoration community and the projected wetland community impacts are provided in Table 1. A total of 1,123 acres of wetland restoration is proposed (Figures 6 and 9), including 12 wetland community types that are planned to replace all impacts in-kind, with the exception of 210 acres of coniferous bog (Table 1).

A summary of the targeted wetland communities planned within each off-site location is provided in Table 7. The specific hydrologic regime characteristics planned for each wetland community are included in Table 8. Detailed descriptions of the targeted wetland communities within the wetland restoration area are provided in the following sections.

4.1 Seasonally Flooded

A total of 20 acres of seasonally flooded depressional wetland is planned in one area at the Hinckley site (Figure 6). Seasonally flooded wetlands typically form in shallow depressions that may or may not be located within a floodplain. The seasonally flooded community is targeted for a dominance of annual species with considerable variation depending on climatic conditions and season. The typical species that are expected include: smartweeds, beggarticks, nut-grasses, and wild millet. The seasonally flooded wetland is expected to be inundated for a few weeks or less each year, typically following snowmelt and heavy summer rainfall events. The wetland is expected to have a water table below the ground surface for much of the growing season.

4.2 Fresh Wet Meadow

A total of 61 acres of wet meadow wetland is planned in one area at the Hinckley site, two areas at the Aitkin site, and will likely be part of two on-site closure projects (Tables 1 and 7, Figures 6 and 9). Wet meadows typically form in the transition zone from upland to aquatic systems, often intergrading into sedge meadows and shrub carr. The wet meadow community is targeted for a dominance of native grasses and perennial forbs, although sedges, rushes, ferns, and some shrubs may also be present. Woody plants should only be present as scattered individuals or small groups. The muck soils are typically saturated close to the surface for much of the growing season with occasional short-term inundation during floods or following snowmelt.

4.3 Sedge Meadow

A total of 87 acres of sedge meadow wetland is planned in four areas of the Hinckley site and one area within the Aitkin site (Table 7, Figures 6 and 9). Sedge meadows typically form with a slightly wetter landscape position than wet meadows, with saturation near the surface typical and shallow inundation of 2-3 inches common, particularly early in the growing season. The sedge meadow community is targeted for a dominance of primarily native sedges, however, grasses such as Canada bluejoint and manna grass may be present along with scattered perennial forbs and some shrubs. The muck soils are typically saturated close to the surface for most of the growing season with shallow inundation common for long periods of time.

4.4 Shallow Marsh

A total of 148 acres of shallow marsh wetland is planned in one area within the Hinckley site, two areas within the Aitkin site, and will likely play a role in three of the on-site closure projects (Tables 1 and 7, Figures 6 and 9). Shallow marshes typically form where more inundation up to 6 inches in depth is present for long periods of time. The shallow marsh community is targeted for a dominance of primarily native emergent vegetation. Based on natural vegetation establishment observed in the farmed fields prior to herbicide treatments, it is expected that arrowhead, bur-reed, water plantain, sedges, cattails, pickerelweed, and bulrushes will form the dominant species. Some grasses, forbs, and shrubs may develop on suitable microsites, but are not expected to be dominant. The shallow marsh restoration areas contain muck soils, with hydrology planned to range from saturation to the surface with up to 6 inches of inundation for much of the growing season.

4.5 Deep Marsh

A total of 84 acres of deep marsh wetland is planned in two areas within the Aitkin site and should be part of two on-site closure projects (Tables 1 and 7, Figure 9). Deep marshes are typically present between shallow marshes and open water communities with 6 inches to 36 inches of inundation present throughout the growing season. The deep marsh community is targeted for a mix of emergent, floating-leaved, and submergent vegetation. Based on natural vegetation establishment in nearby areas of similar hydrology, it is expected that water-lily, pondweed, duckweed, arrowhead, bur-reed, water plantain, wild rice, cattails, pickerelweed, and bulrushes will form the dominant species. Other submergent, floating-leaved, and emergent species are likely to develop. All of the deep marsh restoration areas contain muck soils.

4.6 Shallow, Open Water

A total of 10 acres of shallow, open water wetland is projected in one of the on-site closure projects (Table 1). Shallow, open water communities are permanently inundated and will have water depths typically ranging from 36 inches to 60 inches throughout the growing season. The vegetation is expected to be composed primarily of floating, floating-leaved, and submergent vegetation, likely to include: water-lilies, pondweeds, duckweeds, coontail, and water milfoil.

4.7 Shrub Carr

A total of 171 acres of shrub carr wetland is planned in five locations at the Hinckley site and one area of the Aitkin site (Table 7, Figures 6 and 9). Shrub carr communities are typically saturated close to the surface for much of the growing season with occasional short-term inundation during floods and following snowmelt, particularly where a hummocky surface is present. The vegetation is expected to be composed of at least 50 percent areal coverage of shrubs, including primarily willow, meadowsweet, and dogwood. The understory vegetation is expected to be composed of grasses such as Canada bluejoint and manna grass along with scattered, perennial forbs. The tree coverage is variable in shrub carr wetlands, typically with less than 25 percent coverage of trees taller than six feet. The majority of the shrub carr restoration areas contain muck soils, however portions of two planned shrub carr wetlands have some mineral soils at the Hinckley site (Areas 9 and 21, Figure 6).

4.8 Alder Thicket

A total of 140 acres of alder thicket wetland is planned in four locations at the Aitkin site, one area within the Hinckley site, and is likely to be a component of one on-site closure project (Tables 1 and 7, Figures 6 and 9). Alder thicket communities are typically saturated close to the surface for much of the growing season with occasional short-term inundation during floods and following snowmelt, particularly where a hummocky surface is present. The vegetation is expected to be composed of at least 50 percent areal coverage of shrubs, including primarily speckled alder with some willow, meadowsweet, and dogwood. The understory vegetation is expected to be composed of grasses such as Canada bluejoint and manna grass along with scattered, perennial forbs. The tree canopy is expected to be less than 25 percent coverage of trees taller than six feet. The majority of the alder thicket restoration areas contain muck soils, however portions of one planned alder thicket wetland at the Aitkin site has some mineral soil (Area 6, Figure 9).

4.9 Hardwood Swamp

A total of 66 acres of hardwood swamp wetland is planned in two locations at the Hinckley site and one location at the Aitkin site (Table 7, Figures 6 and 9). Hardwood swamps are typically dominated by black ash, but other tree species such as quaking aspen, balsam poplar and yellow birch may develop. Shrub layer cover is expected to be variable with black ash common, along with mountain maple, and swamp red currant likely. Herbaceous plants may include various grasses, sedges, ferns, and forbs suited to the microtopography present. The hardwood swamp communities are planned in the transition zones between the peat wetlands and uplands. In mature hardwood swamps (older then 75 years) the tree canopy ranges from interrupted to continuous in coverage (50 to 100 percent cover). At the Hinckley site, the hardwood swamp restoration area #11 at the Hinckley site is primarily underlain by peat soils and the partially drained, existing hardwood swamp, restoration area #19, contains a mix of peat and mineral soils. The majority of the hardwood swamp restoration area at the Aitkin site is underlain by mineral soils (Appendix E, Transect 6).

4.10 Coniferous Swamp

A total of 98 acres of coniferous swamp wetland is planned in one location at the Hinckley site and one location at the Aitkin site (Table 7, Figures 6 and 9). Tamarack-dominated coniferous swamp is the targeted community in this wetland restoration plan. While tamarack is targeted as the dominant tree species, black spruce and balsam fir may also be present. Shrub layer cover is expected to be considerable, and may be composed of species such as: speckled alder, winterberry, Labrador tea, blueberries, and the various tree species. The groundlayer is expected to be variable, and may include mosses, grasses, sedges, ferns, and forbs suited to the microtopography present. In coniferous swamps the tall shrub layer coverage is variable and the tree canopy is patchy to interrupted (25 to 75 percent cover). The planned coniferous swamp restoration areas are predominantly underlain by muck soils.

4.11 Open Bog

A total of 74 acres of open bog wetland is planned in one area of the Aitkin site (Table 7, Figure 9). The restoration of open bog communities is somewhat experimental in nature as few such projects have been conducted and monitored (particularly in Minnesota) for a sufficient amount of time to determine realistic goals and performance criteria. Open bogs are composed of a groundlayer of living sphagnum moss growing over a layer of acid peat. Herbaceous plants and the low shrubs of the heath family (Ericaceae) are also typically present. Scattered immature or stunted trees may be present (black spruce or tamarack) but will not be part of the active restoration efforts for the open bog wetland. The mature bog surface is typically fairly level terrain, with pronounced hummock and hollow microtopography, receiving nutrients only from precipitation and limited internal runoff. The Aitkin site appears to be well suited for bog restoration with the presence of peat soils and primarily precipitation-driven hydrology.

Layers of sphagnum can isolate the bog from the influence of nutrient enriched groundwater, and create an environment characterized by high acidity and low oxygen and nutrient levels. Plant diversity is very low in open bogs but includes characteristic and distinctive specialists. The vegetation is expected to be composed of herbaceous plants, including bog sedge, tawny cottongrass, three-way sedge, broad-leaved cattail over a nearly continuous mat of sphagnum mosses (*Sphagnum* spp.). The shrub cover in a typical bog would be composed primarily of leatherleaf, bog rosemary, small cranberry, and large cranberry. The entire open bog restoration area contains peat soils.

4.12 Coniferous Bog

A total of 339 acres of coniferous bog wetland is planned in one area at the Hinckley site and one area at the Aitkin site (Table 7, Figures 6 and 9). The restoration of coniferous bog communities is somewhat experimental in nature as we are unaware of any such projects in Minnesota, making it a challenge to determine realistic goals and performance criteria. The hydrology of coniferous bogs is primarily controlled by direct precipitation (rainfall and snowmelt) and the soils are saturated to the surface throughout the growing season. The Aitkin site appears to be well-suited to bog restoration since it is supported primarily by precipitation. The hydrology at the Hinckley site is supported by some surface water flow from an upstream wetland complex in addition to precipitation.

The plant community composition and structure of coniferous bogs is similar to open bogs except black spruce and/or tamarack trees are the dominant species with patchy coverage ranging from 25 to 75 percent cover. Sphagnum moss is the dominant groundlayer species, with sedges, cottongrass, and blueberry that can tolerate shaded conditions often being present under the tree canopy. In the open areas, shrubs of the heath family (Ericaceae) may be present. The coniferous bog restoration areas contain peat soils.

Considerable efforts were expended from 2005-2007 to plan the restoration of bog wetlands at Site 8362 (described in Section 2.4) and numerous other sites that were evaluated. With the loss of Site 8362 as a viable mitigation option, the opportunities for replacing bog habitats in-kind became much more limited. The final two sites selected for compensatory wetland mitigation provided the opportunity to restore 11 of the 12 impacted wetland types in-kind. However, due to the specific site conditions necessary for planning viable bog restoration, suitable characteristics are present on approximately 414 acres of the mitigation sites. Some of the specific site conditions suitable for bog restoration include:

1. Presence of peat soils
2. Primarily precipitation driven hydrology
3. The potential to restore a saturated hydrologic regime
4. Flat land slopes
5. A buffer of other wetland communities or upland communities between the bog and features such as roads
6. Size – large enough area to reestablish a viable, self-sustaining ecosystem

Instead of trying to force bog restoration into areas of the mitigation sites that are not well suited, we felt it best to plan bog restoration where the natural conditions are best suited to maximizing the potential for success. The presence of mineral soils in some areas of both mitigation sites limits the potential extent of bog communities. There are also lower topographic areas on each mitigation site that are expected to develop with standing water that is not conducive to bog restoration. A wide buffer of other wetland habitats are planned around each proposed bog area to minimize the potential effects of roads, dikes, and ditches. A few small pocket areas with some suitable characteristics were also ruled out because the edge affects may limit the ability to develop viable, self-sustaining bog communities. The logistical and physical constraints of restoring nine other impacted wetland types also limited the total area of bog habitats that could be reasonably planned.

5.0 Wetland Mitigation Performance Standards

Performance standards have been developed for each wetland community type targeted in the wetland restoration plan to guide the restoration activities and to determine success. The performance criteria include measures to evaluate whether or not the hydrology and vegetation meet the plan goals. Several measures of acceptable hydrologic regime characteristics for each wetland community are included in Table 8. Should the performance standards not be met during the five year monitoring period (eight years for the shrub communities and twenty years for the forested, and bog communities), a proposal will be submitted to the Corps and the MDNR Division of Lands and Minerals describing the corrective actions proposed and an implementation schedule.

5.1 General Performance Standards

Several general performance standards apply to all wetland restoration areas:

1. More than 50 percent of the vegetation in each wetland shall be facultative (FAC, FAC+) or wetter (FACW, OBL).

2. Invasive and/or non-native vegetation shall not comprise more than 5 percent cumulative areal coverage within any wetland community at the end of the eighth full growing season for shrub communities; at the end of the twentieth full growing season for the forested, and bog communities; and at the end of the fifth full growing season for all other communities. Invasive and non-native vegetation include, but are not limited to the following: reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), hybrid cattail (*Typha x glauca*), common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Rhamnus frangula*), and Canada thistle (*Cirsium arvense*) (Shaw, 2000). Also included are species listed as non-native on the MDNR Minnesota Native Plant List, dated June 25, 2002.

3. Reference wetlands will be identified for the proposed restoration communities prior to beginning monitoring of the restored wetlands. The location and general characteristics of each reference wetland will be included in the final, detailed wetland monitoring plan for regulatory review and approval prior to the start of monitoring.

5.2 Seasonally Flooded

1. Herbaceous vegetation shall cumulatively comprise at least 80 percent areal cover by the end of the second growing season, except when hindered by seasonal inundation.

2. Shrub and tree vegetation shall comprise less than 50 percent areal cover by the end of the fifth full growing season.

3. Total areal vegetative cover shall be more than 95 percent after the fifth full growing season, except when hindered by seasonal inundation.

4. There shall be at least 10 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns, except when hindered by inundation.

5.3 Fresh Wet Meadow

1. Herbaceous vegetation shall cumulatively comprise at least 80 percent areal cover by the end of the second full growing season.

2. Shrub and tree vegetation shall comprise less than 50 percent areal cover by the end of the fifth full growing season.

3. Total areal vegetative cover shall be more than 95 percent after the fifth full growing season.

4. There shall be at least 10 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns by the end of the fifth full growing season.

5.4 Sedge Meadow

1. Herbaceous vegetation shall comprise at least 70 percent areal cover by the end of the second full growing season.

2. Shrub and tree vegetation shall cumulatively comprise less than 30 percent areal cover by the end of the fifth full growing season.

3. Total areal vegetative cover shall be more than 90 percent after the fifth full growing season.

4. Sedge species shall be dominant by the end of the fourth full growing season; most of which, should be the genus *Carex*, but also may include spike-rushes, bulrushes, and nut-grasses. Grasses, forbs, and true rushes may comprise the remaining herbaceous cover.

5.5 Shallow Marsh

1. Emergent vegetation shall comprise at least 50 percent areal cover by the end of the fifth full growing season.

2. Shrub and tree vegetation shall comprise less than 30 percent areal cover by the end of the fifth full growing season.

3. At least three native aquatic species (e.g. bur-reeds, arrowheads, plantain, bulrushes, wild rice, sedges, cattail) shall be the dominant vegetation after the fifth full growing season unless a community of low diversity, but high integrity (e.g. arrowhead, lake sedge) is present.

5.6 Deep Marsh

1. Emergent vegetation shall comprise at least 25 percent areal cover by the end of the fifth full growing season.

2. Submergent, floating, and floating-leaved vegetation shall comprise more than 30 percent areal cover by the end of the fifth full growing season.

3. Open water with submergent, floating, and floating-leaved vegetation, but without emergent vegetation, may comprise up to 75 percent of each wetland at the end of the fifth full growing season.

4. At least three native aquatic species (e.g. water-lilies, pondweeds, duckweeds, bur-reeds, arrowheads, plantain, bulrushes, wild rice, sedges, cattail) shall be the dominant vegetation after the fifth full growing season unless a community of low diversity, but high integrity (e.g. bulrushes, arrowhead, lotus, wild rice) is present.

5.7 Shallow, Open Water

1. Emergent vegetation may comprise up to 10 percent areal cover by the end of the fifth full growing season.

2. Aquatic bed communities shall comprise greater than 30 percent coverage of the open water area and be dominated by 3 or more species of native aquatic plants such as pondweeds, water lilies, bladderworts, wild celery, duckweed, water crowfoots, native milfoils, etc.; or communities with low diversity but high integrity (e.g., beds of wild celery) by the end of the fifth full growing season.

3. Open water (without emergent vegetation) may comprise up to 100 percent of each wetland at the end of the fifth full growing season.

5.8 Shrub Carr

1. There shall be at least 300 shrubs/acre or greater than 15 percent areal shrub coverage, including primarily willow, meadowsweet, and dogwood seedlings by the end of the second full growing season.

2. Characteristic shrub vegetation (primarily willow and dogwood species) shall comprise more than 25 percent areal cover by the end of the fifth full growing season.

3. Characteristic shrub vegetation (primarily willow and dogwood species) shall comprise more than 50 percent areal cover by the end of the eighth full growing season.

4. Herbaceous vegetation shall form in the understory such that the total areal vegetative cover shall be more than 90 percent by the end of the fifth full growing season.

5. There shall be at least 2 species of native shrubs and 6 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns by the end of the eighth full growing season.

5.9 Alder Thicket

1. There shall be at least 300 shrub seedlings/acre or greater than 15 percent areal shrub coverage, including primarily speckled alder with some willow, meadowsweet, and dogwood seedlings by the end of the second full growing season.

2. Characteristic shrub vegetation (primarily speckled alder with some willow and dogwood species) shall comprise more than 25 percent areal cover by the end of the fifth full growing season.

3. Characteristic shrub vegetation (primarily speckled alder with some willow and dogwood species) shall comprise more than 50 percent areal cover by the end of the eighth full growing season.

4. Herbaceous vegetation shall form in the understory such that the total areal vegetative cover shall be more than 90 percent by the end of the fifth full growing season.

5. There shall be at least 2 species of native shrubs and 6 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns by the end of the eighth full growing season.

5.10 Hardwood Swamp

1. There will be at least 300 tree seedlings/acre present by the end of the second full growing season including primarily black ash, but some quaking aspen, balsam poplar, and yellow birch may be present.

2. The shrub coverage will be at least 30 percent areal coverage at the end of the fifth full growing season including primarily swamp red currant, black ash or other shrub species present in the reference wetland.

3. The herbaceous plant coverage will comprise at least 20 percent areal cover in the open areas, including at least 4 characteristic grass, sedge, fern and/or forb species at the end of the third full growing season.

4. The herbaceous plant coverage will comprise at least 50 percent areal cover in the open areas by the end of the tenth full growing season.

5. At the end of the fifth full growing season, the living tree component will contain within 30 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

6. At the end of the tenth full growing season, the living tree component will contain within 20 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

7. At the end of the twentieth full growing season, the living tree component will contain within 10 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

5.11 Coniferous Swamp

1. There will be at least 300 tree seedlings/acre present by the end of the second full growing season after tree establishment efforts are complete. Tree species will be primarily tamarack, but some black spruce, balsam fir, black ash, or other tree species found in the reference wetland may be present.

2. The shrub coverage will be at least 25 percent areal coverage at the end of the fifth full growing season which may include speckled alder, winterberry, Labrador tea, leatherleaf, and blueberry.

3. The herbaceous plant coverage will comprise at least 20 percent areal cover, including at least 4 characteristic grass, sedge, fern and/or forb species at the end of the third full growing season.

4. The herbaceous plant coverage will comprise at least 50 percent areal cover in the open areas by the end of the tenth full growing season.

5. At the end of the fifth full growing season, the living tree component will contain within 30 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

6. At the end of the tenth full growing season, the living tree component will contain within 20 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

7. At the end of the twentieth full growing season, the living tree component will contain within 10 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

5.12 Open Bog

1. There will be some evidence of creeping snowberry, bog rosemary, and/or small cranberry present by the end of the fourth full growing season. However, given the experimental nature of restoring an open bog community, no quantitative measures are suggested.

2. There will be at least 20 percent sphagnum moss coverage by the end of the fifth full growing season.

3. There will be at least 40 percent sphagnum moss coverage by the end of the tenth full growing season.

4. There will be at least 50 percent sphagnum moss coverage by the end of the twentieth full growing season.

5. The herbaceous plant coverage (not including mosses) will be at least 60 percent by the end of the tenth full growing season and 50 percent by the end of the twentieth full growing season with bog sedge, cottongrass, or other characteristic reference wetland species comprising the dominant species.

5.13 Coniferous Bog

1. There will be at least 300 stems per acre of black spruce, tamarack, or other tree species characteristic of the reference wetland by the end of the fifth full growing season.

2. The shrub coverage will be at least 30 percent areal coverage at the end of the fourth full growing season including species characteristic of the reference wetland such as bog laurel, Labrador tea, leatherleaf, creeping snowberry, and small cranberry.

3. There will be at least 20 percent coverage of sphagnum moss species by the end of the fifth full growing season.

4. There will be at least 40 percent sphagnum moss coverage by the end of the tenth full growing season.

5. There will be at least 50 percent sphagnum moss coverage by the end of the twentieth full growing season.

6. The herbaceous plant coverage (not including mosses) will be at least 60 percent by the end of the tenth full growing season and 50 percent by the end of the twentieth full growing season in the open areas with bog sedge, cottongrass, or other characteristic reference wetland species present.

7. At the end of the fifth full growing season, the living tree component will contain within 30 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of primarily black spruce and tamarack, however, other tree species similar to those present in the reference wetland may also be present.

8. At the end of the tenth full growing season, the living tree component will contain within 20 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

9. At the end of the twentieth full growing season, the living tree component will contain within 10 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

5.14 Upland Buffer

1. Existing upland buffer communities composed of primarily native species will be managed so that no more than 10 percent areal cover of exotic or non-native invasive vegetation is present.

2. Herbaceous vegetation shall cumulatively comprise at least 80 percent areal cover in non-forested buffer areas and 50 percent cover in forested buffer areas by the end of the second full growing season.

3. There shall be at least 10 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns by the end of the second full growing season in non-forested buffer areas.

4. Shrub and tree vegetation shall comprise less than 50 percent areal cover by the end of the fifth full growing season in non-forested buffer areas.

5. Total areal vegetative cover shall be more than 95 percent after the fifth full growing season dominated by warm-season grasses and late successional forbs in non-forested buffer areas.

6. There should be no more than 10 percent areal cover of exotic, non-native invasive vegetation at any time during the monitoring period.

6.0 Wetland Restoration Site Description

6.1 Hinckley Wetland Mitigation Site Description

The Hinckley wetland mitigation plans include the restoration of 313 acres of wetland and the preservation of 79 acres of upland buffer on a sod farm (Figure 6). The wetland restoration site is located in Section 5, Township 39 North, Range 22 West, Pine County, Minnesota (Figure 5). The site is located in the Snake River #36 major watershed and Bank Service Area #6 (Figure 1). The National Wetland Inventory map for the wetland restoration area is provided in Figure 8.

6.1.1 Geology and Soils

Patterson and Knaeble (2001) mapped the surficial geology within the restoration area as primarily peat and organic-rich sediment deposited in marshes and shallow lakes during the Holocene and Late Pleistocene. An area of silty and sandy sediment deposited in shallow water is also mapped within the southeast corner of the Hinckley wetland restoration site over sandy deposits (Patterson and Knaeble, 2001). Knaeble, et al. (2001) show the presence of Glacial Lake Grantsburg encompassing the proposed Hinckley wetland restoration site during the period when the Grantsburg sublobe of the Des Moines lobe advanced into Pine County from the southwest. During that period, till and lake sediment were deposited over much of southern Pine County, including the proposed wetland restoration site (Knaeble, et al., 2001).

County Well Index boring logs in the vicinity of the restoration site indicate deposits of primarily clayey gravel with layers of sand with bedrock (primarily sandstone) at depths ranging from 80 feet to 130 feet. The soils within the wetland restoration areas are mapped in the Soil Survey of Pine County, Minnesota (Simmons, et al., 1941) as primarily peat soils throughout approximately the northern three-fourths of the site with mineral soils mapped along the south and east sides of the property. The Natural Resources Conservation Service has conducted a more detailed mapping of the soils within the site, and a preliminary mapping of the soils was obtained from the public record as part of another project, however, it is not in a format that can be readily published. The preliminary NRCS soil mapping indicates that the majority of the site is Markey muck within the northern three-fourths of the site and most of Areas 22 and 9 (Figure 6). Areas 11 and 12, located east of the railroad tracks are mapped as Cathro muck (Figure 6). The non-hydric mineral soils are mapped primarily within proposed upland buffer Areas 7, 13, 14, 17, 18, and 23 (Figure 6). The majority of the upstream watershed area is also mapped as peat soils. The water table appears to be near the surface throughout much of the general area, as indicated by the large wetland complexes underlain by peat soils.

6.1.2 Topography

The topographic relief is minimal throughout the site. A topographic survey of the site was completed and a one-foot contour map was created from the data (Appendix A). Detailed survey data indicates ground elevations on the wetland restoration site range from about 985 feet MSL to 1000 feet MSL with elevations in the ditches down to 979 feet MSL and on the dikes up to 1004 feet MSL. The gradient in the wetland restoration area ranges from flat to about 1 percent.

6.1.3 Climate and Hydrology

The average annual precipitation for Hinckley, based on the current 30-year normal period 1971-2000 is 31.2 inches (NRCS, 2007). A water budget completed by Lindholm et al. (1974) for the Snake River watershed calculated general runoff in the watershed to be 8.5 inches based on annual, average precipitation of 28.93 inches from the normal period 1939-1968. The wetland restoration site is located near the middle of the Snake River watershed, for which the water budget was calculated. While the average annual runoff value calculated by Lindholm et al. (1974) may not accurately reflect runoff conditions in all areas of the watershed, it provides a reasonable estimate for computing an order-of-magnitude water volume that might be expected to discharge from various portions of the watershed.

6.1.4 Hydrology

A total of approximately 6,360 acres of upstream watershed area drains to and through the Hinckley site (Figure 7). The primary drainage feature affecting the site is an unnamed tributary that carries discharge from the 5,634 acre upstream drainage area. The portion of this tributary that runs along the north and west side of the restoration site is a designated county ditch. It appears that the county ditch was constructed prior to 1939 (Figure 13) and the same areas of the site that are in sod production today have been farmed since prior to 1939, with the exception of the northeast corner. Based on review of the 1991 aerial photograph (Figure 16), it appears that the northeast corner of the site had not been cultivated as of 1991. While not confirmed, it has been reported that much of Area 3 (Figure 6) was put into production in about 1997. The north tributary drainage splits at the wetland restoration site with a portion discharging to Pokegama Creek approximately 4.5 miles east and the other discharging to Mud Creek approximately 0.7 miles downstream of the site (Figure 7).

Hydrology will be restored within the majority of the proposed wetland restoration areas by reestablishing the natural discharge flow pathways from the large wetland complexes located north of the farm. As the farm was developed, starting in the early 1900's, a ditch system was constructed to intercept that discharge and either route it around the farm or utilize it for irrigation/water supply. Those natural flow paths will be restored to the planned restoration areas.

6.2 Aitkin Wetland Mitigation Site Description

The Aitkin wetland mitigation plans include the restoration of 810 acres of wetland and the preservation of 123 acres of upland buffer on a sod farm (Figure 9). The wetland restoration site is located in Section 6, Township 47 North, Range 26 West; and Section 1, Township 47 North, Range 27 West, Aitkin County, Minnesota. The site is located in the upper portion of the Mississippi River-Brainerd #10 major watershed and Bank Service Area #5 (Figure 1). The National Wetland Inventory map for the wetland restoration area is provided in Figure 11.

6.2.1 Geology and Soils

Oakes and Bidwell (1968) mapped the surficial geology within the restoration area as glacial lake peat deposits, silts, sands and clays with flat topography. The property is located in an area of extensive peat deposits in the glacial Lake Upham area. County Well Index boring logs in the vicinity of the restoration site indicate layered deposits of primarily clay and sand to a depth of 150 feet or more below the surficial soils. The soils within the wetland restoration areas are mapped in the Soil Survey of Aitkin County, Minnesota (NRCS, 1999) as primarily muck soils, including the Cathro (Map Unit 1983), Sago (Map Unit 532), and Sax (Map Unit 1154) soil series (Figure 12). Mineral hydric soils including: Baudette silt loam (Map Unit 1982), Spooner silt loam (Map Unit 147), Sandwick loamy sand (Map Unit 625), and Waukenabo fine sandy loam (Map Unit 759) are mapped within portions of the site (Figure 12). The legend for the Soil Survey of Aitkin County is provided in Appendix D.

All soils mapped within the wetland restoration areas are hydric. The majority of the entire land area located upstream of the wetland restoration site is also mapped as hydric soils, and includes predominantly muck and peat soils in the large wetland complexes and mineral hydric soils in the mesic forested areas. The water table appears to be near the surface throughout much of the general area, as indicated by the large wetland complexes underlain by muck and peat soils.

Soil profiles and water table information were collected during fieldwork conducted on April 25, 2007 and June 5-6, 2007. A topographic survey was completed for the site and a one-foot contour map was created from the data (Appendix B). The survey data along with soil information was used to create stratigraphic fence diagrams that show the complexity of the soils in the area. The water table information collected during the field survey was also plotted on the diagrams (Figures A2-A9, Appendix E). A discussion of the site, based on the fieldwork, is presented in the following sections.

6.2.1.1 East Area Soils

Soil borings were completed on the east side of the property and showed that deep organic soils were present across the majority of Fields 17, 18, 21, 22, and 23 (Figure A1, Appendix E). Soils that have an organic layer that is 16 or more inches thick (within the upper 32 inches of soil) are classified as Histosols. These soils are typically found in the areas likely to have been the wettest historically. These soils are in areas that are poorly to very poorly drained with long periods of saturation in their undisturbed state. The depth of peat and/or muck at the sites ranged from 16 inches to more than 48 inches in depth, typically underlain by either sand or fine textured materials (e.g., clay, silt, silt loam, etc.). These profiles are described at sites 1-4, 7, 8, 18-21, and 24 (Figure A1, Appendix E).

Soils with an organic layer that is more than eight inches but less than 16 inches in depth have a histic epipedon. These soils are typically formed under somewhat poorly drained conditions with frequent periods of high water tables. The depth of peat and/or muck at these sites ranges from 6 to 15 inches in depth, and is typically underlain by either fine sand, silt, clay, and/or clay loam soils. These profiles are described at sites 5, 6, 16, and 17 (Figure A1, Appendix E).

The remainder of the sites have mineral soil profiles that typically contain up to seven different textural horizons within 36 to 42 inches below the soil surface. The textures throughout the profiles include fine sand, loam, silt, clay, clay loam, loamy fine sand, fine sandy loam, fine sandy clay loam, and fine sandy clay. The presence of multiple strata within 3 to 4 feet of soil indicates these soils were created in near-shore conditions with little wave action so that finer textured materials settle out over time. These profiles are generally formed under poorly drained conditions with periods of short inundation. All the profiles were classified as hydric except sites 10, 11, and 12, which are located in the northeast area (upland buffer Area 13, Figure 9) at elevations above 1202 feet MSL (Appendix E).

6.2.1.2 West Area Soils

Soil borings were completed on the west side of the property in Fields 2, 6, 8, 9, 10, and 11 (Figure A-1 to A-9, Appendix E). These borings show that organic soils are present to a depth of at least 15 inches below the soil surface. In addition, soil samples were collected throughout the west area of the property for a seedbank germination project. A walk-over of the west area during the collection of soil samples indicated that organic soils were present throughout the ditch system and the sod fields.

The soil survey indicates that nearly the entire area is mapped as Cathro muck, which typically has peat and/or muck to a depth of 16-51 inches below the soil surface. There are two areas of mapped mineral soil, Spooner silty loam, in the northwest and southwest areas. This series is typically a poorly drained soil that formed from glaciolacustrine parent material and it is classified as hydric. Soils in this area typically formed under poorly to very poorly drained conditions with long periods of saturation.

6.2.2 Topography

The topographic relief is fairly minimal throughout the site. The USGS quadrangle topography indicates an elevation of 1205 feet MSL in the west-central portion of the farm area to an elevation of 1204 feet MSL in the east-central portion of the farm. The USGS topography does not show any contours through most of the fields. Detailed survey data indicates ground elevations in the wetland restoration areas ranging from 1196 feet MSL to 1201 feet MSL with elevations on the dikes up to 1213 feet MSL. The gradient in the wetland restoration area ranges from flat to about 1.5 percent in the northwest and northeast corners of the site. The gradient in the wetland complex located north of the restoration area appears to be about 1.5 feet per mile or 0.03%.

6.2.3 Climate

The average annual precipitation for Aitkin, based on the current 30-year normal period 1971-2000 is 28.9 inches (NRCS, 2007). A water budget completed by Oakes and Bidwell (1968) for the Mississippi River headwaters watershed calculated general runoff in the watershed to be 5.34 inches based on annual, average precipitation of 25.33 inches. The wetland restoration site is located in the downstream portion of the Mississippi River headwaters watershed, for which the water budget was calculated. While the average annual runoff value calculated by Oakes and Bidwell (1968) may not accurately reflect runoff conditions in all areas of the watershed, it provides a reasonable estimate for computing an order-of-magnitude water volume that might be expected to discharge from various portions of the watershed.

6.2.4 Hydrology

The Mississippi River Diversion Channel (Diversion Channel), constructed in the 1950s to prevent flood damages to the city of Aitkin, is located on the north side of the property (Figure 10). The flood channel diverts a portion of the Mississippi River flows downstream to lower portion of the river during high flows. A flood study was published for the Aitkin County area in 1981 (FEMA, 1981) in which specific flood elevations were determined for the Aitkin project area. The 10-year flood elevation for the site is approximately 1200.5 feet MSL and the 100-year flood elevation for the site is approximately 1203 feet MSL. The flood channel also intercepts the Little Willow River and carries its discharge to the Mississippi River. It appears that the Diversion Channel may also intercept some surface and subsurface drainage from the north that may have historically made its way to the restoration property. However, based on a review of historic topography maps and aerial photographs, it appears that the drainage area affecting the wetland restoration property may be limited. There is an artesian well located near the central part of the property that will flow freely when not restricted. However, the specifications of that well are unknown. It does indicate that there is a general upward groundwater head gradient at some depth at the site. The Mississippi River abuts the east side of the property. The existing contributing watershed area to the restoration site is currently confined to the site itself and there is no upstream drainage that enters the site (Figure 10).

The primary drainage features affecting the farm are surface ditches spaced approximately every 700 feet with the fields contoured to drain to the ditches. There are four outlets from the west part of the property; two in the northwest part (one north through the Diversion Channel dike and one through the west dike), one in the southeast corner, and another near the center of the east side (Sheets C-01 and C-02, Appendix A). These outlets range in elevation from 1193.6 feet MSL in the northwest to 1195 feet MSL in the east and southeast, generally 5-7 feet below the field elevations. There is a small county ditch located west of the property. The west half of the property is bordered by dikes on the north and west sides. The north dike ranges in elevation from about 1205 feet MSL to 1210 feet MSL. The west dike ranges in elevation from about 1200 feet MSL to about 1204 feet MSL. County Highway 1 acts as a dike along the east and south sides of the west part of the property ranging in elevation from about 1205 feet MSL to more than 1207 feet MSL.

There are two outlets from the east half of the property; one in the northwest corner discharging to the Diversion Channel and one along the east side discharging to the Mississippi River. These outlets range in elevation from 1194.4 feet MSL in the northwest corner to 1196.2 feet MSL in the east, generally 5-6 feet below the field elevations (Sheet C-02, Appendix A). The east outlet has an adjustable control structure that can be modified to control water levels. The east half of the property is bordered by a dike on the north side ranging in elevation from about 1205 feet MSL to 1213 feet MSL. County Highway 1 acts as a dike on the west side, ranging in elevation from about 1205 feet MSL to more than 1207 feet MSL. The south side of the east half is bordered by a dike that ranges in elevation from about 1201 feet MSL to 1205 feet MSL. The east side of the east half is bordered by

391st Lane which ranges in elevation from about 1202 feet MSL in the south to 1205 feet MSL in the north.

Review of the 1940 aerial photograph indicates that much of the Aitkin property was under agricultural production at that time and some of the drainage ditches had already been constructed (Figure 14). The 1991 aerial photograph (Figure 15) shows the site during the years of wild rice production, which apparently extended from as early as the late 1950's until about 1998 when the site was converted for sod production. Hydrology will be restored within the majority of the proposed wetland restoration areas by reconnecting the site to the Diversion Channel with surface overflows/inlets, filling the drainage ditches, and blocking or raising outlet structures to historic elevations to the degree feasible. The detailed construction plans are described in Section 7.

6.2.4.1 East Area Hydrology

During the site soil and water investigation on June 5 and 6, 2007, the depth of each borehole and the depth to the water table were measured after the soil profile description was completed. The boreholes were left open and the water table was rechecked after 15-21 hours. There was no rainfall during this time period. Only three sites recorded a water table upon the initial measurement (Figure A1, Appendix E); Site 3 at a depth of 32 inches, Site 18 at a depth of 39 inches, and Site 22 at a depth of 36 inches. The water table at these three sites was located in fine sand or at a fine sand and clay boundary.

A water table was recorded at 11 sites during the second round of measurements. The boreholes generally had collapsed 0-10 inches depending on the soil texture at the bottom of the borehole (clay, sand, etc.). The water table was measured at 27-41 inches below the soil surface (Figures A2-A9 Appendix E). Five transects were completed in the east half of the site that show the soil stratigraphy and the water table (Figure A1: Transects 1, 2, 3, 5, 6/4, Appendix E). The water table was observed in most ditches on the property, with the wider and deeper ditches conveying a greater amount of surface water. Typically the water table rose near the ditches, but as the distance increased from the ditch, the water table flattened out or disappeared to a depth greater than the sampling depth (Figures A2-A7 Appendix E). There is an area at the north end of Field 17 where approximately 1-2 feet of topsoil has been removed from the deep organic soils, resulting in occasional inundation. The excavation area appears to have altered the hydrology by establishing a collection area for runoff and by exposing and/or resulting in more compacted subsoils, thereby allowing the area to pond surface water (Figures 6/4-1 and 6/4-2 Appendix E).

Because the east area is dominated by organic soils or hydric mineral soils, this area was formed under very poorly to poorly drained conditions. Typical water tables should range from one foot above to one foot below the soil surface for organic soils and 0.5-1.5 feet (6-18 inches) below the soil surface for mineral soils under unaltered conditions. The placement of drainage ditches on the property has altered the hydrology of the site so that the drainage class for the current soils on the site range from well drained to somewhat poorly drained soil, rather than the typical poorly drained to very poorly drained classes.

6.2.4.2 West Area Hydrology

The ground elevations in the west area range from a low area at 1196-1199 feet MSL in the northwest corner to generally 1200-1201 feet MSL throughout the remainder of the area. There are typically ditches on at least three sides of each field so that no spot on the ground is more than 350 feet away from a ditch. The presence of the current ditch system, in place since about 1998, and a much more extensive ditch system historically, has significantly altered the hydrology throughout the site. The west area is dominated by organic soils that historically developed with a water table that ranged from one foot above to one foot below the soil surface. There is an apparent water table within most ditches in the west area, but not beneath the fields. The exception is the ditch located at the north side of Field 9, which was dry on June 6, 2007. Transect 7 (Figure A8, Appendix E) shows the same trend for the water table as Transects 1, 2, and 3 on the east side of County Highway 1. The soils along these transects on the west and east sides are typically organic soils underlain by loam or sand with a ditch located to the south.

Soil borings were conducted in the west area on April 25, 2007 to determine peat depths and document the presence of the water table within the peat or upper part of the mineral soil horizon. Soil borings SB-1 through SB-9 (Figure A-1, Appendix E) were completed to depths ranging from 18-32 inches, or until frost was encountered. Peat depths ranged from 15 inches to greater than 28 inches (Table 1, Appendix E) in the west half and no water table was encountered within the mineral soils, which were located at depths of 20-32 inches (where frost was not present). Given that no water table was observed in the sub-surface mineral soils during the wetter portion of the water year (starting October 1 through about May is the typical period of soil moisture recharge), and that it was a slightly wetter than normal water year; it was expected that if wetland hydrology were to be present, it should have been present on April 25, 2007. Because the ditches, organic soil, and elevations are similar to the east side, the high water table on the west side appears to be at least two feet below its normal pre-drainage conditions throughout the area.

7.0 Wetland Restoration Plan

The two proposed off-site wetland restoration sites are both currently operated as sod production facilities, which require considerable control over the hydrology of the site. The hydrology at each site is controlled by a series of ditches throughout each farm, typically surrounded by a system of dikes with outlet structures through the perimeter dikes. Water levels in the ditches are typically maintained approximately 3-5 feet below the field elevations to ensure an aerated rooting zone without soil saturation. The goal for each step in the restoration process is to continually progress toward the final goal of establishing a variety of wetland communities with the appropriate hydrology and dominated by characteristic native vegetation within each community.

7.1 Hinckley Wetland Restoration Construction Plan

The ultimate objective of the Hinckley restoration plan is to restore the hydrologic connection between the upstream watersheds and the restoration site and disable the internal drainage system within the site. The hydrology will be restored utilizing broad, rock-lined weirs, eliminating culverts that would otherwise require perpetual maintenance to establish specific hydrologic conditions that will meet the goals and performance standards described in Sections 4 and 5.

The restoration process will start with activities to restore the hydrology. The restoration construction plans are provided in Appendix A. Prior to constructing the surface inlets and outlets, silt fence/barrier will be installed downstream of the restoration areas within the primary outlet ditches. Before restoration work begins within the site, the water flow from the upstream watershed will be temporarily blocked to prevent flooding during construction. In general, the proposed outlet modifications will be constructed first, then moving upstream within the site, culverts will be removed and internal ditches will be filled in accordance with the plans. The final step will be to reestablish the connections to upstream watersheds. The final connection to upstream watersheds will be sequenced by first constructing the inlet weirs and lastly, filling the exterior ditch (Appendix A).

The inflow/outflow weirs will be constructed by lowering sections of dike to the elevations shown on the plans (Appendix A) within approximately a 20 foot bottom width with 20H:1V slopes connecting into the top of the established dike. Each overflow would then be covered with 1/2-inch to 4-inch rock over geotextile fabric to a depth of 12 inches and extending up the sides of the overflow 1-2 feet in elevation. The rock will also extend on the upstream and downstream slopes. Organic or mineral hydric soils removed from the dike during construction will be utilized to fill the interior field ditches where practical. After the water supply has been reestablished, efforts will be focused on establishment of the targeted wetland communities as described in Section 7.3.

7.2 Aitkin Wetland Restoration Construction Plan

The ultimate objective of the Aitkin restoration plan is to restore the hydrology within the restoration site by removing the internal drainage system and constructing outlets to establish specific hydrologic conditions that will meet the goals and performance standards described in Sections 4 and 5. The hydrology will be restored utilizing broad, rock-lined weirs, eliminating culverts with the exception of the culverts crossing County Highway 1 and the east outlet crossing 391st Lane.

The restoration process will start with activities to restore the hydrology. The restoration construction plans are provided in Appendix B. Prior to constructing the surface inlets and outlets, silt fence/barrier will be installed downstream of the restoration areas within the primary outlet ditches. A ring dike will first be constructed around the homestead property that is excluded from the restoration plans. The dike will be constructed to elevation 1202 feet MSL to prevent surface flooding.

The proposed outlet modifications will be constructed next, then moving upstream within the site, culverts will be removed and internal ditches will be filled in accordance with the plans. The step will involve raising the dikes and land area as shown on the plans (Appendix B) to prevent flooding of neighboring properties. The west dike will be raised to elevation 1202 feet MSL. The land along the south and southeast corner of the west half will be raised to elevation 1201 feet MSL to prevent water from the restoration area from entering the County Highway 1 drainage system. A berm will be constructed to elevation 1203 feet MSL around the proposed bog areas to protect them from Mississippi River flooding during flood events with a 100-year return frequency or shorter based on modeling data from FEMA (1981).

An inlet/outlet will be constructed through the diversion dike on the west half of the property with an overflow elevation of 1200 feet MSL (Sheets C-01 and C-03). This will allow the diversion channel to spill into the site during high flows and will allow the site to drain, maintaining saturated soil conditions over the majority of the area. An inlet/outlet will be constructed through the diversion dike on the east half of the property with an overflow elevation of 1201 feet MSL (Sheets C-02 and C-04, Appendix B). This will allow the diversion channel to spill into the site during high flows and will allow the site to drain, maintaining saturated soil conditions over the majority of the restoration area.

The inflow/outflow weirs will be constructed by lowering sections of dike to the elevations shown on the plans (Appendix A) within approximately a 20 foot bottom width with 20H:1V slopes connecting into the top of the established dike. Each overflow would then be covered with 1/2-inch to 4-inch rock over geotextile fabric to a depth of 12 inches and extending up the sides of the overflow 1-2 feet in elevation. The rock will also extend on the upstream and downstream slopes. The culverts under County Highway 1 connecting the east and west parts of the site will not be modified and therefore will allow water movement between them. The culverts that cross County Highway 1 near the south part of the site will also remain in place to maintain drainage from the road generally as it currently exists. The east outlet across 391st Lane will be reconstructed with a concrete weir and pipe with a control elevation of 1201 feet MSL (Sheet C-02, Appendix B). The organic or mineral hydric soils removed from the dike during construction would be utilized to fill the interior field ditches where practical. After the water supply has been reestablished, efforts will be focused on establishment of the targeted wetland communities as described in Section 7.3.

7.3 Vegetation Restoration/Management

An adaptive management program is proposed to guide the development of the restored wetlands to the targeted conditions. The vegetative restoration community types proposed in the off-site wetland restoration areas are shown on Figures 6 and 9 and are summarized in Tables 1 and 7. The vegetative restoration of each non-forested, non-bog wetland community will be conducted to promote the establishment of characteristic native species that are present in the seed bank or that may be transported to the area from adjacent wetlands. By reestablishing the hydrologic connection to upstream wetlands as the first restoration activity at the Hinckley site, one of the primary seed transport mechanisms will be restored to assist in the development of wetland communities native to the area. The process for restoration of the wetlands is designed to meet the goals described in Section 4 and the performance objectives described in Section 5 in the most effective manner.

The goal of the restoration is to provide a setting and conditions in which the restoration areas will be restored to naturally self-sustaining and functioning wetlands to the extent feasible. The proposed wetland communities have been planned in areas that appear to match the natural hydrologic characteristics of each community type. However, during the restoration process, it is expected that the defined areas and wetland communities may change to some degree and the plan will allow for adaptation to the conditions.

Where feasible, reference wetlands will be identified in the vicinity of the sites for each restoration community type that represent an approximation of the wetland communities anticipated after restoration. It is recognized that this process cannot be accomplished within a year or two, but will take time, and therefore, short-term interim goals are also included in the performance standards.

7.3.1 General Site Preparation

Prior to or concurrent with conducting hydrologic restoration activities, existing, non-native and invasive vegetation will be removed from the restoration sites through mechanical means or herbicide application. Sod will be cut using traditional, mechanical methods and will be removed from the site to establish bare soil. The soil will be lightly harrowed to loosen the soil surface. Areas where sod had previously been removed and vegetation has started to grow will be assessed to determine the most appropriate vegetation management treatments. Treatment methods that may be used include mowing (for annual weeds), selective herbicide application (for broadleaf weeds or non-native or invasive grasses), or broad-spectrum herbicide application (for areas where limited desirable species are present).

7.3.2 Natural Regeneration - Seasonally Flooded, Wet Meadow, Sedge Meadow, Shallow Marsh, Deep Marsh, Shrub Carr and Alder Thicket Communities

The proposed vegetation establishment and maintenance activities anticipated to meet the goals of the plan are listed for the conditions described as appropriate to the restoration schedule:

1. **Presence of reed canary grass or other non-native grasses.** Spray Sethoxydim herbicide at label rates in late fall (after desirable native vegetation has senesced) within wetland restoration areas containing more than 20 percent areal coverage of reed canary grass or other non-native or invasive grasses and all dikes and ditch slopes adjacent to the wetland restoration areas. The purpose of this treatment is to kill reed canary grass and other actively growing non-native grasses while desirable native plants are dormant. Other restoration projects have had considerable success using this treatment recently.

2. **Presence of broadleaf weeds.** Spray perimeter dikes and slopes adjacent to wetland restoration areas and other areas where warranted with a broadleaf herbicide (e.g. Transline) at recommended rates targeting stinging nettle, Canada thistle, and other broadleaf non-native species.

3. **Revegetate berms and dikes**. Seed ditch banks and dikes with BWSR Berm Mix No. 2 at 30 pounds/acre (Table 9).

4. **Hydrologic restoration and monitoring.** Construct hydrologic restoration activities as described in Sections 7.1 and 7.2 within 4 weeks after initial herbicide application where invasive or non-native vegetation is a concern. Monitor water levels in restored wetlands to determine if target hydrology is present.

5. **Presence of annual weeds**. Where annual weeds are present, mow seeded areas to 6-8 inch height with low ground-pressure mower to prevent any annual weeds present from going to seed.

6. **Vegetation characterization.** Characterize vegetation establishing in each wetland restoration area in June and August of each year to determine necessary management and establishment procedures. Vegetation characterization will include documenting all species present and the approximate areal coverage of each species by conducting meandering surveys within each wetland restoration area as described in Section 8.

7. **General weed control**. Continue treatments 1, 2, and 5 annually until reed canary grass, stinging nettle, Canada thistle and other non-native or invasive species are adequately controlled (see list in Section 5.1).

8. **Site specific treatment.** Spot spray wetland restoration areas two times annually to control reed canary grass and other perennial non-native or invasive species for up to 8 years in shrub communities, 20 years in bog and forested communities, and 5 years in other communities following initial restoration. Extensive treatments may not be needed after a sustainable wetland dominated by characteristic native vegetation is established such that the performance standards described in Section 5 are achieved.

9. **Weed control.** Conduct a spring burn in the sedge meadow and wet meadow communities after the second or third growing season to kill weed seed and promote germination of native plants, assuming that there is sufficient fuel for burning and assuming that there are no concerns with fire management due to climate conditions or potential for peat fires.

10. **Shallow and deep marsh weed control.** Should narrow-leaved cattails, hybrid cattails or other invasive, non-native emergent species become denser than described in the performance standards, control measures will be implemented. A herbicide approved for use over water may be wick-applied selectively to the species in need of control.

7.3.3 Seeding/Planting - Seasonally Flooded, Wet Meadow, Sedge Meadow, Shallow Marsh, Deep Marsh, Shrub Carr and Alder Thicket Communities

Diverse, native wetland vegetation is expected to develop in the restoration wetlands from the existing seedbank and from the wetland vegetation that surrounds the wetland restoration sites (both through vegetative propagation and through seed transport) or by other seed dispersal methods. At the end of the second growing season, a detailed assessment of seed bank re-establishment will be conducted within the wetland areas. Based upon the results of the assessment as per the performance standards in Section 5, areas that have not met the requirements will be seeded as follows:

1. **Sedge and wet meadow** areas that do not have adequate wetland vegetation cover or appropriate species established after the second full growing season will be seeded in the fall of the second full growing season with appropriate seed mixes. Seed mixes will be submitted for review and approval prior to seeding. Example seed mixes that may be considered are included in Appendix C.

2. **Shallow and deep marsh drawdown vegetation development.** Shallow and deep marsh communities that have not developed adequate species diversity and cover after the second full growing season may be drawn down to expose the soils and promote vegetation development.

3. **Emergent fringe seeding.** After the second full growing season, shallow and deep marsh fringe areas that have not had adequate wetland vegetation cover established will be drawn down to expose the soils and the emergent wetland fringe will be seeded with a mix similar to the Emergent Mixed Height seed mix provided in Appendix C at a rate of 5 lbs/acre.

4. **Shrub carr communities.** Shrub carr wetlands that do not meet the performance standards after the second full growing season will be planted with locally collected dormant cuttings of willow and dogwood species, which will be staked in the fall or spring at approximately 1 grouping of 3 stems per 400 square feet.

5. **Alder thicket communities.** Alder thicket wetlands that do not meet the performance standards by the end of the second full growing season will be seeded with alder seed. In addition, locally collected dormant cuttings of willow and dogwood species will be staked in the fall or spring at approximately 1 grouping of 3 stems per 1,000 square feet.

7.3.4 Hardwood and Coniferous Swamp

1. Surface preparation
   a. Existing vegetation will be removed from the site by mechanical removal or herbicide treatment.
   b. The peat surfaces will be lightly harrowed to loosen soil surface.

2. Herbaceous seeding
   a. Hardwood swamp communities will be seeded with lake sedge (*Carex lacustris*), manna grass (*Glyceria sp.*), Canada bluejoint grass (*Calamagrostis canadensis*), and marsh marigold (*Caltha palustris*) at an appropriate seeding rate (to be determined).
   b. Coniferous swamp communities will be seeded with lake sedge (*Carex lacustris*), manna grass (*Glyceria sp.*), and hop sedge (*Carex lupulina*), at an appropriate seeding rate (to be determined).

3. Tree Establishment
   a. The hardwood swamp communities will be planted with approximately 400 black ash seedlings/acre in a clumped distribution that will cover approximately 25 percent of each planned community area.
   b. Coniferous swamp communities will be established by direct seeding tamarack at a rate of 4 oz/acre. As tamarack seed does not exhibit dormancy it will be planted in the spring.
   c. If tree densities do not appear to be on a trajectory to meet the performance standards after the third full growing season, bare root seedlings of black ash (in the hardwood swamp communities) and tamarack (in the coniferous swamp communities) will be interplanted to achieve a stem density that exceeds that of the reference wetland by 25 percent in order to achieve the performance standards assuming 25 percent mortality

7.3.5 Open and Coniferous Bog – Restoration Methodology

The *Sphagnum* restoration methods planned for the PolyMet wetland mitigation sites have been largely planned based on methods presented in the Peatland Restoration Guide (Quinty and Rochefort, 2003). Numerous attempts were made to obtain information from bog restoration projects conducted in Minnesota by the Natural Resources Research Institute, however little information could be located. The study by Johnson, et al. (2000) to evaluate the effects of planting time, mulch application, and planting of companion *Carex* species on the establishment of *Sphagnum* mosses was evaluated and considered in the development of this plan.

1. Surface preparation
   a. Existing vegetation will be removed from the site by mechanical removal or herbicide treatment.
   b. Loose sod remnants and peat will be removed to form a smooth soil surface.

   c. Where specified, a perimeter berm will be constructed surrounding the bog restoration areas.

2. Trees – Direct Seeding for Coniferous Bog
   a. Tamarack will be established by direct seeding at a rate of 4 oz/acre; as tamarack seed does not exhibit dormancy it will be planted in the spring prior to the *Sphagnum* fragment spreading.
   b. Black spruce will be direct seeded at 2 oz/acre (50,000 seeds) with a hand rotary seeder in the spring prior to *Sphagnum* fragment spreading. The seed will be mixed with sawdust or vermiculite to ensure a uniform seeding rate.
   c. If tree densities do not appear to be on a trajectory to meet the performance standards after the third full growing season, bare root seedlings of tamarack and black spruce will be interplanted to achieve a stem density that exceeds that of the reference wetland by 25 percent in order to achieve the performance standards assuming 25 percent mortality.

4. Sphagnum collection
   a. Based on current research, the appropriate amount of Sphagnum plant material needed for application at the restoration site, is the equivalent of what can be collected from an area approximately 1/10 the size of the restoration area.
   b. A suitable site or sites will be selected in the fall prior to harvesting and a detailed characterization of each collection site will be submitted to the Corps and MDNR for review and approval. Preliminary candidate sites include suitable areas of the project mine site and Site 8362 located near Floodwood (Figure 4). It is expected that the project mine site may be suitable for providing up to half of the donor Sphagnum, while the remainder may be collected at the Floodwood site. Additional potential donor sites located closer to the restoration sites will be evaluated prior to construction. Assuming that half of the donor material can be obtained from the project mine site, approximately an additional 20 acres of donor bog area will be utilized at the Floodwood site.
   c. Plant material will be collected in late fall, winter, or early spring before the frost has melted. Sphagnum fragments collected in late fall or winter will be stored over winter for use the following spring.
   d. The top 4-6 inches of the sphagnum surface will be shredded with a Rotovator or other equipment to shred surface vegetation. Shredded Sphagnum vegetation will be windrowed using a dozer or back-scraper and will be loaded in trucks using a front-end loader.
   e. The plant material will be transported to the restoration site and stockpiled close to the restoration area to minimize multiple hauls.

5. Sphagnum spreading
    a. The plant fragments will be spread over the bog restoration site with a standard box manure spreader, ideally in early spring over frozen ground.
    b. The restoration site soil surfaces will be covered with a uniform 1 – 5 cm thick, fluffy layer of plant fragments.
6. Straw spreading
    a. Clean, fresh, straw mulch will be applied over plant fragments as soon as possible after plant spreading (the same day) to improve growing conditions for plant fragments by creating a wetter and cooler air layer at the peat surface.
    b. Attempts will be made to utilize equipment that allows straw to be spread without traveling on top of plant fragments, such as a sideways straw bale spreader with a mulch pass made after plant spreading from adjacent areas not yet completed.
    c. Straw application rate: 2,500 lbs/ac, 10 to 12 - 4 foot diameter round bales or 7 to 8 - 5 foot diameter round bales per acre.
7. Fertilizer application
    a. Slow-release phosphate rock fertilizer (P_2O_5) will be applied to approximately one-half of the bog restoration areas with a conic spreader at 17.5 pounds/acre available phosphate to provide adequate nutrients to favor a rapid establishment of the sphagnum mat. Since current research is not conclusive regarding the benefits of fertilizer, it will only be applied to one-half of the bog restoration areas at the Aitkin site to determine the effectiveness of this treatment and the potential for deleterious effects of promoting invasive vegetation establishment. The fertilization plan for the bog restoration at the Hinckley site will be determined based on the results observed at the Aitkin site.
    b. Equipment that allows fertilizer to be spread by traveling on top of plant fragments and straw mulch will be used, such as with a conic spreader pulled behind an all terrain vehicle, after mulch spreading has been completed.
8. Shrubs for Open and Coniferous Bog
    a. Shrub species will be planted as bare root in the fifth year if volunteer shrub densities do not meet the performance criteria after the fourth full growing season. Target shrub species in the open bog communities will include bog rosemary (*Andromeda glaucophylla*), creeping snowberry (*Gautheria hispidula*), and small cranberry (*Vaccinium oxycoccus*). Target shrub species in the coniferous bog communities will include leatherleaf (*Chamaedaphne calyculata*), bog laurel

(*Kalmia polifolia*), Labrador tea (*Ledum groenlandicum*), creeping snowberry and small cranberry.

7.3.6 Upland Area Management

Vegetation in the existing upland areas will be managed to promote natural succession of the existing plant communities. Each of the plant cover layers – ground, shrub and tree layers – will be managed to promote the ecological integrity and function of native plant communities. The primary maintenance activity will be control of non-native invasive species such as, but not limited to buckthorn, honeysuckle and garlic mustard. Protecting the site from further disturbances and allowing natural colonization and successional processes will maintain ecosystem biodiversity and structure.

Maintenance activities will include:

- Monitoring sites to identify and anticipate problems with invasive species before they reach problem proportions. Particular attention will be paid to edges of the upland sites.
- Removing or treating with appropriate herbicides all non-native or invasive plant species when found; timing/season of treatment will be based upon best practices for control of the species.
- Seeding or planting of appropriate native species based on the target communities.

8.0 Wetland Restoration and Management Schedule

The following schedule represents a preliminary plan of the expected activities that may be involved in restoring wetlands at the Hinckley and Aitkin sites. However, with an adaptive management perspective, it should be recognized that the timing of specific establishment and management activities are likely to change as the restoration work progresses. The overall schedule for restoration activities at the Hinckley and Aitkin sites is to complete the restoration work within the first 4 years of the project. Within the first year after permit issuance, the Year 1 restoration work will be completed within the Aitkin site. Within 2 to 3 years after permit issuance, the Year 1 restoration work will be completed within the northern half of the Hinckley site, including all areas that ultimately discharge from the east side of the site. The Year 1 restoration activities within the southern half of the Hinckley site will be completed within 4 years after permit issuance. The remaining restoration activities will generally follow the conceptual schedule provided below.

The wetlands restored as mitigation for the PolyMet project will require regular management to become established. This is critical in the first five to ten years and should be recognized as integral to the wetland mitigation success. Management will include both eliminating non-native and invasive species, creating ideal conditions for the native plants to flourish, and seeding/planting to supplement natural regeneration. Weeds can establish quickly as the wetlands develop because the ground is bare at the time of restoration. Some weeds are very aggressive and will out-compete the desirable wetland seedlings. Therefore, weed removal and careful monitoring is important during the early stages of the restoration. As native plants grow and spread over the years, and as thatch builds, the site will become less vulnerable to weed species. Removal of weeds does continue to be important during the first five to ten years to ensure that the native plant communities become established. Structures constructed to control hydrology within the restoration areas will be inspected annually during the 20 year monitoring period established and repairs will be made to maintain the goals of the plan. After final certification of the restored wetlands by the appropriate regulatory agencies, the land owner of each site will be required by the *Permanent Conservation Easements* that will be recorded after completion of construction (examples provided in Appendix F), to regularly inspect and maintain those structures to sustain the goals of the approved plan.

8.1 Year 1

8.1.1 Fall/Winter

1. Remove existing sod from restoration areas and apply herbicide to areas where undesirable natural regeneration has begun.

2. Construct berms (around bog areas and excluded homestead area at Aitkin site) and fill ditches as shown on the plans.

3. Complete hydrologic restoration construction as described in Sections 7.1 and 7.2 and as shown on the wetland restoration plans.

4. Spray Sethoxydim (grass-selective) and Transline (broad-leaf) herbicides on dikes and dike slopes adjacent to restoration areas.

5. Seed dike and dike slopes with BWSR Berm Mix No. 2.

6. Spray restoration fields containing at least 20 percent areal coverage of non-native or invasive grass species with Sethoxydim.

7. Seed herbaceous species as described in Sections 7.3.3 and 7.3.4.

8. Harvest sphagnum material and store at site as described in Section 7.3.5.

8.1.2 Spring/Summer

1. Monitor water levels in restored wetlands.

2. Seed tamarack, black spruce, and plant black ash during late winter/early spring in appropriate communities as described in Sections 7.3.4 and 7.3.5.

3. Prepare soil surface in planned bog communities so that it is smooth and firm. Distribute sphagnum in late winter/early spring followed immediately by mulch and fertilizer application.

4. Characterize vegetation in restoration areas in June and August followed by development of specific management objectives for the remainder of the year based on the findings.

5. Mow seasonally flooded, sedge meadow, and wet meadow wetlands in spring if annual weeds are present.

6. Apply grass-selective and broad-leaf herbicide to dikes and dike slopes where non-native or invasive species are present.

7. Spot spray wetland restoration areas to eliminate non-native or invasive species.

8.2 Year 2

8.2.1 Fall – End of First Full Growing Season

1. Complete monitoring report, including documentation of wetland establishment activities completed during the previous year conducted in comparison to the plan and recommended actions for the following year.

2. Monitor water levels in restored wetlands.

3. Apply herbicides as necessary to control non-native and invasive species in all communities.

8.2.2 Spring/Summer

1. Monitor water levels in restored wetlands.

2. Spray grass-selective and broad-leaf herbicides (typically in early June) on dikes and dike slopes adjacent to restoration areas where non-native or invasive grass and forb species are present before seed production is complete.

3. Characterize vegetation in restoration areas in June and August followed by development of specific management objectives for the remainder of the year based on the findings.

4. Spot spray or wick-apply wetland restoration areas with Rodeo or other appropriate herbicide to eliminate non-native or invasive species.

5. Mow seasonally flooded, sedge meadow, and wet meadow wetlands if annual weeds are present prior to seed production.

8.3 Year 3

8.3.1 Fall – End of Second Full Growing Season

1. Complete monitoring report, including documentation of wetland establishment activities completed during the previous year conducted in comparison to the plan and recommended actions for the following year. Make recommendations for permanent water level control adjustments that may be needed for restored wetlands to better promote vegetation development that meets performance standards.

2. Monitor water levels in restored wetlands.

3. Apply herbicides as necessary to control non-native and invasive species in all communities.

4. If shrub development does not conform to performance standards, conduct shrub staking or seeding.

5. If species diversity or vegetative cover development in sedge meadow or wet meadow communities does not conform to performance standards, conduct seeding.

6. If marsh communities do not meet performance standards, draw down water levels and seed fringe areas.

8.3.2 Spring/Summer

1. Monitor water levels in wetlands.
2. Spray grass-selective and broad-leaf herbicides (typically in early June) on dikes and dike slopes adjacent to restoration areas where non-native or invasive grass and forb species are present before seed production is complete, reseed if bare soils are present.
3. If shrub development does not conform to performance standards, conduct shrub staking or seeding.
4. Characterize vegetation in restoration areas in June and August followed by development of specific management objectives for the remainder of the year based on the findings.
5. Spot spray or wick-apply wetland restoration areas with Rodeo to eliminate non-native or invasive species.
6. If non-native or invasive species are present in the sedge meadow or wet meadow communities, conduct a spring burn.

8.4 Years 4-5

Many of the management activities described for Year 3 will be continued in Years 4 and 5 along with the monitoring activities. If tree development in hardwood swamp, coniferous swamp, and coniferous bog communities does not conform with performance standards, seedlings will be planted as described in Sections 7.3.4 and 7.3.5. If shrub development in coniferous and open bog communities does not conform with performance standards, shrub seedlings will be planted as described in Section 7.3.5. The monitoring report completed after the fifth growing season will assess whether or not restored, wetland communities (with the exception of shrub, forested, and bog communities) are in conformance with performance standards such that the 5-year monitoring would be sufficiently complete.

8.5 Years 6-20

Because establishment of shrub, forested, and bog wetland communities can take longer, active management and monitoring will be conducted for eight years within shrub communities and twenty years in forested and bog communities. Many of the management activities described for Years 4-5 will be continued in Years 6-20 along with the monitoring activities.

9.0 Wetland Mitigation Monitoring

The wetland restoration area will be monitored for at least five years (eight years for shrub communities and twenty years for forest and bog communities) beginning in the first full growing season after beginning hydrologic restoration to document the progress and condition of the wetland communities at the mitigation sites. For wetlands other than shrub, forest, and bog communities, monitoring reports will be prepared each year in years 1 through 5 following construction. For shrub communities, monitoring reports will be prepared and submitted in years 1, 2, 3, 5, and 8 following construction. For forested and bog communities, monitoring reports will be prepared and submitted in years 1, 2, 3, 5, 10, and 20 following construction. The monitoring report completed after the final growing season will assess whether or not the restored wetlands are in conformance with performance standards. Future wetland mitigation plans will be submitted for review and approval to address mitigation wetlands that are not in conformance with the performance standards.

Hydrologic parameters will be evaluated in the mitigation areas more intensively during the first two years and then at a level appropriate to the hydrologic characteristics of each area thereafter. Any significant modifications to the monitoring frequency proposed herein will be described in a revised monitoring plan to be submitted for review and approval prior to implementation. In addition to monitoring the restored wetlands, one reference wetland of each wetland restoration community type (if available) will be monitored within the general area of the restoration site, in areas with relatively natural hydrologic conditions. A monitoring plan will be submitted for review and approval that will include proposed locations of reference wetlands prior to implementing the monitoring program. Continuous recording wells will be utilized to the extent feasible.

9.1 Hydrologic Monitoring Years 1-2

9.1.1 Shallow Marsh, Deep Marsh, and Open Water Communities

Hydrologic monitoring in these inundated wetland communities will be conducted using staff gages placed within each restored wetland area. Water elevations will be recorded once per week during the first 10 weeks of the growing season and twice monthly through the remainder of the growing season.

9.1.2 All Other Communities

Hydrologic monitoring in these generally saturated wetland communities will be conducted using shallow wells placed within each restored wetland area. Water elevations will be recorded once per week during the first 10 weeks of the growing season and twice monthly through the remainder of the growing season.

9.2 Hydrologic Monitoring Years 3-20

9.2.1 Shallow Marsh; Deep Marsh; and Shallow, Open Water Communities

If the monitoring conducted during Years 1-2 indicate a stable and consistent hydrologic regime similar to the reference wetlands, water elevations will be recorded monthly throughout the growing season during Years 3-5. In wetlands where water elevation fluctuations differ substantially from the reference wetlands, water elevations will be recorded once per week during the first 10 weeks of the growing season and twice monthly through the remainder of the growing season during Years 3-5.

9.2.2 All Other Communities

If the monitoring conducted during Years 1-2 indicate a stable and consistent hydrologic regime similar to the reference wetlands, water elevations will be recorded once per week during the first 6 weeks of the growing season and monthly throughout the remainder of the growing season during Years 3-5 for sedge and wet meadow communities and Years 3-8 for the shrub, forest, and bog communities.

In wetlands where water elevation fluctuations differ substantially from the reference wetlands, water elevations will be recorded once per week during the first 10 weeks of the growing season and twice monthly through the remainder of the growing season during Years 3-5 for sedge and wet meadow communities and Years 3-8 for shrub, forest, and bog communities. Hydrologic monitoring in the forested and bog communities will continue in years 9-20 utilizing recording wells with water levels recorded approximately once every 4 hours during the growing season and downloaded approximately once per month.

9.3 Vegetation Monitoring

A detailed vegetation survey will be conducted once per year (typically August) in each wetland mitigation community, as well as the reference wetland communities, to evaluate the success of the restoration during the appropriate monitoring period for each community type. A time meander search will randomly sample 20 percent of each wetland restoration community with the exception of the deep marsh and open water communities. Vegetation monitoring within the submergent zones of deep marsh and open water communities will be conducted from 1-2 representative locations within each community using the hook/rake method. This sampling method involves anchoring a boat at the sampling location, throwing a hook or rake in each of 4 directions from the sampling location and dragging the hook approximately 2 meters across the bottom to gather vegetation. Each species and density of plant growth will be documented for each throw and that data will be averaged for the 4 throws at each sampling location. Documentation photographs will also be taken in August from fixed reference points around each restored wetland area.

9.4 Monitoring Report

A monitoring report will be prepared annually during the 5-year monitoring period for all except the shrub, forested, and bog communities. Annual monitoring reports will be prepared following growing seasons 1, 2, 3, 5, and 8 following restoration for the shrub communities and following growing seasons 1, 2, 3, 5, 10, and 20 for the forested and bog communities. The report will describe the status of the wetland mitigation, summarize the results of the vegetative and hydrologic monitoring, and discuss management activities and corrective actions conducted during the previous year, and activities planned for the following year. The report will be submitted to the MDNR and Corps by December 31 of each year. The annual report will include the following information at a minimum:

- A brief description of the wetland mitigation area, including location, size, vegetative and hydrologic monitoring data, current wetland types and desired wetland types.

- Preparation of an as-built survey within the first year after construction is complete along with a comparison of the as-built survey to the approved plans. This as-built survey will be prepared upon the completion of establishing the permanent overflow structures, which may not be completed during the first year.

- A summary of water level measurements taken to date and a determination whether the hydrology in the wetlands meets the design elevations and wetland hydrology criteria as defined in the performance standards.

- Vegetation survey information, including species and percent areal coverage within each restored wetland community and a determination of whether the vegetation meets the performance criteria.

- A map of the various plant communities present within the restoration areas will be prepared as distinctly different communities develop.

- Color photographs of the wetland mitigation sites taken in August of each year at designated photo-reference points.

- A summary of management activities and/or corrective actions conducted in the wetlands during the previous year and activities planned for the following year.

10.0 References

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Tables

Table 1: Summary of Total Project Wetland Impacts and Mitigation
by Eggers and Reed Classification
January 15, 2008
PolyMet Mining Company

Wetland Type	Aitkin Wetland Mitigation Area (acres)	Hinckley Wetland Mitigation Area (acres)	On-Site Wetland Mitigation (acres)	Wetland Mitigation Total (acres)	Proposed Project Wetland Impacts (acres)	Proposed 5-Year Wetland Impacts (acres)	Total Wetland Impacts Compensated[1] (ac)
Deepwater					0.5	0.5	0.0
Type 1 Seasonally Flooded	0.0	20.1	0.0	20.1	0.0	0.0	13.4
Type 2 Fresh (Wet) Meadow	21.8	14.3	25.0	61.1	14.6	14.6	42.7
Type 2 Sedge Meadow[2]	47.1	39.9	0.0	87.0	28.1	26.8	61.7
Type 3 Shallow Marsh	86.9	1.4	60.0	148.3	25.6	21.1	102.3
Type 4 Deep Marsh	33.6	0.0	50.0	83.6	0.2	0.2	55.8
Type 5 Shallow, Open Water	0.0	0.0	10.0	10.0	0.05	0.05	6.7
Type 6 Shrub-Carr	83.9	87.1	0.0	171.0	9.1	9.1	115.2
Type 6 Alder Thicket	82.8	27.4	30.0	140.2	66.9	61.2	102.4
Type 7 Hardwood Swamp[3]	52.6	13.2	0.0	65.8	20.1	15.0	46.5
Type 7 Coniferous Swamp	89.1	8.4	0.0	97.5	63.1	63.1	73.4
Type 8 Open Bog	74.2	0.0	0.0	74.2	76.1	45.6	59.4
Type 8 Coniferous Bog	238.2	101.2	0.0	339.4	549.7	444.6	271.5
Upland Buffer	123.1	79.2	0.0	202.3			50.6
Upland Total	**123.1**	**79.2**	**0.0**	**202.3**			**50.6**
Wetland Total	**810.2**	**313.0**	**175.0**	**1298.2**	**854.1**	**701.8**	**951.0**
Total	**933.3**	**392.2**	**175.0**	**1500.5**	**854.1**	**701.8**	**1001.5**

[1] Assumes 1.25:1 replacement for the same wetland types and 1.5:1 for different types.

[2] The total restoration area includes 0.8 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

[3] The total restoration area includes 6.1 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

Table 2: Total Project Wetland Impact Detail
Revised November 26, 2007
NorthMet Mine/PolyMet Mining Co.

Project Area	Wetland ID	Dominant Circular 39 Type	Total Wetland Area (acres)	Projected Direct Wetland Impacts (acres)	Projected Indirect Wetland Impacts (acres)	Dominant Community Type	Vegetative Diversity/ Integrity	Overall Wetland Quality	Disturbance Level	Disturbance Type	Wetland Origin	Field Delineated	Impact Type (Direct/Indirect)
Mine Site	1	3	0.42	0.00	0.00	shallow marsh	Moderate	Moderate	High	Impounded	Natural	Y	Direct
Mine Site	3	3	0.35	0.00	0.00	shallow marsh	Moderate	Moderate	High	Impounded	Natural	N	Direct
Mine Site	5	2	0.61	0.61	0.00	wet meadow	High	High	Low		Natural	Y	Direct
Mine Site	6	3	0.62	0.00	0.00	shallow marsh	Moderate	Moderate	High	Impounded	Natural	Y	Direct
Mine Site	7	2	0.07	0.00	0.00	wet meadow	Moderate	Moderate	High	Impounded	Natural	N	Direct
Mine Site	8	2	6.16	4.87	1.29	sedge meadow	Moderate	Moderate	High	Impounded/Fill	Natural	Y	Direct/Indirect
Mine Site	9	3	1.84	0.04	0.00	shallow marsh	High	High	Moderate	Impounded	Natural	Y	Direct
Mine Site	10	2	1.17	0.00	0.00	sedge meadow	High	High	Low		Natural	Y	Direct
Mine Site	11	8	8.88	0.00	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	12	6	227.92	0.00	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	13	2	5.03	0.19	0.00	wet meadow	High	High	High	Impounded	Natural	Y	Direct
Mine Site	14	2	0.33	0.33	0.00	wet meadow	High	High	Low		Natural	Y	Direct
Mine Site	15	8	2.79	0.00	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	16	3	0.31	0.11	0.00	shallow marsh	High	High	Low		Natural	Y	Direct
Mine Site	18	3	18.89	18.89	0.00	shallow marsh	High	High	Moderate	Impounded	Natural	Y	Direct
Mine Site	19	3	1.68	1.68	0.00	shallow marsh	High	High	Low		Natural	Y	Direct
Mine Site	20	2	21.89	21.07	0.82	sedge meadow	High	High	Low		Natural	N	Direct/Indirect
Mine Site	22	3	8.71	0.00	0.00	shallow marsh	High	High	Low		Natural	Y	Direct
Mine Site	24	6	0.80	0.80	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	25	8	1.95	0.00	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	27	8	1.07	1.07	0.00	black spruce bog	Moderate	Moderate	High	Road Fill	Natural	Y	Direct
Mine Site	29	3	12.01	2.34	0.00	shallow marsh	High	High	Low		Natural	Y	Direct
Mine Site	32	8	69.89	64.40	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	33	6	23.91	7.41	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	34	6	0.99	0.99	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	37	6	2.39	2.39	0.00	shrub carr	High	High	Low		Natural	N	Direct
Mine Site	43	6	8.33	8.08	0.22	alder thicket	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	44	6	3.27	1.98	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	45	6	30.58	16.89	5.17	alder thicket	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	47	8	0.54	0.54	0.00	open bog	High	High	Low		Natural	Y	Direct
Mine Site	48	8	98.45	38.74	18.17	cedar bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	51	6	2.91	2.91	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	52	6	3.88	3.88	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	53	6	132.33	2.68	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	54	6	10.24	0.00	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	55	6	3.91	3.91	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	56	8	2.79	0.00	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	57	7	83.83	54.70	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site	58	6	33.28	0.00	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	60	6	5.95	5.95	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	61	7	0.45	0.00	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site	62	8	12.13	0.00	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	64	7	0.31	0.00	0.00	forested swamp	High	High	Low		Natural	N	Direct
Mine Site	68	7	20.05	7.55	0.00	forested swamp	High	High	Low		Natural	N	Direct
Mine Site	72	7	1.38	0.59	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site	74	7	6.12	6.12	0.00	hardwood swamp	High	High	Low		Natural	Y	Direct
Mine Site	76	8	3.38	2.42	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	77	8	13.00	7.86	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	78	8	0.81	0.81	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	79	8	2.39	0.00	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	80	8	0.29	0.29	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	81	7	1.68	1.68	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site	82	8	61.52	58.31	3.11	coniferous bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	83	8	21.78	3.69	0.00	open bog	High	High	Low		Natural	Y	Direct
Mine Site	84	8	8.76	1.33	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	85	8	1.41	1.41	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	86	8	2.47	2.47	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	88	8	5.57	4.96	0.61	coniferous bog	High	High	Low		Natural	N	Direct/Indirect
Mine Site	90	8	189.35	70.13	5.42	open bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	95	8	2.54	2.54	0.00	black spruce bog	High	High	Low		Natural	N	Direct
Mine Site	96	8	17.29	15.34	1.95	black spruce bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	97	8	3.53	0.75	2.78	black spruce bog	High	High	Low		Natural	N	Direct/Indirect

Table 2: Total Project Wetland Impact Detail
Revised November 26, 2007
NorthMet Mine/PolyMet Mining Co.

Project Area	Wetland ID	Dominant Circular 39 Type	Total Wetland Area (acres)	Projected Direct Wetland Impacts (acres)	Projected Indirect Wetland Impacts (acres)	Dominant Community Type	Vegetative Diversity/ Integrity	Overall Wetland Quality	Disturbance Level	Disturbance Type	Wetland Origin	Field Delineated	Impact Type (Direct/Indirect)
Dunka Road & Water Pipeline	4015	6		0.19	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4016	6		0.48	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4017	6		0.04	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4018	6		0.20	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4019	6		0.27	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4021	7		0.45	0.00	coniferous swamp	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4023	deepwater		0.45	0.00	deepwater	High	HIgh	Low		Natural	Y	Direct
Water Pipeline Subtotal				**9.8**	0.00		**20/22 High 2/22 Moderate**	**20/22 High 2/22 Moderate**					
Project Total			**2486.0**	**794.0**	**60.1**								

Table 2: Total Project Wetland Impact Detail
Revised November 26, 2007
NorthMet Mine/PolyMet Mining Co.

Project Area	Wetland ID	Dominant Circular 39 Type	Total Wetland Area (acres)	Projected Direct Wetland Impacts (acres)	Projected Indirect Wetland Impacts (acres)	Dominant Community Type	Vegetative Diversity/ Integrity	Overall Wetland Quality	Disturbance Level	Disturbance Type	Wetland Origin	Field Delineated	Impact Type (Direct/Indirect)
Mine Site	98	8	15.49	15.49	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	99	8	1.40	0.55	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	100	8	605.59	119.24	1.53	coniferous bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	101	8	15.09	7.18	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	103	8	125.89	106.88	19.01	tamarack bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	104	8	3.57	3.57	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	105	8	19.80	0.00	0.00	black spruce bog	High	High	Moderate	Logged	Natural	Y	Direct
Mine Site	107	8	65.80	42.51	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	109	6	6.03	6.03	0.00	alder thicket	High	High	Low	Partly cleared	Natural	Y	Direct
Mine Site	114	8	89.76	0.73	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	120	3	0.58	0.58	0.00	shallow marsh	Moderate	Moderate	Moderate	Impounded	Natural	Y	Direct
Mine Site	200	7	7.26	6.36	0.00	hardwood swamp	High	High	Low		Natural	Y	Direct
Mine Site	201	2	13.48	13.48	0.00	wet meadow	High	High	Low		Natural	Y	Direct
Mine Site	202	7	242.30	5.67	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site Subtotal	**59**		**2,429**	**784.0**	**60.1**		**56/59 High 3/59 Moderate**	**56/59 High 3/59 Moderate**					
Railroad	R-1	2	1.05	0.00	0.00	wet meadow	High	High	Moderate	Road fill	Natural		
Railroad	R-2	3	1.65	0.00	0.00	shallow marsh	High	High	Moderate	Road fill	Natural		
Railroad	R-3	7	0.63	0.10	0.00	hardwood swamp	High	High	Moderate	Road fill	Natural		
Railroad	R-4	6	3.50	0.17	0.00	shrub carr	High	High	Low		Natural		
Railroad	R-5	3	24.41	0.00	0.00	shallow marsh	High	High	Moderate	Impounded	Natural		
Railroad	R-6	3	10.42	0.00	0.00	shallow marsh	High	High	Low		Natural		
Railroad	R-7	6	12.14	0.00	0.00	shrub carr	High	High	Moderate	Impounded	Natural		
Railroad	R-8	6	3.00	0.00	0.00	shrub carr	High	High	Moderate	Impounded	Natural		
Railroad Subtotal	**8**		**56.80**	**0.3**	**0.00**		**2/2 High**	**2/2 High**					
Tailings Basin Drain System				0.0	0.0							N	
Tailings Basin Subtotal				**0.0**	**0.0**								
Dunka Road & Water Pipeline	4000	3		0.78	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4001	3		0.45	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4002	3		0.30	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4003	3		0.47	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4004	3		0.01	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4005	4		0.25	0.00	deep marsh	Moderate	Moderate	Moderate	impounded	Natural	Y	Direct
Dunka Road & Water Pipeline	4006	5		0.05	0.00	open water	Moderate	Moderate	Moderate	impounded	Natural	Y	Direct
Dunka Road & Water Pipeline	4007	6		0.88	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4008	6		1.28	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4009	6		0.03	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4010	6		0.68	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4011	6		1.27	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4012	6		0.06	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4013	6		0.92	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4014	6		0.29	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct

Table 3: Summary of Total Project Wetland Impacts by Eggers & Reed Type [1]
Revised November 26, 2007
NorthMet Mine/PolyMet Mining Inc.

Project Area	**Circular 39**	**1**	**2**	**2**	**3**	**4**	**5**	**6**	**6**	**7**	**7**	**8**	**8**	**Wetland Total**
	Eggers and Reed Wetland Classification	**Deepwater**	**Fresh (Wet) Meadow**	**Sedge Meadow**	**Shallow Marsh**	**Deep Marsh**	**Shallow, Open Water**	**Shrub-Carr**	**Alder Thicket**	**Hardwood Swamp**	**Coniferous Swamp**	**Open Bog**	**Coniferous Bog**	
Mine Site	Direct (acres)	0.0	14.6	25.9	23.6	0.0	0.0	2.4	61.5	20.0	62.6	70.7	502.5	784.0
	Indirect (acres)	0.0	0.0	2.1	0.0	0.0	0.0	0.0	5.4	0.0	0.0	5.4	47.2	60.1
	Total (acres)	0.0	14.6	28.1	23.6	0.0	0.0	2.4	66.9	20.0	62.6	76.1	549.7	844.1
	# wetlands	0	1	16	1	0	0	4	2	6	1	2	26	59
Railroad	(acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.10	0.00	0.00	0.00	0.3
	# wetlands	0	0	0	0	0	0	1	0	1	0	0	0	2
Tailings Basin Drain System	(acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	# wetlands													
Dunka Road/Water Pipeline	(acres)	0.5	0.0	0.0	2.0	0.2	0.05	6.6	0.0	0.0	0.4	0.0	0.0	9.8
	# wetlands	1	0	0	4	1	1	13	0	0	1	0	0	21
Total	(acres)	0.5	14.6	28.1	25.6	0.2	0.05	9.1	66.9	20.1	63.1	76.1	549.7	854.1

Table 4: Summary of 5-Year Wetland Impacts and Mitigation
by Eggers and Reed Classification[1]
November 26, 2007
PolyMet Mining Company

Wetland Type	Aitkin Wetland Mitigation Area (acres)	Hinckley Wetland Mitigation Area (acres)	Wetland Mitigation Total (acres)	Proposed Project Wetland Impacts (acres)	Proposed 5-Year Wetland Impacts (acres)	5-Year Wetland Impacts Compensated[2] (acres)
Deepwater	0.0	0.0	0.0	0.5	0.5	0.0
Type 1 Seasonally Flooded	0.0	0.0	0.0	0.0	0.0	0.0
Type 2 Fresh (Wet) Meadow	21.8	14.3	36.1	14.6	14.6	26.0
Type 2 Sedge Meadow[3]	47.1	5.4	52.5	28.1	26.8	38.7
Type 3 Shallow Marsh	86.9	0.0	86.9	25.6	21.1	61.4
Type 4 Deep Marsh	33.6	0.0	33.6	0.2	0.2	22.4
Type 5 Shallow, Open Water	0.0	0.0	0.0	0.05	0.05	0.0
Type 6 Shrub-Carr	83.9	38.9	122.8	9.1	9.1	83.1
Type 6 Alder Thicket	82.8	27.4	110.2	66.9	61.2	82.4
Type 7 Hardwood Swamp[4]	52.6	0.0	52.6	20.1	15.0	37.8
Type 7 Coniferous Swamp	89.1	0.0	89.1	63.1	63.1	67.8
Type 8 Open Bog	74.2	0.0	74.2	79.8	45.6	59.4
Type 8 Coniferous Bog	238.2	101.2	339.4	546.0	444.6	271.5
Upland Buffer	123.1	11.4	134.5			33.6
Upland Total	**123.1**	**11.4**	**134.5**			**33.6**
Wetland Total	**810.2**	**187.2**	**997.4**	**854.1**	**701.8**	**750.5**
Total	**933.3**	**198.6**	**1131.9**	**854.1**	**701.8**	**784.1**

[1] Assumes restoration of the entire Aitkin site and the northern half of the Hinckley site within the first 5 years of the project.

[2] Assumes 1.25:1 replacement for the same wetland types and 1.5:1 for different types.

[3] The total restoration area includes 0.8 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

[4] The total restoration area includes 6.1 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

Table 5: Summary of 5-Year Project Wetland Impacts by Eggers & Reed Type [1]

Revised November 26, 2007

NorthMet Mine/PolyMet Mining Inc.

Project Area	Circular 39	1	2	2	3	4	5	6	6	7	7	8	8	
	Eggers and Reed Wetland Classification	**Deepwater**	**Fresh (Wet) Meadow**	**Sedge Meadow**	**Shallow Marsh**	**Deep Marsh**	**Shallow, Open Water**	**Shrub-Carr**	**Alder Thicket**	**Hardwood Swamp**	**Coniferous Swamp**	**Open Bog**	**Coniferous Bog**	**Wetland Total**
Mine Site	Direct (acres)	0.0	14.6	26.8	19.1	0.0	0.0	2.4	61.2	14.9	62.6	45.6	444.6	691.7
	Indirect (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total (acres)	0.0	14.6	26.8	19.1	0.0	0.0	2.4	61.2	14.9	62.6	45.6	444.6	691.7
	# wetlands	0	4	2	8	0	0	1	15	3	6	5	28	72
Raillroad	(acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.10	0.00	0.00	0.00	0.3
	# wetlands	0	0	0	0	0	0	1	0	1	0	0	0	2
Tailings Basin Drain System	(acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	# wetlands													
Dunka Road/Water Pipeline	(acres)	0.5	0.0	0.0	2.0	0.2	0.05	6.6	0.0	0.0	0.4	0.0	0.0	9.8
	# wetlands	1	0	0	5	1	1	13	0	0	1	0	0	22
Total	(acres)	0.5	14.6	26.8	21.1	0.2	0.05	9.1	61.2	15.0	63.1	45.6	444.6	701.8

Table 6: Summary of Off-Site Wetland Mitigation
January 15, 2008
PolyMet Mining Company

Wetland Type	**Aitkin Wetland Mitigation Area (acres)**	**Hinckley Wetland Mitigation Area (acres)**	**Off-Site Wetland Mitigation Total (acres)**	**Proposed Project Wetland Impacts (acres)**	**Total Wetland Impacts Compensated[1] (ac)**
Deepwater				0.5	0.0
Type 1 Seasonally Flooded	0	20.1	20.1	0.0	13.4
Type 2 Fresh (Wet) Meadow	21.8	14.3	36.1	14.6	26.0
Type 2 Sedge Meadow[2]	47.1	39.9	87.0	28.1	61.7
Type 3 Shallow Marsh	86.9	1.4	88.3	25.6	62.3
Type 4 Deep Marsh	33.6	0.0	33.6	0.2	22.4
Type 5 Shallow, Open Water	0.0	0.0	0.0	0.05	0.0
Type 6 Shrub-Carr	83.9	87.1	171.0	9.1	115.2
Type 6 Alder Thicket	82.8	27.4	110.2	66.9	82.4
Type 7 Hardwood Swamp[3]	52.6	13.2	65.8	20.1	46.5
Type 7 Coniferous Swamp	89.1	8.4	97.5	63.1	73.4
Type 8 Open Bog	74.2	0.0	74.2	76.1	59.4
Type 8 Coniferous Bog	238.2	101.2	339.4	549.7	271.5
Upland Buffer	123.1	79.2	202.3		50.6
Upland Total	**123.1**	**79.2**	**202.3**		**50.6**
Wetland Total	**810.2**	**313.0**	**1123.2**	**854.1**	**834.3**
Total	**933.3**	**392.2**	**1325.5**	**854.1**	**884.9**

[1] Assumes 1.25:1 replacement for the same wetland types and 1.5:1 for different types.

[2] The total restoration area includes 0.8 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

[3] The total restoration area includes 6.1 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

Table 7: Wetland Mitigation Target Community Summary
PolyMet Mining Company

Restoration Area ID	Area (acres)	Circ 39 Wetland Type	Eggers & Reed Classification
Aitkin Wetland Restoration Site			
1	21.6	Type 4	Deep Marsh
2	36.2	Type 3	Shallow Marsh
3	47.1	Type 2	Sedge Meadow
4	14.7	Type 2	Wet Meadow
5	23.4		Upland
6	55.6	Type 6	Alder Thicket
7	74.2	Type 8	Open Bog
8	83.9	Type 6	Shrub Carr
9	238.2	Type 8	Coniferous Bog
10	23.1		Upland
11	7.1	Type 2	Wet Meadow
12	89.1	Type 7	Coniferous Swamp
13	71.4		Upland
14	12.0	Type 4	Deep Marsh
15	50.7	Type 3	Shallow Marsh
16	52.6	Type 7	Hardwood Swamp
17	27.2	Type 6	Alder Thicket
18	1.4		Upland
19	3.8		Upland
Hinckley Wetland Restoration Site			
1	21.1	Type 6	Shrub Carr
2	4.2		Upland
3	27.4	Type 6	Alder Thicket
4	5.4		Upland
5	14.3	Type 2	Wet Meadow
6	101.2	Type 8	Coniferous Bog
7	1.7		Upland
8	5.4	Type 2	Sedge Meadow
9	44.1	Type 6	Shrub Carr
10	22.2	Type 2	Sedge Meadow
11	10.1	Type 7	Hardwood Swamp
12	8.4	Type 7	Coniferous Swamp
13	9.7		Upland
14	23.0		Upland
15	1.4	Type 3	Shallow Marsh
16	20.1	Type 1	Seasonally Flooded
17	3.9		Upland
18	15.7		Upland
19[1]	3.1	Type 7	Hardwood Swamp
20[1]	0.4	Type 2	Sedge Meadow
21	4.1	Type 6	Shrub Carr
22	11.9	Type 2	Sedge Meadow
23	15.6		Upland
24	12.3	Type 6	Shrub Carr
25	5.5	Type 6	Shrub Carr
Upland Total	202.3		
Wetland Total	1123.2		

[1] Area shown is the 50 percent credit proposed for restoring existing, partially drained wetland.

P:\Mpls\23 MN\69\2369862\WorkFiles\WO 008 Corps Wetlands Permit\WetlandMitigation\WetlandMitigation\RS-20T_03\PolyMet_Mitigation_Tables2_112807.xls\Table7_112807

Table 8: Wetland Mitigation Target Hydrology
PolyMet Mining Company

Circular 39	**Eggers and Reed Wetland Classification**	**Target Hydrology (inches)**	**Target Hydroperiod (days)[1]**	**Storm Event Flooding Tolerance (depth in./days)[2]**
1	Seasonally Flooded	24 to -12	>15	30/45
2	Fresh (Wet) Meadow	0 to -6	>60	12/15
2	Sedge Meadow	3 to -6	>120	6/7
3	Shallow Marsh	0 to 6	>60	18/30
4	Deep Marsh	6 to 36	>140	48/30
6	Shrub-Carr	6 to -6	>30	12/15
6	Alder Thicket	6 to -6	>30	12/15
7	Hardwood Swamp	0 to -6	>60	12/30
7	Coniferous Swamp	0 to -6	>60	6/30
8	Open Bog	0 to -6	>90	6/30
8	Coniferous Bog	0 to -6	>90	6/30

[1] Time during the growing season, under normal conditions, in which target hydrology is present

[2] Water depth tolerance in response to 10-year return period storm event

Table 9: Berm and Dike Upland Seed Mix
PolyMet Mining Company

BWSR Berm Mix No. 2

Common Name	**Botanical Name**	**% of Mix**
Slough grass, American	*Beckmannia syzigachne*	4.0
Oats or Winter wheat*	*Avena sativa or Triticum aestivum*	40.0
Grama, sideoats	*Bouteloua curtipendula*	6.0
Wild-rye, Canadian	*Elymus canadensis*	6.0
Wild-rye, Virgina	*Elymus virginicus*	8.0
Wheat-grass, slender	*Elymus trachycaulus*	10.0
Rye-grass, annual	*Lolium italicum*	8.0
Switchgrass	*Panicum virgatum*	2.0
Bluestem, little	*Schizachyrium scoparium*	8.0
Bluegrass, fowl	*Poa palustris*	8.0
	Total:	100.0

Rate: 30.0 PLS lbs/acre

***Note:** Oats are used in spring plantings and winter wheat in fall plantings

Figures

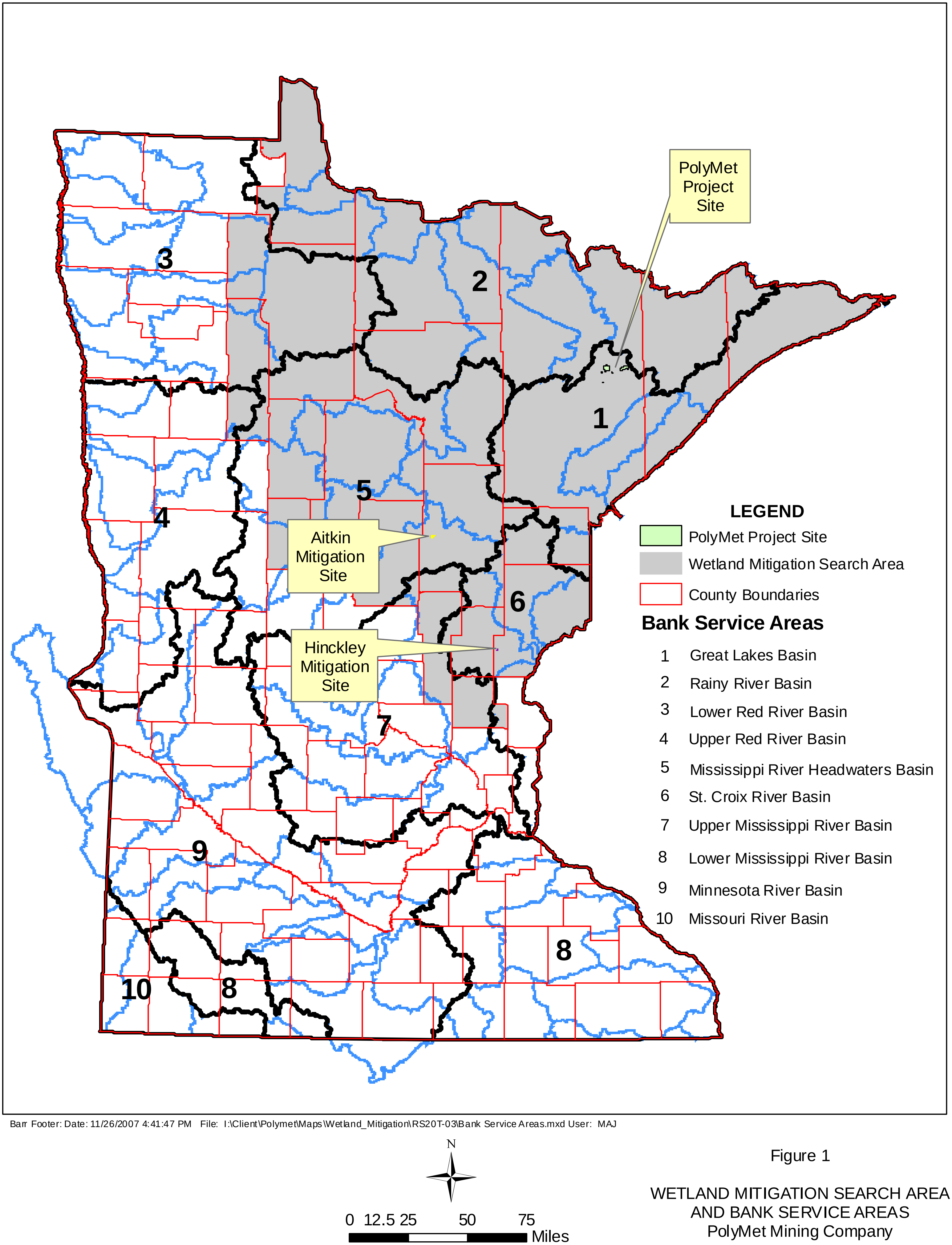

Figure 1

WETLAND MITIGATION SEARCH AREA
AND BANK SERVICE AREAS
PolyMet Mining Company

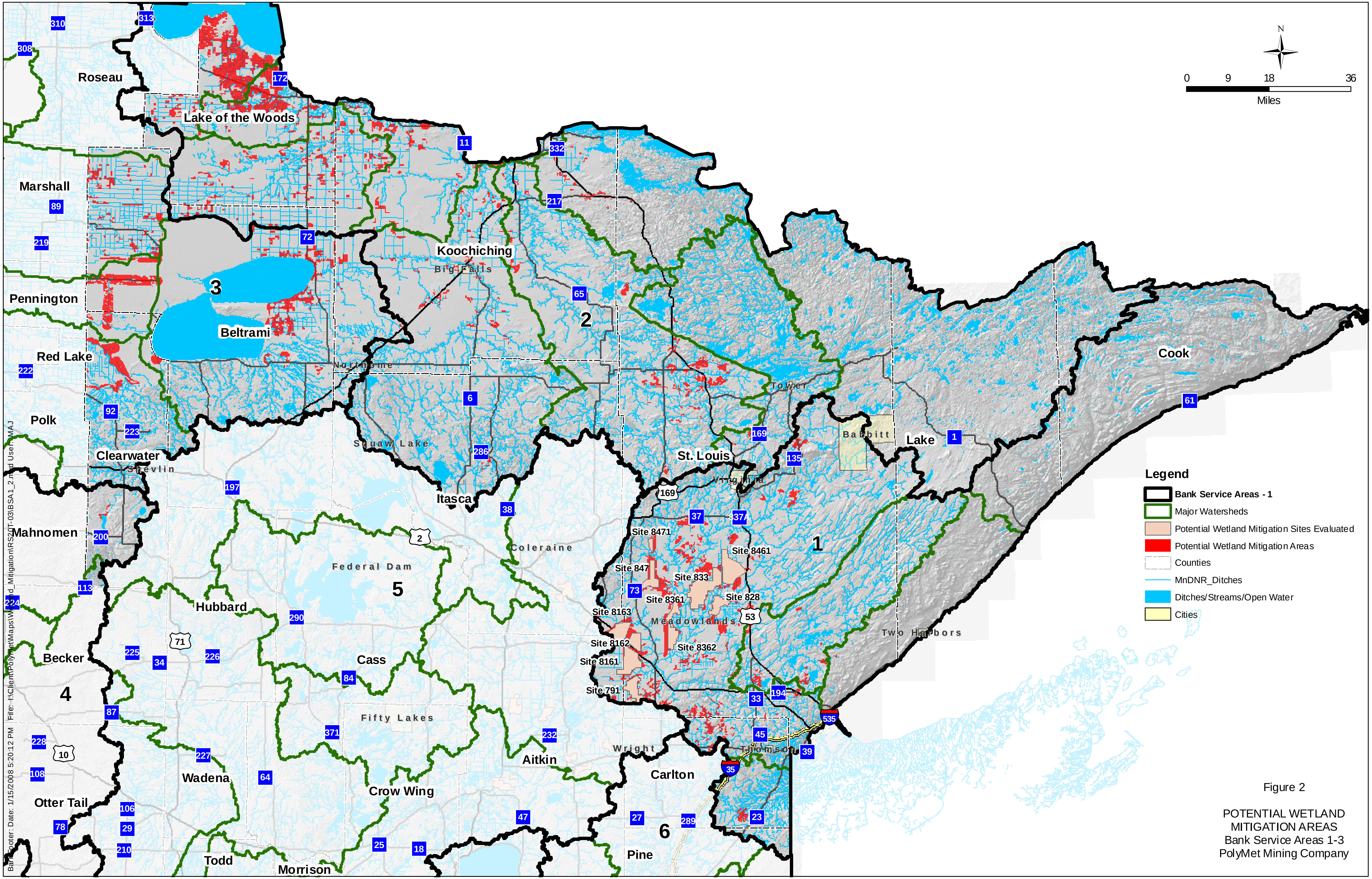

Figure 2

POTENTIAL WETLAND
MITIGATION AREAS
Bank Service Areas 1-3
PolyMet Mining Company

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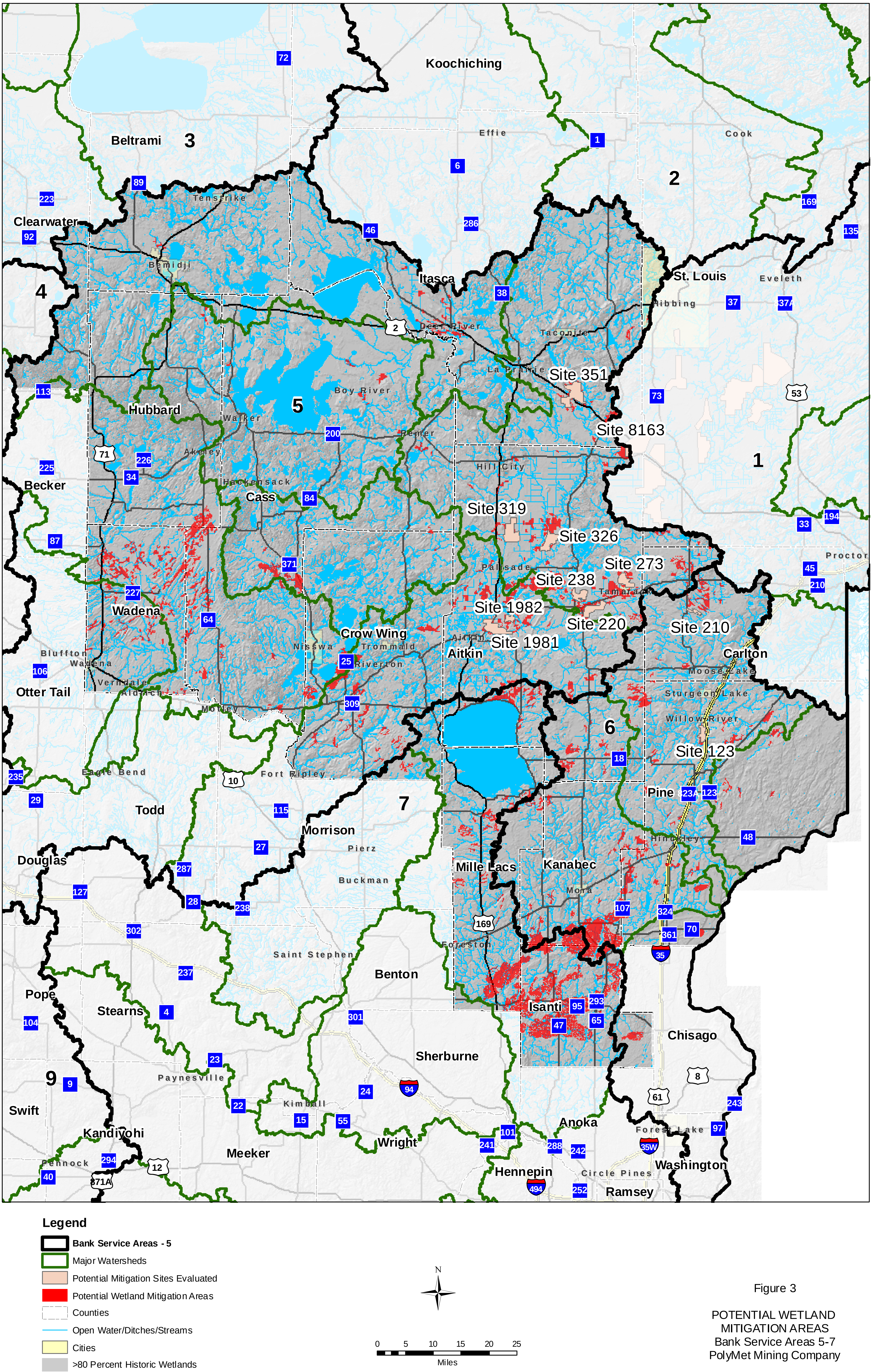
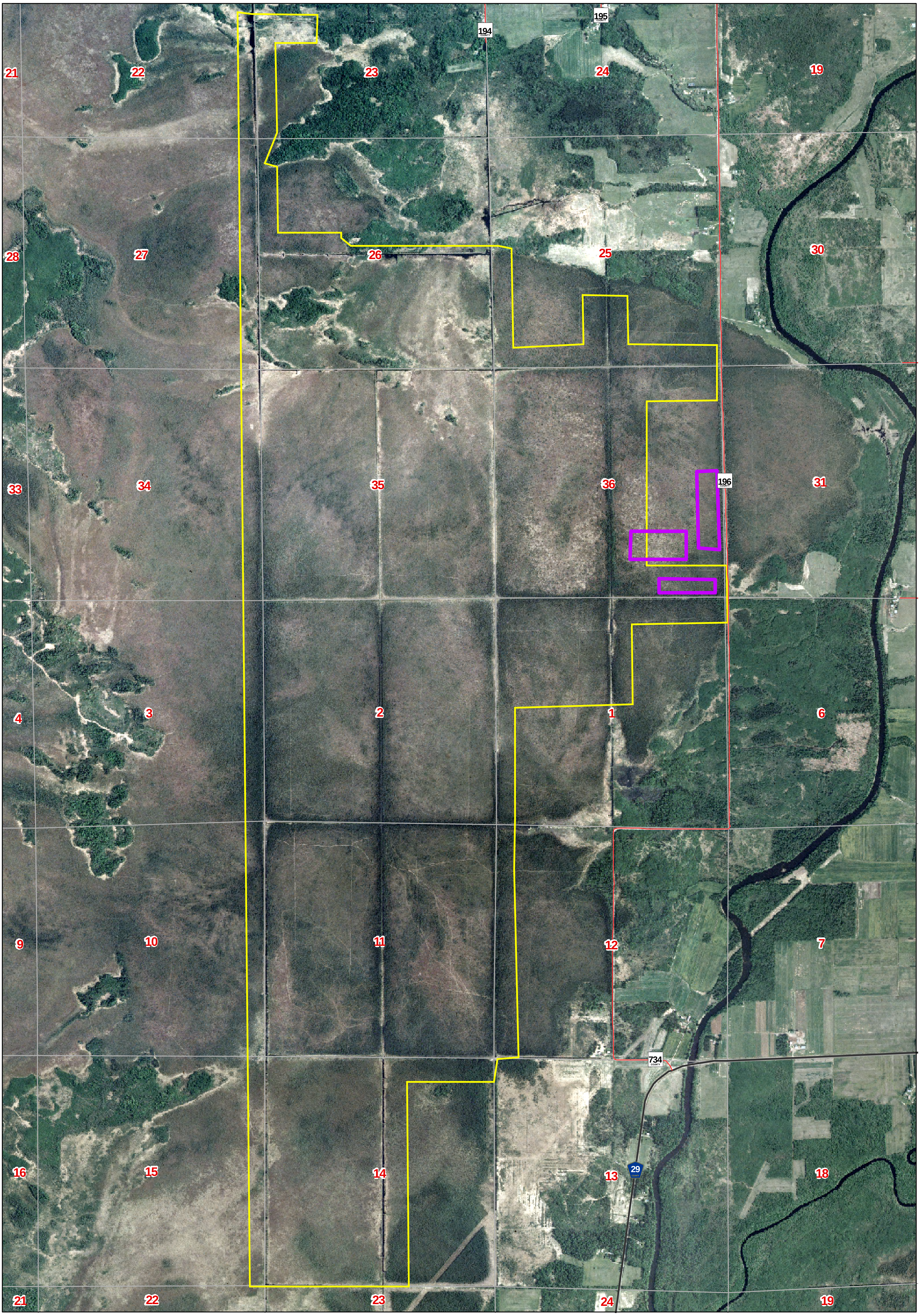


Figure 3

POTENTIAL WETLAND
MITIGATION AREAS
Bank Service Areas 5-7
PolyMet Mining Company



Legend

🟪 Potential Sphagnum Donor Sites - 46 acres

🟨 Wetland Restoration Area Studied

☐ Sections

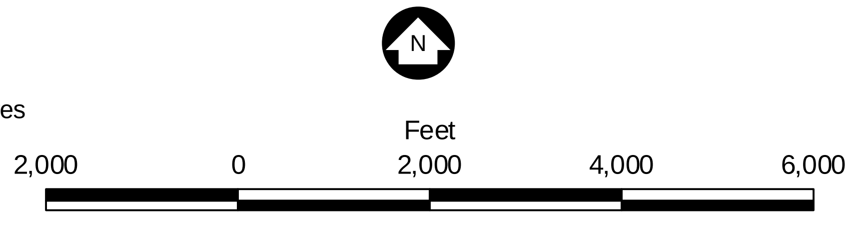
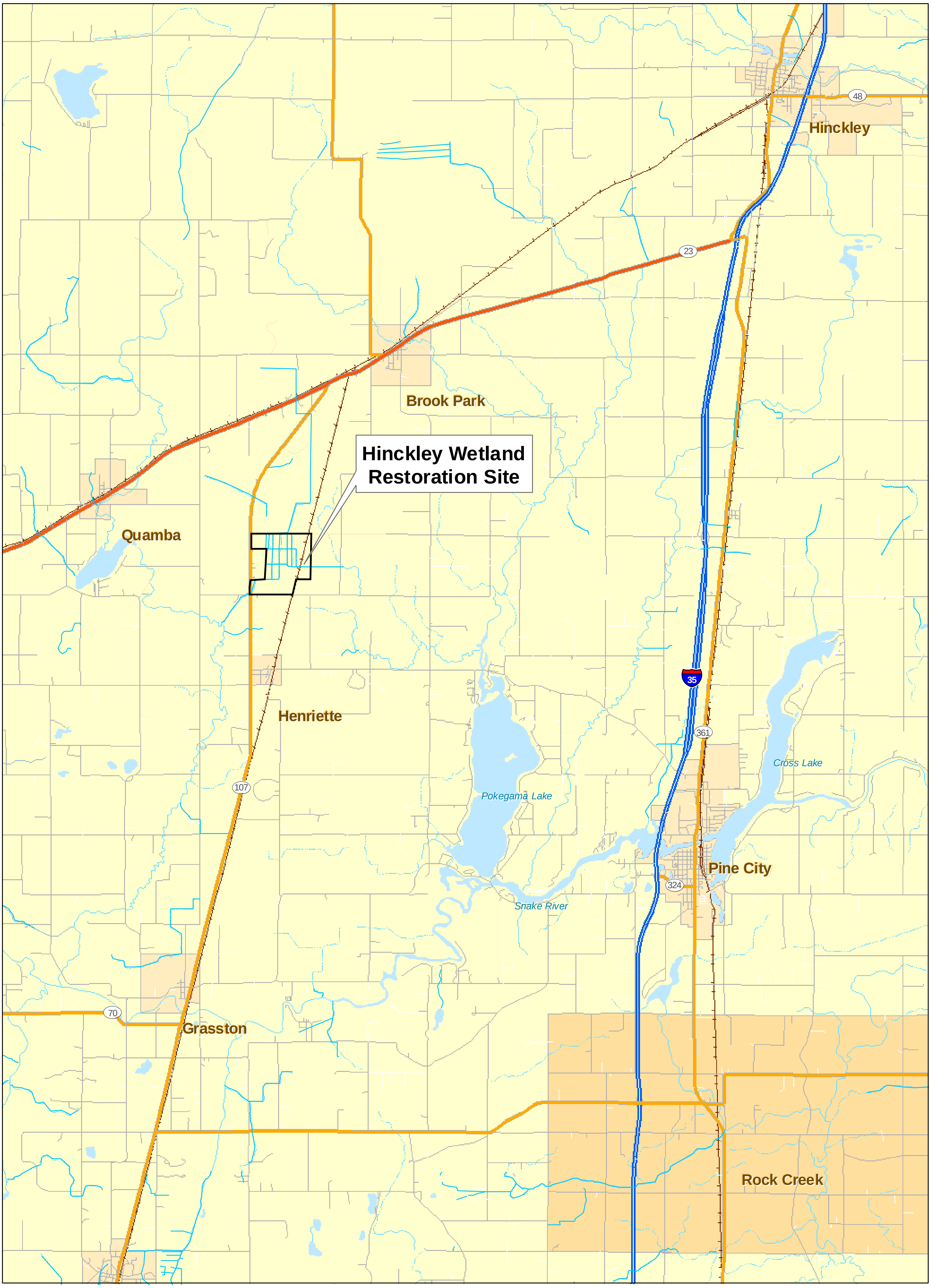


Figure 4

SITE 8362
NorthMet Mine/PolyMet Mining Co.
St. Louis County, Minnesota



Legend

- ▭ Approximate Property Boundaries
- ═ Limited Access
- ━ Highway
- ━ Major Road
- ─ Local Road
- ─ Minor Road
- ‐‐‐ Other Road

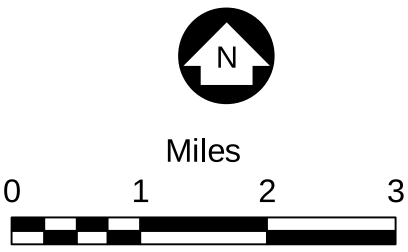


Figure 5

LOCATION MAP
Hinckley Wetland Mitigation Site
PolyMet Mining Company
Pine County

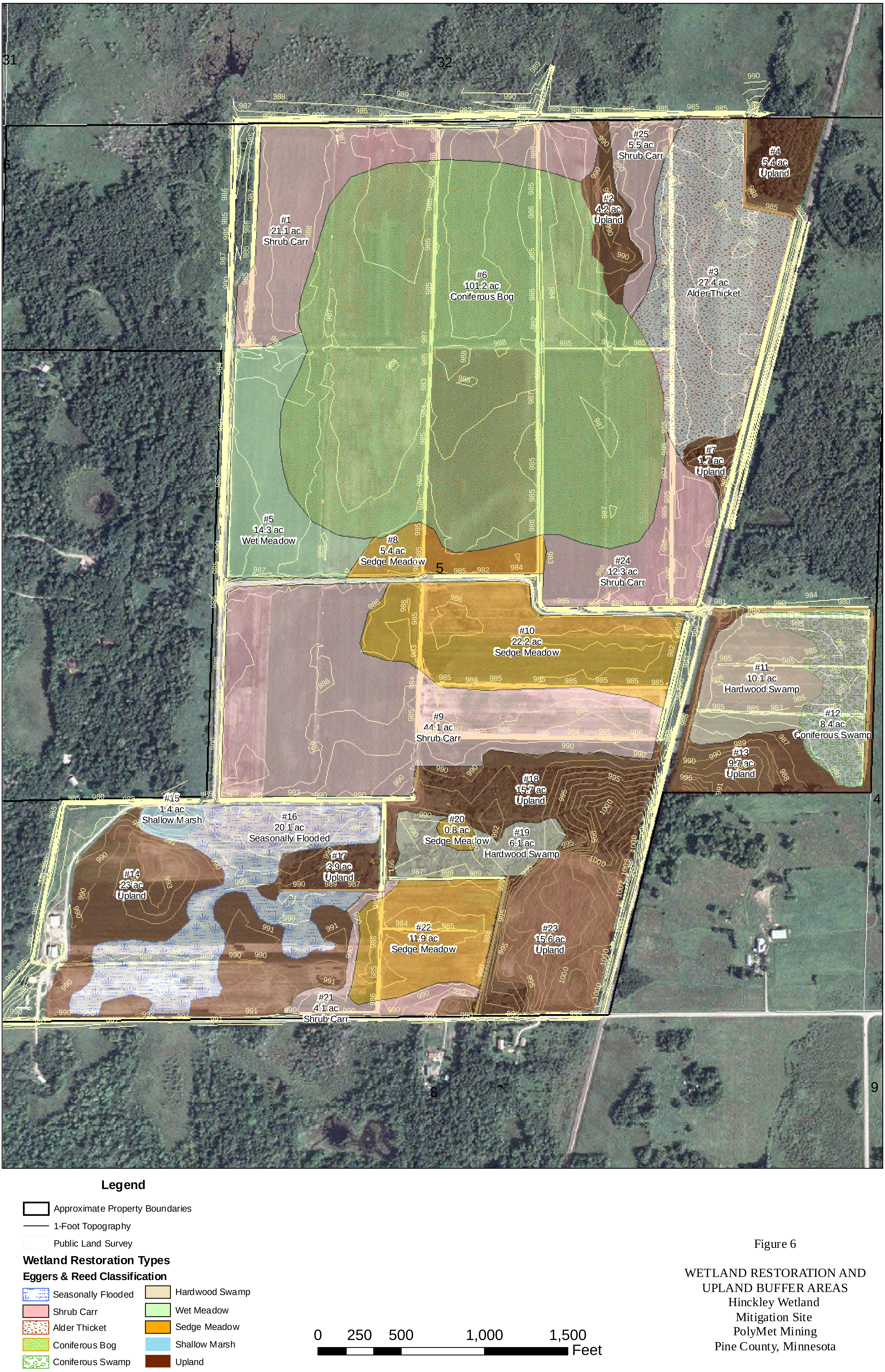


Figure 6

WETLAND RESTORATION AND
UPLAND BUFFER AREAS
Hinckley Wetland
Mitigation Site
PolyMet Mining
Pine County, Minnesota

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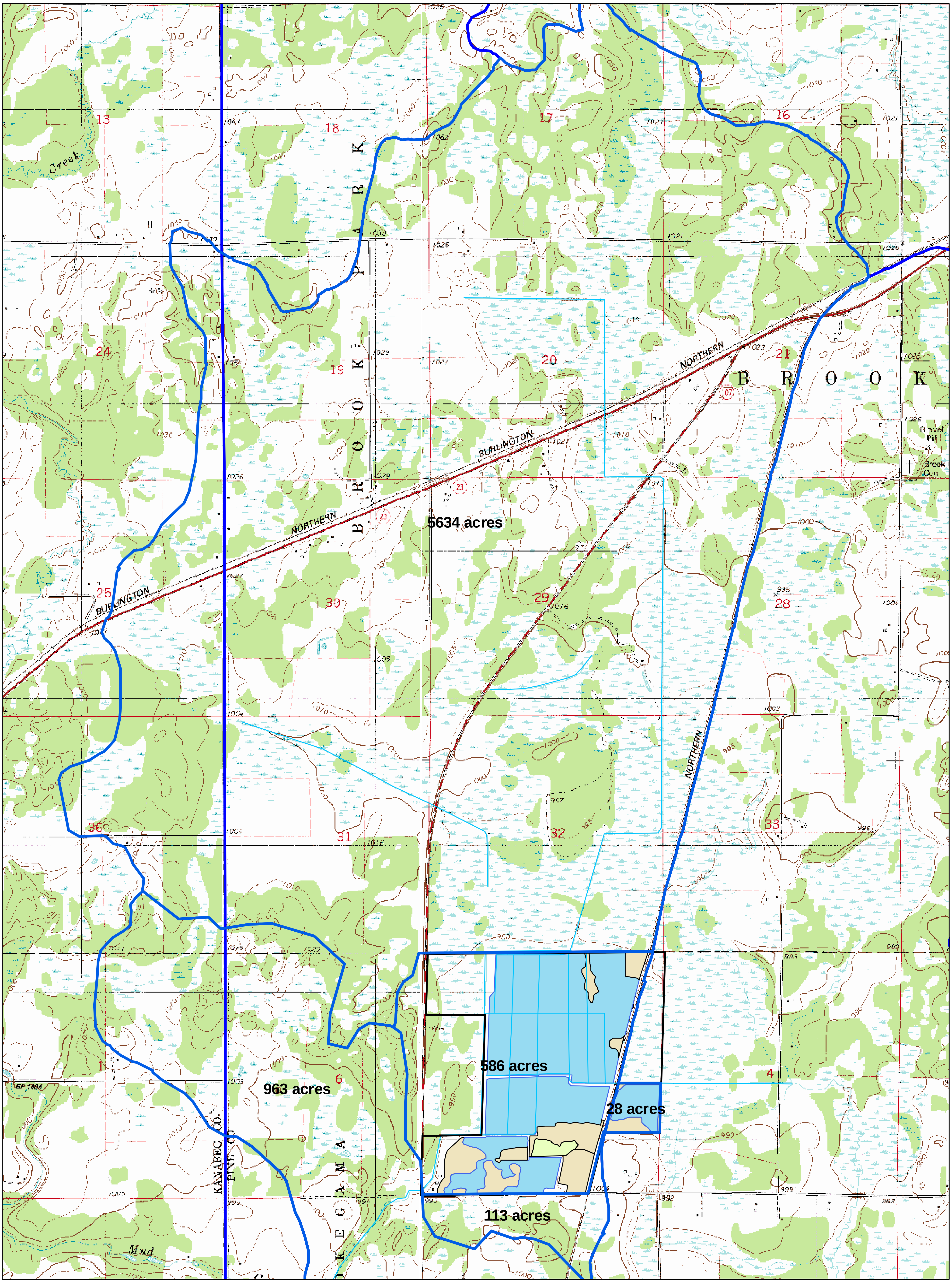

Legend

🟦 Drainage Areas

☐ Approximate Property Boundaries

Restoration Areas

▨ Upland Buffer

🟦 Wetland

0 1,000 2,000 4,000
Feet

Figure 7

DRAINAGE AREAS
Hinckley Wetland
Mitigation Site
PolyMet Mining Company
Pine County, Minnesota

Barr Footer: Date: 12/7/2007 2:45:14 PM File: I:\Client\Polymet\Maps\Wetland_Mitigation\RS20T-03\Figure7_Hinckley_Sod_Drainage_Areas.mxd User: MAJ

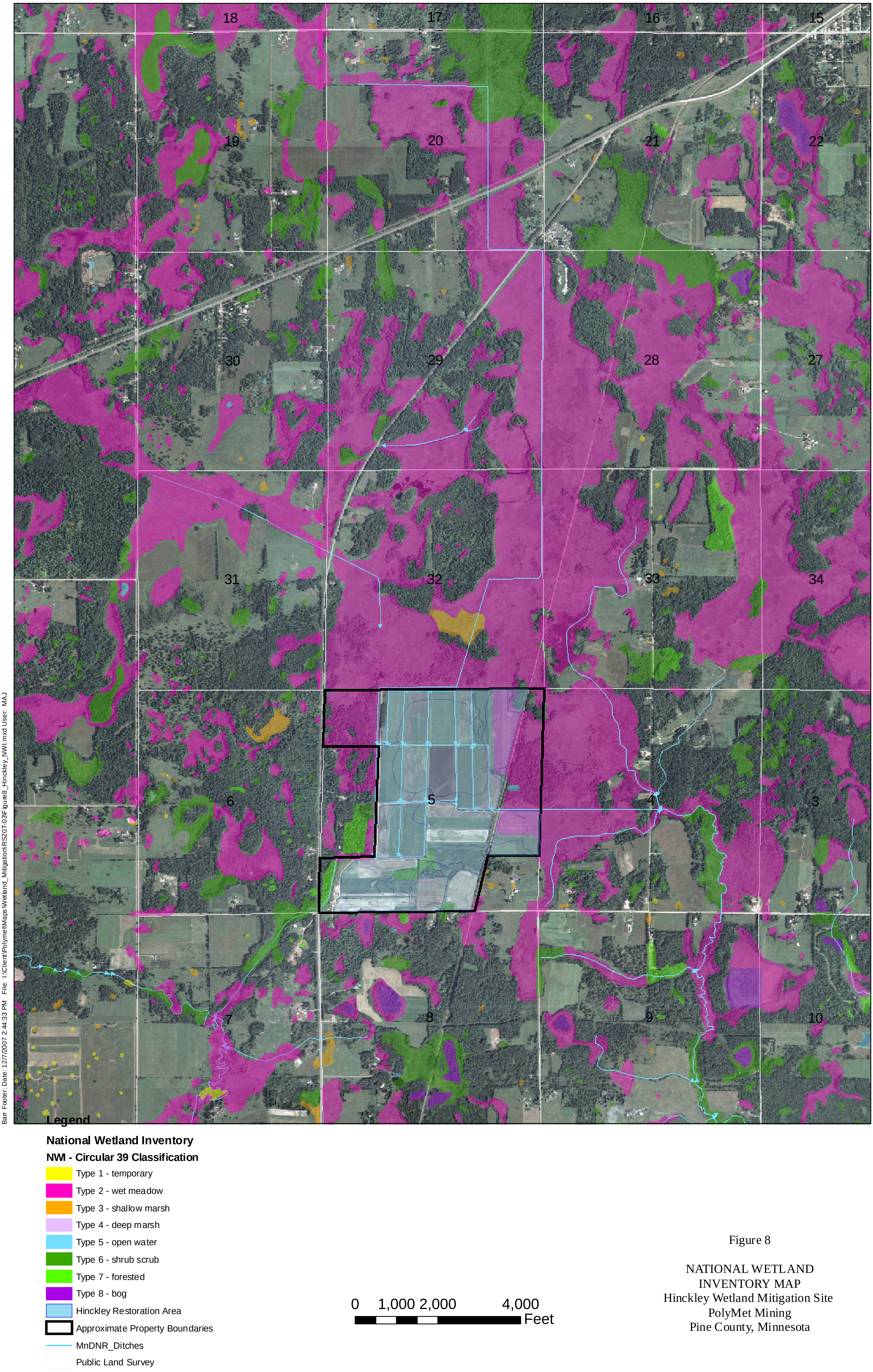

Figure 8

NATIONAL WETLAND
INVENTORY MAP
Hinckley Wetland Mitigation Site
PolyMet Mining
Pine County, Minnesota

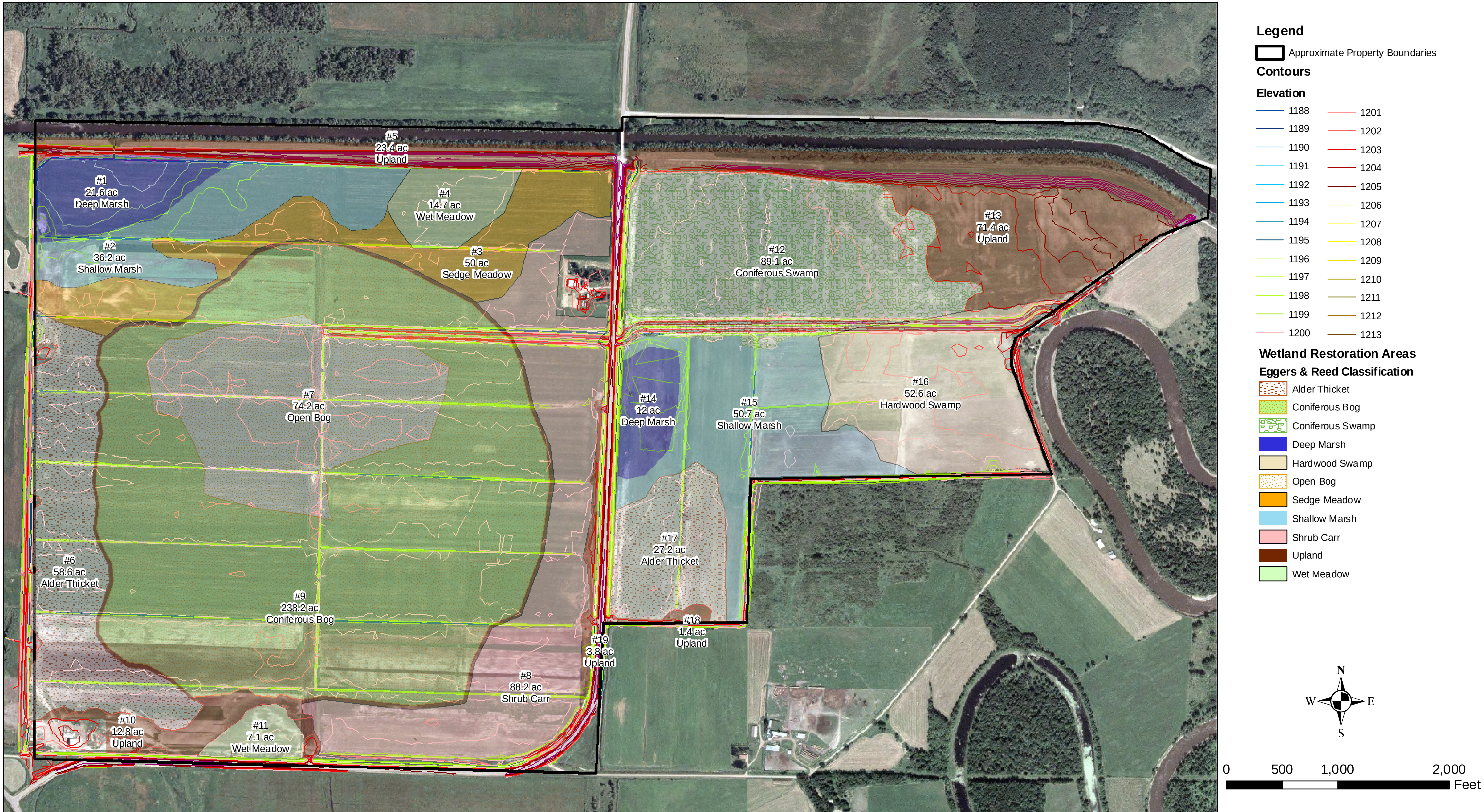

Figure 9

WETLAND RESTORATION PLAN
Aitkin Wetland Restoration Site
PolyMet Mining Company

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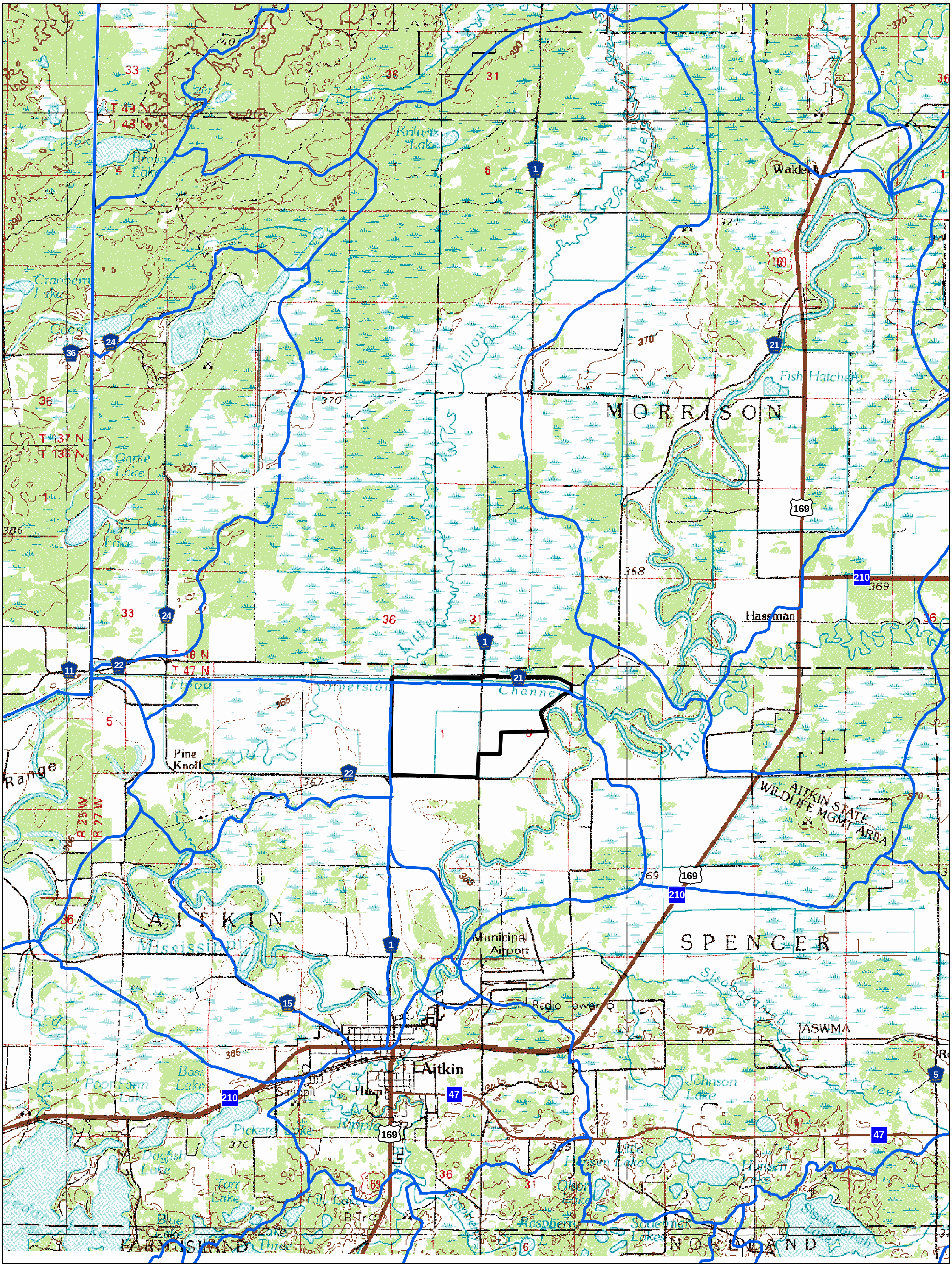


Legend

▭ Subwatersheds

▭ Aitkin Wetland Restoration Site

N

Miles

1 0 1

Figure 10

DRAINAGE AREA MAP
Aitkin Wetland Restoration
PolyMet Mining Company
Aitkin County, Minnesota

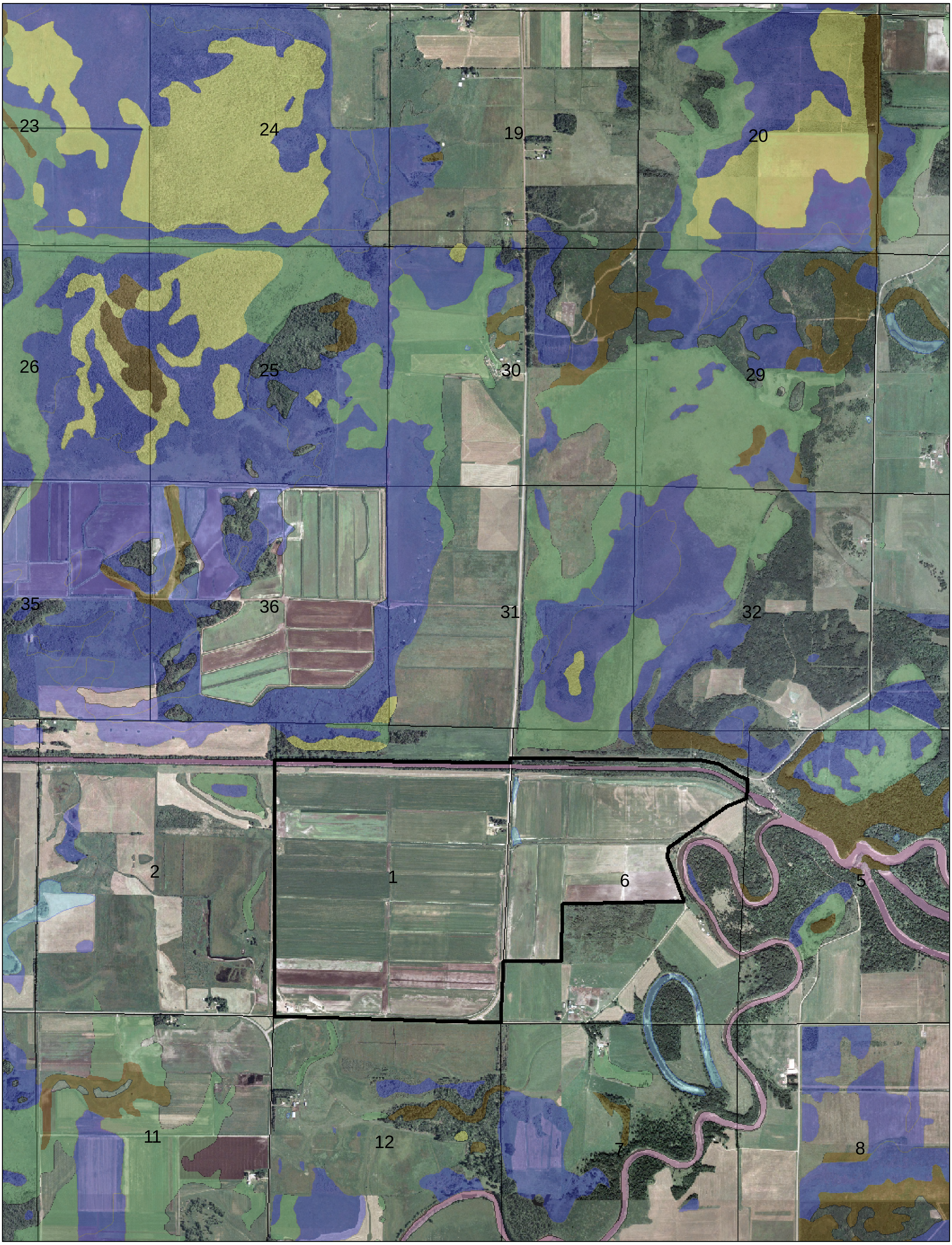


Figure 11

NATIONAL WETLAND INVENTORY
Aitkin Wetland Restoration Site
PolyMet Mining Company

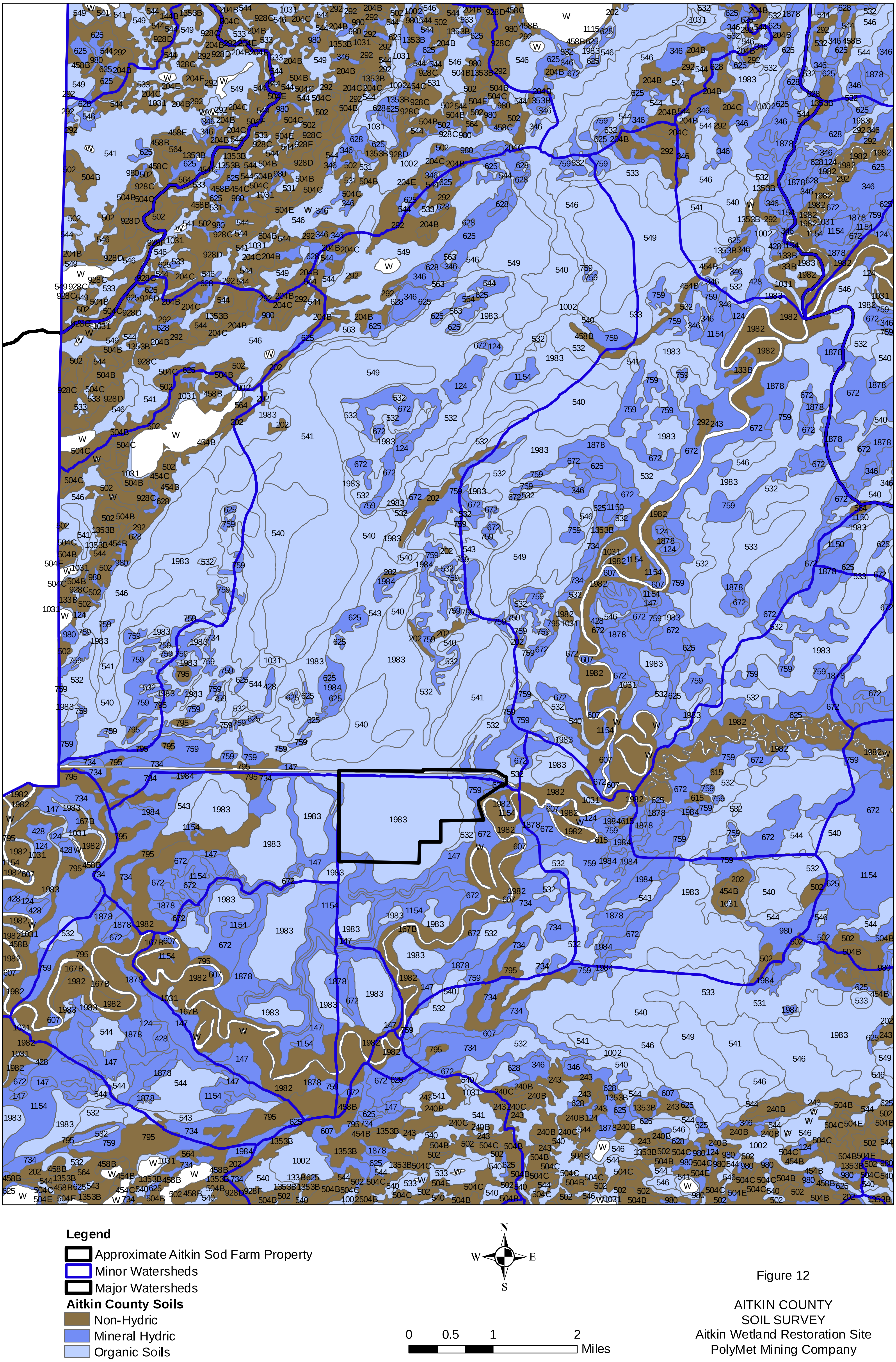


Figure 12

AITKIN COUNTY
SOIL SURVEY
Aitkin Wetland Restoration Site
PolyMet Mining Company

Figure 13

1939 AERIAL PHOTO
Hinckley Wetland
Mitigation Site
PolyMet Mining
Pine County, Minnesota

Legend

▭ Approximate Property Boundaries

Figure 14

1940 AERIAL PHOTO
Aitkin Wetland Restoration Site
PolyMet Mining Company
Aitkin, Minnesota

Legend

🟥 Approximate Property Boundaries

☐ Public Land Survey

Figure 15

1991 AERIAL PHOTO
Aitkin Wetland Restoration Site
PolyMet Mining Company
Aitkin, Minnesota

Legend

Wetland Restoration Areas

🟩 Partially Drained Wetland
🟫 Upland Buffer
🟦 Wetland
⬜ Public Land Survey

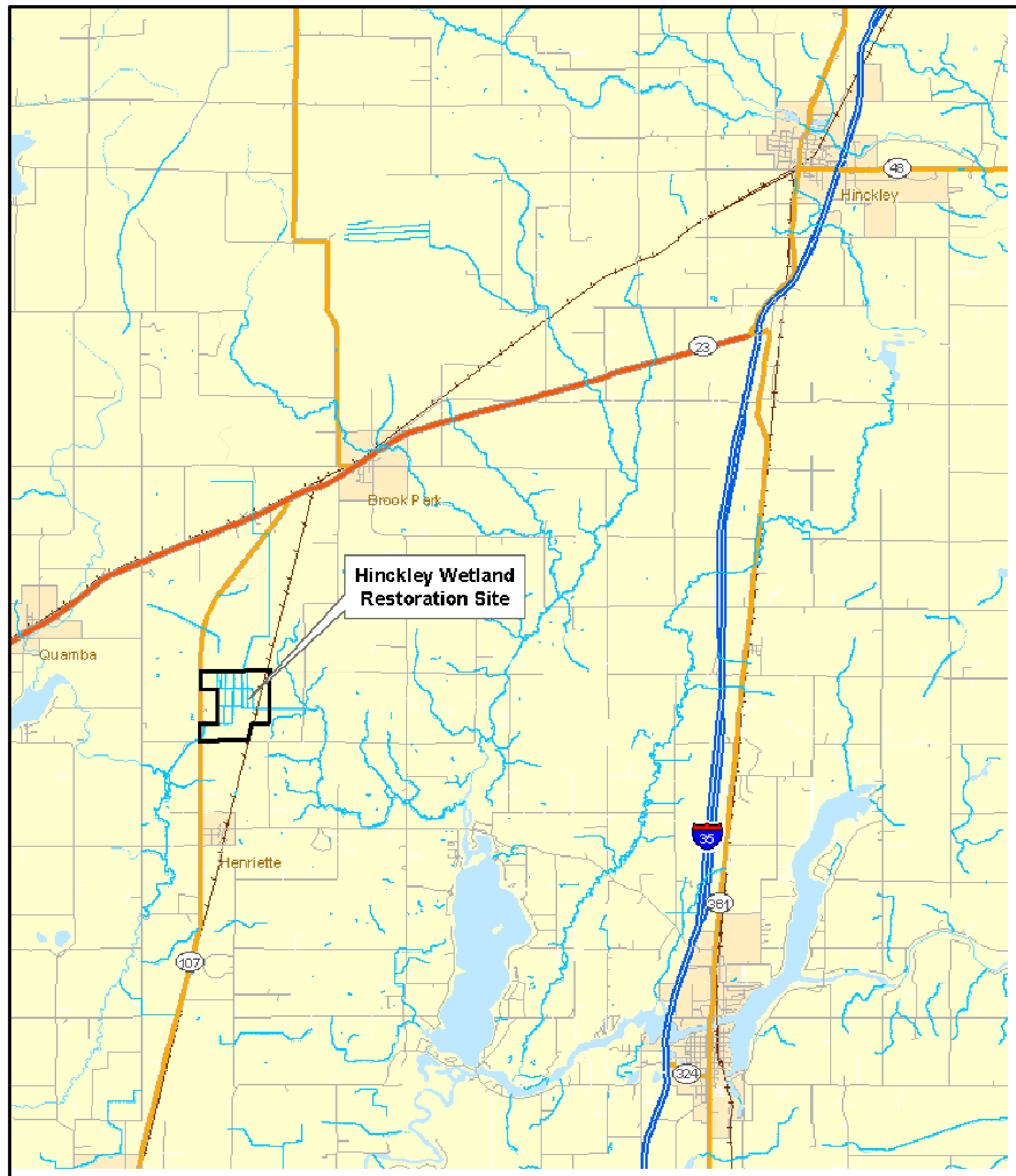
0 300 600 1,200
Feet

Figure 16

1991 AERIAL PHOTOGRAPH
Hinckley Wetland
Mitigation Site
PolyMet Mining
Pine County, Minnesota

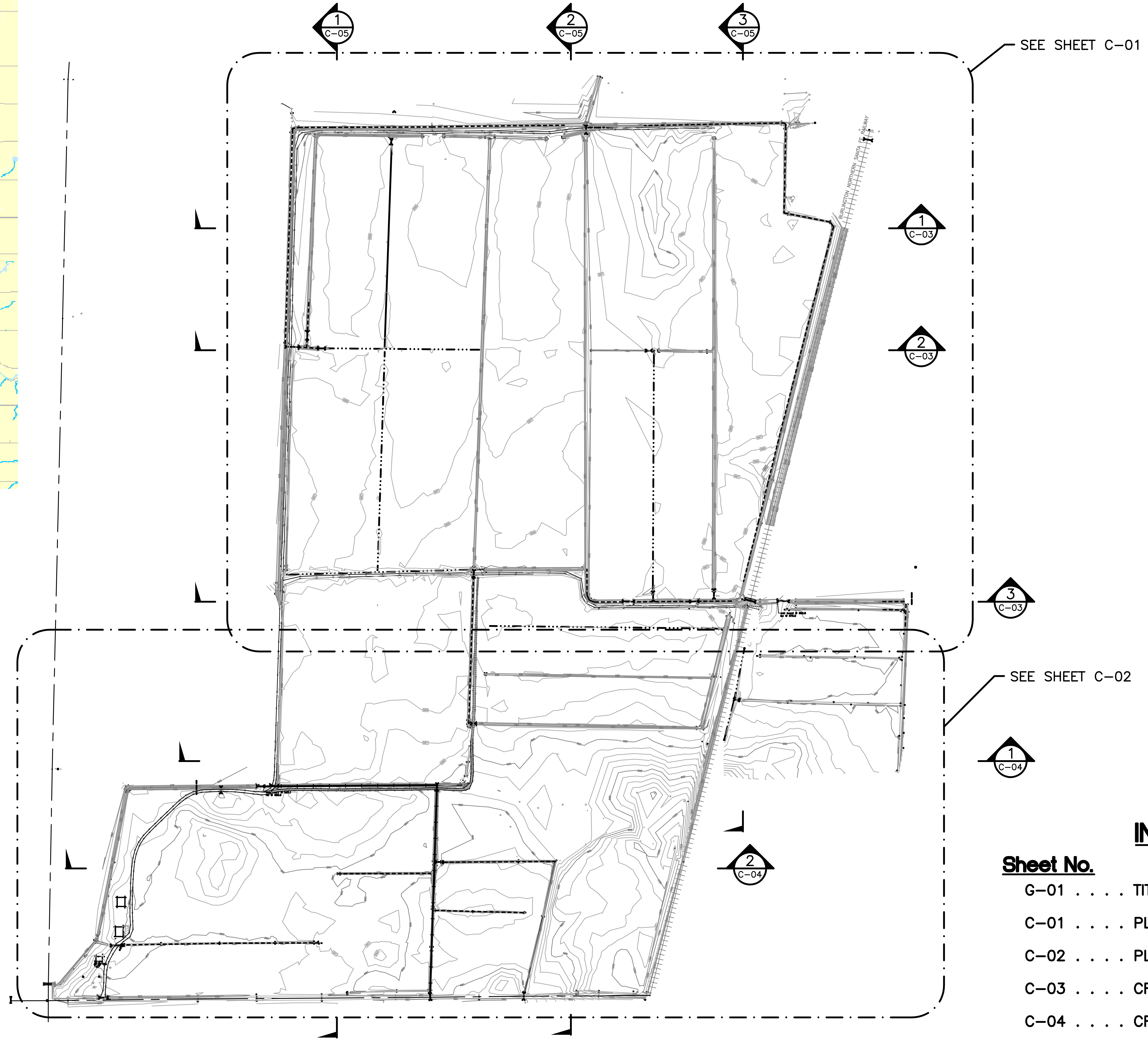
Appendix A
Hinckley Wetland Restoration Plans

POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA
HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA



SITE LOCATION MAP

STATE MAP



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SCALE IN FEET

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Designed	MAJ
Approved	MAJ

POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

TITLE SHEET, INDEX, AND
SITE LOCATION MAP

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. G-01
REV. No.

① PLAN: PLAN DETAILS – SOUTH HALF
1"=200'-0"

0 200 400
SCALE IN FEET

LEGEND

▨	FILL DITCH
▨	ABANDON STRUCTURE
▨	REMOVE DIKE/ESTABLISH OVERFLOW
▨	RESTORE WETLAND

>—<	PERMANENT CULVERT
>═<	TEMPORARY CULVERT WITH FUTURE WEIR
⌒	WEIR
▪▪▪▪▪▪	FILL DITCH
— 988 —	1-FOOT CONTOURS

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HOYT LAKES, MINNESOTA

HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

PLAN DETAILS – SOUTH HALF

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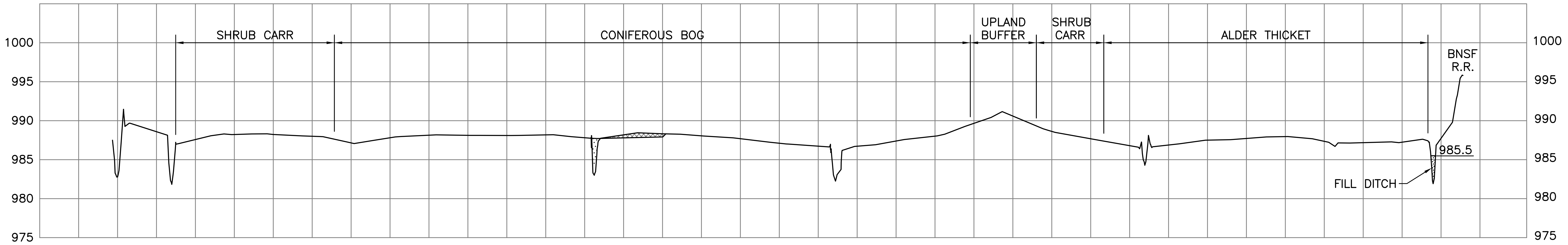
23/69-862
CLIENT PROJECT No.

DWG. No.
C-02
REV. No.



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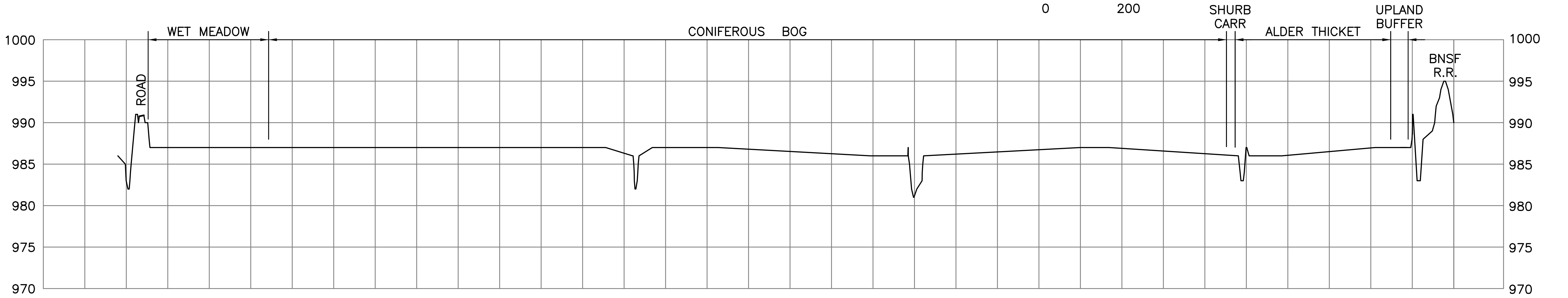

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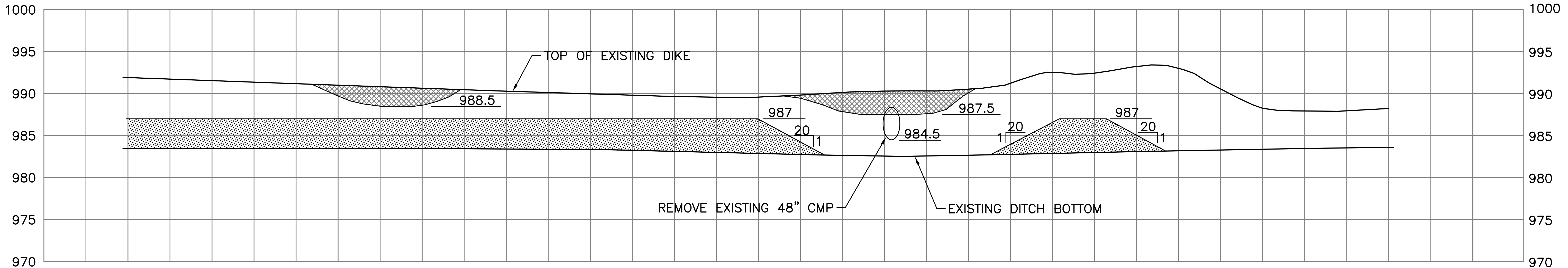
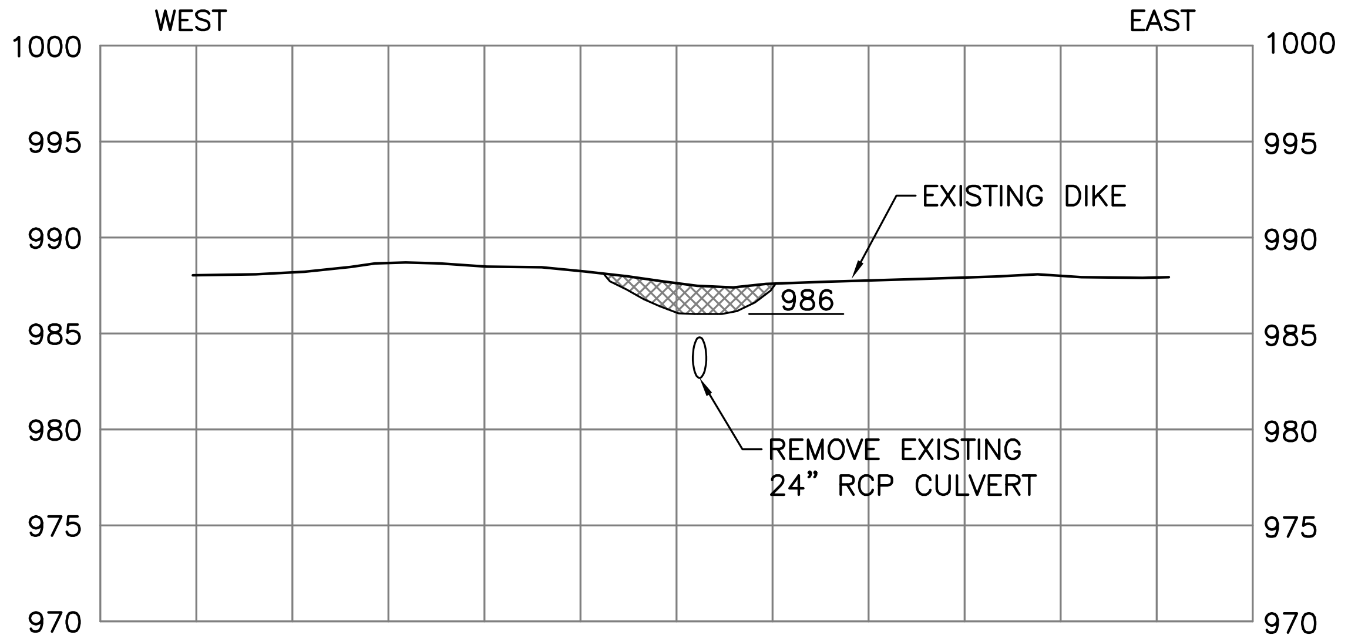
▨ ABANDON STRUCTURE

▩ REMOVE DIKE/LOWER OVERFLOW

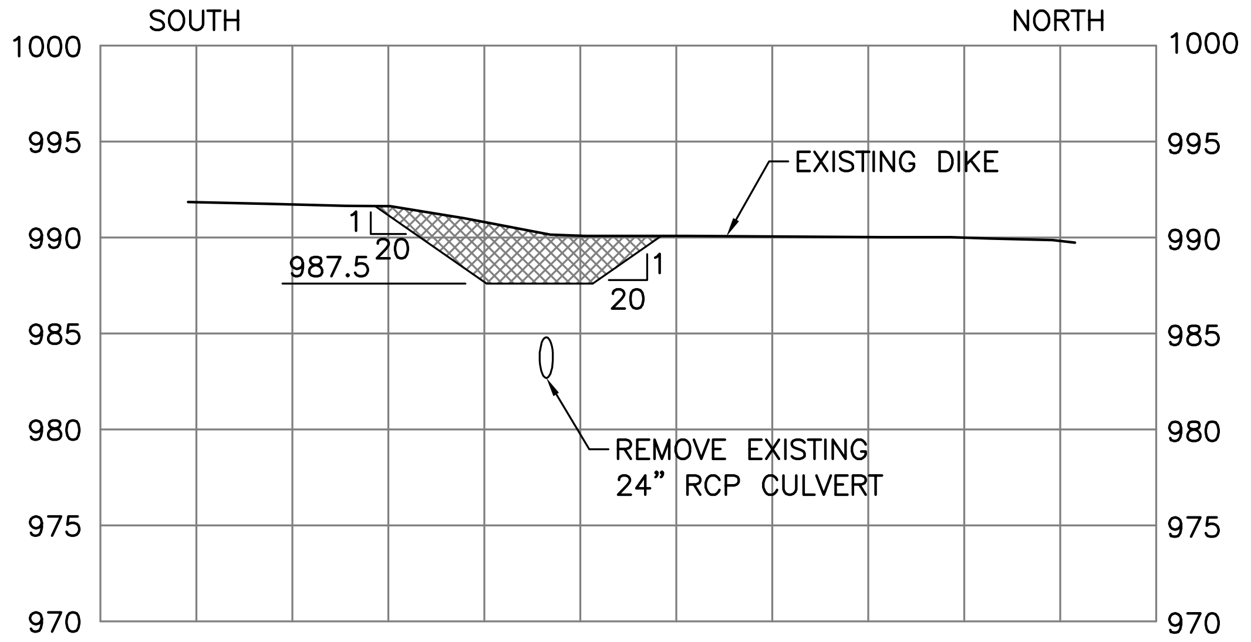
RESTORE WETLAND



3 C-01 SECTION: PROFILE – NORTH DITCH



4 C-01 SECTION: PROFILE – CENTRAL OVERFLOW



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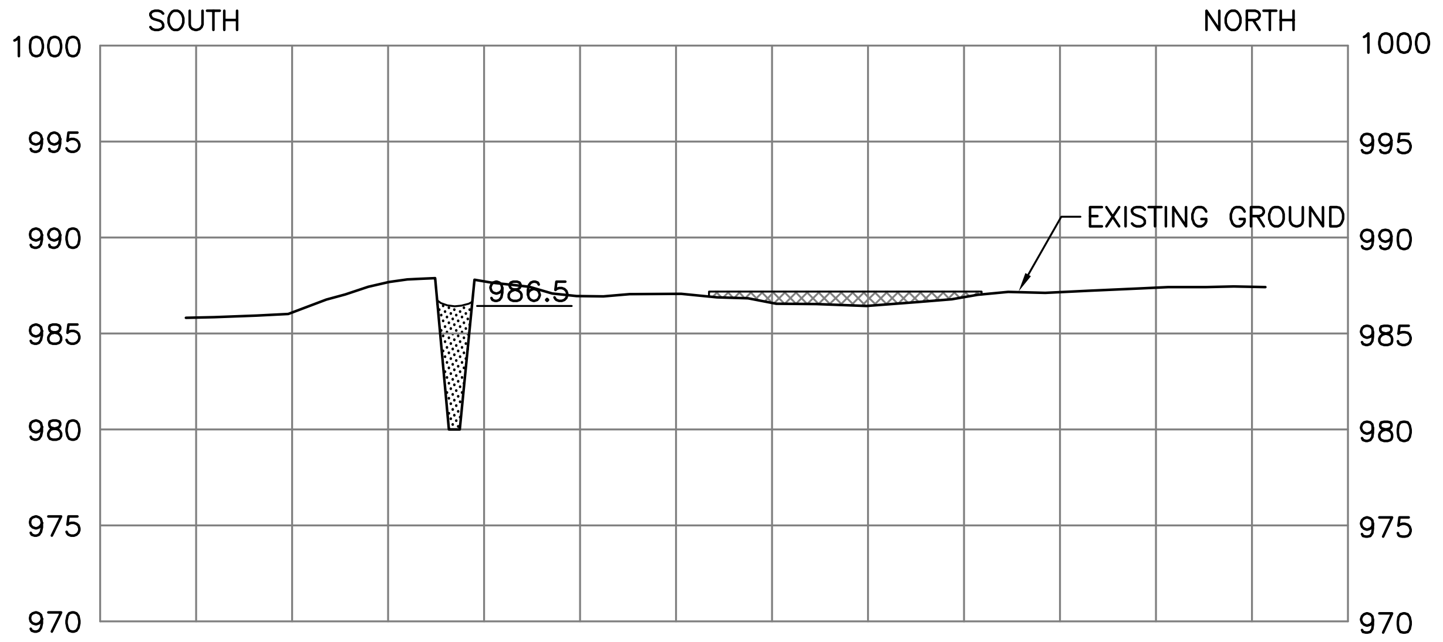

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HOYT LAKES, MINNESOTA

HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

CROSS SECTIONS – NORTH HALF

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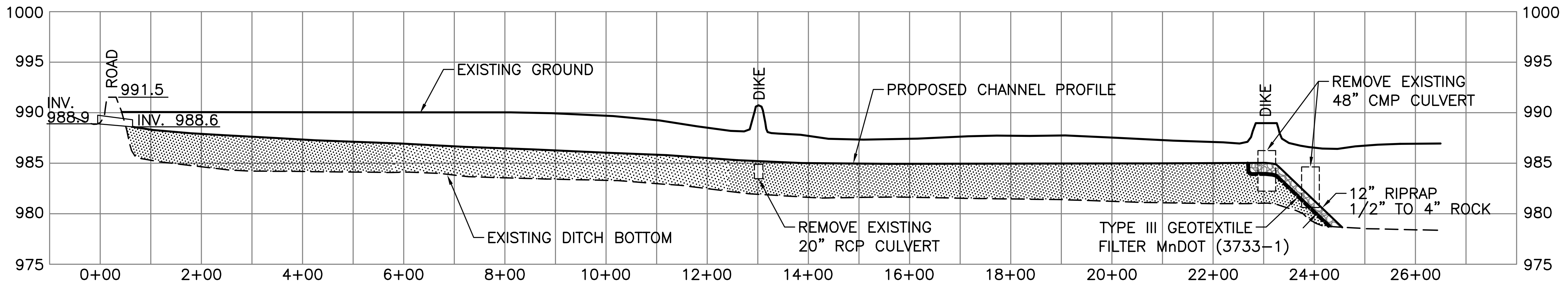

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C-02

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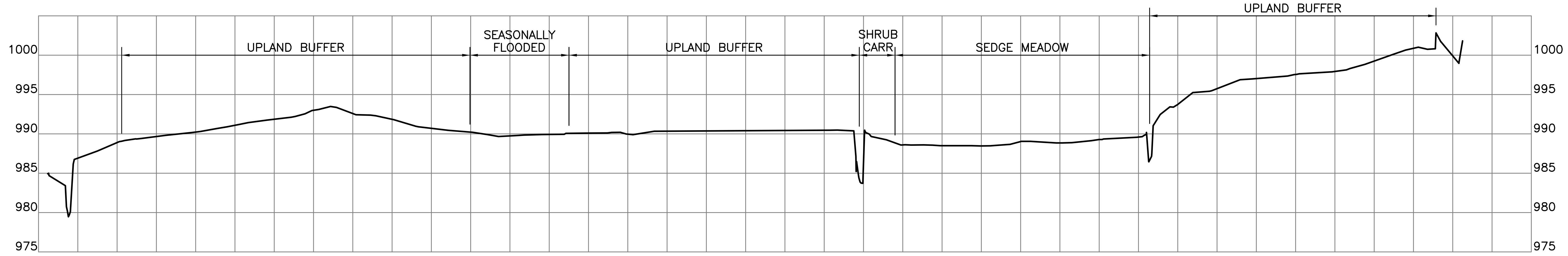
▨ ABANDON STRUCTURE

▩ REMOVE DIKE/LOWER OVERFLOW

⠿ RESTORE WETLAND



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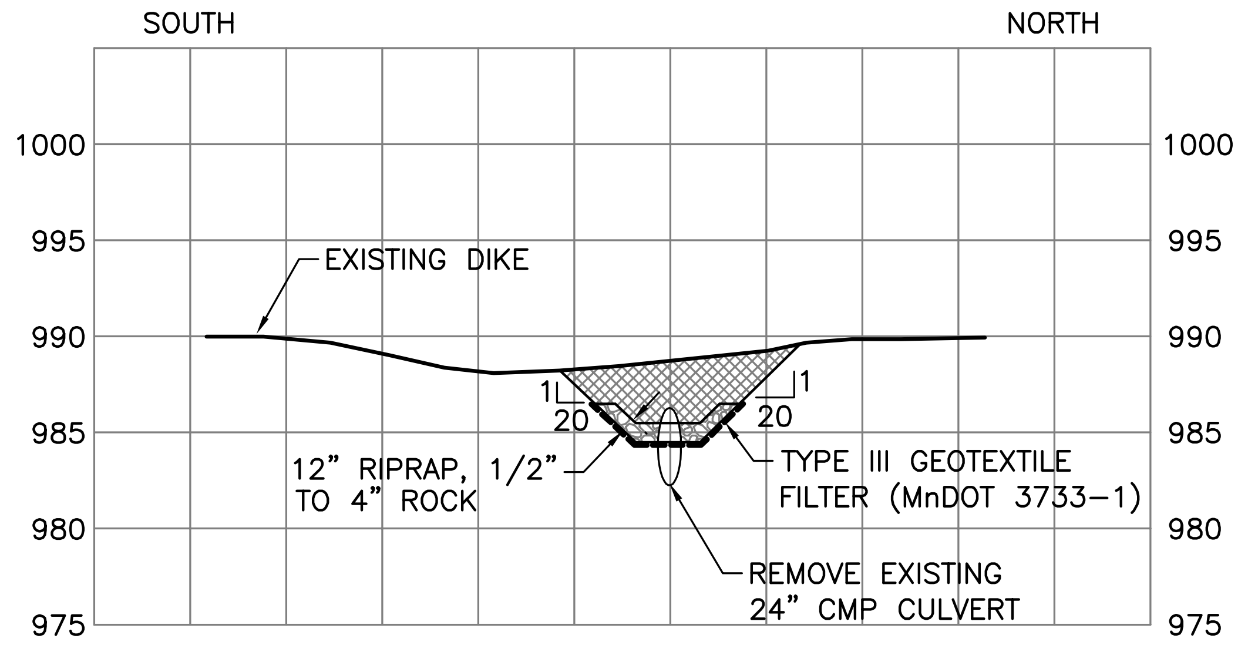

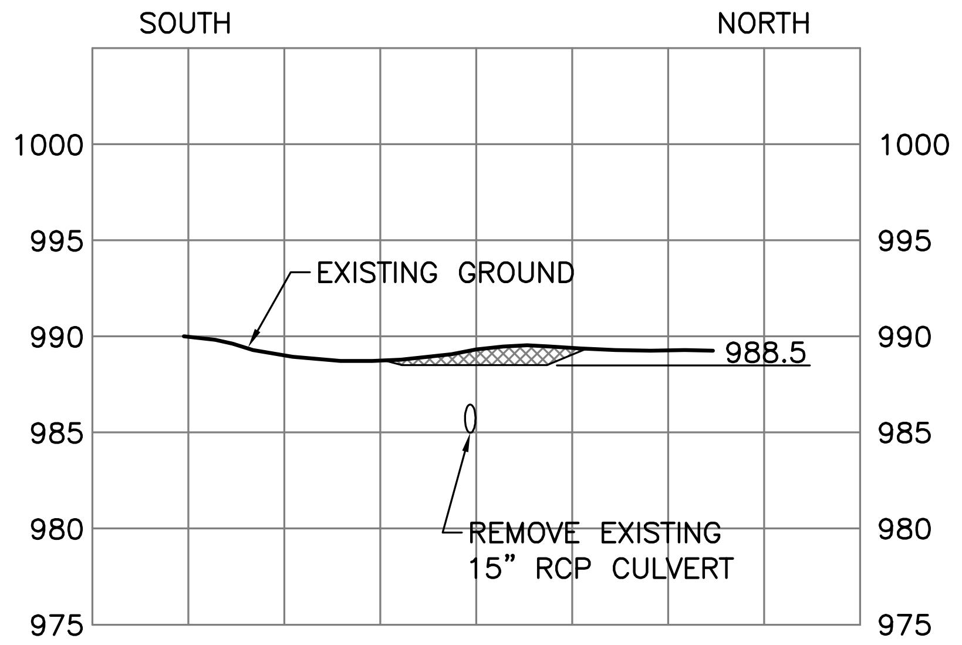

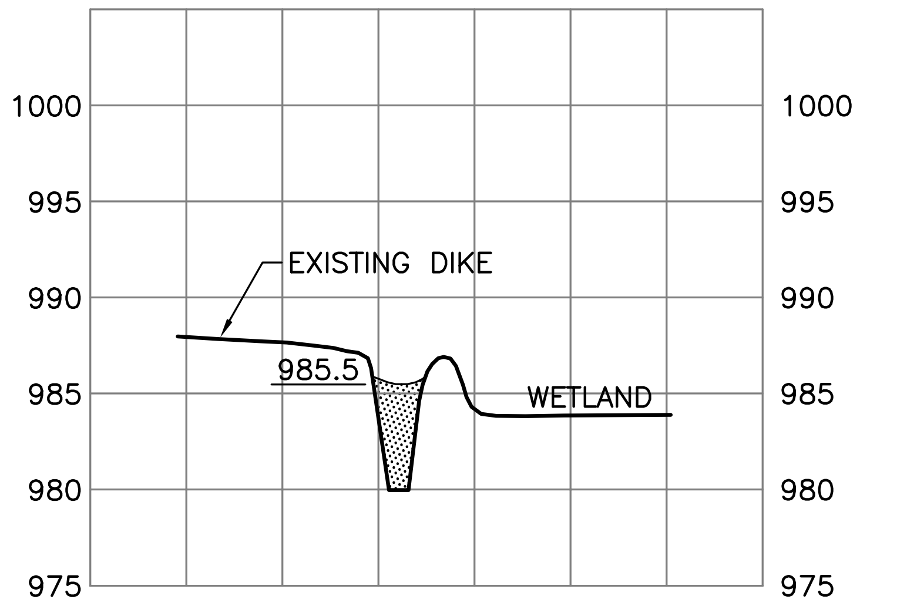

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C-02

SCALE IN FEET 0 – 10 / 0 – 200

④ SECTION: PROFILE – SOUTHWEST OVERFLOW
C-02

SCALE IN FEET 0 – 10 / 0 – 200

⑤ SECTION: PROFILE – EAST OUTLET
C-02

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POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

CROSS SECTIONS – SOUTH HALF

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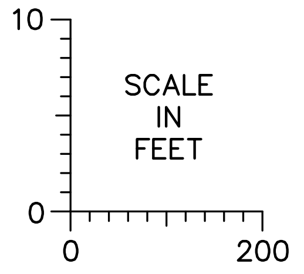
REV. No.

1 G-01 SECTION: CROSS SECTION – ENTIRE SITE



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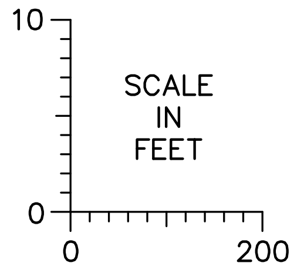

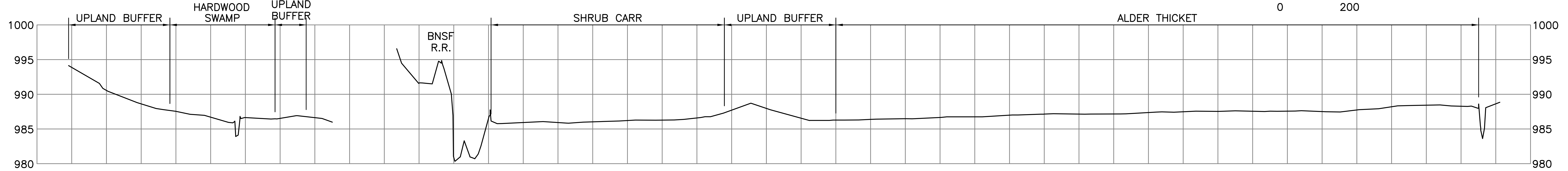

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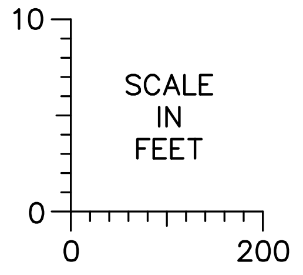

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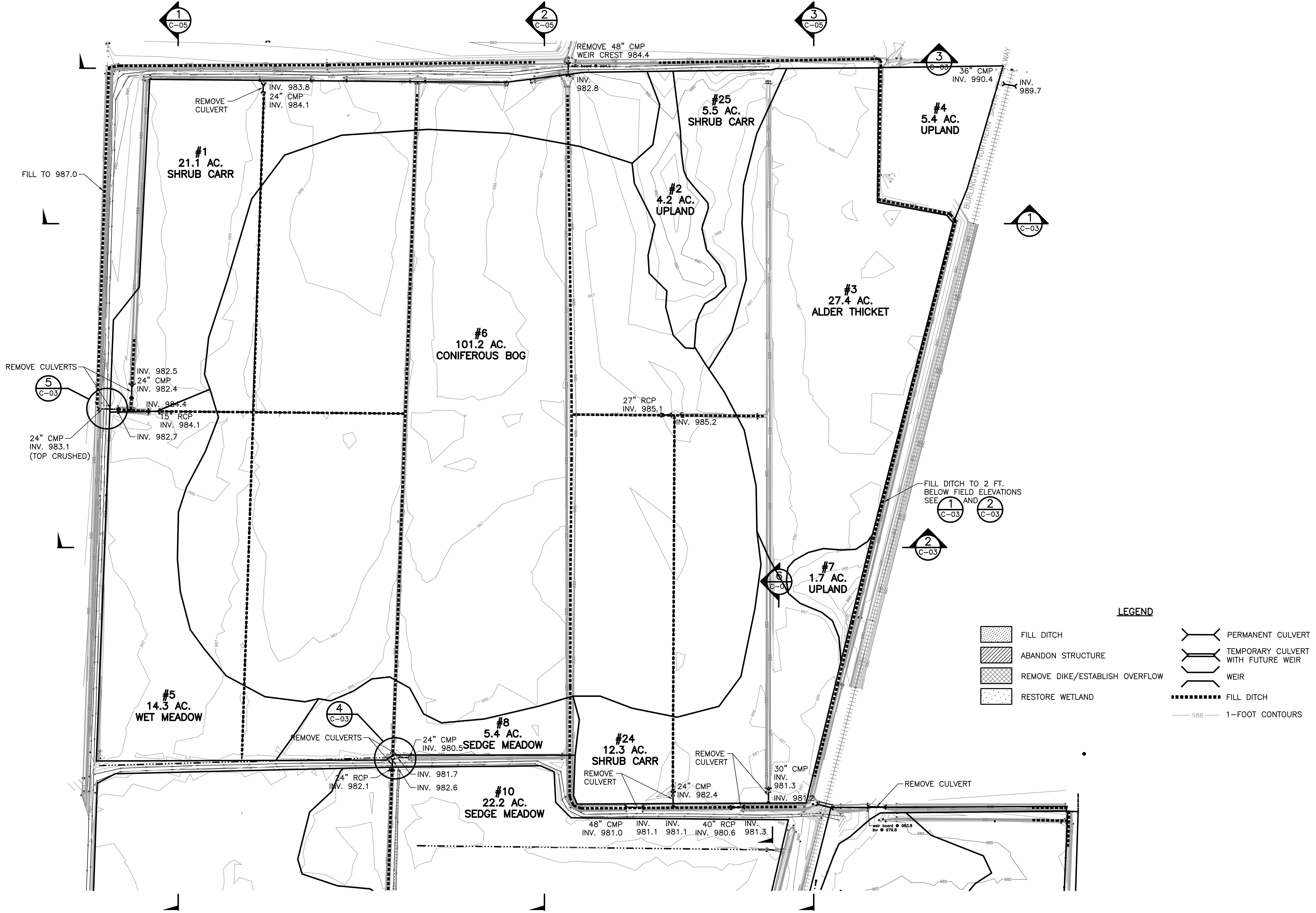
55435–4803
Ph: 1–800–632–2277
Fax: (952) 832–2601
www.barr.com

Scale	AS SHOWN
Date	6/20/07
Drawn	JMW
Checked	MAJ
Designed	MAJ
Approved	MAJ

POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA
CROSS SECTIONS – ENTIRE SITE

BARR PROJECT No. 23/69–862
CLIENT PROJECT No.
DWG. No. C–05
REV. No.



① PLAN: PLAN DETAILS – NORTH HALF
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Designed	MAJ
Approved	MAJ

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HOYT LAKES, MINNESOTA

HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

PLAN DETAILS – NORTH HALF

BARR PROJECT No.
23/69-862
CLIENT PROJECT No.
DWG. No.
C-01
REV. No.

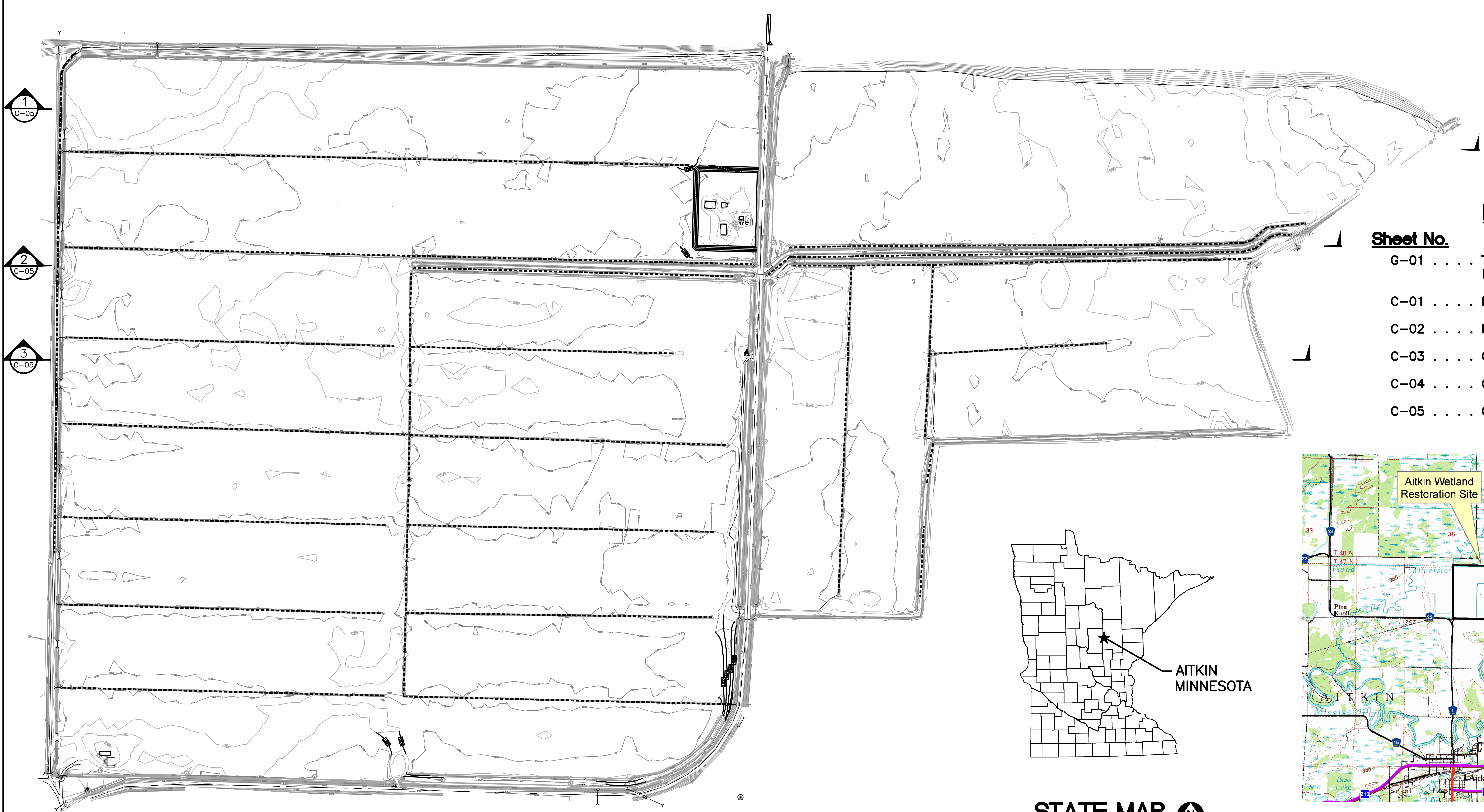
Appendix B
Aitkin Wetland Restoration Plans

POLYMET MINING COMPANY

HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN

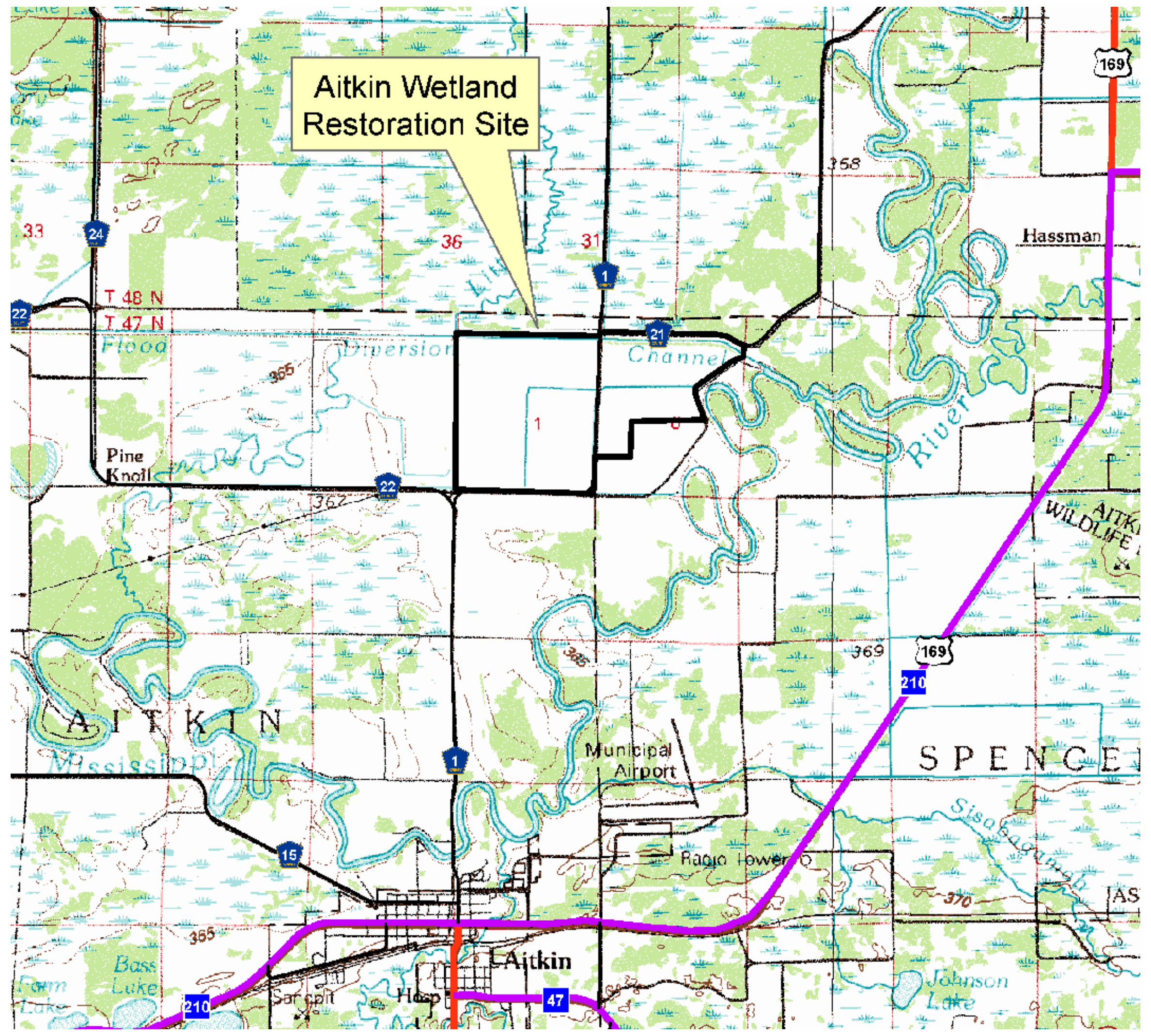
AITKIN, MINNESOTA



INDEX

Sheet No. **Title**

STATE MAP



SITE LOCATION MAP

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HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

TITLE SHEET, INDEX, AND
SITE LOCATION MAP

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. G-01
REV. No.

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CONSTRUCTION							
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AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

PLAN DETAILS – WEST HALF

BARR PROJECT No.
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DWG. No.
C-01
REV. No.

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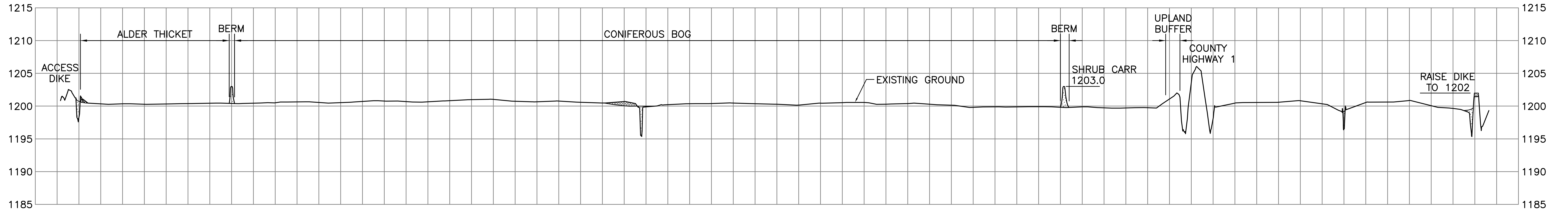
HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

PLAN DETAILS – EAST HALF

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. C-02
REV. No.



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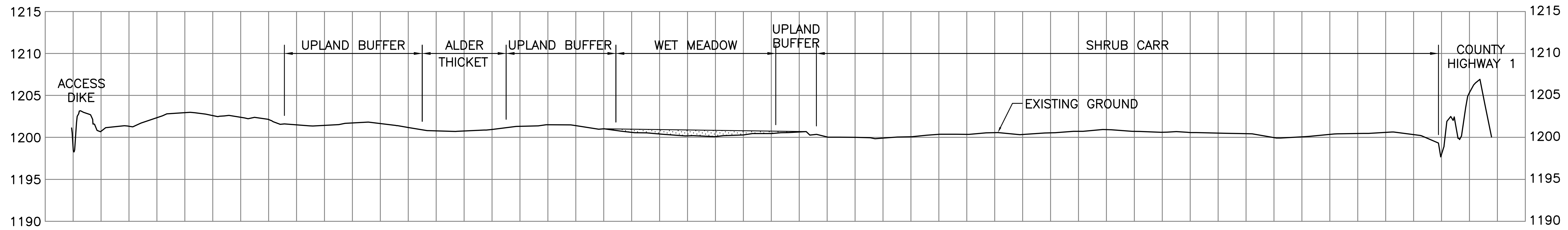

② C-01 **SECTION: CROSS SECTION –**

SCALE IN FEET
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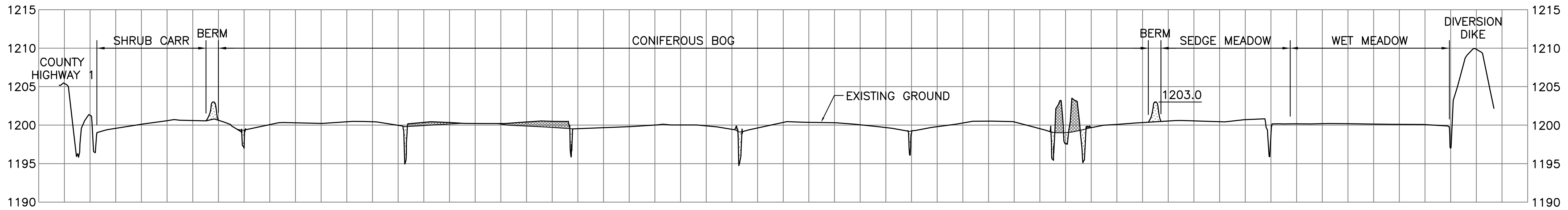
LEGEND

- ░ FILL DITCH/BUILD BERM
- ▨ ABANDON STRUCTURE
- ▩ REMOVE DIKE/ESTABLISH OVERFLOW



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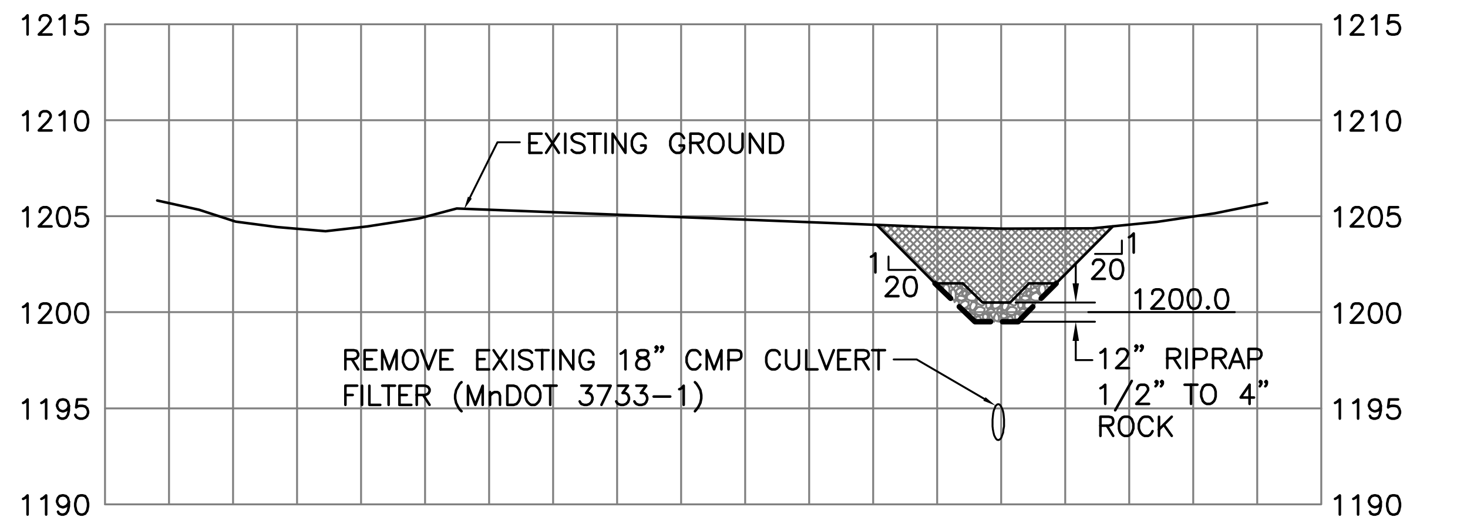

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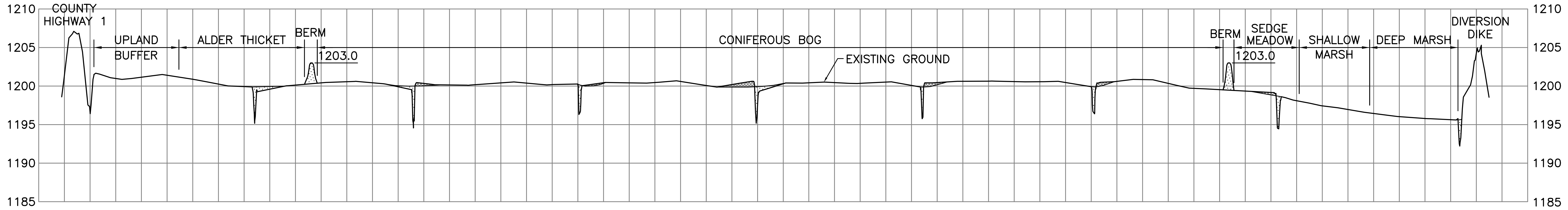

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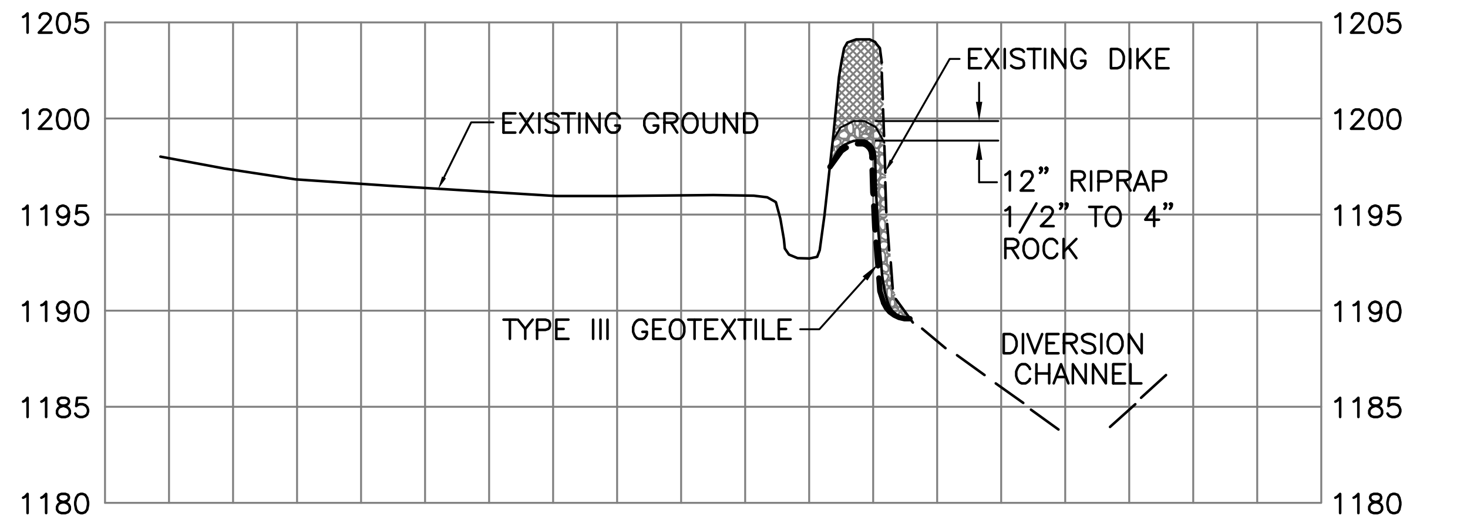

⑥ C-01 **SECTION: PROFILE – DIVERSION DIKE OVERFLOW**

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Approved	MAJ

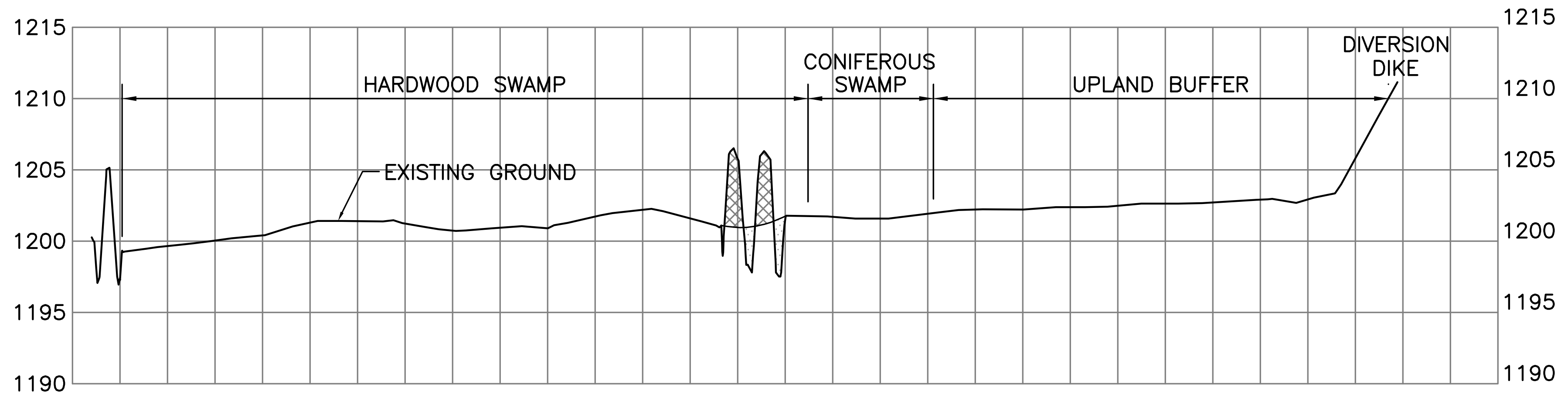
POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

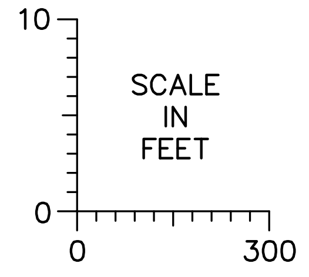
AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

CROSS SECTIONS – WEST HALF

BARR PROJECT No.
23/69-862
CLIENT PROJECT No.

DWG. No.
C-03
REV. No.

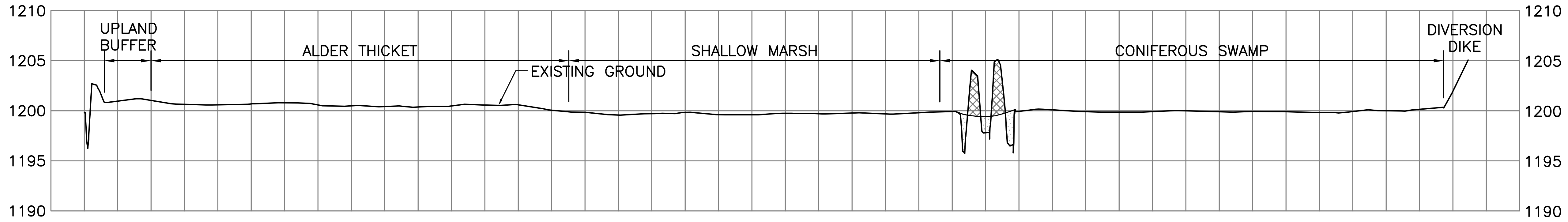


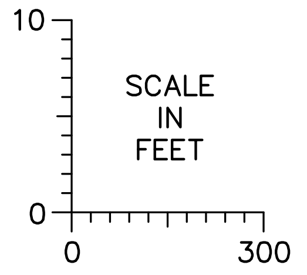


1 C-02 SECTION: CROSS SECTION –

LEGEND

☐	FILL DITCH
▨	ABANDON STRUCTURE
▩	REMOVE DIKE/ESTABLISH OVERFLOW
░	RESTORE WETLAND





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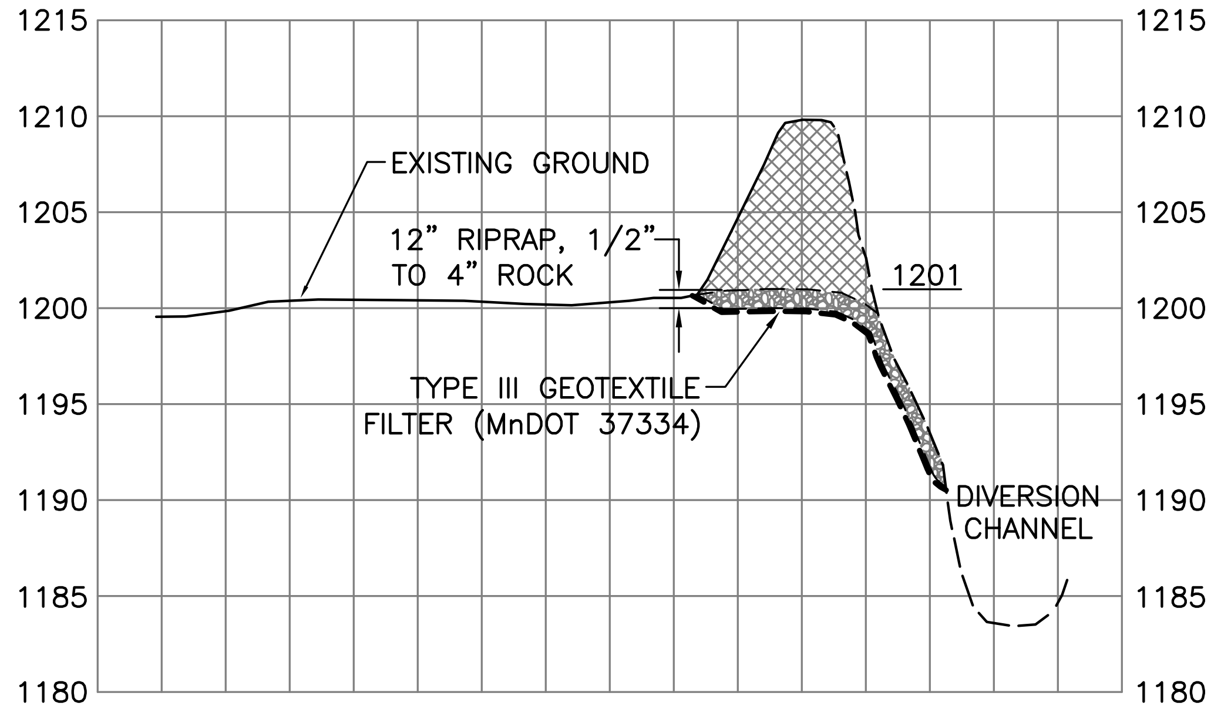
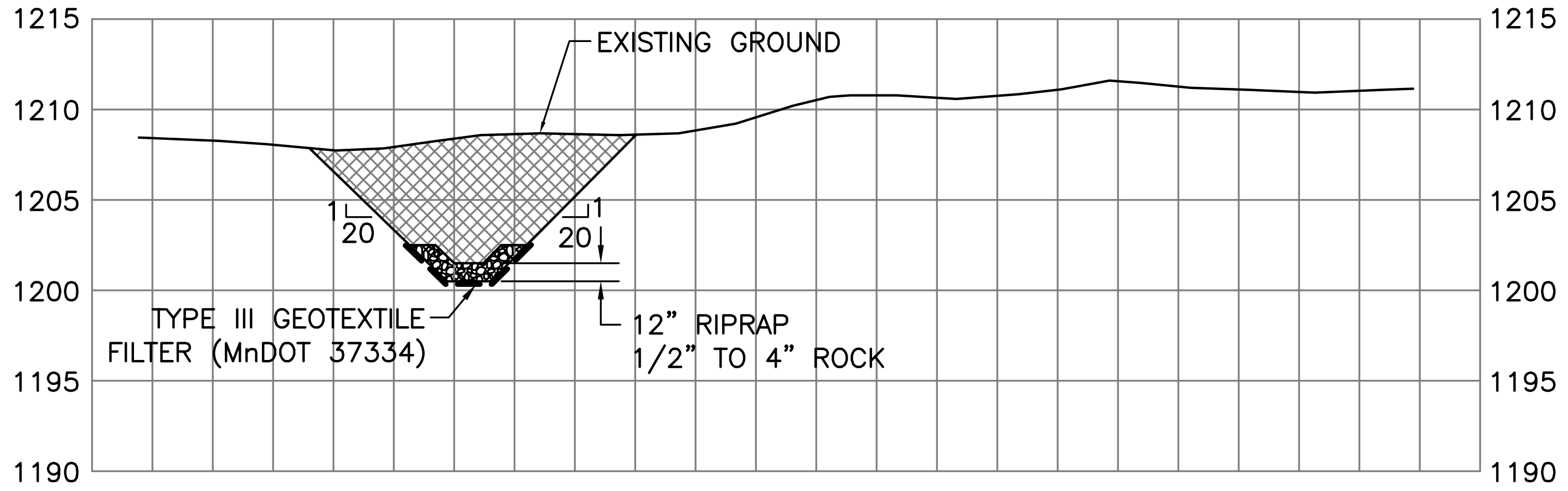
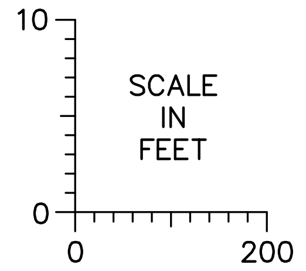




4 C-02 SECTION: PROFILE – EAST PROPERTY DIVERSION CHANNEL INLET



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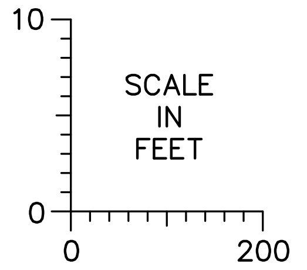

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HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

CROSS SECTIONS – EAST SIDE

BARR PROJECT No.
23/69-862
CLIENT PROJECT No.
DWG. No.
C-04
REV. No.

0 300 600
SCALE IN FEET

(1) G-01 **SECTION: CROSS SECTION –**

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SCALE IN FEET
0 0 300

(2) G-01 **SECTION: CROSS SECTION –**
1"=200'-0"

10
SCALE IN FEET
0 0 300

(3) G-01 **SECTION: CROSS SECTION –**
1"=200'-0"

10
SCALE IN FEET
0 0 300

LEGEND

░ FILL DITCH/BUILD BERM
▨ ABANDON STRUCTURE
▩ REMOVE DIKE/ESTABLISH OVERFLOW

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HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

CROSS SECTIONS – ENTIRE SITE

BARR PROJECT No.
23/69-862
CLIENT PROJECT No.

DWG. No.
C-05
REV. No.

Appendix C
Example Seed Mixes

Agrecol®
Agricultural Ecological Solutions

2918 Agriculture Drive
Madison, WI 53718
608-226-2544
ecosolutions@agrecol.com

Agrecol warranties that the product conforms to the description on the label. This warranty is limited to the amount of the purchase price. Agrecol has no responsibility to special, consequential or contingent damages.

WET PRAIRIE MIXED HEIGHT

LOT #	SM-WPM	
COVERAGE AREA	43560	SQ.FT.
SEEDS	60	PER SQ.FT.
PLS WEIGHT	157.138	OUNCES
TESTED	2/22/2005	
NOXIOUS WEED/LB	NONE	

Mix Diversity	% Seed Count	Species Count	PLS Ounces	% Weight
Grasses	40.00%	11.00	78.507	49.96%
Sedges	10.00%	5.00	1.570	1.00%
Wildflowers	47.00%	30.00	53.820	34.25%
Legumes	3.00%	3.00	23.240	14.79%
Totals	**100.00%**	**49.00**	**157.138**	**100.00%**

Species Information

LATIN NAME	COMMON NAME	ORIGIN	TOTAL PLS OZS	PERCENT OF MIX
GRASSES				
ANDROPOGON GERARDII	BIG BLUESTEM	SE WI	5.734	3.65%
BROMUS CILIATUS	FRINGED BROME	IOWA COUNTY	14.508	9.23%
CALAMAGROSTIS CANADENSIS	BLUE JOINT GRASS	WAUSHARA CO WI	0.467	0.30%
ELYMUS CANADENSIS	CANADA WILD RYE	IA	14.038	8.93%
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	ROCK CO WI	22.107	14.07%
GLYCERIA CANADENSIS	RATTLESNAKE GRASS	WI	3.308	2.10%
GLYCERIA GRANDIS	REED MANNA GRASS	GREEN CO WI	1.341	0.85%
LEERSIA ORYZOIDES	RICE CUTGRASS	DANE CO WI	2.788	1.77%
PANICUM VIRGATUM	SWITCH GRASS	KENOSHA CO WI	2.521	1.60%
SORGHASTRUM NUTANS	INDIAN GRASS	GREEN CO WI	5.349	3.40%
SPARTINA PECTINATA	PRAIRIE CORD GRASS	MN	6.346	4.04%
SEDGES				
CAREX STIPATA	COMMON FOX SEDGE	DANE CO WI	1.032	0.66%
CAREX VULPINOIDEA	BROWN FOX SEDGE	DANE CO WI	0.333	0.21%
JUNCUS TENUIS	PATH RUSH	DANE CO WI	0.030	0.02%
SCIRPUS ATROVIRENS	DARK-GREEN BULLRUSH	DANE CO WI	0.128	0.08%
SCIRPUS CYPERINUS	WOOL GRASS	DANE CO WI	0.047	0.03%
WILDFLOWERS				
ASCLEPIAS INCARNATA	MARSH MILKWEED	ROCK CO WI	6.292	4.00%
ASCLEPIAS SYRIACA	COMMON MILKWEED	DANE CO WI	1.910	1.22%
ASTER NOVAE-ANGLIAE	NEW ENGLAND ASTER	IOWA CO WI	0.587	0.37%
ASTER PUNICEUS	RED-STEMMED ASTER	ROCK CO WI	0.503	0.32%
BIDENS FRONDOSA	COMMON BEGGARS'S TICK	DANE CO WI	1.346	0.86%
ERYNGIUM YUCCIFOLIUM	RATTLESNAKE MASTER	JEFFERSON CO WI	2.951	1.88%
EUPATORIUM MACULATUM	SPOTTED JOE PYE WEED	IOWA CO WI	0.514	0.33%
EUPATORIUM PERFOLIATUM	BONESET	DANE CO WI	0.299	0.19%
HELENIUM AUTUMNALE	SNEEZEWEED	IOWA CO WI	0.382	0.24%
HELIANTHUS GROSSESERRATUS	SAW-TOOTH SUNFLOWER	LACROSSE CO WI	1.375	0.87%
HELIOPSIS HELIANTHOIDES	EARLY SUNFLOWER	GREEN CO WI	6.369	4.05%
HYPERICUM PYRAMIDATUM	GREAT ST. JOHN'S WORT	KENOSHA CO WI	0.047	0.03%
LIATRIS SPICATA	MARSH BLAZING STAR	KENOSHA CO WI	3.399	2.16%
MIMULUS RINGENS	MONKEY FLOWER	PA	0.028	0.02%
~~MONARDA FISTULOSA~~	~~WILD BERGAMOT~~	~~WAUKESHA CO WI~~	~~0.681~~	~~0.43%~~
NAPAEA DIOICA	GLADE MALLOW	ROCK CO WI	5.967	3.80%
PARTHENIUM INTEGRIFOLIUM	WILD QUININE	WI	3.266	2.08%
PYCNANTHEMUM VIRGINIANUM	MOUNTAIN MINT	WALWORTH CO WI	0.257	0.16%
~~RATIBIDA PINNATA~~	~~YELLOW CONEFLOWER~~	~~JEFFERSON CO WI~~	~~1.528~~	~~0.97%~~
RUDBECKIA SUBTOMENTOSA	SWEET BLACK-EYED SUSAN	IOWA CO WI	0.965	0.61%
SILPHIUM PERFOLIATUM	CUPPLANT	LAFAYETTE CO WI	3.770	2.40%
SILPHIUM TEREBINTHINACEUM	PRAIRIE DOCK	ADAMS CO WI	3.040	1.93%
SOLIDAGO GRAMINIFOLIA	GRASS-LEAVED GOLDENROD	IOWA CO WI	0.071	0.04%
~~SOLIDAGO OHIOENSIS~~	~~OHIO GOLDENROD~~	~~WALWORTH, WI~~	~~0.535~~	~~0.34%~~
SOLIDAGO RIDDELLII	RIDDELL'S GOLDENROD	KENOSHA CO WI	0.595	0.38%
THALICTRUM DASYCARPUM	PURPLE MEADOW RUE	WALWORTH CO WI	2.221	1.41%
VERBENA HASTATA	BLUE VERVAIN	ROCK CO WI	0.611	0.39%
VERNONIA FASCICULATA	IRONWEED	COLUMBIA CO, WI	1.619	1.03%
VERONICASTRUM VIRGINICUM	CULVER'S ROOT	DANE CO WI	0.107	0.07%
ZIZIA AUREA	GOLDEN ALEXANDERS	IOWA CO WI	2.586	1.65%
LEGUMES				
BAPTISIA LEUCANTHA	WILD WHITE INDIGO	IOWA CO WI	4.752	3.02%
CASSIA HEBECARPA	WILD SENNA	DANE CO WI	10.863	6.91%
DESMODIUM CANADENSE	CANADA TICK TREFOIL	KENOSHA CO WI	7.625	4.85%

Agrecol®
Agricultural Ecological Solutions

SEDGE MEADOW MIXED HEIGHT (STANDARD MIX)		
ITEM #	SM-SMM	
COVERAGE AREA	43,560	SQ.FT.
SEEDS	60	PER SQ.FT.
PLS WEIGHT	4.605	POUNDS

MIX DIVERSITY BY TYPE	% OF SEED COUNT	SPECIES COUNT	OUNCES	% WEIGHT
GRASSES	15%	6	15.955	21.66%
SEDGES	45%	13	14.558	19.76%
WILDFLOWERS	40%	29	32.302	43.84%
LEGUMES	1%	1	10.863	14.74%
TOTALS	**100%**	**49**	**73.678**	**100.00%**

SPECIES INFORMATION

LATIN NAME	COMMON NAME	TOTAL SEEDS	% TOTAL SEEDS
GRASSES			
BROMUS CILIATUS	FRINGED BROME	32,670	1.25%
CALAMAGROSTIS CANADENSIS	BLUE JOINT GRASS	81,675	3.13%
GLYCERIA CANADENSIS	RATTLESNAKE GRASS	65,340	2.50%
GLYCERIA GRANDIS	REED MANNA GRASS	65,340	2.50%
LEERSIA ORYZOIDES	RICE CUTGRASS	81,675	3.13%
SPARTINA PECTINATA	PRAIRIE CORD GRASS	65,340	2.50%
SEDGES			
CAREX BEBBII	BEBB'S SEDGE	113,088	4.33%
CAREX COMOSA	BRISTLY SEDGE	67,853	2.60%
CAREX CRINITA	FRINGED SEDGE	45,235	1.73%
CAREX HYSTERICINA	PORCUPINE SEDGE	90,471	3.46%
CAREX STIPATA	COMMON FOX SEDGE	90,471	3.46%
CAREX STRICTA	TUSSOCK SEDGE	67,853	2.60%
CAREX VULPINOIDEA	BROWN FOX SEDGE	90,471	3.46%
JUNCUS DUDLEYI	DUDLEY'S RUSH	90,471	3.46%
JUNCUS TENUIS	PATH RUSH	90,471	3.46%
JUNCUS TORREYI	TORREY'S RUSH	113,088	4.33%
SCIRPUS ATROVIRENS	DARK-GREEN BULLRUSH	113,088	4.33%
SCIRPUS CYPERINUS	WOOL GRASS	113,088	4.33%
SCIRPUS VALIDUS	SOFT-STEM BULLRUSH	90,471	3.46%
WILDFLOWERS			
ACORUS CALAMUS	SWEET FLAG	35,599	1.36%
ALISMA SUBCORDATUM	COMMON WATER PLANTAIN	35,599	1.36%
ASCLEPIAS INCARNATA	MARSH MILKWEED	17,800	0.68%
ASTER NOVAE-ANGLIAE	NEW ENGLAND ASTER	53,399	2.04%
ASTER PUNICEUS	RED-STEMMED ASTER	48,059	1.84%
BIDENS FRONDOSA	COMMON BEGGARS'S TICK	7,120	0.27%
CACALIA SUAVEOLENS	SWEET INDIAN PLANTAIN	8,900	0.34%
EUPATORIUM MACULATUM	SPOTTED JOE PYE WEED	53,399	2.04%
EUPATORIUM PERFOLIATUM	BONESET	53,399	2.04%
HELENIUM AUTUMNALE	SNEEZEWEED	53,399	2.04%
HELIANTHUS GROSSESERRATUS	SAW-TOOTH SUNFLOWER	8,900	0.34%
HYPERICUM PYRAMIDATUM	GREAT ST. JOHN'S WORT	17,800	0.68%
IRIS VIRGINICA SHREVEI	BLUE FLAG IRIS	3,560	0.14%
LOBELIA CARDINALIS	CARDINAL FLOWER	49,839	1.91%
LOBELIA SIPHILITICA	GREAT BLUE LOBELIA	53,399	2.04%
LYCOPUS AMERICANUS	WATER HOREHOUND	44,499	1.70%
MIMULUS RINGENS	MONKEY FLOWER	53,399	2.04%
PENTHORUM SEDOIDES	DITCH STONECROP	44,499	1.70%
PHYSOSTEGIA VIRGINIANA	OBEDIENT PLANT	17,800	0.68%
PYCNANTHEMUM VIRGINIANUM	MOUNTAIN MINT	44,499	1.70%
SILPHIUM PERFOLIATUM	CUPPLANT	8,900	0.34%
SILPHIUM TEREBINTHINACEUM	PRAIRIE DOCK	3,560	0.14%
~~SOLIDAGO OHIOENSIS~~	~~OHIO GOLDENROD~~	~~53,399~~	~~2.04%~~
SOLIDAGO RIDDELLII	RIDDELL'S GOLDENROD	53,399	2.04%
THALICTRUM DASYCARPUM	PURPLE MEADOW RUE	17,800	0.68%
VERBENA HASTATA	BLUE VERVAIN	58,738	2.25%
VERNONIA FASCICULATA	IRONWEED	44,499	1.70%
VERONICASTRUM VIRGINICUM	CULVER'S ROOT	51,619	1.98%
ZIZIA AUREA	GOLDEN ALEXANDERS	35,599	1.36%
LEGUMES			
CASSIA HEBECARPA	WILD SENNA	13,068	0.50%

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EMERGENT MIXED HEIGHT (STANDARD MIX)

ITEM #	SM-EM	
COVERAGE AREA	43,560	SQ.FT.
SEEDS	60	PER SQ.FT.
PLS WEIGHT	5.276	POUNDS

MIX DIVERSITY BY TYPE	% OF SEED COUNT	SPECIES COUNT	OUNCES	% WEIGHT
GRASSES	30%	5	23.515	27.86%
SEDGES	60%	15	26.383	31.26%
WILDFLOWERS	10%	7	34.514	40.89%
LEGUMES	0%	0	0.000	0.00%
TOTALS	**100%**	**27**	**84.412**	**100.00%**

SPECIES INFORMATION

LATIN NAME	COMMON NAME	TOTAL SEEDS	% TOTAL SEEDS
GRASSES			
CALAMAGROSTIS CANADENSIS	BLUE JOINT GRASS	156,816	6.00%
GLYCERIA CANADENSIS	RATTLESNAKE GRASS	117,612	4.50%
GLYCERIA GRANDIS	REED MANNA GRASS	235,224	9.00%
LEERSIA ORYZOIDES	RICE CUTGRASS	117,612	4.50%
SPARTINA PECTINATA	PRAIRIE CORD GRASS	156,816	6.00%
SEDGES			
CAREX COMOSA	BRISTLY SEDGE	104,544	4.00%
CAREX CRINITA	FRINGED SEDGE	78,408	3.00%
CAREX HYSTERICINA	PORCUPINE SEDGE	104,544	4.00%
CAREX STRICTA	TUSSOCK SEDGE	78,408	3.00%
JUNCUS DUDLEYI	DUDLEY'S RUSH	104,544	4.00%
JUNCUS EFFUSUS	COMMON RUSH	130,680	5.00%
JUNCUS TENUIS	PATH RUSH	104,544	4.00%
JUNCUS TORREYI	TORREY'S RUSH	130,680	5.00%
SCIRPUS ACUTUS	HARD-STEMMED BULRUSH	52,272	2.00%
SCIRPUS ATROVIRENS	DARK-GREEN BULLRUSH	156,816	6.00%
SCIRPUS CYPERINUS	WOOL GRASS	156,816	6.00%
SCIRPUS FLUVIATILIS	RIVER BULLRUSH	26,136	1.00%
SCIRPUS PENDULUS	RED BULLRUSH	104,544	4.00%
SCIRPUS PUNGENS	COMMON THREE SQUARE RUSH	26,136	1.00%
SCIRPUS VALIDUS	SOFT-STEM BULLRUSH	209,088	8.00%
WILDFLOWERS			
ACORUS CALAMUS	SWEET FLAG	46,671	1.79%
ALISMA SUBCORDATUM	COMMON WATER PLANTAIN	65,340	2.50%
BIDENS FRONDOSA	COMMON BEGGARS'S TICK	18,669	0.71%
IRIS VIRGINICA SHREVEI	BLUE FLAG IRIS	9,334	0.36%
MIMULUS RINGENS	MONKEY FLOWER	46,671	1.79%
SAGITTARIA LATIFOLIA	ARROWHEAD	65,340	2.50%
SPARGANIUM EURYCARPUM	GIANT BUR-REED	9,334	0.36%
LEGUMES			

Appendix D
Aitkin County Soil Survey Legend

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

AITKIN COUNTY, MINNE

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter The initial numbers represent the kind of soil A capital letter following these numbers represents the class of slope Symbols without a slope letter are for nearly level soils or miscellaneous areas

SYMBOL	NAME
72	Shooker very fine sandy loam
119C	Pomroy loamy fine sand, 6 to 12 percent slopes
124	Brickton silt loam
133B	Dalbo very fine sandy loam, 1 to 6 percent slopes
142	Nokay fine sandy loam
144B	Flak sandy loam, 3 to 8 percent slopes
144C	Flak sandy loam, 8 to 15 percent slopes
146B	Wabedo sandy loam, 1 to 6 percent slopes
147	Spooner silt loam
152B	Milaca fine sandy loam, 3 to 8 percent slopes
152C	Milaca fine sandy loam, 8 to 15 percent slopes
152E	Milaca fine sandy loam, 15 to 25 percent slopes
164B	Mora fine sandy loam, 1 to 4 percent slopes
166	Ronneby loam
167B	Baudette silt loam, 1 to 5 percent slopes
186	Nemadji loamy fine sand
188B	Omega loamy fine sand, 2 to 6 percent slopes
188C	Omega loamy fine sand, 6 to 12 percent slopes
188E	Omega loamy sand, 12 to 25 percent slopes
202	Meehan loamy sand
204B	Branstad loam, 2 to 6 percent slopes
204C	Cushing loam, 6 to 12 percent slopes
204E	Cushing loam, 12 to 25 percent slopes
218	Watab fine sand
240B	Warba very fine sandy loam, 1 to 6 percent slopes
240C	Warba very fine sandy loam, 6 to 12 percent slopes
243	Stuntz very fine sandy loam
266	Freer silt loam
268B	Cromwell fine sandy loam, 1 to 6 percent slopes
268C	Cromwell sandy loam, 6 to 12 percent slopes
268E	Cromwell fine sandy loam, 12 to 25 percent slopes
268F	Cromwell fine sandy loam, 25 to 40 percent slopes
292	Alstad loam
302B	Rosholt fine sandy loam, 2 to 6 percent slopes
302C	Rosholt fine sandy loam, 6 to 12 percent slopes
346	Talmoon fine sandy loam
428	Hassman muck
454B	Mahtomedi loamy coarse sand, 2 to 6 percent slopes
454C	Mahtomedi loamy coarse sand, 6 to 12 percent slopes
454E	Mahtomedi loamy coarse sand, 12 to 25 percent slopes
454F	Mahtomedi gravelly loamy sand, 25 to 40 percent slopes
458B	Menahga loamy sand, 1 to 6 percent slopes
458C	Menahga loamy sand, 6 to 12 percent slopes
458E	Menahga loamy sand, 12 to 25 percent slopes
464B	Brennyville silt loam, 2 to 5 percent slopes
469B	Hillcity silt loam, 1 to 6 percent slopes
502	Dusler silt loam
504B	Duluth fine sandy loam, 1 to 6 percent slopes
504C	Duluth fine sandy loam, 6 to 12 percent slopes
504E	Duluth fine sandy loam, 12 to 25 percent slopes
531	Beseman muck
532	Sago muck
533	Loxley peat
540	Seelyeville muck
541	Rifle peat
543	Markey muck
544	Cathro muck
546	Lupton muck
549	Greenwood peat
563	Northwood muck
564	Friendship loamy sand
607	Pengilly silt loam
615	Cowhorn loamy very fine sand
617B	Goodland silt loam, 1 to 10 percent slopes
618B	Itasca silt loam, 1 to 6 percent slopes
621	Morph very fine sandy loam
625	Sandwick loamy sand
627	Tawas muck
628	Talmoon muck, depressional
629B	Wawina loamy very fine sand, 1 to 10 percent slopes
672	Willosippi loam
685	Oesterle fine sandy loam
732B	Bushville loamy fine sand, 1 to 6 percent slopes
734	Cormant loamy fine sand, stratified substratum
736	Ronneby-Mora complex
738B	Milaca-Millward complex, 2 to 8 percent slopes
738C	Milaca-Millward complex, 8 to 15 percent slopes
759	Waukenabo fine sandy loam
795	Redby loamy fine sand, stratified substratum
797	Mooselake and Lupton mucky peats
798	Sago and Roscommon soils
799	Seelyeville-Bowstring association
869	Lobo and Waskish peats
870B	Itasca-Goodland complex, 2 to 6 percent slopes
870C	Itasca-Goodland complex, 6 to 12 percent slopes
870E	Itasca-Goodland complex, 12 to 25 percent slopes
872	Pengilly-Winterfield association
928C	Cushing-Mahtomedi complex, 2 to 10 percent slopes
928D	Cushing-Mahtomedi complex, 10 to 25 percent slopes
928F	Cushing-Mahtomedi complex, 25 to 40 percent slopes
980	Blackhoof and Mahtowa soils
990	Twig and Giese soils
1002	Borosaprists and Fluvaquents, frequently flooded
1030	Pits, gravel-Udipsamments complex
1031	Histosols, ponded
1072	Udorthents, shallow (sanitary landfill)
1115	Newson loamy sand
1150	Jevne fine sandy loam
1154	Sax muck
1353B	Cutaway loamy fine sand, 1 to 6 percent slopes
1354A	Aftad fine sandy loam, 0 to 3 percent slopes
1356	Water, miscellaneous
1372	Wealthwood loamy fine sand
1375B	Alban fine sandy loam, 3 to 8 percent slopes
1878	Hamre muck
1982	Baudette-Spooner complex
1983	Cathro muck, stratified substratum
1984	Leafriver muck
W	Water

CUL

BOUNDARIES

County or pa

Field sheet r

LAND DIVISIO
(sections an

ROAD EMBLE

Federal

State

PITS

Gravel pit

Appendix E
Aitkin Soil and Water Transect Data

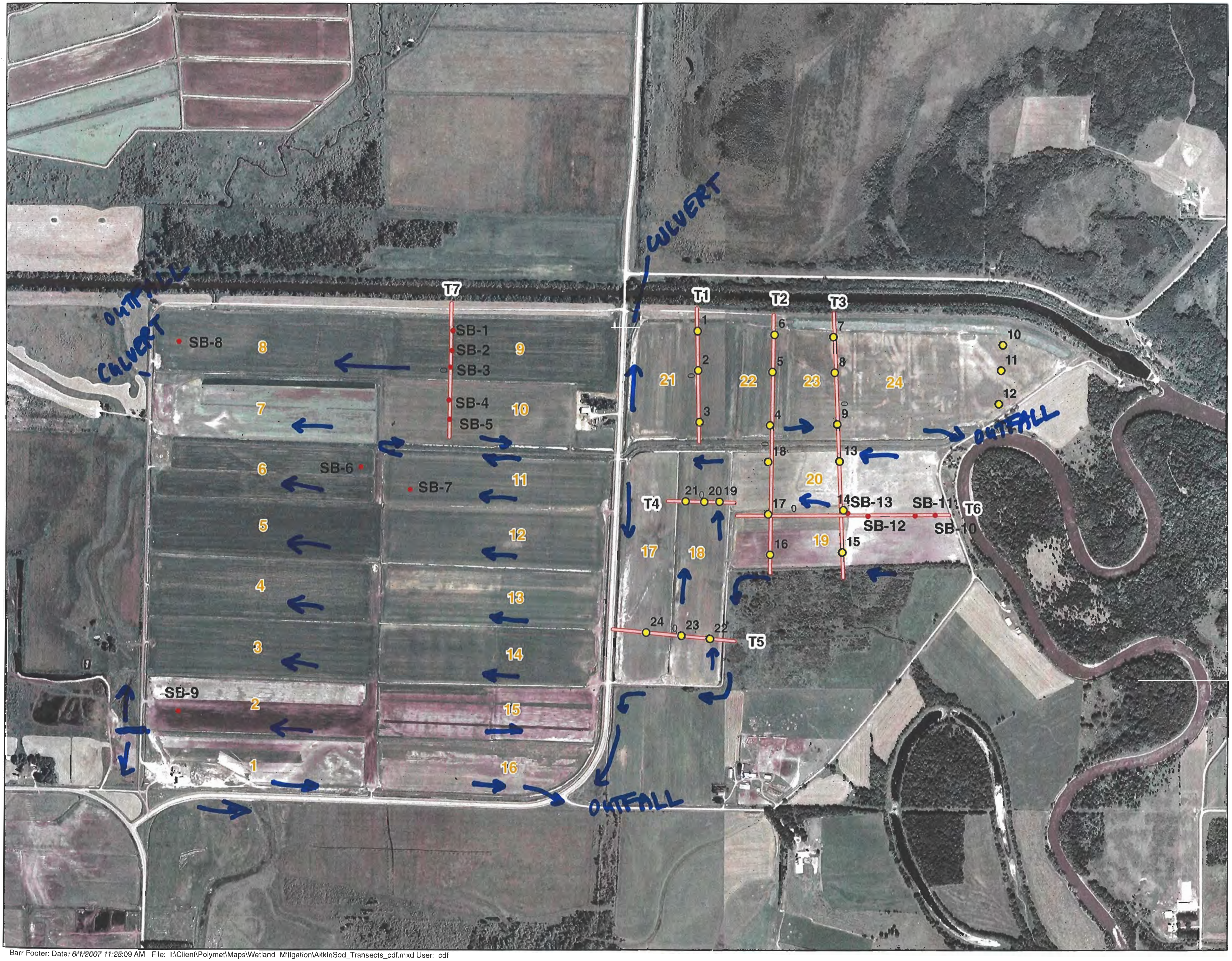


Figure A-1

TRANSECT LOCATIONS
Aitkin Sod Farm
Wetland Restoration
PolyMet Mining Co.

Legend for Soil Stratigraphy and Water Table Diagrams

Organic Soil

🟩 Sod/Oe = grass sod layer that is usually about 4 inches thick with peat soil

🟥 Oe = peat soil (Organic, Hemic)

▩ Oa = mucky soil (Organic, Sapric)

Mineral Soil (ordered from coarse to fine textured)

⁙ s = sand

▨ fs = fine sand

🟧 lfs = loamy fine sand

○ sl = sandy loam

⁘ fsl = fine sandy loam

▥ l = loam

⁖ scl = sandy clay loam

▧ fscl = fine sandy clay loam

▨ cl = clay loam

🟨 si = silt

✕ sicl = silty clay loam

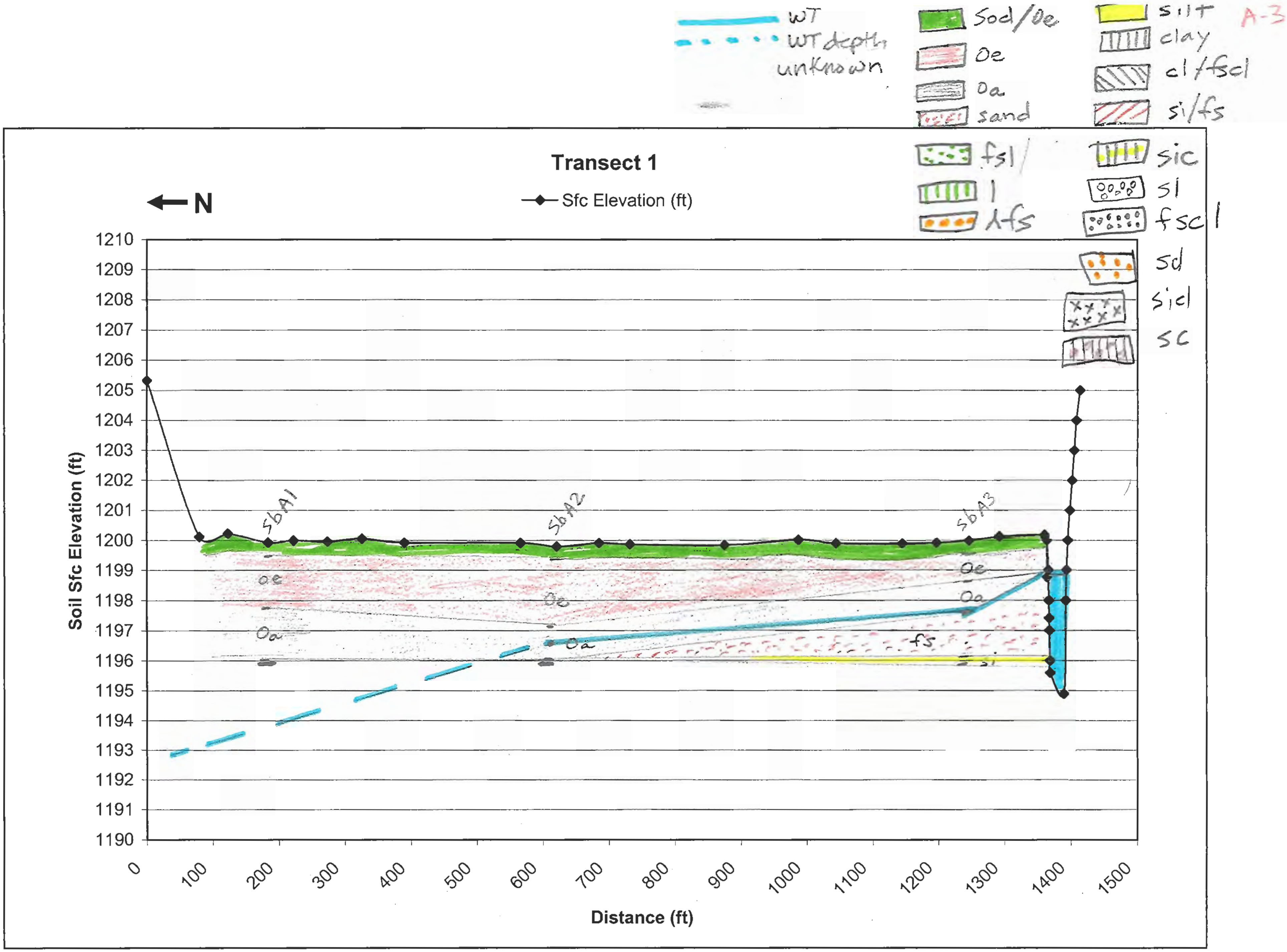
▥ sic = silty clay

▥ sc = sandy clay

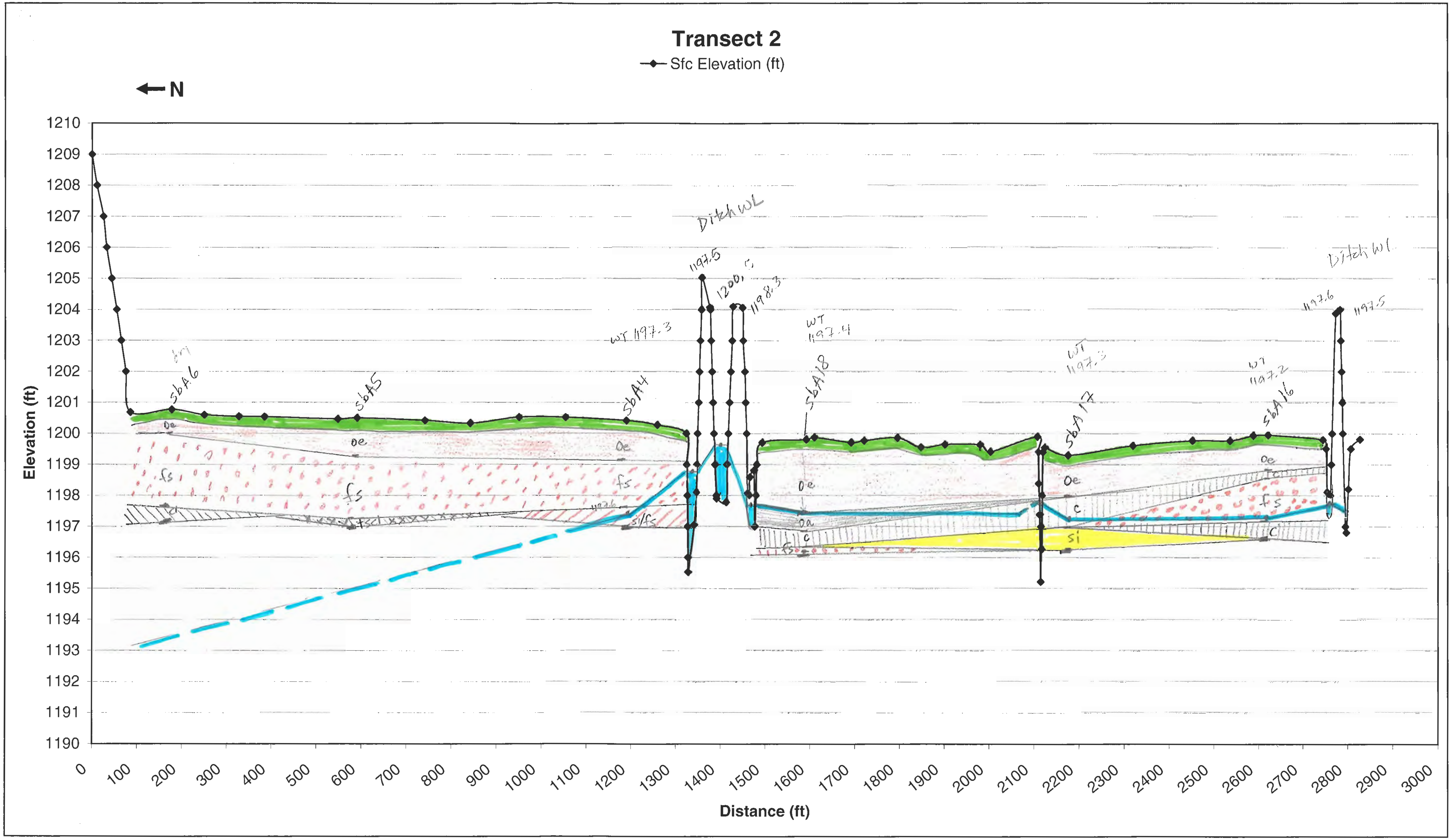
▥ c = clay

━ Measured / observed water Table

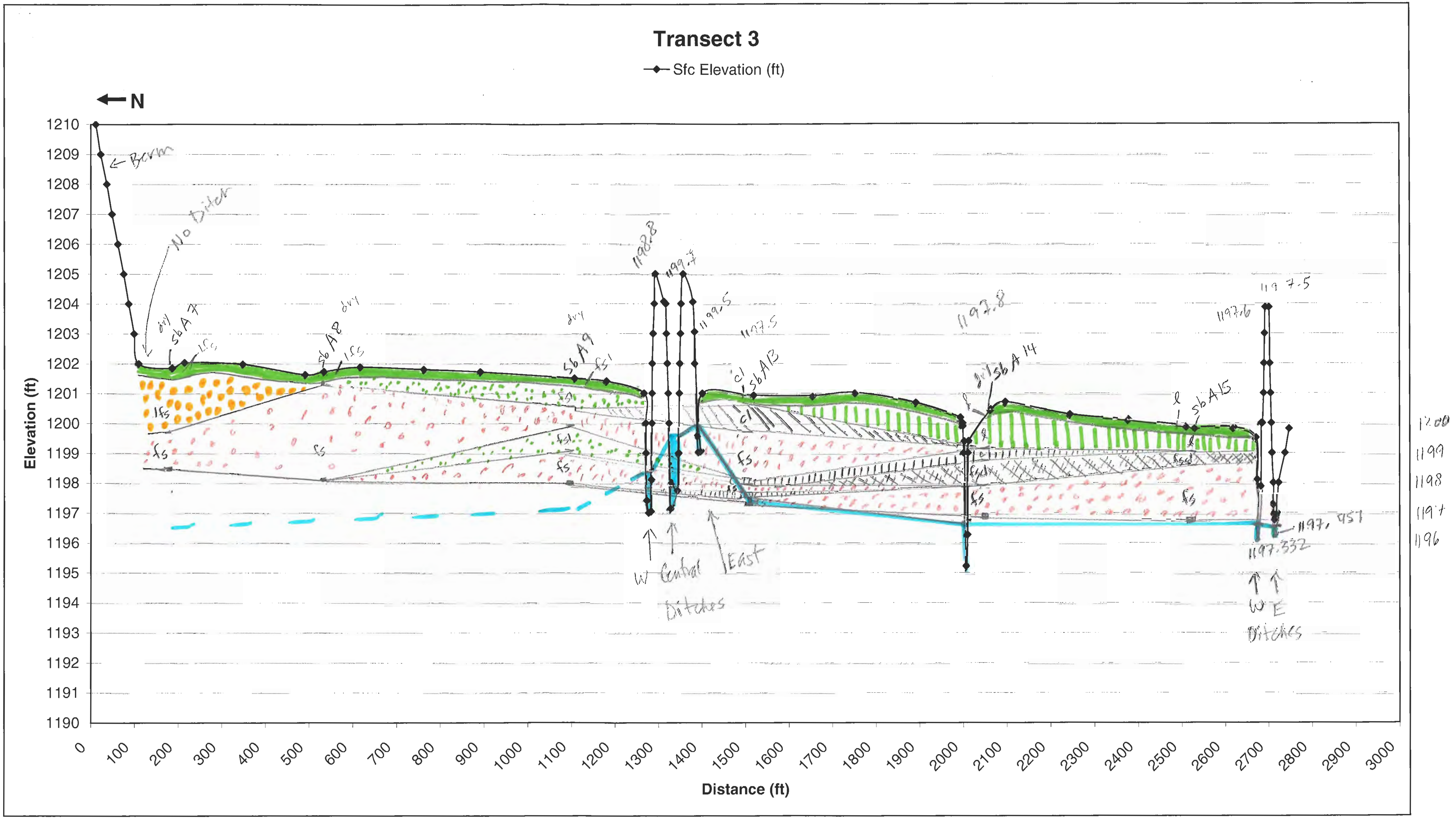
╍ Assumed Water Table - below the bore hole depth


WT
WT depth unknown
Sod/Oe
Oe
Oa
sand
fsl
l
lfs
silt
clay
cl/fscl
si/fs
sic
sl
fscl
sd
sicl
sc
A-3
Transect 1
N
Sfc Elevation (ft)
Soil Sfc Elevation (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Distance (ft)
SbA1
SbA2
SbA3
Oe
Oa
Oe
Oa
Oe
Oa
fs
si

A-4

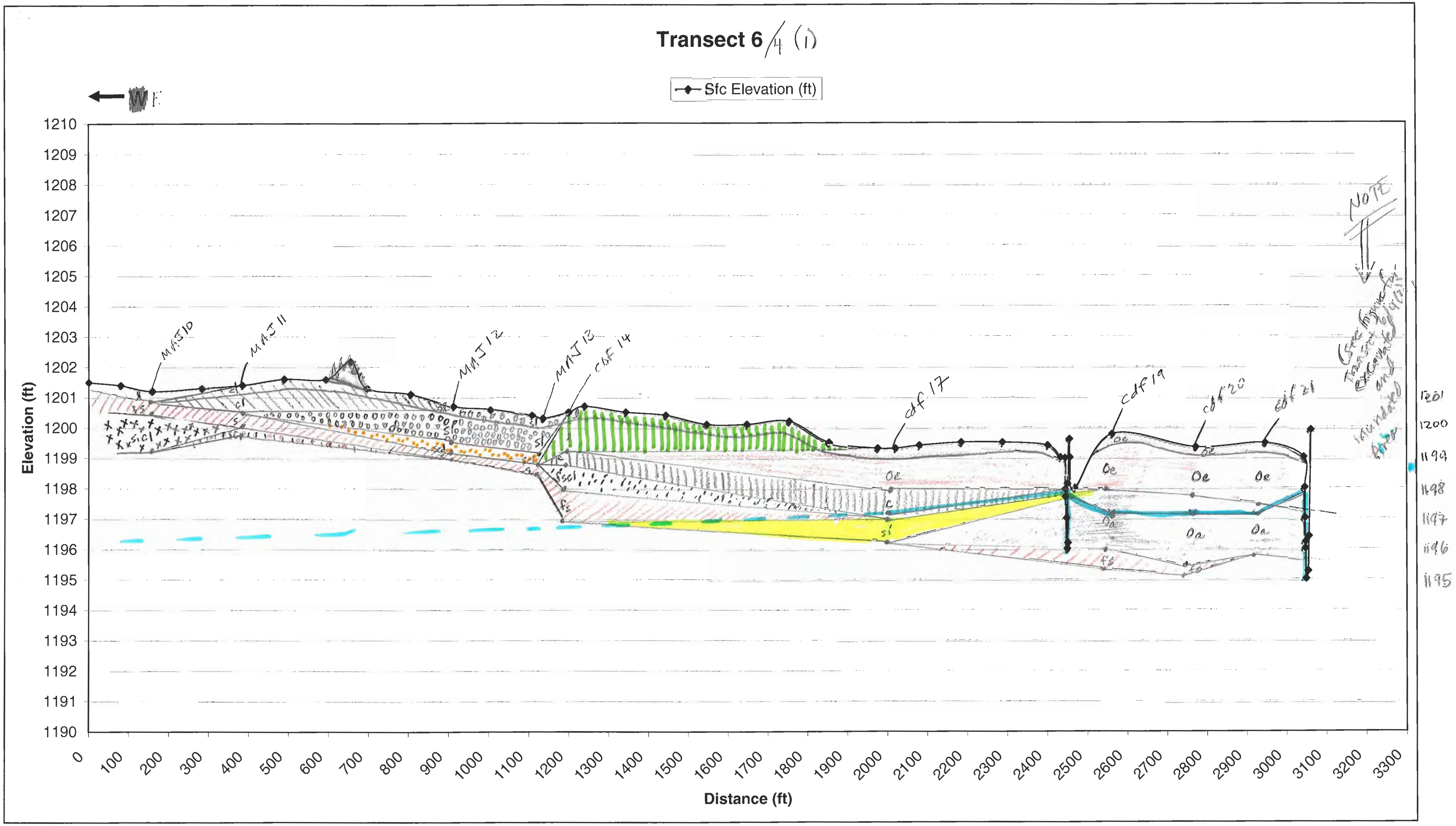

Transect 2
Sfc Elevation (ft)
N
Elevation (ft)
Distance (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
Ditch WL
1197.5
1200.5
1198.3
WT 1197.3
WT 1197.4
WT 1197.3
WT 1197.2
Ditch WL
1197.6
1197.5
sbA6
sbA5
sbA4
sbA18
sbA17
sbA16
Oe
fs
c
si
Oa

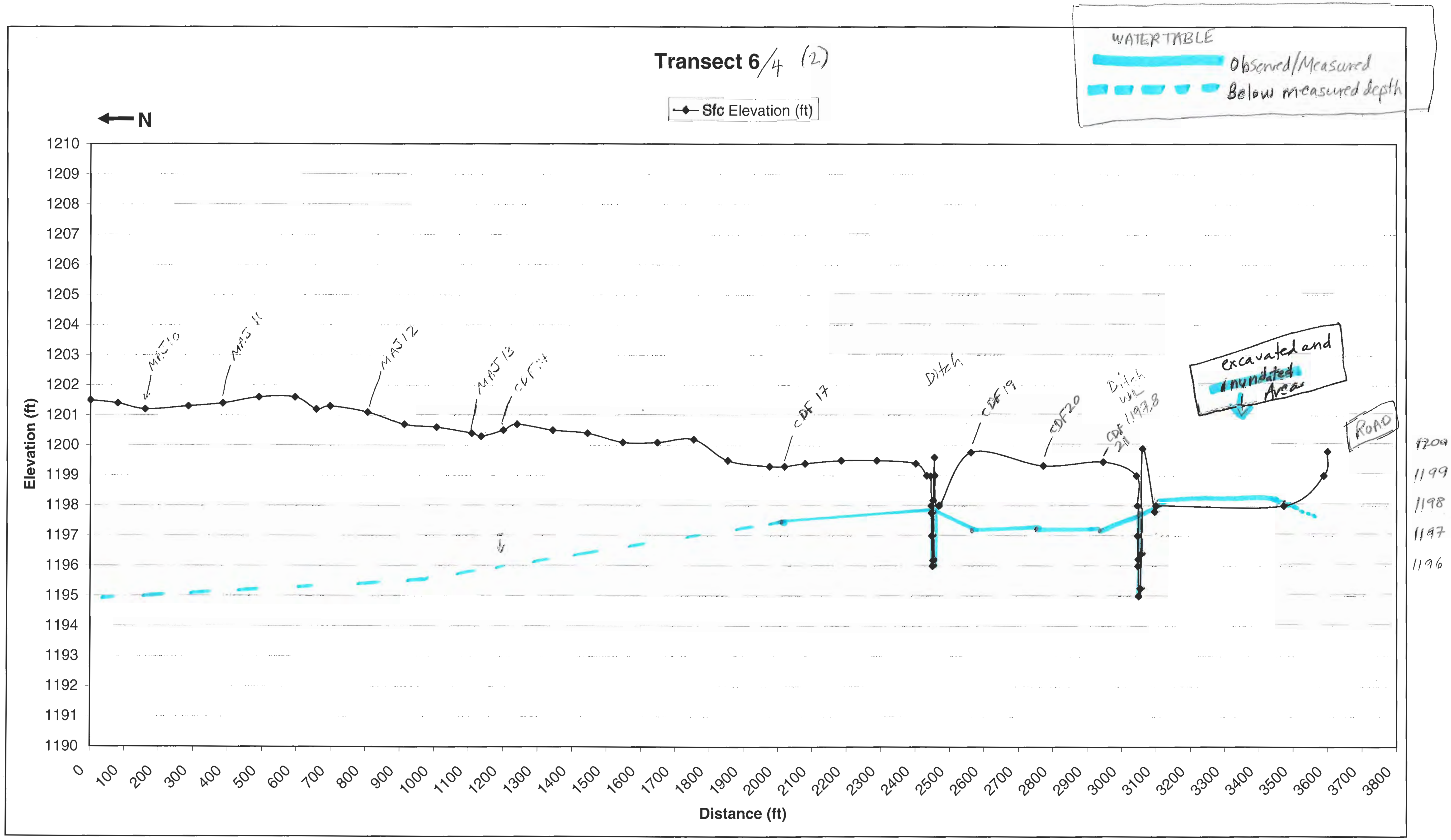
A-5



Transect 3

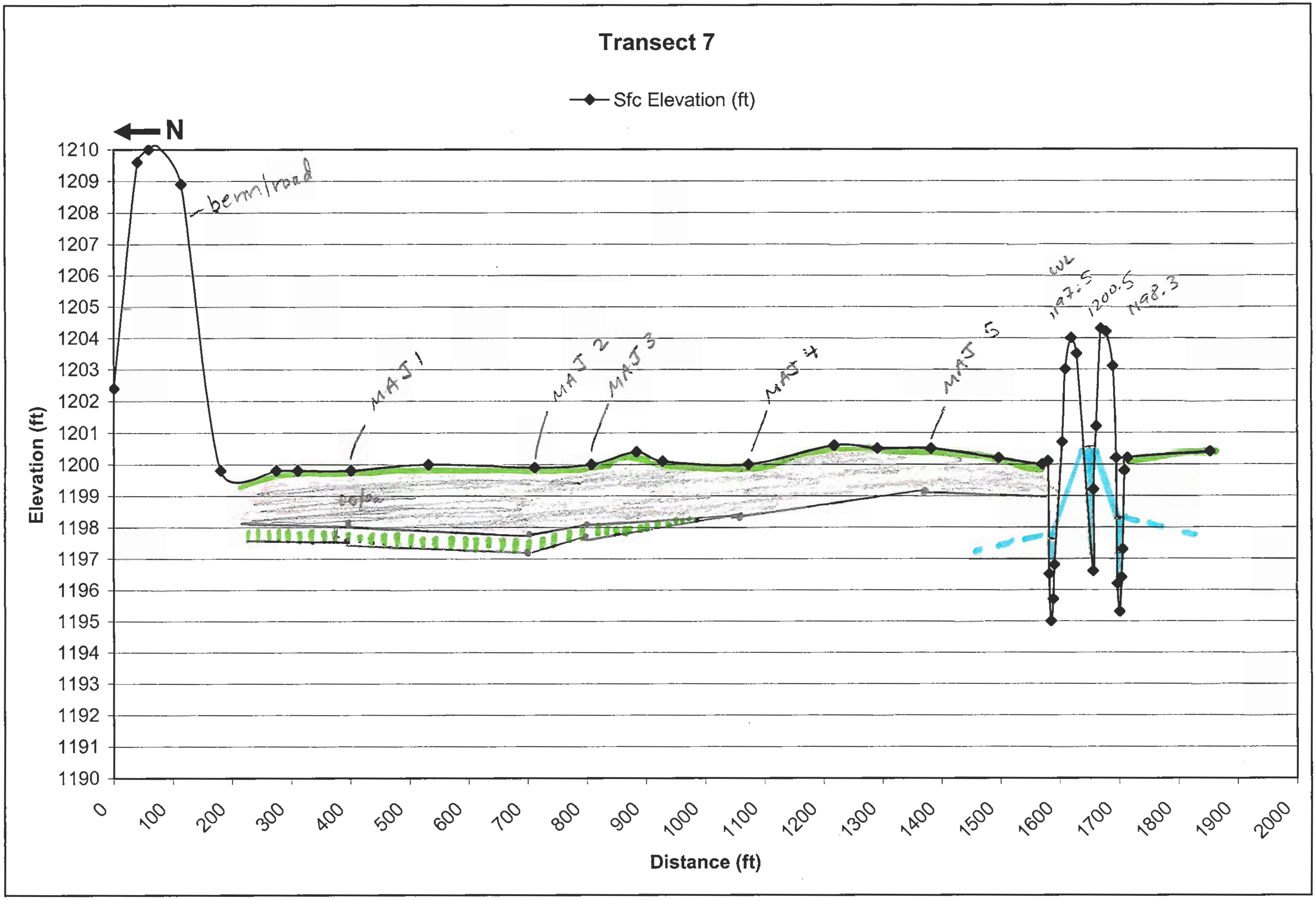
A-6


Transect 6/4 (1)
Sfc Elevation (ft)
← W E
Elevation (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
Distance (ft)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100
3200
3300
MAJ10
MAJ11
MAJ12
MAJ13
cdf 14
cdf 17
cdf 19
cdf 20
cdf 21
ss
cl
s
sicl
sl
Sfs
fs
c
Oe
Oa
NOTE
(see figure for Transect 6/4(2)) excavated and inundated Area
1201
1200
1199
1198
1197
1196
1195


Transect 6/4 (2)
Sfc Elevation (ft)
WATER TABLE
Observed/Measured
Below measured depth
N
Elevation (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
Distance (ft)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100
3200
3300
3400
3500
3600
3700
3800
MAJ 10
MAJ 11
MAJ 12
MAJ 13
CDF 14
CDF 17
Ditch
CDF 19
CDF 20
Ditch W/L 1197.8
CDF 21
excavated and inundated Area
ROAD
1200
1199
1198
1197
1196

A-8

West Side


Transect 7
Sfc Elevation (ft)
N
Elevation (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
Distance (ft)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
berm/road
MAJ 1
MAJ 2
MAJ 3
MAJ 4
MAJ 5
coke
WL
1197.5
1200.5
1198.3

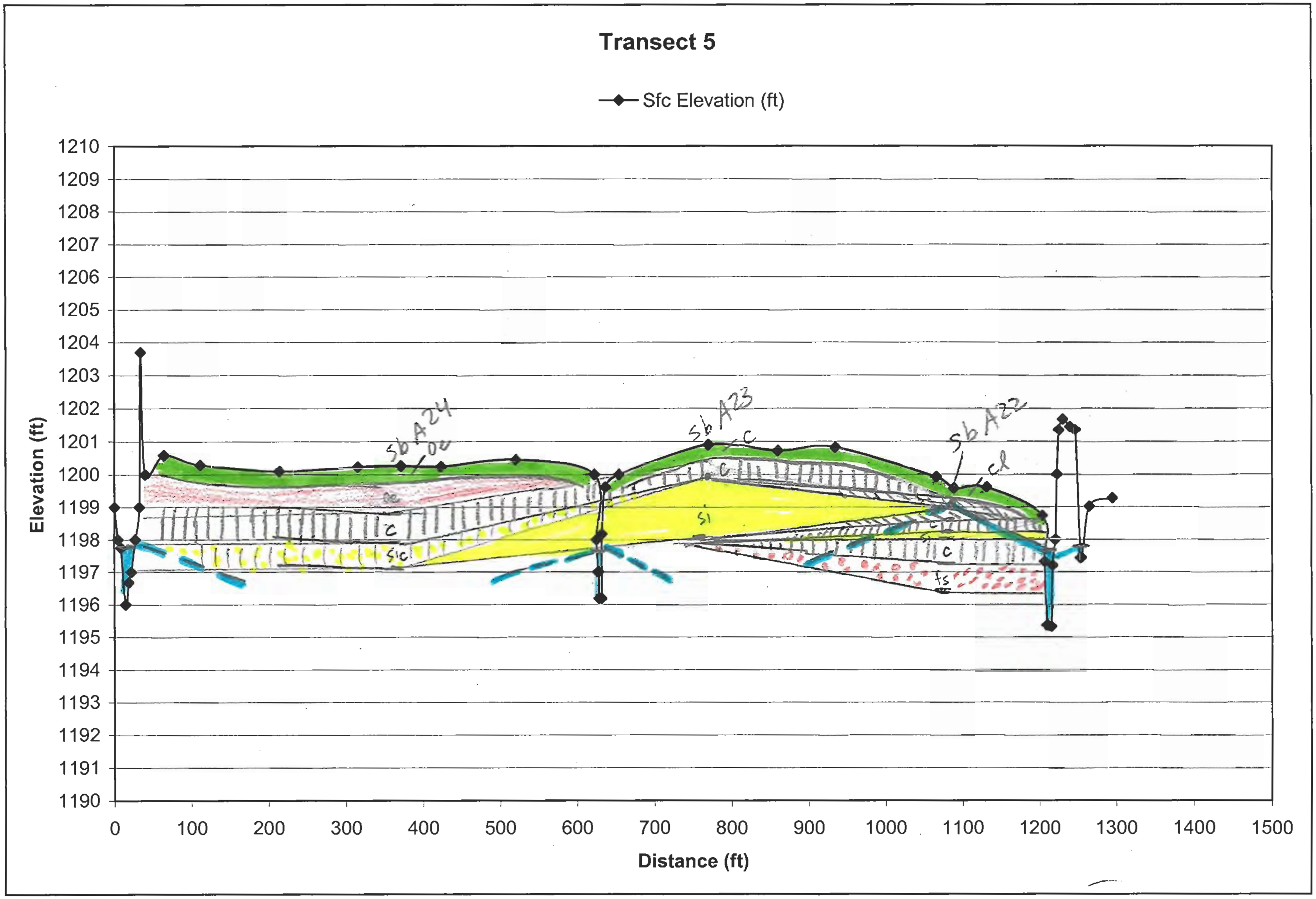

Transect 5
Sfc Elevation (ft)
Elevation (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Distance (ft)
sb A24
oe
oe
c
sic
sb A23
c
c
si
sb A22
cl
c
si
c
fs

Table 1
Aitkin Wetland Mitigation Site
Soil Boring Summary
PolyMet Mining Co.

Soil Boring ID	Depth (inches)	Soil Type	Hydrology	Date	Location Description	Vegetation	Approximate Ground Elevation (ft. MSL)
West Side of Highway 1							
SB-1	0-20	mucky peat/peaty muck	No saturation, no water table	4/25/2007	T47N, R27W, S1	Kentucky blue grass	1199.9
	20+	black loam	No saturation, no water table				
SB-2	0-28	mucky peat/fibric peat	No saturation, no water table	4/25/2007	T47N, R27W, S1	Kentucky blue grass	1200
	28-32+	dark brown loam	No saturation, no water table				
SB-3	0-22	mucky peat/fibric peat	No saturation, no water table	4/25/2007	T47N, R27W, S1		1199.9
	22-24+	dark brown to black loam	No saturation, no water table				
SB-4	0-20	mucky peat/fibric peat	Frost at 12-20 inches, no saturation	4/25/2007	T47N, R27W, S1	Kentucky blue grass	1200
SB-5	0-17	mucky peat/fibric peat	Frost at 11-17 inches, no saturation	4/25/2007	T47N, R27W, S1	Kentucky blue grass	1200.4
SB-6	0-12	muck	No saturation, no water table	4/25/2007	T47N, R27W, S1	Sod field	1201.1
	12-28	fibric peat	No saturation, no water table				
	28+	gleyed and tan silt loam	No saturation, no water table				
SB-7	0-11	muck	No saturation, no water table	4/25/2007	T47N, R27W, S1	Sod field	1201
	11-24	fibric peat	Frost 12-24 inches, no saturation				
	24-28+	mucky peat	No frost, no saturation				
SB-8	0-15	fibric peat	No saturation, no water table	4/25/2007	T47N, R27W, S1	No vegetation	1196.4
	15-18	gleyed silt loam	Frost at 16 inches, no saturation				
SB-9	0-11	muck	No saturation, no water table	4/25/2007	T47N, R27W, S1	Canada bluejoint grass?, Juncus sp.?, reed canary grass	1200
	11-16	mucky peat/fibric peat	Frost at 14 inches, no saturation				
East Side of Highway 1							
SB-10	0-4	black loam	No saturation, no water table	4/25/2007	T47N, R26W, S6	Recently cut sod, no vegetation	1201.1
	4-8	light brown fine sand	No saturation, no water table				
	8-24	mixed sand, silty clay loam, mottling at 11 inches, mixed colors-light brown, black, and reddish mottles	No saturation, no water table				
SB-11	0-12	black sandy clay loam	No saturation, no water table	4/25/2007	T47N, R26W, S6	Recently cut sod, no vegetation	1201.5
	12-16	light brown sand	No saturation, no water table				
	16-18+	mixed silt, sandy clay, mixed colors-yellowish-brown, light brown	No saturation, no water table				
SB-12	0-14	black sandy loam	No saturation, no water table	4/25/2007	T47N, R26W, S6	Recently cut sod, no vegetation	1200.6
	14-17	dark gray sandy clay loam	No saturation, no water table				
	17-18+	tan sand	No saturation, no water table				
SB-13	0-12	black sandy loam	No saturation, no water table	4/25/2007	T47N, R26W, S6	Kentucky blue grass	1200.3
	12-17	dark gray sandy clay loam	No saturation, no water table				
	17-18+	tan sand	No saturation, no water table				
Reference Wetlands							
SB-14	0	Soils frozen at the surface	1-2 inches of inundation	4/25/2007	T48N, R26W, S7, 5 miles north of Aitkin sod farm	sedge meadow/ shrub carr/ tamarack swamp	N/A
SB-15	0	Soils frozen at the surface to 1-3 inches in depth under shrubs	0-2 inches of inundation	4/25/2007	T48N, R26W, S8, 5 miles north of Aitkin sod farm	shrub carr/ sedge meadow	N/A

Appendix F
Permanent Conservation Easement Examples

(Above Space is Reserved for Recording Information)

PERPETUAL CONSERVATION EASEMENT
FOR WETLAND BANK

Grantor:

Location: within Section 5, Township 39 North, Range 22 West, County of Pine

This Perpetual Conservation Easement for Wetland Replacement ("Easement") is made on (date) by the undersigned, hereinafter referred to collectively as the "Grantor":

RECITALS

A. This Easement is made pursuant to and in furtherance of the Wetland Conservation Act of 1991, as amended, Minn. Stat. §103G.222, *et. seq*. ("WCA") and the rules implementing WCA, Minn. R. ch. 8420 ("WCA Rules").

B. This Easement pertains to all or part of the real property in Pine County, Minnesota, which is legally described on *Exhibit A* attached hereto and made a part hereof ("Real Property").

C. The Real Property is the subject of a wetland bank plan pursuant to Minn. R.8420.0740.

D. The Grantors include all of the following (1) all the fee owners of the Real Property and (2) the applicants under the bank plan if different from the fee owners. The term "Grantor" includes all of the Grantors if there is more than one. The Grantors are jointly and severally responsible for complying with the terms of this instrument. This Easement and the duties and restrictions contained in it shall also run with the land.

E. WCA is administered by the State of Minnesota through its Board of Water and Soil Resources ("State").

F. The local government unit ("LGU") charged under WCA with approval of the subject wetland replacement plan ("replacement plan") is the Minnesota Department of Natural Resources – Division of Lands and Minerals. The subject wetland mitigation plan includes all fully executed forms provided by the State, all supporting maps, engineering plans, drawings, monitoring plan, vegetation establishment plan and management plan and facilities maintenance plan. A complete copy of the replacement plan is on file at the LGU. The address of the LGU is 1525 Third Avenue East, Hibbing, MN 55746. The State is responsible for the acceptance of this Easement.

G. The replacement plan requires the restoration or creation of a wetland on the portion of the Real Property designated in Exhibit B attached hereto and made a part hereof ("Replacement Area"). The replacement plan may also require the establishment of upland buffer within the Replacement Area. This Easement pertains to both wetlands and specified uplands within the Replacement Area.

H. The Replacement Area is subject to the WCA, WCA Rules and all other provisions of law that apply to wetlands, except that the exemptions in Minn. Stat. §103G.2241 and Minn. R. 8420.0122 do not apply to the Replacement Area, pursuant to Minn. Stat. §103G.222, subd. 1(h) and Minn. R. 8420.0115.

I. All references in this Easement to Minnesota Statutes and to Minnesota Rules are to the statutes and rules currently in effect and as amended or renumbered in the future.

J. The purposes of this Easement are to maintain and improve the ecological values of the Replacement Area through the means identified in the replacement plan and to preserve the Replacement Area in a natural condition in perpetuity.

IN ADDITION, THE GRANTORS, FOR THEMSELVES, THEIR HEIRS, SUCCESSORSAND ASSIGNS COVENANT THAT THEY:

1. Shall establish and maintain wetlands and upland buffers within the Replacement Area as specified in the replacement plan approved by the LGU and on file at the offices of the LGU. The wetland and any specified upland buffer area shall be the size and type specified in the replacement plan. Grantor shall not make any use of the Replacement Area that would adversely affect any of the functions or values of the area. Those functions and values are identified in Minn. R. 8420.0540, subp. 10, or specified in the approved replacement plan.

2. Shall pay the costs of establishment, maintenance, repairs and reconstruction of the wetlands and specified upland buffers within the Replacement Area, which the LGU or the State may deem necessary to comply with the specifications for the Replacement Area in the approved replacement plan. The Grantor's obligations under this paragraph include the payment of any lawful taxes or assessments on the Real Property.

3. Shall establish and maintain visible monuments such as signs, numbered fence posts or survey posts at prominent locations along the boundary of the Replacement Area in accordance with the approved replacement plan. If numbered fence posts are used, Grantor's Replacement Plan must contain a survey or scaled drawing of the property that corresponds to the fence post numbering. Posts

must be at least 4 feet high and notably visible on the landscape. If signs are used, such signs must be have a surface area of at least one quarter (1/4) square feet, mounted on a fence post at least 4 feet above ground, and minimally contain the words “Boundary of Wetland Replacement Area - Subject to Perpetual Conservation Easement Restrictions – Contact MN Board of Water and Soil Resources or Local Soil and Water Conservation District for Further Information.” Said monuments must be made of non-degradable material and shall be at least four feet in height.

4. Grants to the LGU, the State, and the agents and employees of the LGU and the State, reasonable access to the Replacement Area for inspection, monitoring and enforcement purposes. The LGU, the State, and the agents and employees of the State are hereby granted a perpetual ingress and egress easement ("Access Easement") for access to and from the Replacement Area. The Access Easement shall be over and across the area ("Access Area") that is specified on Exhibit A attached hereto and made a part hereof or, if not specified on Exhibit A, the most reasonably direct and convenient route between the Replacement Area and a public road. If all or any part of the Access Area is owned by a person or entity other than Grantor, then the owner has joined in this Easement for purposes of granting the Access Easement by signing below. The signed written consent and subordination of all other holders of interests in the Access Area has been or will be obtained by Grantor and recorded in the same manner as specified in paragraph 5 below. This Easement grants no access to or entry to the Real Property, the Replacement Area, or the Access Area to the general public.

5. Represents that Grantor is (a) the fee owner of the Real Property and (b) the applicant under the replacement plan, if different from the fee owner. Grantor represents that all other parties who may have an interest in the Real Property (e.g., mortgagees, contract for deed vendees, holders of easements, etc.) have consented and subordinated their interests to this Easement by signing below. If it is determined at any time that there is any other party who may have an interest in the Real Property that is prior to this Easement, then Grantor shall immediately obtain and record a consent and subordination agreement signed by such other party. Acceptance of this Easement does not release Grantor from the obligation to obtain and record a consent and subordination agreement signed by any party who may have an interest in the Real Property that is prior to this Easement, even if such interest was of record at the time of acceptance.

6. Will record this easement at Grantor’s expense in the real property records of the county where the Real Property is located. Said recording shall take place within 30 days of the State’s acceptance of this Easement. The Grantor shall provide the original copy of the recorded easement to the State prior to making any credits from this replacement area available for use.

7. Acknowledge that this Easement shall be unlimited in duration, without being re-recorded. This Easement shall be deemed to be a perpetual conservation easement pursuant to Minn. Stat. ch. 84C.

8. Acknowledge that, unless expressly authorized in writing by the LGU in the approved replacement plan, Grantor:

(a) Shall not produce agricultural crops on the Replacement Area, except that this provision does not restrict the harvest of the seeds of native vegetation if only the seed-head is removed in the process of harvest and does not involve the use of vehicular, motorized equipment;

(b) Shall not cut hay, mow vegetation or cut timber on the Replacement Area except as allowed or prescribed in the Replacement Plan;

(c) Shall not make any vegetative alterations on the Replacement Area that do not enhance or would degrade the ecological functions and values of the Replacement Area. Vegetative alterations shall be limited to those listed in the approved replacement plan;

(d) Shall not graze livestock on the Replacement Area;

(e) Shall not place any materials, substances or other objects, nor erect or construct any type of structure, temporary or permanent, on the Replacement Area.

(f) Shall not allow vehicular traffic on the Replacement Area except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(g) Shall not alter the topography of the Replacement Area by any means including plowing, dredging, filling, mining or drilling except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(h) Shall not modify the hydrology of the Replacement Area in any way or by any means including pumping, draining, ditching, diking, impounding or diverting surface or ground water into or out of the Replacement Area except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(i) Shall regularly inspect and maintain structures specified in the Replacement Plan in good working condition to sustain the goals in the approved Replacement Plan.

9. Acknowledge that the Grantor is responsible, at Grantor’s cost, for weed control by complying with noxious weed control laws and emergency control of pests necessary to protect the public health on the Replacement Area.

10. Acknowledge that this Easement may be modified only by the joint written approval of the LGU and the State. If the Replacement Area has been used to mitigate wetland losses under the Federal Water Pollution Control Act, the U.S. Army Corps of Engineers (or successor agency) must also agree to the modification in writing.

11. Acknowledge that this Easement may be enforced, at law or in equity, by the LGU or the State. The LGU and the State shall be entitled to recover an award of reasonable attorney’s fees from Grantor in any action to enforce this Easement. The right to enforce the terms of this Easement is not waived or forfeited by any forbearance or failure to act on the part of the State or LGU. If the subject Replacement Area is to be used partially or wholly to fulfill permit requirements under the Federal Water Pollution Control Act or a federal farm program, then the provisions of this Easement

that run to the State or the LGU may also be enforced by the United States of America in a court of competent jurisdiction.

12. Acknowledge that this Easement is not valid until the Easement has been accepted by the State, the Grantor has recorded this Easement and the State has received evidence of such recording.

SIGNATURE OF GRANTOR

SIGNATURE OF FEE OWNER(S): ____

____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name(s) with marital status).

____
Notary Public

Notarial Stamp or Seal

SIGNATURE OF BANK APPLICANT (S),
IF DIFFERENT FROM FEE OWNER: ____

____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name(s) with marital status).

____
Notary Public

Notarial Stamp or Seal

ACCEPTANCE

The State accepts the foregoing Easement.

MINNESOTA BOARD OF WATER AND SOIL RESOURCES:

By: ____

Its: ____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name of person) as (title) of the Board of Water and Soil Resources.

____
Notary Public

Notarial Stamp or Seal

This instrument was drafted by the Board of Water and Soil Resources
One West Water Street, St. Paul, MN 55107

If there are additional holders of interest the subject real property CHECK HERE ☐ and attach their Consent and Subordination agreement [BWSR Form Number: wca-bank-03 (consent).doc].

EXHIBIT A

Legal Description of Real Property

EXHIBIT B

Map or Survey of Bank Area

(Above Space is Reserved for Recording Information)

PERPETUAL CONSERVATION EASEMENT FOR WETLAND BANK

Grantor:

Location: within Section 6, Township 47 North, Range 26 West, County of Aitkin and Section 1, Township 47 North, Range 27 West, County of Aitkin

This Perpetual Conservation Easement for Wetland Replacement ("Easement") is made on (date) by the undersigned, hereinafter referred to collectively as the "Grantor":

RECITALS

A. This Easement is made pursuant to and in furtherance of the Wetland Conservation Act of 1991, as amended, Minn. Stat. §103G.222, *et. seq*. ("WCA") and the rules implementing WCA, Minn. R. ch. 8420 ("WCA Rules").

B. This Easement pertains to all or part of the real property in Aitkin County, Minnesota, which is legally described on *Exhibit A* attached hereto and made a part hereof ("Real Property").

C. The Real Property is the subject of a wetland bank plan pursuant to Minn. R.8420.0740.

D. The Grantors include all of the following (1) all the fee owners of the Real Property and (2) the applicants under the bank plan if different from the fee owners. The term "Grantor" includes all of the Grantors if there is more than one. The Grantors are jointly and severally responsible for complying with the terms of this instrument. This Easement and the duties and restrictions contained in it shall also run with the land.

E. WCA is administered by the State of Minnesota through its Board of Water and Soil Resources ("State").

F. The local government unit ("LGU") charged under WCA with approval of the subject wetland replacement plan ("replacement plan") is the Minnesota Department of Natural Resources – Division of Lands and Minerals. The subject wetland mitigation plan includes all fully executed forms provided by the State, all supporting maps, engineering plans, drawings, monitoring plan, vegetation establishment plan and management plan and facilities maintenance plan. A complete copy of the replacement plan is on file at the LGU. The address of the LGU is 1525 Third Avenue East, Hibbing, MN 55746. The State is responsible for the acceptance of this Easement.

G. The replacement plan requires the restoration or creation of a wetland on the portion of the Real Property designated in Exhibit B attached hereto and made a part hereof ("Replacement Area"). The replacement plan may also require the establishment of upland buffer within the Replacement Area. This Easement pertains to both wetlands and specified uplands within the Replacement Area.

H. The Replacement Area is subject to the WCA, WCA Rules and all other provisions of law that apply to wetlands, except that the exemptions in Minn. Stat. §103G.2241 and Minn. R. 8420.0122 do not apply to the Replacement Area, pursuant to Minn. Stat. §103G.222, subd. 1(h) and Minn. R. 8420.0115.

I. All references in this Easement to Minnesota Statutes and to Minnesota Rules are to the statutes and rules currently in effect and as amended or renumbered in the future.

J. The purposes of this Easement are to maintain and improve the ecological values of the Replacement Area through the means identified in the replacement plan and to preserve the Replacement Area in a natural condition in perpetuity.

IN ADDITION, THE GRANTORS, FOR THEMSELVES, THEIR HEIRS, SUCCESSORSAND ASSIGNS COVENANT THAT THEY:

1. Shall establish and maintain wetlands and upland buffers within the Replacement Area as specified in the replacement plan approved by the LGU and on file at the offices of the LGU. The wetland and any specified upland buffer area shall be the size and type specified in the replacement plan. Grantor shall not make any use of the Replacement Area that would adversely affect any of the functions or values of the area. Those functions and values are identified in Minn. R. 8420.0540, subp. 10, or specified in the approved replacement plan.

2. Shall pay the costs of establishment, maintenance, repairs and reconstruction of the wetlands and specified upland buffers within the Replacement Area, which the LGU or the State may deem necessary to comply with the specifications for the Replacement Area in the approved replacement plan. The Grantor's obligations under this paragraph include the payment of any lawful taxes or assessments on the Real Property.

3. Shall establish and maintain visible monuments such as signs, numbered fence posts or survey posts at prominent locations along the boundary of the Replacement Area in accordance with the approved replacement plan. If numbered fence posts are used, Grantor's Replacement Plan must contain a survey or scaled drawing of the property that corresponds to the fence post numbering. Posts

must be at least 4 feet high and notably visible on the landscape. If signs are used, such signs must be have a surface area of at least one quarter (1/4) square feet, mounted on a fence post at least 4 feet above ground, and minimally contain the words “Boundary of Wetland Replacement Area - Subject to Perpetual Conservation Easement Restrictions – Contact MN Board of Water and Soil Resources or Local Soil and Water Conservation District for Further Information.” Said monuments must be made of non-degradable material and shall be at least four feet in height.

4. Grants to the LGU, the State, and the agents and employees of the LGU and the State, reasonable access to the Replacement Area for inspection, monitoring and enforcement purposes. The LGU, the State, and the agents and employees of the State are hereby granted a perpetual ingress and egress easement ("Access Easement") for access to and from the Replacement Area. The Access Easement shall be over and across the area ("Access Area") that is specified on Exhibit A attached hereto and made a part hereof or, if not specified on Exhibit A, the most reasonably direct and convenient route between the Replacement Area and a public road. If all or any part of the Access Area is owned by a person or entity other than Grantor, then the owner has joined in this Easement for purposes of granting the Access Easement by signing below. The signed written consent and subordination of all other holders of interests in the Access Area has been or will be obtained by Grantor and recorded in the same manner as specified in paragraph 5 below. This Easement grants no access to or entry to the Real Property, the Replacement Area, or the Access Area to the general public.

5. Represents that Grantor is (a) the fee owner of the Real Property and (b) the applicant under the replacement plan, if different from the fee owner. Grantor represents that all other parties who may have an interest in the Real Property (e.g., mortgagees, contract for deed vendees, holders of easements, etc.) have consented and subordinated their interests to this Easement by signing below. If it is determined at any time that there is any other party who may have an interest in the Real Property that is prior to this Easement, then Grantor shall immediately obtain and record a consent and subordination agreement signed by such other party. Acceptance of this Easement does not release Grantor from the obligation to obtain and record a consent and subordination agreement signed by any party who may have an interest in the Real Property that is prior to this Easement, even if such interest was of record at the time of acceptance.

6. Will record this easement at Grantor’s expense in the real property records of the county where the Real Property is located. Said recording shall take place within 30 days of the State’s acceptance of this Easement. The Grantor shall provide the original copy of the recorded easement to the State prior to making any credits from this replacement area available for use.

7. Acknowledge that this Easement shall be unlimited in duration, without being re-recorded. This Easement shall be deemed to be a perpetual conservation easement pursuant to Minn. Stat. ch. 84C.

8. Acknowledge that, unless expressly authorized in writing by the LGU in the approved replacement plan, Grantor:

(a) Shall not produce agricultural crops on the Replacement Area, except that this provision does not restrict the harvest of the seeds of native vegetation if only the seed-head is removed in the process of harvest and does not involve the use of vehicular, motorized equipment;

(b) Shall not cut hay, mow vegetation or cut timber on the Replacement Area except as allowed or prescribed in the Replacement Plan;

(c) Shall not make any vegetative alterations on the Replacement Area that do not enhance or would degrade the ecological functions and values of the Replacement Area. Vegetative alterations shall be limited to those listed in the approved replacement plan;

(d) Shall not graze livestock on the Replacement Area;

(e) Shall not place any materials, substances or other objects, nor erect or construct any type of structure, temporary or permanent, on the Replacement Area.

(f) Shall not allow vehicular traffic on the Replacement Area except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(g) Shall not alter the topography of the Replacement Area by any means including plowing, dredging, filling, mining or drilling except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(h) Shall not modify the hydrology of the Replacement Area in any way or by any means including pumping, draining, ditching, diking, impounding or diverting surface or ground water into or out of the Replacement Area except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(i) Shall regularly inspect and maintain structures specified in the Replacement Plan in good working condition to sustain the goals in the approved Replacement Plan.

9. Acknowledge that the Grantor is responsible, at Grantor's cost, for weed control by complying with noxious weed control laws and emergency control of pests necessary to protect the public health on the Replacement Area.

10. Acknowledge that this Easement may be modified only by the joint written approval of the LGU and the State. If the Replacement Area has been used to mitigate wetland losses under the Federal Water Pollution Control Act, the U.S. Army Corps of Engineers (or successor agency) must also agree to the modification in writing.

11. Acknowledge that this Easement may be enforced, at law or in equity, by the LGU or the State. The LGU and the State shall be entitled to recover an award of reasonable attorney's fees from Grantor in any action to enforce this Easement. The right to enforce the terms of this Easement is not waived or forfeited by any forbearance or failure to act on the part of the State or LGU. If the subject Replacement Area is to be used partially or wholly to fulfill permit requirements under the Federal Water Pollution Control Act or a federal farm program, then the provisions of this Easement

that run to the State or the LGU may also be enforced by the United States of America in a court of competent jurisdiction.

12. Acknowledge that this Easement is not valid until the Easement has been accepted by the State, the Grantor has recorded this Easement and the State has received evidence of such recording.

SIGNATURE OF GRANTOR

SIGNATURE OF FEE OWNER(S): ______________________________

____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name(s) with marital status).

____
Notary Public

Notarial Stamp or Seal

SIGNATURE OF BANK APPLICANT (S),
IF DIFFERENT FROM FEE OWNER: ______________________________

____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name(s) with marital status).

____
Notary Public

Notarial Stamp or Seal

ACCEPTANCE

The State accepts the foregoing Easement.

MINNESOTA BOARD OF WATER AND SOIL RESOURCES:

By: ____

Its: ____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name of person) as (title) of the Board of Water and Soil Resources.

____
Notary Public

Notarial Stamp or Seal

This instrument was drafted by the Board of Water and Soil Resources
One West Water Street, St. Paul, MN 55107

If there are additional holders of interest the subject real property CHECK HERE ☐ and attach their Consent and Subordination agreement [BWSR Form Number: wca-bank-03 (consent).doc].

EXHIBIT A

Legal Description of Real Property

EXHIBIT B

Map or Survey of Bank Area

Attachment D

Zim Sod Wetland Mitigation Site

Zim Sod Wetland Mitigation Site
Wetland Mitigation Plan

Preliminary Wetland Mitigation Plan 2011

Prepared for
PolyMet Mining Inc.

November 2011

Zim Sod Wetland Mitigation Site Wetland Mitigation Plan

Preliminary Wetland Mitigation Plan 2011

Prepared for
PolyMet Mining Inc.

November 2011

4700 West 77th Street
Minneapolis, MN 55435-4803
Phone: (952) 832-2600
Fax: (952) 832-2601

Zim Sod Wetland Mitigation Site
Wetland Mitigation Plan
Preliminary Wetland Mitigation Plan 2011

November 2011

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1.0 Introduction

On behalf of PolyMet Mining Inc. (PolyMet), Barr Engineering Company (Barr) has prepared the following project-specific wetland mitigation plan for the Zim Sod Wetland Mitigation Site (Site). The Site is located in two separate units on approximately 569 acres of land, much of which is proposed to be restored for wetland mitigation credits for the NorthMet Project (Project). The two units will be developed concurrently and are hereby collectively referred to as the Site. The Site is located in St. Louis County in the St. Louis River major watershed (#3) within the Lake Superior basin (Bank Service Area #1) and southwest of Eveleth (see Figure 1). The North Unit is about 481 acres and the South Unit is about 88 acres.

The Site is currently an active sod farm that has been drained with ditches and sub-surface drain tiles. The project-specific mitigation plan includes the following methods of restoration to receive wetland mitigation credits, additional details are provided in Tables 1 and 2:

- Restoration of 401.5 acres of drained wetland to receive 100 percent mitigation credit or 401.5 credits;
- Hydrologic restoration of 48.1 acres of partially-drained wooded wetlands to receive 50 percent credit or 24.1 credits;
- Restoration of natural surface grade and wetland conditions in 21.5 acres of ditches which will be filled to receive 50 percent credit or 10.7 credits; and
- Restoration of native vegetation on 22.6 acres of upland buffers within drained fields and filled ditches, each of which will remain drained due to open ditches that cannot be filled, for 5.7 credits based on the 25 percent credit calculation for upland buffer.
- Easement protection of 28.8 acres of native coniferous bog communities at 12.5 percent credit for a total of 3.6 credits for preservation.

A total of 454 compensatory wetland mitigation credits are proposed from the Site. A permanent conservation easement, including legal access, will be prepared and recorded to protect the Site within one year after initiating the restoration activities.

This mitigation plan includes discussions of the project-specific wetland mitigation site, wetland restoration goals, construction activities, and performance standards. The plan is being submitted to the U.S. Army Corps of Engineers (USACE) as part of the Section 404 Clean Water Act Permit application and the Minnesota Department of Natural Resources (MNR), which acts as the administrator of the Minnesota Wetland Conservation Act (WCA) (Minnesota Rules 8420) for mining activities.

2.0 Wetland Mitigation Site Description

2.1 Mitigation Site Selection

The Site is within the same Bank Service Area and major watershed as the Project (Figure 1). The Project lies within the headwaters of the St. Louis River major watershed (#3) in St. Louis County and within Bank Service Area #1, which encompasses the watershed of Lake Superior.

The Site was selected for several reasons, including:

1. Private land ownership with wetland mitigation potential that is located near large areas of tax-forfeit or state-owned land,
2. The lack of roads or other public infrastructure that could be affected by wetland restoration,
3. The presence of sub-surface drain tiles installed to lower the water table and prevent soil saturation at the ground surface thereby effectively draining wetlands,
4. A high density of ditching within the site, and
5. Minimal effect on neighboring properties by altering site drainage.

The Site is located in central St. Louis County, between the towns of Zim and Sax. The proposed wetland restoration area is located within Sections 2, 3, 10, 11, 26, 27, and 34; Township 55 North; Range 18 West. Currently the Site is owned by two parties, but the entirety will be acquired by one party following the issuance of permits for the Project and will be controlled by PolyMet for the sole purpose of wetland mitigation during the required monitoring period.

2.2 Zim Sod Site History

2.2.1 Pre-Agricultural History

Available data were reviewed to determine information on site history and pre-settlement conditions. The Original Public Lands Survey Plat Map from 1867 (Minnesota Historical Society) and a map created from the original plat maps (Marschner, 1974) each show that the majority of the area was a coniferous bog or swamp, with some areas of open bog. These data are reliable indicators of regional vegetation types, though are not accurate predictors of site-specific design parameters.

2.2.2 Agricultural and Land Use History

Based on a review of historic aerial photos, it is evident that ditches have been present at the Site since before 1939. Only some portions of the North Unit along County Highway 7 had been cleared and cultivated for agriculture as of 1939. In each photo reviewed since 1939, it is evident that additional areas were added to the cultivation on the North unit. By 1981, the majority of the agricultural portions of the South Unit were developed and under intensive management for crop or sod production; likewise for the North Unit in the 1989 photo. According to the current landowner, much of the Site has been in operation as a sod farm for 40-50 years, though some portions were developed within the last 10 years.

2.3 Zim Sod Geology, Hydrology, and Ecology

2.3.1 Geology and Soils

According to soil mapping by the United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS), the entire Site is mapped as the Greenwood soil series (USDA, 2010). The Greenwood soil (Dysic, frigid Typic Haplohemist) is a very poorly drained hydric soil formed in organic deposits more than 51 inches thick. The official soil series description for this soil is provided in Appendix A. The organic deposits in the area accumulated over lacustrine sediment, mostly silt, deposited by Glacial Lake Upham (MDNR, 2010). However, at the Site, the underlying lacustrine deposits were observed to be gleyed clay. The Greenwood soil series is described as having a pH ranging from 3.5 to 4.5 and the typical vegetation is composed of bog species including: black spruce (*Picea mariana*), tamarack (*Larix laricina*), bog rosemary (*Andromeda polifolia*), bog laurel (*Kalmia polifolia*), leatherleaf (*Chamaedaphne calyculata*), blueberries (*Vaccinium* spp.), and sphagnum (*Sphagnum* spp.)

2.3.2 Topography

A topographic survey was completed in November 2010 and the one-foot contours based on the survey data are provided in Appendix B and in Figures 2 and 3. Ditches are the most noticeable topographic features on the Site, ranging from 2 to 9 feet in elevation lower than the surrounding field surface. The USGS quadrangle maps show ground elevations just northeast of the North Unit at 1330 feet Mean Sea Level (ft MSL) sloping downward, to the south and west, to about 1315 ft MSL within the South Unit (Figure 2). The on-site topographic survey indicates that ground surface elevations within the North Unit have subtle variations ranging from 1326 ft MSL along the north edge to 1321 ft MSL in the southwest corner of the Site. The county ditch along the western edge of the North Unit decreases from 1319 ft MSL at the northern end to about 1313 ft MSL at the southern end. The field surface elevation within the South Unit varies from 1314 ft MSL in the northeast corner to 1308 ft MSL in the southwest corner. The lowest elevation within the South Unit is the bottom of the ditch in the southwest corner at 1300 ft MSL, which is eight feet lower than the adjacent field (Figure 3).

2.3.3 Climate

The average annual precipitation for Zim, Minnesota, is 27.9 inches based on the 30-year normal period 1971 to 2000. The average annual temperature in this area is about 37.7 degrees Fahrenheit.

2.3.4 Hydrology

The Site lies near the middle of a large peatland complex that encompasses approximately 130 square miles, which is roughly bound by the Swan River to the west, U.S. Routes 2 to the south, 169 to the north, and 53 on the east. The hydrology in the majority of the peatland system has not been significantly altered by ditching or draining, although the area immediately to the south and east of the Site has ditches approximately every mile (on the section lines). Hydrology on the Site is likely to be primarily driven by direct precipitation and localized shallow groundwater with predictable annual declines in groundwater elevations during the summer. Groundwater in this peatland likely would contain very low mineral nutrients. Without mineral nutrients to buffer it, the soil water tends to be very acidic, which supports conditions appropriate for a bog community. Soil and/or water pH analyses will be completed prior to restoration to provide additional soil information. In particular, if the soil is acidic (below pH 4.2) the Site is expected to support bog communities.

According to information from the current landowner, drain tiles are present throughout the Site within each field. The current landowner and operator of all sod production activities reports that the drain tiles are spaced 50 to 100 feet apart at depths of 4 to 5 feet and effectively drain the area for sod production. In some years, irrigation is necessary to maintain soil moisture for growing sod grasses. An estimated location of these drain tiles was created using a review of historic aerial photos (Figures 4 and 5). In many of these photos, distinct parallel signatures are evident within the fields that appear to be caused by subsurface drainage. Additional information will be gathered on-site to verify drain tile locations and abundance by locating outlets in the ditches and confirming their presence below ground.

The primary water discharge within the Site and the general area is to the south and west through a system of drainage ditches which receive water from the subsurface drain tiles. The majority of these ditches are private ditches that only affect the drainage on the Site and primarily transmit water into a public, county ditch along County Highway 7 along the west edge of both units of the Site. The ditch along the eastern edge of the North Unit, flowing along the section line, is also a public ditch. Within the North Unit, the ditches along the north and south lines of Section 11 (along Dibbell Road and Ellsmere Road) are both public ditches. Public ditches and private ditches that facilitate drainage for the adjacent properties or the homesteads on the Site would not be impacted by restoration activities for this mitigation project as discussed later in this report. The South Unit has only one primary east-west ditch, which flows directly west into the county ditch along Highway 7.

The ditches are generally between 2 and 6 feet deep relative to the adjacent fields and are mostly well-maintained to be clear of obstructions. The county ditch along Highway 7 is the deepest and widest ditch on the Site and at the southern end of the South Unit it is up to 9 feet lower in elevation than the adjacent field. Within the private ditches, there are several control structures that maintain water levels within about 18 inches of the soil surface for sod production.

2.3.5 Natural Communities

The MDNR Ecological Classification System (2010) considers this region of the state to be the Tamarack Lowlands Subsection. This area is characterized by the level peatlands that occur in the bed of former Glacial Lake Upham. Most of the natural communities in this sub-section are coniferous bog or swamp wetlands that are dominated by black spruce and tamarack as well as extensive open bogs and sedge meadows. The wetlands on-site and nearby are primarily tamarack and black spruce bog communities. This area is also identified as the Sax-Zim Bog Important Bird Area (IBA) (National Audubon Society, 2010) due to a rich diversity of bird species and a large number of owls residing in the area.

2.3.6 Site Constraints

One utility easement crossing a portion of the North Unit is a Northern Natural Gas (NNG) underground pipeline. Two utility easements cross portions of the South Unit: the NNG pipeline and a Minnesota Power overhead transmission line. Typically, within these types of easements, tree and shrub growth is not allowed. The companies holding these easements will be contacted prior to restoration activities for specific information regarding the easements and any limitations. If necessary, credit calculations will be adjusted to reflect the appropriate area of each of these utilities.

In the North Unit, two homes are located within the Site boundary and two additional properties with homes are outside of, but adjacent to the Site boundary. These homes are elevated above the wetland restoration areas and the drainage on each of these properties will be maintained to protect the buildings from increased water levels. Additional analysis will be completed to ensure the homeowners will not be affected the hydrologic restoration on the Site.

2.4 Existing Wetlands

The site was evaluated for the presence of wetlands in November, 2010. Wetland data forms are provided in Appendix D, documenting that evaluation. All of the sod fields on the Site are identified as drained wetland, which is maintained by an intensive system of subsurface drain tiles and ditches (Figures 2 and 3). The fields have been systematically drained for many years and managed primarily for sod production. The ditches are considered degraded wetlands. Partially-drained wetlands on the Site are likely present within the wooded areas, which have not been cleared for sod farming, but have been affected by the drainage system.

2.5 Additional Site Information Needed

Prior to restoration, additional information will be collected for the final restoration design and planning. Ecologists will visit the Site to verify the effects and extent of existing drainage systems, soil, and vegetation. The following information will be collected:

- Drain tile outlets will be located and subsurface drain tiles mapped in representative portions of the Site.
- Shallow monitoring wells will be installed within some of the fields and in the forested areas to confirm the effects of the drainage.
- Vegetation will be reviewed in areas adjacent to the mitigation Site to help establish target communities.
- Soil and groundwater pH will be tested to determine suitability for bog restoration.

Information will be used for planning final restoration methods and to determine the final estimate of compensatory mitigation credits available for the Site.

3.0 Wetland Mitigation Goals and Credit Allocation

To the degree feasible, the primary goal of the wetland restoration on the Site is to restore a native wetland plant community. The plan for the restoration will also include an adaptive management plan to account for the natural development and to recognize changing conditions and unpredictable factors contributing to the dynamics of the Site. Restoration methods will be designed to restore a coniferous bog community (Eggers and Reed, 1997); however, developing a bog community is highly dependent on soil and groundwater parameters that are difficult to control. Therefore, a coniferous swamp community will be the contingent community if the soil and groundwater conditions are not adequate for bog regeneration. Coniferous bog or swamp is the target for the majority of the Site, from which 438 forested wetland credits will be established.

Historically, portions of this landscape were open, emergent wetland communities. Trees may not become established in some portions of the Site with excess soil moisture or where easements prevent planting. Where trees do not successfully establish, the target community will be an open bog or sedge meadow. Credit allocation may be modified in the future for areas where trees do not develop.

Shallow open water communities will be the target communities in the ponds created on the Site. These ponds will be excavated in order to gather borrow materials used to backfill ditches elsewhere on the Site to eliminate drainage. Shallow open water communities will be created on 8.3 acres.

The target communities described below include four primary wetland types that may become established. Credit allocation calculations are provided in Tables 1 and 2; a map of the conceptual restoration plan showing the anticipated restoration is provided in Figures 4 and 5.

3.1 Target Plant Communities

The majority of the Zim Sod Site will be restored to a coniferous bog or swamp community. The restoration of coniferous bogs and swamps are somewhat experimental in nature as few such projects have been successfully completed in Minnesota, making it difficult to determine realistic goals and performance criteria. As such, performance standards for the Site will be somewhat general in that the primary target is a forested native wetland community.

3.1.1 Coniferous Bog

Coniferous bogs occur where an accumulation of peat becomes isolated from mineral-rich groundwater such that the majority of the water and all mineral inputs come from precipitation. The peat continues to accumulate upward in the bog from the growth and deposition of sphagnum moss and other vegetation. Black spruce and several other bog species are sensitive to extended periods of high water, but are able to survive within the bog because the upper levels of peat remain aerated, especially in the middle of summer as the water table drops below the peat surface. The groundwater in the bog tends to be very acidic because there are very few minerals to act as a buffer (MDNR, 2010).

Sphagnum moss is difficult to establish and will be a limiting component for the restoration of a true bog community. A dense mat of sphagnum is an important component responsible for maintaining the appropriate soil pH, hydrologic, and peat conditions for the coniferous bog community. Coniferous bogs are dominated by black spruce and tamarack trees, though the trees are often stunted and slow-growing and canopy cover is often less than 50 percent. The ground layer is dominated by sphagnum mosses, sedges (*Carex* spp.), and various low ericaceous shrubs such as leather leaf and small cranberry (*Vaccinium oxycoccos*). Restoration of these and other bog dominants is difficult, because the species are difficult to propagate and many are not available commercially.

In order to restore sphagnum, the moss must be harvested from a donor site by shredding and collecting the upper 4 to 6 inches of sphagnum and applying the materials to the restoration site, which is still an unreliable practice. Furthermore, the accumulation of the sphagnum can be slow when applied to a heavily disturbed agricultural site, especially a site in which the soil has been regularly stripped for sod farming.

3.1.2 Coniferous Swamp

Although coniferous bog restoration techniques will be implemented throughout the Site, the development of the bog community is not guaranteed. Therefore, the coniferous swamp community will be the contingency community for development. Coniferous swamps have a poorly developed sphagnum mat and a greater predominance of minerotrophic species than a bog. Furthermore, many species present in a coniferous swamp are available commercially; whereas, bog species are much more difficult to re-introduce.

Coniferous swamp communities occur in peat soils with no direct contact to mineral soil, though mineral-rich groundwater contributes some nutrients to the plants and buffers the acidity of the peat.

Typically, in large peatland systems, this community type would occur adjacent to mineral-rich discharge or between bog communities and uplands. It generally occurs in areas where the high water table is more stable than that in a bog, leading to longer periods of surface soil saturation.

It is unlikely that mineral-rich groundwater is near the soil surface in the Site because it occurs within such a large complex of deep peat soil. However, there are two reasons a coniferous swamp may be more appropriate for the Site than a bog community. First, farming practices have physically and chemically altered the soil and hydrology and some of the peat topsoil has been stripped as part of the sod farming, thereby lowering the elevation relative to the regional groundwater table. Second, the residual mineral fertilizer is likely to favor species that would not otherwise thrive in a mineral-deficient peat soil. In this geomorphic setting, it is expected that a bog community will develop, but that process is difficult to control because it depends on the groundwater inputs and soil chemistry and may only occur after many years under natural conditions.

3.1.3 Sedge Meadow or Open Bog

The degree of soil moisture may be somewhat variable across the Site, though this is difficult to predict. It is expected that the majority of the Site will have saturated soil throughout most of the year, with seasonal draw-downs, especially during drought periods. Such hydrology will support black spruce and tamaracks, which tolerate considerable soil moisture, but require some periods of aerobic soil conditions. However, where the soil surface is saturated for the entire growing season, these tree species may not establish or growth will be slow. It is unclear which areas may not support trees, so the sedge meadow or open bog communities are presented as a contingency target community in the event that some areas are better suited for emergent wetland community types. Sphagnum would be a dominant ground cover in an open bog, though this may take many years to develop even with sphagnum introduction.

A community similar to a sedge meadow may develop if the soil and hydrology are more favorable to minerotrophic species and trees are unable to become established. The dominant plants in a sedge meadow include bluejoint grass (*Calamagrostis canadensis*), sedges (*Carex* spp.), and bulrushes (*Scirpus* spp.). Sedge meadows occur in a wide range of soils, including deep peats, though there is usually input from ground or surface water containing dissolved minerals. At the Site such mineral inputs are unlikely, though residual nutrients from fertilizer may provide this condition.

3.1.4 Shallow Open Water

Besides providing soil to restore hydrology and return ditches to natural condition, the open water will provide some additional wildlife habitat on the Site, ideal for waterfowl and amphibians. The ponds will receive full mitigation credit because each occurs in an area that naturally would be wetland. The shallow open water community would be dominated by submergent and floating-leaved plant species. Typical species would include pondweeds (*Potamogeton* spp.), coontail (*Ceratophyllum demersum*), and duckweeds (*Lemna* spp.). The fringes of these ponds would also support species commonly present in deep and shallow marsh communities.

3.2 Hydrologic Restoration

Restoration of the original hydrology is the primary goal at the Site. The majority of the internal private ditches on the Site will be filled with soil excavated from elsewhere on the Site. Filling these ditches will eliminate the drainage effects and plug the end of the drain tiles that discharge into the ditches. As a result, groundwater elevations are expected to rise within the fields and runoff from precipitation will no longer drain through subsurface tiles and the ditches. The majority of the water that will saturate the peat will come from precipitation that falls directly on the Site. Some groundwater will also contribute as it flows into the Site well as some groundwater flow from the large peatland complex to the north and east.

Ditches will be filled with soil excavated from areas adjacent to the ditches and from excavations on the Site. Material scraped from the edge of the ditches will not be excavated deeper than 1 foot below the presumed natural grade. Some ditches have shallow mounds from the ditch spoils; these will pushed back into the ditch to recreate the level peatland grade. Because natural hydrology is being restored within the filled ditches and the elimination of the ditches recreates the natural landscape, the ditches will receive partial credit (50 percent).

Mineral and peat soils will be place in appropriate layers within the backfilled ditches. Clay and other mineral soil will be placed in the bottom of the ditch to plug the drain tiles, ensuring that the artificial drainage will be eliminated. The majority of the mineral soils will come from the deeper portions of the excavations, though some may be present in spoil mounds adjacent to each ditch. Peat soils will be placed in the upper portions of the filled ditches. The peat will also effectively restrict flow and help return a near natural grade to the land. Much of the peat will come from the upper layers in the excavations, but may also be pushed in from the edge of each ditch.

Some ditches within or adjacent to the Site will not be filled because they are public ditches or protect neighboring private property from flooding. For ditches that cannot be filled, the drain tiles that flow into that ditch will be broken and removed near the outlet into the ditch. At least 20 feet of drain tile will be removed near the outlet into the ditch, and additional segments will be removed upslope when necessary. Because most of the tiles are placed in very level fields, removing a single segment should be sufficient for most tiles. Additional information on the tile location, flow, and elevation change will be reviewed prior to removal.

The lateral effect of the open ditches has been calculated to help determine wetland credits. Lateral effects are based on the van Schilfgaarde Equation (NRCS, 2011) and the results for ditches at varying drainage depths are provided in Appendix C. These drainage effects were calculated for the Greenwood and Wabuse soil series assuming there are no obstructions in the ditches and that they can drain free to the ditch bottom or to the bottom of the nearest downstream culvert. Ditches that remain open will not be eligible for mitigation credit and the adjacent areas drained by the lateral effect of these ditches will be eligible for the upland buffer credit (25 percent).

For wooded areas affected by the drainage system on the Site, hydrologic restoration will be the primary action for mitigation credit. These areas are already forested with coniferous bog or swamp species, but the adjacent drainage system has eliminated wetland hydrology or reduced the period of saturation. For the areas not surrounded by ditches, the lateral effects were calculated to determine how much the area is affected by the existing drainage. Ditch filling will restore these forested wetland areas. Because some portions of these wooded areas are still wetland but partially-drained, mitigation credits are projected based on restoration of partially-drained wetlands (50 percent).

3.3 Partially-drained wetlands

Several wooded areas occur within the scope and effect of the existing Zim Sod drainage system. These wooded areas are dominated by wetland trees, including tamaracks and black spruce, but are drained fully or partially by the nearby ditches and subsurface drain tiles. Once the drainage system is disabled, bog hydrology will return to these forests. Also, if necessary, portions of these forests may be managed to control invasive species or to encourage re-colonization by native species. The forests will also be within the area protected by a conservation easement and will be managed to eliminate invasive species. Therefore, these wooded are eligible for restoration of partially-drained wetlands.

3.4 Excavated Ponds

In order to fill the ditches, soil will be collected from excavated ponds scattered throughout the Site, which will become shallow open water communities. The ponds will be shallow enough to maintain rooted vegetation which will be allowed to establish naturally. Each of the ponds will be odd-shaped and have uneven bottom contours to provide some variability and natural character to the ponds. Besides providing soil, the open water will provide some additional wildlife habitat on the Site, ideal for waterfowl and amphibians. The ponds will receive full mitigation credit.

3.5 Wetland Preservation

Two forested wetland areas outside the effects of the drainage system will be protected under an easement in order to receive credits for wetland preservation. These areas are currently subject to logging, peat harvest, and drainage, much like nearby sites have been used for peat harvest and logging activities. The preservation area is coniferous bog, which will be protected from potential future degradation by a permanent conservation easement. The preservation areas will also be managed to control invasive species as part of this plan.

3.6 Credit Allocation

Mitigation credits are based on acreages shown in Tables 1 and 2 and in Figures 4 and 5, which were calculated primarily based on the on-site topographic survey and site mapping from aerial photos as verified by on-site assessments. The majority of the credits are proposed from the restoration of drained wetlands that are currently used for sod farming, from which there will be 100 percent credit for the areas restored. Credit from the removal of drainage and subsequent management of the partially-drained forested wetlands currently on the Site is allocated at 50 percent. Filled ditches will also receive 50 percent credit because the ditches will be restored to the natural hydrology regime with native vegetation. Areas near the public ditches will still be drained by the lateral effect of the open ditches; these areas will still be preserved as upland buffer. Thus, the credit allocation within the area of the ditch lateral effect will be based on credits for upland buffers, or 25 percent of the total area. Preservation areas will receive 12.5 percent credit for the areas within the legal easement boundaries.

The summary of the credits is as follows (all numbers are approximate):

- 401.5 credits for drained wetland restoration on 351.5 acres within the North Unit and 50.0 acres within the South Unit;

- 8.3 credits for the excavated ponds: 7.0 acres in the North Unit and 1.3 acre in the South Unit.
- 10.8 credits for filling ditches: 18.3 acres in the North Unit and 3.2 acres in the South Unit;
- 24.1 credits for restoration of partially-drained wooded areas: 43.6 acres in the North Unit and 4.5 acres in the South Unit;
- 5.7 credits for upland buffers in the ditch lateral effect area: 12.3 acres in the North Unit and 10.4 acres in the South Unit; and
- 3.6 credits for preservation of forested wetland areas: 11.6 acres in the North Unit and 17.2 acres in the South Unit.

In addition, ditches that remain open and roads that will be used to maintain access to the Site will not be eligible for credit.

4.0 Wetland Restoration Plan

The vegetation and hydrology will be restored to the Site over a one- to two-year construction phase followed by 20 years of management. Coniferous bog or swamp communities will be established using bog restoration methods. The whole site will be treated with similar methods because soil and hydrology are expected to be quite similar throughout. The interior ditches will be filled, raised berms will be leveled, and drain tiles will be disabled to restore wetland hydrology. Native, harvested bog materials will be spread throughout the Site to facilitate the re-introduction of sphagnum mosses and other bog species that cannot be easily re-introduced by seed. Natural re-generation of the herbaceous ground cover, in combination with the addition of bog harvest materials, will be supported by intensive weed management. Tree and shrub seedlings will be installed by hand throughout the Site. The Site will be carefully monitored and managed and supplemental plantings and seeding may be used to encourage development until performance standards are met.

4.1 General Site Preparation

At the beginning of the restoration, it is expected that all of the sod will have been recently removed and bare soil will be present throughout the Site. For any areas that are not bare, the vegetation will be removed to bare soil, especially non-native and invasive species. Soils may be cultivated as part of the weed control and for surface preparation for sphagnum spreading. Prior to the start of construction and hydrologic alterations, water levels will be lowered using the existing control structures to provide dry soil for safe machinery access.

4.2 Site Grading and Hydrology Restoration

Construction activities on the Site are intended to remove or minimize the effect of the artificial drainage features and return the hydrology to the original conditions. The existing drainage is largely maintained by subsurface drain tiles that lead to a system of ditches. To minimize drainage, the majority of the ditches will be filled with soils obtained from elsewhere on the Site, which will plug the ends of the subsurface drain tiles and prevent flow in the ditches. Some of the ditches cannot be filled because they affect other properties, so any subsurface drain tiles that flow into these ditches will be broken and disabled. The plan for construction activities is shown on the plan sheets in Appendix B.

Restoration activities will be initiated through site grading to fill ditches and break drain tiles. Ditch fill material will be collected from existing spoil banks and from pond excavations identified throughout the restoration area. Some topsoil may be pushed into the ditches from adjacent fields into the ditches, grading down no more than one-foot below existing surface elevation (except on spoil mounds). Mineral soils, preferably clay, will be placed in the bottom of the ditches up to the top of drain tile outlets or higher. Peat soils will be placed on top of the mineral soils, similar to the natural soil horizons. Ditches will be filled to near the existing grade or mounded higher to account for settling. Subsurface drain tiles that flow into ditches that will remain open will be broken and segments removed to prevent drainage into the ditches.

As soon as the ditches are filled and tiles are broken, bog materials will be spread onto the disturbed areas by side-casting as much as possible to minimize compaction. These activities will be performed immediately after the ditches are filled assuming the soil does not become too saturated for machinery access (see detailed bog restoration methods Section 4.3).

4.3 Bog Restoration Methods

The sphagnum moss restoration methods planned for the Site have been largely planned based on methods presented in the Peatland Restoration Guide (Quinty and Rochefort 2003) and based on information from peatland restoration projects by the Natural Resources Research Institute (NRRI), located near Zim. The study by Johnson, et al. (2000) to evaluate the effects of planting time, mulch application, and planting of companion *Carex* species on the establishment of sphagnum mosses was evaluated and considered in the development of this plan.

Suitable donor site(s) for bog harvest materials will be selected based on a review of sites on the proposed NorthMet mine (Mine Site) and from other sites near the mitigation Site. A suitable site would have a large area of a sphagnum mat, at least 12 inches thick and with relatively few trees and shrubs. The donor site would also need to be relatively accessible by machinery for harvest and loading the materials for transport. The ideal bog donor site(s) would occur at the proposed Mine Site in bogs that are proposed to be impacted by the mining activity. However, that would require transport of the bog materials from a considerable distance and may require many truckloads of materials. Therefore, sites closer to the mitigation Site would also be reviewed. If sufficient suitable sites are not found on the proposed Mine Site or transportation is considered to be impractical, a donor site closer to the mitigation Site may be used. For donor sites not located on the Mine Site, PolyMet would confer with the USACE and the MDNR before harvest of materials.

The donor site(s) will be characterized in the summer or fall prior to bog material harvest to identify existing cover of plants and mosses. Based on current research, the appropriate amount of sphagnum plant material needed for application at the restoration site is the equivalent of what can be collected from an area approximately 1/10 the size of the restoration area. Therefore, approximately 42 acres will be required to collect sufficient plant material.

Bog restoration would be completed as follows:

1. **Mitigation site surface preparation**
    a. Existing vegetation will be removed by mechanical removal or herbicide treatment in the summer and fall prior to spreading bog harvest material in the spring.

    b. Loose sod remnants and peat will be removed to form a smooth soil surface.

2. **Bog harvest material collection**
    a. Plant material will be collected in late fall, winter, or early spring before the frost has melted. Sphagnum fragments and additional materials collected in late fall or winter will be stored over winter for use the following spring.

    b. The top 4 to 6 inches of the bog surface will be shredded with a Rotovator or other equipment appropriate to shred surface vegetation. Shredded bog vegetation will be windrowed using a dozer or back-scraper and will be loaded in trucks using a front-end loader.

    c. The plant material will be transported to the restoration site and stockpiled close to the restoration area to minimize multiple hauls.

3. **Bog material spreading**
    a. The plant fragments will be spread over the site with a standard box manure spreader, ideally in early spring over frozen ground.

    b. The restoration site soil surface will be covered with a uniform 1 to 5 cm thick, fluffy layer of plant fragments.

4. **Straw spreading**
    a. Clean, fresh, straw mulch will be applied over plant fragments as soon as possible after plant spreading (the same day) to improve growing conditions for plant fragments by creating a wetter and cooler air layer at the peat surface.

b. Attempts will be made to utilize equipment that allows straw to be spread without traveling on top of plant fragments, such as a sideways straw bale spreader with a mulch pass made after plant spreading from adjacent areas not yet completed.

c. Straw application rate: 2,500 lbs/ac, 10 to 12 – 4-foot diameter round bales or 7 to 8 – 5-foot diameter round bales per acre.

5. **Fertilizer application**

a. Slow-release phosphate rock fertilizer (P_2O_5) will be applied to approximately one-half of the restoration areas with a conic spreader at 17.5 pounds/acre available phosphate to provide adequate nutrients to favor a rapid establishment of a sphagnum mat. Because current research is not conclusive regarding the benefits of fertilizer, it will only be applied to one-half of the Site to determine the effectiveness of this treatment and the potential for deleterious effects of promoting invasive vegetation establishment. If additional information becomes available prior to restoration this treatment may be eliminated or added to the Site.

b. Equipment that allows fertilizer to be spread without traveling on top of plant fragments and straw mulch will be used, such as with a conic spreader pulled behind an all-terrain vehicle, after mulch spreading has been completed.

4.4 Tree and Shrub Installation

Approximately, one to three years following bog harvest material installation, tree and shrub seedlings will be planted on the Site. The trees will be installed into the peat soil, through the newly establishing sphagnum and herbaceous community. After three years of monitoring the tree plantings, supplemental plantings may be recommended in certain areas, especially if maintenance activities or invasive species are problematic. Black spruce and tamarack will be the primary trees targeted for the planting, but other species may be considered based on their prevalence in bogs as shown in Table 3.

4.5 Excavated Ponds

Several ponds will be excavated to provide fill material for the existing ditches and will become shallow open water communities. Water in the ponds will be less than 6 feet deep, so that these still qualify as wetland communities and will still support rooted vegetation. The slopes within the ponds will be gradual, no steeper than 5:1 slopes (horizontal to vertical), ideally 8:1. The bottoms will be uneven and the shape of each pond will be irregular to maintain natural appearance and structure.

The majority of the substrate in the ponds will be mineral soil, primarily clay, though some peat will be returned after the excavation to provide a natural muck layer. However, this layer would likely settle into the deepest portions and could not be maintained evenly throughout the bottom.

The ponds will be managed similar to other portions of the Site except some herbaceous species will be planted to encourage establishment. Some emergent and floating-leaved species will be installed along the edges of the ponds. The majority of the vegetation is expected to colonize naturally and invasive species will be managed, when feasible and appropriate.

4.6 Natural Regeneration and Bog Establishment

The general restoration strategy for the majority of the native herbaceous community is to promote natural regeneration during the first two to three years after hydrologic restoration. To the extent practicable, the majority of the weed control will be completed by hand, ATV, or aerial application to minimize the impact on the developing sphagnum and the young trees. The proposed vegetation establishment and maintenance activities anticipated to meet the goals of the plan are listed for the conditions described, as appropriate for the restoration schedule:

1. **Presence of invasive species.** Apply appropriate herbicides within wetland restoration areas containing more than 10% areal coverage of reed canary grass or other invasive species. Depending on the density of each species in a given area, selective or broad-spectrum herbicides may be used. A list of invasive species is provided in Table 4. Mowing may also be used to prevent seed set, especially for annuals.
2. **Vegetation characterization.** Characterize vegetation in each wetland restoration area twice each year between May and September to determine necessary management and establishment procedures. Vegetation characterization will include documenting problem species present and the approximate areal coverage of each species.
3. **Spot treatment.** Spot spray up to three times annually to control reed canary grass and other perennial non-native or invasive species for 10 years or longer following initial restoration. Extensive treatments may not be needed after a sustainable wetland dominated by characteristic native vegetation is established such that the performance standards are achieved.
4. **General weed control**. Continue treatments 1, 2, and 3 annually until non-native or invasive species are adequately controlled.

4.7 Supplemental Planting and Seeding

Careful monitoring of vegetation development on the Site will be completed annually to determine where problems are occurring and, to the degree possible, to determine the cause of those problems. Beginning in the third growing season after planting, supplemental trees and shrubs may be installed if performance standards are not met. Seed additions may also be used, beginning in the third growing season, if areas are present where suitable native vegetation has not developed. As such, native seed mixes would be used similar to those recommended by the Minnesota Board of Water and Soil Resources (BWSR) and applied after appropriate measures have been taken to control the invasive species.

5.0 Wetland Mitigation Performance Standards

Performance standards have been developed for the Site to guide the restoration activities and to measure success. The performance standards are appropriate for either a coniferous bog or swamp community because the conditions for each are generally similar. The performance criteria include measures to evaluate whether or not the hydrology and vegetation meet the plan goals. If the performance standards are not met during the 20-year monitoring period for the forested communities, a proposal will be submitted describing the corrective actions proposed and an implementation schedule or monitoring may continue for a longer duration.

5.1 Performance Standards

5.1.1 General

Nearby reference wetlands will be identified prior to monitoring of the restored wetlands. Reference wetlands will be used to provide local context to supplement available information, expertise, and knowledge on natural wetland communities that are similar types as the mitigation wetlands. It is expected that the Site will meet these minimum general performance standards:

1. More than 75 percent of the vegetation in each wetland shall be facultative (FAC) or wetter (FACW, OBL).
2. Invasive plant species shall not comprise more than 10 percent cumulative areal coverage within any wetland community by the end of the eighth full growing season. Invasive species include those provided in Table 4.
3. Vegetative coverage will comprise at least 90 percent areal coverage by the end of the second full growing season to ensure adequate soil coverage, except in shallow open water communities.

5.1.2 Coniferous Bog or Swamp

The coniferous bog or swamp community will meet these minimum performance standards:

1. There will be at least 108 living tree stems per acre by the end of the tenth full growing season. The trees will be dominated by tamarack and or black spruce, but other species may be present.

2. Invasive plant species shall not comprise more than 10 percent cumulative areal coverage within any wetland community by the end of the eighth full growing season. Invasive species include those provided in Table 4.
3. Vegetative coverage will comprise at least 90 percent areal cover by the end of the fifth full growing season to ensure adequate soil coverage, except in shallow open water communities.

5.1.3 Sedge Meadow or Open Bog

In the event that trees do not become well-established in certain portions of the Site and supplemental plantings are not expected to be successful, the target community will be modified to a sedge meadow or open bog and the new target area will be described and enumerated in the annual monitoring reports. The sedge meadow or open bog community will meet the following performance standard:

1. By the end of the fifth full growing season, the herbaceous plant coverage will be comprised of at least 10 native grass, sedge, fern, rush, and/or forb species in sedge meadow communities and 5 native, herbaceous species within open bog communities; or will have a vegetative diversity/integrity rating of high quality using the Minnesota Routine Assessment Method for Evaluating Wetland Functions (MnRAM).
2. Hydrology will be similar to that which is recorded in a nearby reference wetland site. This will likely consist of a water table within 12 inches of the soil surface for at least half of the growing season except during growing seasons with precipitation below the range of normal (driest 30 percent of most recent 30-year period of precipitation records).

5.1.4 Shallow Open Water

The ponds will be excavated below the groundwater table and therefore will have standing water throughout most of the area. The edges of the ponds will be more similar to a shallow or deep marsh community, but are not separated here for practical purposes. The majority of the ponds will meet the following performance standard:

1. By the end of the fifth full growing season, the plant coverage will be comprised of at least 4 native emergent or floating-leaved species.
2. Ponds shall be inundated by at least 36 inches of water (in the deepest part) throughout the growing season except during growing seasons with precipitation below the range of normal (driest 30 percent of most recent 30-year period of precipitation records).

6.0 Wetland Restoration and Management Schedule

The following schedule represents a preliminary plan of the expected activities to restore wetlands at the Site. However, with an adaptive management perspective, it should be recognized that the timing of specific establishment and management activities are likely to change as the restoration progresses. The overall schedule for restoration activities is to complete the restoration work within the first 2 years of the Project. Within the first year after permit issuance, the Year 1 restoration work will be completed. The remaining restoration activities will generally follow the conceptual schedule provided below.

The wetlands restored on the Site will require regular management to become established. This is critical in the first 5 to 8 years and should be recognized as integral to the wetland restoration success. Management will include eliminating invasive species, creating ideal conditions for the native plants to flourish, and seeding/planting to supplement natural regeneration. Weed removal and careful monitoring is important during the early stages of the restoration. All management activities described below apply to the management of the entire Site, including areas receiving credit for restoration of drained and partially-drained wetlands, preservation, and upland buffers.

After certification from the permitting agencies that construction was completed as planned, a permanent conservation easement will be recorded and documentation will be provided to the USACE, the WCA administrator, and other appropriate regulatory agencies.

6.1 Preparation – Year 0

6.1.1 Fall and Winter

1. Lower existing water control structures to reduce water levels in the ditches prior to being filled with soil.
2. Remove all existing sod or other crops from the Site and eliminate all vegetation down to bare soil using herbicide applications, mowing, and cultivation where needed.
3. Harvest sphagnum from the donor site, Mine Site or other local site, and store at the Site through the winter.
4. Fill ditches and break subsurface drain tiles to restore site hydrology.

6.2 Year 1

6.2.1 Early Spring

1. Spread donor sphagnum material onto the site prior to melting frost.
2. Monitor water levels in restored wetlands.

6.2.2 Spring/Summer

1. Assess the presence of potentially problematic weeds and implement appropriate management methods including spot treatments with selective herbicides.
2. Complete construction repairs, as needed.

6.2.3 Fall—End of First Full Growing Season

1. Complete monitoring report, including documentation of wetland establishment activities during the year in comparison to the plan and recommend actions for the following year.
2. Apply herbicides as necessary to control non-native and invasive species in all communities.
3. Report on water levels in restored wetlands from the full growing season.
4. Prepare as-built survey and report following construction completion and request certification of construction.
5. Complete construction repairs, as needed.

6.3 Year 2

6.3.1 Spring/Summer

1. Monitor water levels in wetlands.
2. If hydrologic conditions have stabilized and are appropriate, plant trees and shrubs, otherwise wait until spring of Year 3.
3. Apply appropriate herbicides to control invasive species.

6.3.2 Fall—End of Second Full Growing Season

1. Complete monitoring report, including documentation of wetland establishment activities completed during the year in comparison to the plan and recommend actions for the following year.
2. Apply herbicides as necessary to control invasive species.
3. Report on water levels in restored wetlands from the full growing season.

6.4 Year 3

6.4.1 Spring/Summer

1. Monitor water levels in wetlands.
2. Apply appropriate herbicides to control invasive species.

6.4.1 Fall—End of Third Full Growing Season

1. Apply herbicides as necessary to control invasive species.
2. Complete monitoring report, including documentation of wetland establishment activities completed during the year in comparison to the plan and recommend actions for the following year.
3. Report on water levels in restored wetlands from the full growing season. Determine if the hydrology performance standard has been met or if the groundwater has sufficiently stabilized such that no further groundwater monitoring is necessary.
4. If large areas of invasive species are still present, those areas should be aggressively controlled and seeding and/or other remedial activities should be planned.
5. If trees and shrubs are not meeting performance criteria, re-planting efforts should be planned for next spring. If high groundwater is problematic in certain areas, the target communities in those areas should be altered to sedge meadow or open bog.

6.5 Years 4 through 20

Many of the management activities described for Year 3 will be continued in Years 4-20. Monitoring reports will be completed in years 1, 3, 5, 10, and 20, if necessary. Hydrology monitoring wells will be removed from the Site at the end of year 5, assuming the hydrology performance standards are met. The monitoring report completed after the tenth growing season will assess whether or not the restoration is sufficiently complete and, if additional monitoring and reporting are warranted.

7.0 Wetland Mitigation Monitoring

The Site will be monitored for 20 years beginning in the first full growing season after completing hydrologic restoration. The purpose of the monitoring is to document the progress and condition of the restored wetland communities. Monitoring reports will be prepared and submitted in Years 1, 2, 3, 5, 10, and 20. The monitoring reports will assess whether or not the restored wetlands are in conformance with performance standards and determine whether continued monitoring is required. Monitoring visits will include review of the areas receiving credit for restoration of partially-drained wetlands and in the preservation areas to identify potential problems with invasive species or other forms of degradation.

Hydrologic parameters will be evaluated in the mitigation areas more intensively during the first two years and then at a level appropriate to the hydrologic characteristics of each area thereafter. Any significant modifications to the monitoring frequency proposed herein will be described in a revised monitoring plan to be submitted for review and approval prior to implementation. In addition to monitoring the restored wetlands, one reference wetland of each wetland restoration community type (if available) will be monitored within the general area of the restoration site in areas with relatively natural hydrologic conditions. A monitoring plan will be submitted for review and approval that will include proposed locations of reference wetlands prior to implementing the monitoring program. Continuous recording wells will be utilized to the extent feasible.

7.1 Hydrologic Monitoring

Hydrologic monitoring in these generally saturated wetland communities will be conducted using shallow wells placed throughout the Site sufficient to characterize hydrology through year 5. Water elevations will be recorded at least once per week from May through mid-July and monthly thereafter until the end of the growing season.

7.2 Vegetation Monitoring

A detailed vegetation survey will be conducted once per year (typically July-August) in each wetland mitigation community, as well as the reference wetland communities, to evaluate the success of the restoration during the appropriate monitoring period for each community type. At least 10 permanent monitoring points will be established throughout the Site (at least 2 plots in the South Unit). Vegetation sampling at each of these points will be completed based on guidance from the 1987 Wetland Delineation Manual (Environmental Laboratory, 1987) and the Northcentral and Northeast

Regional Supplement (Environmental Laboratory, 2009) or appropriate updated version. Monitoring within the established plots will include a count of living trees and shrubs to estimate survivorship rates. Meander surveys will also be incorporated during the site visits to identify the overall vegetation and the presence of invasive species throughout the Site. Documentation photographs will also be taken during monitoring from fixed reference points around each restored wetland area.

7.3 Monitoring Report

A monitoring report will be prepared following growing seasons in years 1, 2, 3, 5, 10, and 20. The report will describe the status of the wetland mitigation and summarize the results of the vegetative and hydrologic monitoring. Additionally, the report will document all management activities and corrective actions conducted during the previous year and describe those activities planned for the following year. The report will be submitted by January 31 of the year following monitoring. The annual report will include the following information at a minimum:

- A brief description of the wetland mitigation areas; including location, size, vegetative and hydrologic monitoring data, current wetland types, and desired wetland types.
- An as-built survey will be provided in the first-year report along with a comparison of the as-built survey to the approved plans.
- A summary of water level measurements taken to date and a determination whether the hydrology in the wetlands meets the design elevations and wetland hydrology criteria as defined in the performance standards.
- Vegetation survey information, including species and percent areal coverage within each restored wetland community and each upland buffer community and a determination of whether the vegetation meets the performance criteria.
- A map of the various plant communities present within the restoration areas will be prepared as distinctly different communities develop.
- Annual color photographs of the wetland mitigation sites taken during vegetation monitoring at designated photo-reference points.
- A summary of management activities and/or corrective actions conducted in the wetlands during the previous year and activities planned for the following year.

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Tables

Table 1
Wetland Mitigation Credits on the North Unit of the Zim Sod Site
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, Minnesota

Field Number/Feature Type	**Area (acres)**	**Credit**
N01	16.1	16.1
N02	17.8	17.8
N03	2.2	2.2
N04	18.8	18.8
N05	21.1	21.1
N06	17.8	17.8
N07	17.6	17.6
N08	21.5	21.5
N09	23.1	23.1
N10	13.6	13.6
N11	19.0	19.0
N12	20.9	20.9
N13	19.2	19.2
N14	22.2	22.2
N15	22.9	22.9
N16	26.1	26.1
N17	21.9	21.9
N18	29.9	29.9
North Unit Drained Fields Total (100% Credit)	*351.5*	*351.5*
N03	2.1	2.1
N05	0.3	0.3
N10	2.4	2.4
N16	0.5	0.5
N17	1.7	1.7
North Unit Total Excavations (100% Credit)	*7.0*	*7.0*
Wooded areas - partially drained (50% Credit)	*43.6*	*21.8*
Ditch fill (50% Credit)	*18.3*	*9.2*
Upland Buffer - Ditch Lateral Effect (25% Credit)	*12.3*	*3.1*
Preservation areas	*11.6*	*1.4*
Open Ditches (0% Credit)	*2.3*	-
Road (0% Credit)	*5.3*	-
Additional land - no credits	*28.7*	-
North Unit Totals	**480.6**	**394.0**

Table 2

Wetland Mitigation Credits on the South Unit of the Zim Sod Site

NorthMet Project

PolyMet Mining Inc.

Hoyt Lakes, Minnesota

Field Number/Feature Type	**Area (acres)**	**Credit (acres)**
S01	6.3	6.3
S02	39.6	39.6
S03	4.2	4.2
South Unit Drained Fields Total (100% Credit)	*50.0*	*50.0*
S02	1.3	1.3
South Unit Excavations Total (100% Credit)	*1.3*	*1.3*
Wooded areas - partially drained (50% Credit)	*4.5*	*2.3*
Ditch fill (50% Credit)	*3.2*	*1.6*
Upland Buffer - Ditch Lateral Effect (25% Credit)	*10.4*	*2.6*
Preservation (12.5% Credit)	*17.2*	*2.2*
Open Ditches (0% Credit)	*1.5*	-
Road (0% Credit)	*0.4*	-
South Unit Totals	**88.5**	**59.9**

Table 3
Potential tree species that may be planted at the Zim Sod Site
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, Minnesota

Scientific Name	**Common Name**	**Expected occurrence in:**	
		Coniferous Swamp	**Coniferous Bogs**
Acer rubrum	Red Maple	Infrequent	Rare
Betula papyrifera	Paper Birch	Common	Rare
Fraxinus nigra	Black Ash	Infrequent	Rare
Populus tremuloides	Quaking aspen	Infrequent	Rare
Abies balsamifera	Balsam fir	Common	Rare
Larix laricina	Tamarack	Abundant	Common
Picea nigra	Black spruce	Abundant	Abundant
Thuja occidentalis	White cedar	Common	Rare
Alnus incana	Speckled alder	Common	Rare
Betula pumila	Bog birch	Common	Rare
Amelanchier spp.	Juneberries	Infrequent	Rare

Table 4
Potentially problematic invasive species for the Zim Sod Site[1]
NorthMet Project
PolyMet Mining Inc.
Hoyt Lakes, Minnesota

Common Name	**Scientific Name**
Flowering rush	*Botomus umbellatus*
Canada thistle	*Cirsium arvense*
Yellow iris	*Iris pseudacorus*
Bird's Foot trefoil	*Lotus corniculatus*
Purple loosestrife	*Lythrum salicaria*
Reed canary grass	*Phalaris arundinacea*
Buckthorns	*Rhamnus* spp
Curly dock	*Rumex crispus*
Foxtail	*Setaria* spp.
Common tansy	*Tanacetum vulgare*
Narrowleaf cattail	*Typha angustifolia*
Blue cattail	*Typha* x *glauca*
Common reed	*Phragmites australis*
Perennial sow thistle	*Sonchus arvensis*
Sweet clover	*Melilotus alba*
Smooth brome grass	*Bromus inermis*

[1] Also includes other non-native species based on Minnesota Department of Natural Resources (2002).

Figures

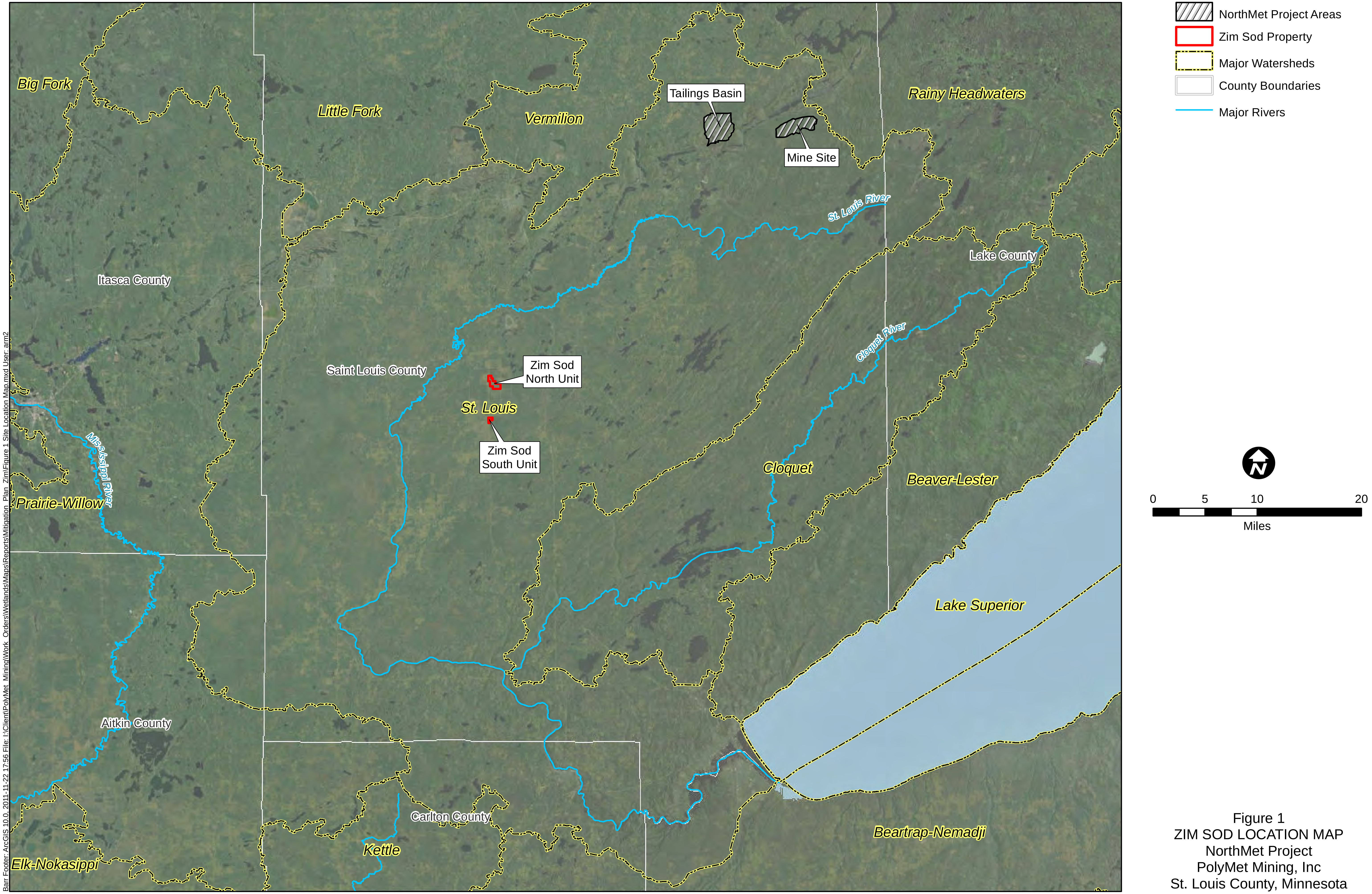
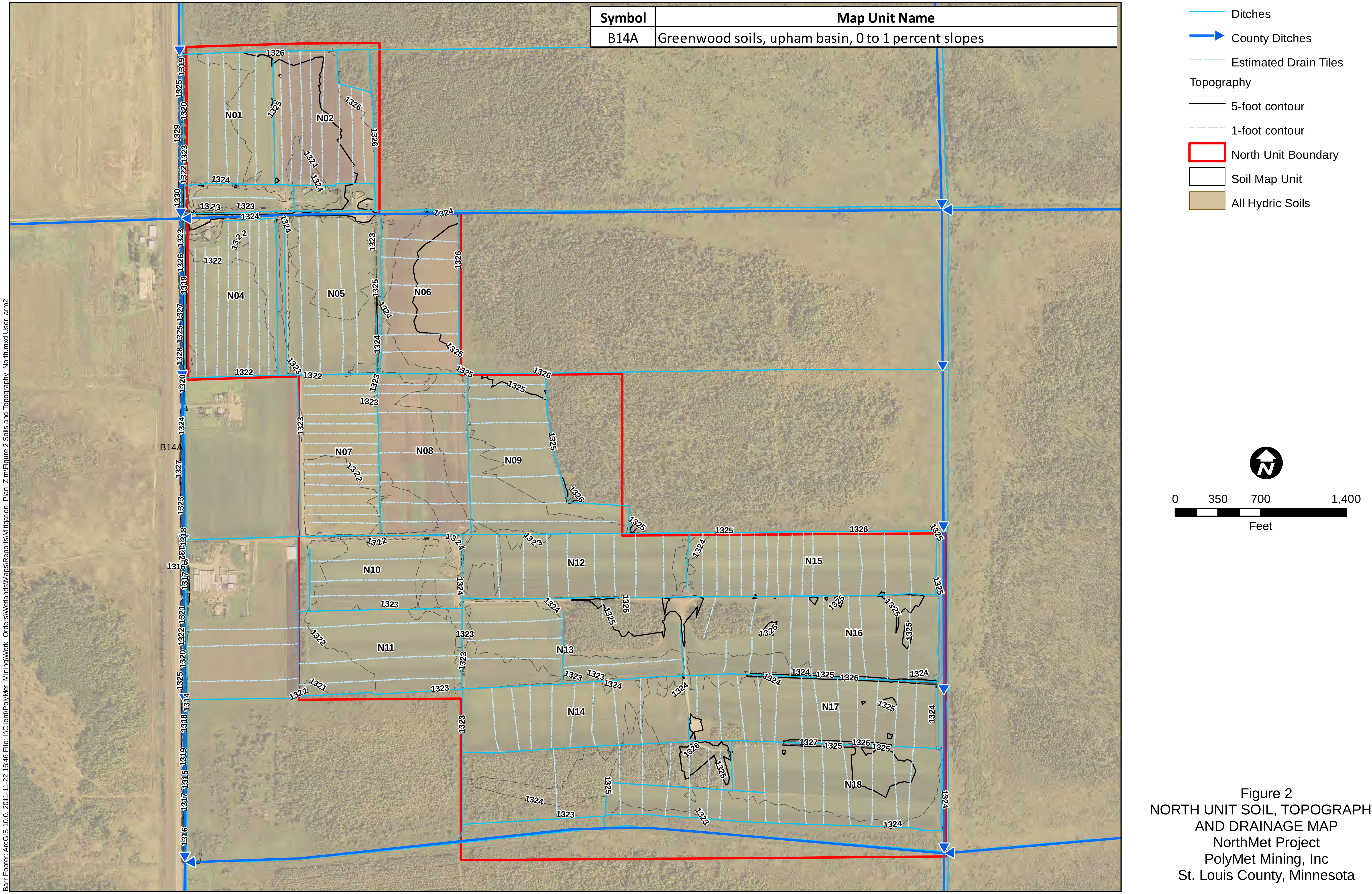
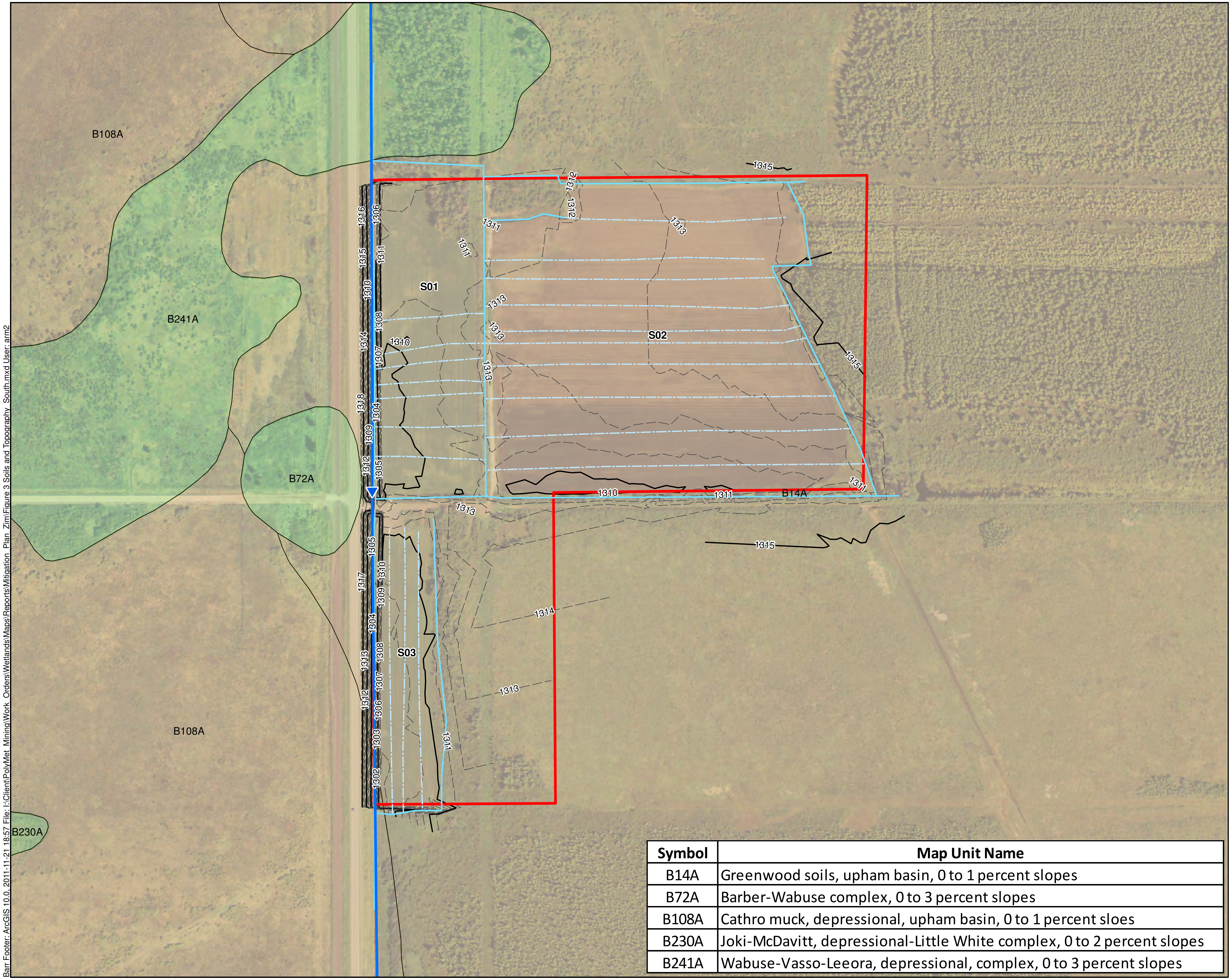


Figure 1
ZIM SOD LOCATION MAP
NorthMet Project
PolyMet Mining, Inc
St. Louis County, Minnesota



Symbol	Map Unit Name
B14A	Greenwood soils, upham basin, 0 to 1 percent slopes

Figure 2
NORTH UNIT SOIL, TOPOGRAPHY,
AND DRAINAGE MAP
NorthMet Project
PolyMet Mining, Inc
St. Louis County, Minnesota



Symbol	Map Unit Name
B14A	Greenwood soils, upham basin, 0 to 1 percent slopes
B72A	Barber-Wabuse complex, 0 to 3 percent slopes
B108A	Cathro muck, depressional, upham basin, 0 to 1 percent sloes
B230A	Joki-McDavitt, depressional-Little White complex, 0 to 2 percent slopes
B241A	Wabuse-Vasso-Leeora, depressional, complex, 0 to 3 percent slopes

Figure 3
SOUTH UNIT SOIL, TOPOGRAPHY,
AND DRAINAGE MAP
NorthMet Project
PolyMet Mining, Inc
St. Louis County, Minnesota

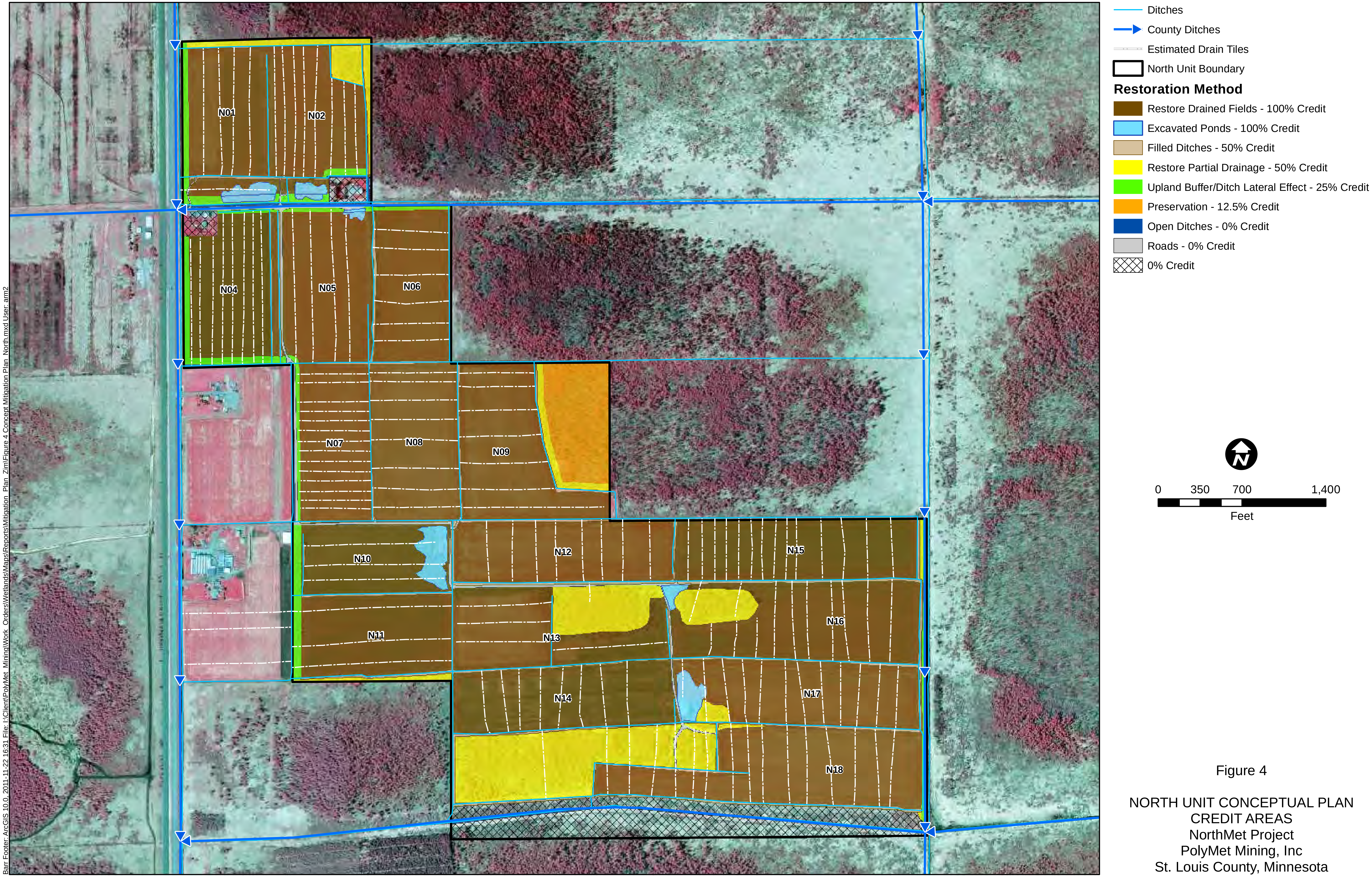


Figure 4

NORTH UNIT CONCEPTUAL PLAN
CREDIT AREAS
NorthMet Project
PolyMet Mining, Inc
St. Louis County, Minnesota

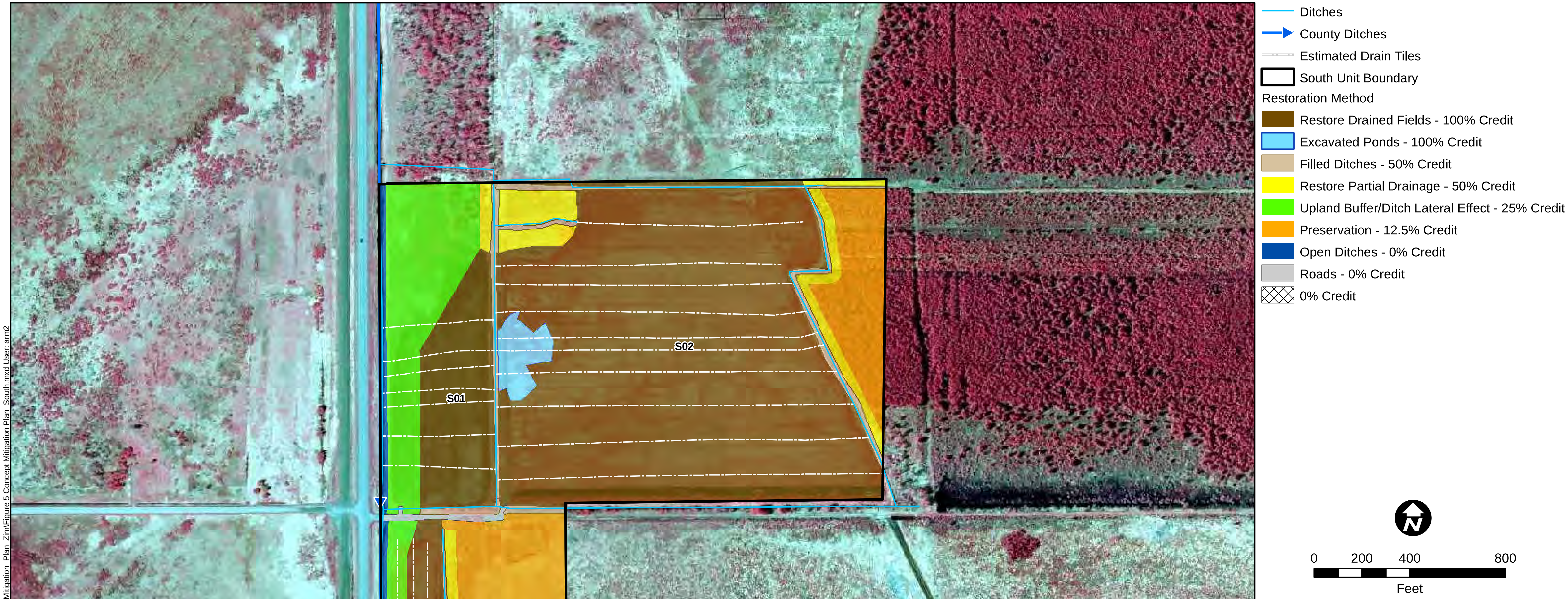


Figure 5
SOUTH UNIT CONCEPTUAL PLAN
CREDIT AREAS
NorthMet Project
PolyMet Mining, Inc
St. Louis County, Minnesota

Barr Footer: ArcGIS 10.0, 2011-11-22 16:39 File: I:\Client\PolyMet Mining\Work Orders\Wetlands\Maps\Reports\Mitigation Plan Zim\Figure 5 Concept Mitigation Plan South.mxd User: arm2

Appendices

Appendix A

Greenwood Soil Series Official Soil Description

`LOCATION GREENWOOD          MI+MA ME MN NH NY WI`

Established Series
Rev. LWB-WEF-LMC
11/2004

GREENWOOD SERIES

The Greenwood series consists of very deep ,very poorly drained soils formed in organic deposits more than 51 inches thick on outwash plains, till floored lake plains, or lake plains. These soils have moderate or moderately rapid permeability. Slopes range from 0 to 2 percent. Mean annual precipitation is about 29 inches, and mean annual temperature is about 43 degrees F.

TAXONOMIC CLASS: Dysic, frigid Typic Haplohemists

TYPICAL PEDON: Greenwood mucky peat - on a 1 percent slope in a forested area. (Colors are for moist soil unless otherwise stated.)

Oi--0 to 6 inches; brown (7.5YR 4/4) peat (fibric material); about 95 percent fiber, about 90 percent rubbed; massive; friable; primarily live roots and sphagnum moss; extremely acid; clear smooth boundary.

Oe1--6 to 10 inches; very dark brown (10YR 2/2) broken face and rubbed mucky peat (hemic material); about 80 percent fiber, about 20 percent rubbed; massive; friable; primarily herbaceous fibers; extremely acid; gradual smooth boundary.

Oe2--10 to 35 inches; dark brown (7.5YR 3/2) broken face and rubbed mucky peat (hemic material); about 80 percent fibers, about 20 percent rubbed; massive; friable; primarily herbaceous fibers; extremely acid; gradual smooth boundary.

Oe3--35 to 60 inches; dark brown (7.5YR 3/2) broken face and rubbed mucky peat (hemic material); about 90 percent fibers, about 35 percent rubbed; massive; friable; primarily herbaceous fibers; very strongly acid.

TYPE LOCATION: Clare County, Michigan; about 5 miles south and 1 mile west of Temple; 300 feet east and 825 feet south of the northwest corner, sec. 16, T. 18 N., R. 6 W.

RANGE IN CHARACTERISTICS: The organic layers are more than 51 inches thick. The surface tier is commonly peat (fibric material) derived from sphagnum moss. In some places, these layers are largely undecomposed sphagnum moss and in others they are stratified muck, mucky peat, and peat derived from both herbaceous plants and sphagnum moss. Muck, mucky peat, and peat types have been recognized. The O layers have hue of 10YR to 5YR, value of 2 to 6, and chroma of 1 to 4; colors become darker upon brief exposure to air. Oi layers have the highest values and chromas. In some pedons, colors after rubbing change from 0.5 to 1 unit in value or chroma or both. The layers in the subsurface and bottom tiers are dominantly mucky peat (hemic material) derived from herbaceous plants. In some pedons, layers of peat or muck have a combined thickness of less than 10 inches in the lower two tiers. These layers have pH of 4.5 or less in 0.01M calcium chloride and commonly range from pH 3.5 to 4.5. Fragments of woody material ranging from about 1 to 8 inches in diameter are throughout the control section. Woody fibers comprise less than 50 percent of the organic volume after rubbing. There is no mineral soil material recognized in the profile.

COMPETING SERIES: There are none. The Burnt Vly, Citypoint, Dawson, Loxley and Pleasant Lake soils are in closely related families. All of these soils are dominantly composed of sapric materials. In addition,the Citypoint series has a lithic or paralithic contact within 60 inches and the Burnt Vly and Dawson soils have sandy mineral soil within 51 inches of the surface.

GEOGRAPHIC SETTING: Greenwood soils are in depressions that range in size from small enclosed bogs in moraines to areas of about 1,000 acres in size. The larger areas commonly are on outwash plains, till floored lake plains, or lake plains. The mineral soils in the surrounding upland are generally derived from acid parent materials. Slopes range from 0 to 2 percent. Then mean annual precipitation ranges from about 22 to 35 inches, and the mean annual temperature is about 36 to 45 degrees F. Frost free days range from 88 to 150. Elevation above sea level ranges from 600 to 1,600 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Dawson, Deford, Kinross, and Roscommon soils. Dawson soils are shallow organic soils in similar landscape positions underlain by sand at a depth of 16 to 50 inches. The Deford, Kinross and Roscommon soils are poorly or very poorly drained sandy mineral soils in slightly higher landscape positions.

DRAINAGE AND PERMEABILITY: Very poorly drained. The representative depth to wet soil moisture status is at the surface to 1 foot below the surface at some time throughout the year. The representative depth of ponding is from 0 to 1.0 foot at some time throughout the year. Surface runoff is negligible. Permeability is moderate or moderately rapid.

USE AND VEGETATION: Very little use is made of these soils because of the extreme acidity and high water table. Few trees except some black spruce and tamarack grow on these soils. Ground cover is blueberries, bog rosemary, laurel, leatherleaf, and sphagnum mosses.

DISTRIBUTION AND EXTENT: Minnesota, Wisconsin, New Hampshire, New York, and the northern Lower Peninsula and Upper Peninsula of Michigan. The soil is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Ogemaw County, Michigan, 1923.

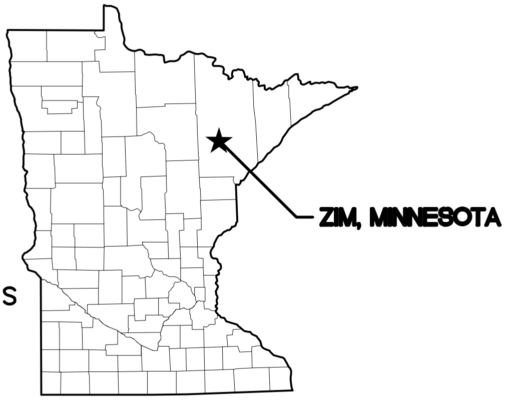
National Cooperative Soil Survey
U.S.A.

Appendix B

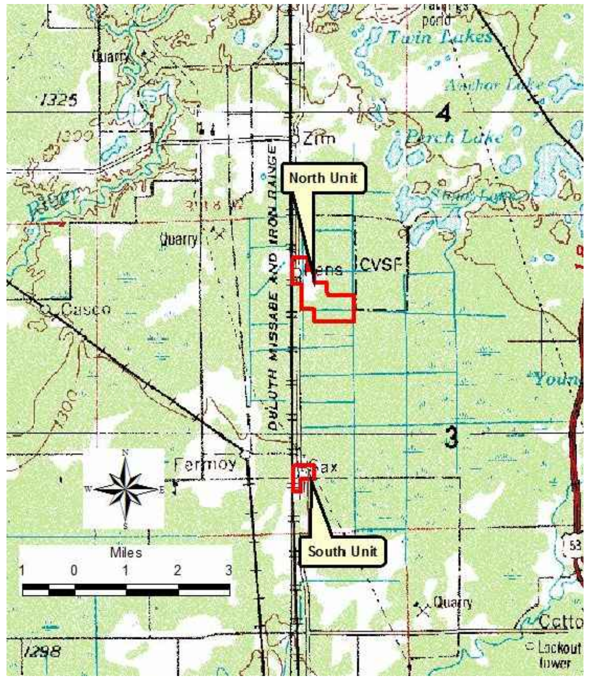
Wetland Mitigation Plan Drawings

POLYMET
ZIM SOD WETLAND MITIGATION PLANS
ZIM, MINNESOTA

INDEX

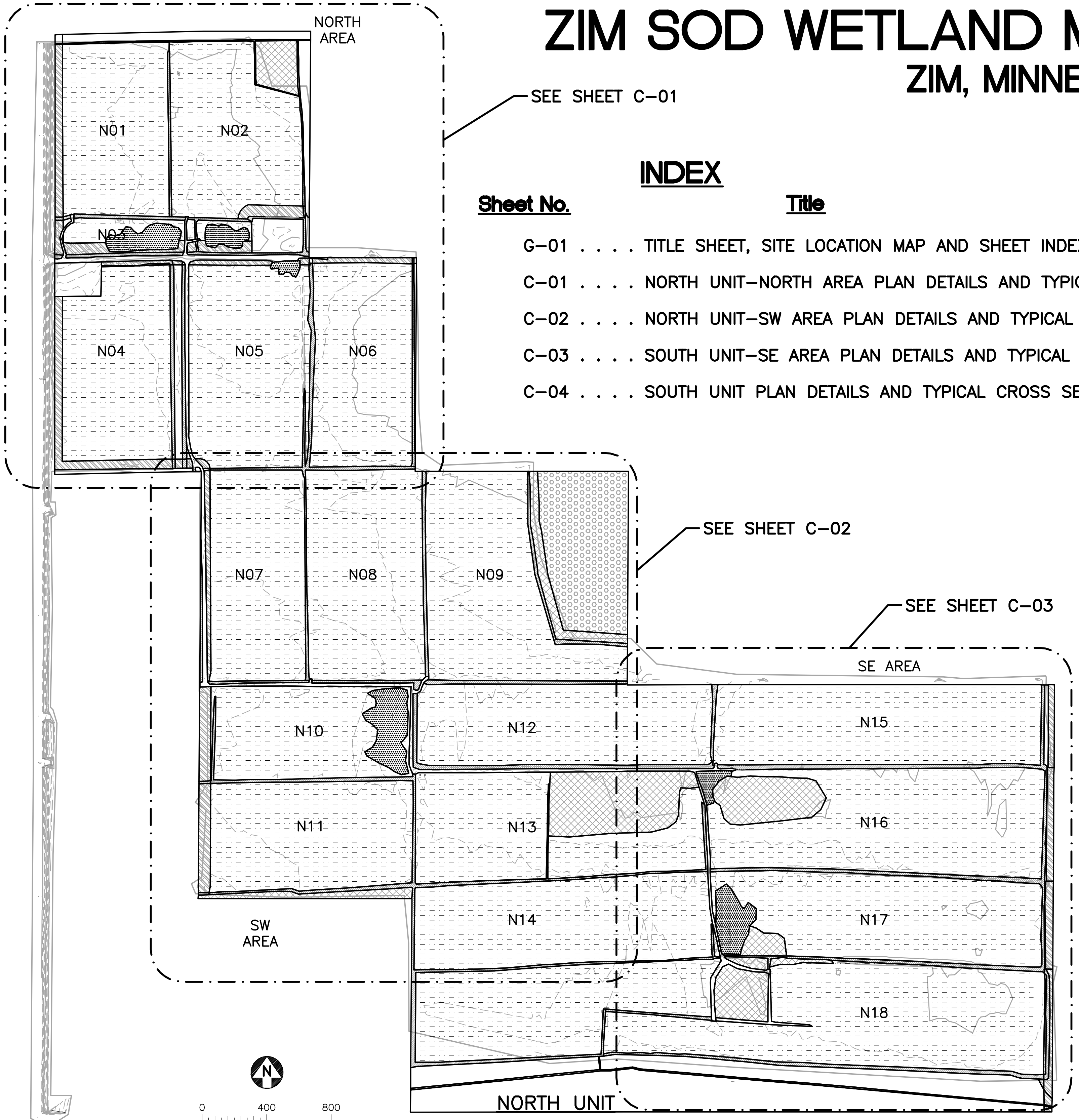


STATE MAP

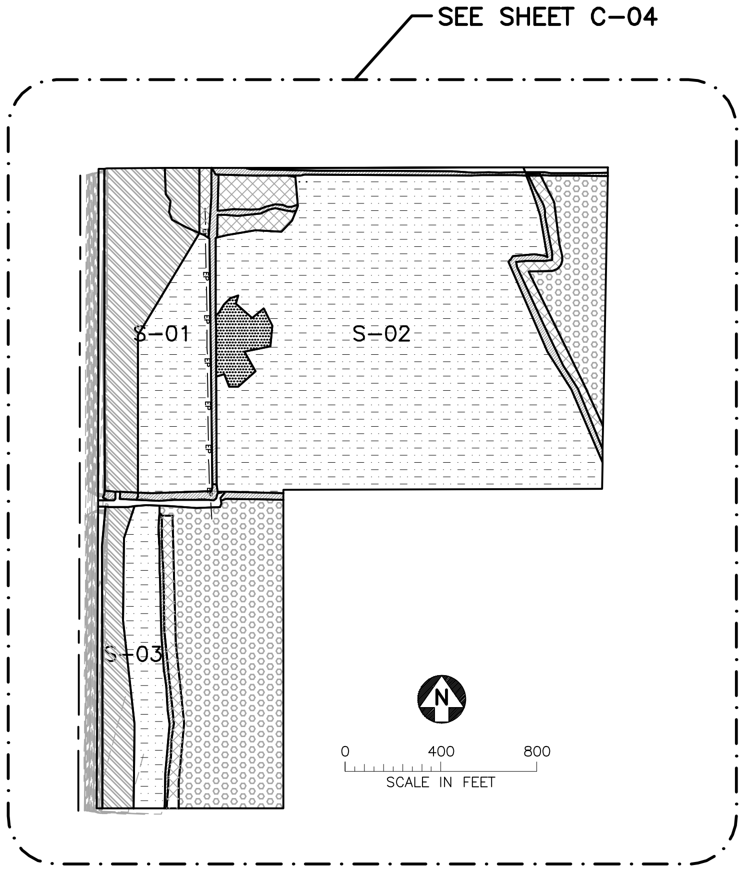


SITE LOCATION MAP

CALL 48 HOURS BEFORE DIGGING
GOPHER STATE ONE CALL
TWIN CITIES AREA 651-454-0002
MN TOLL FREE 1-800-252-1166



NORTH UNIT



SOUTH UNIT

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Designed	MAJ
Approved	MAJ

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ZIM SOD WETLAND MITIGATION PLANS
ZIM, MINNESOTA

TITLE SHEET, SITE LOCATION MAP, AND SHEET INDEX

BARR PROJECT No. 23690862

CLIENT PROJECT No.

DWG. No. G-01

REV. No. A

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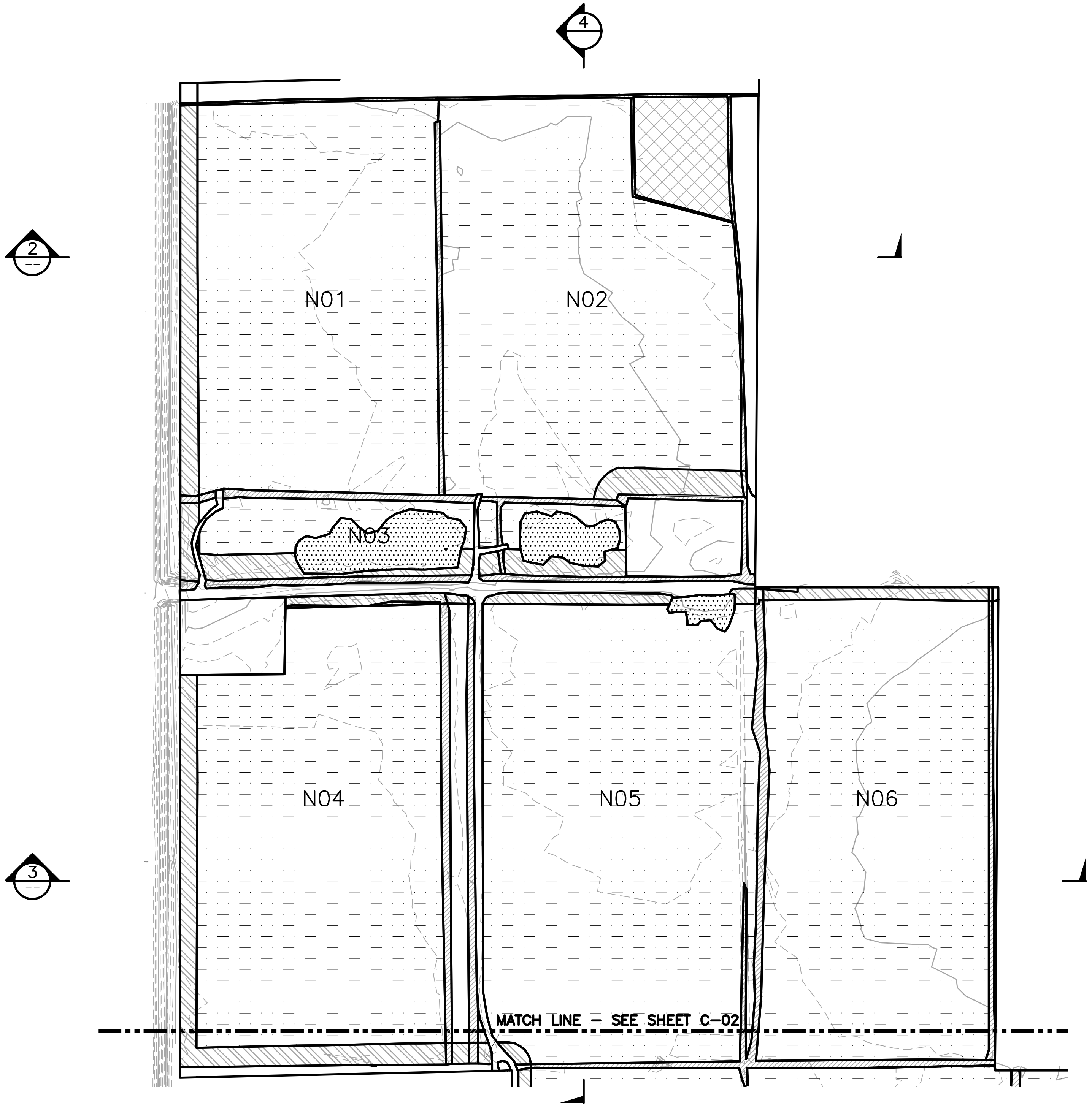


1 PLAN: NORTH UNIT–NORTH AREA

0 200 400
SCALE IN FEET

LEGEND

▭	RESTORE DRAINED WETLAND – 100% CREDIT
▩	RESTORE HYDROLOGY TO PARTIALLY DRAINED WETLAND – 50% CREDIT
☐	FUTURE ROAD ACCESS – NO CREDIT
▨	DITCH FILL – 50% CREDIT
▧	DITCH LATERAL EFFECT – 25% CREDIT
░	PRESERVATION – 12.5% CREDIT
░	EXCAVATION – 100% CREDIT

5
0
0 200
SCALE IN FEET
40X VERTICAL EXAGGERATION

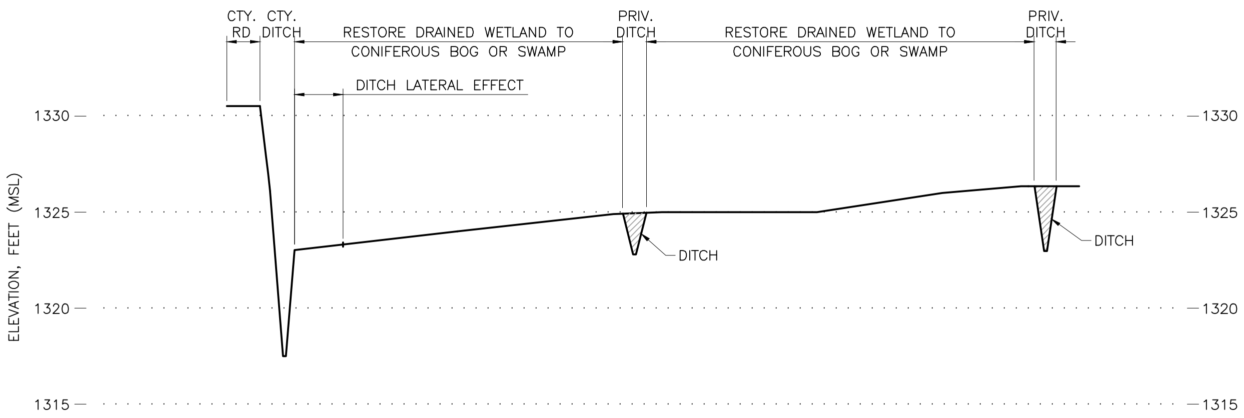
CONSTRUCTION NOTES:

1. FILL DITCHES, TO MATCH GRADE USING LOCAL MATERIALS.

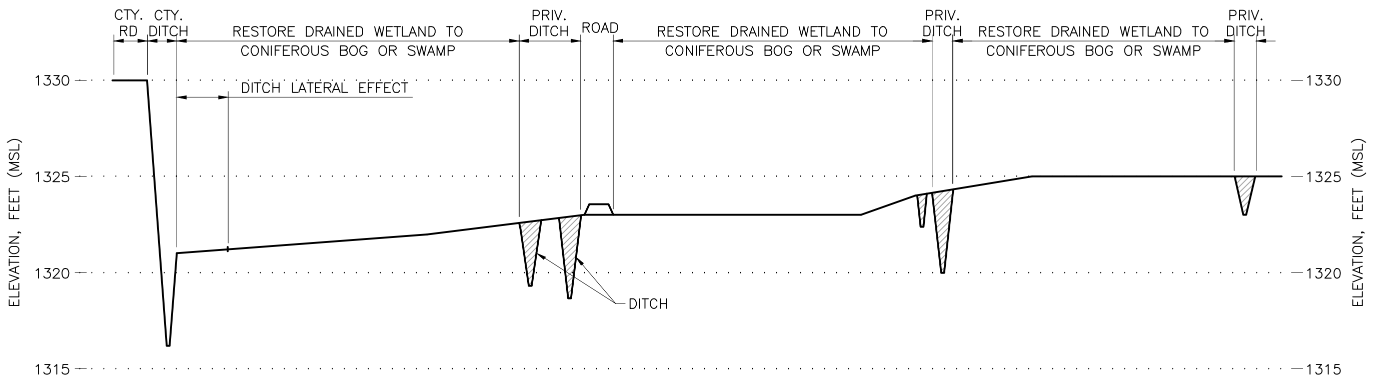
LEGEND

░	REMOVE
▨	FILL

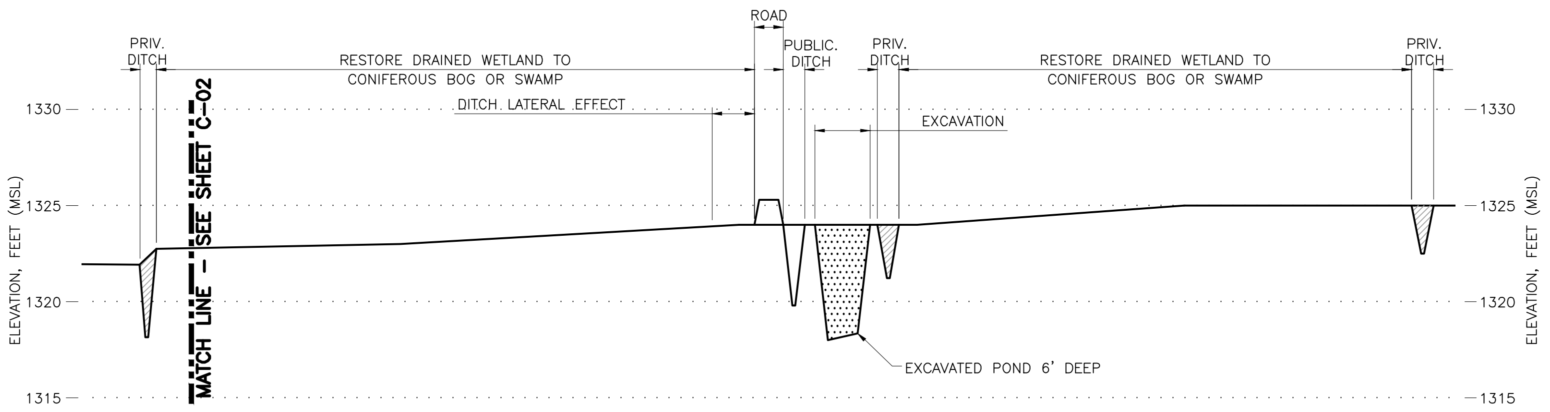
NOTES:
–FIELD WIDTHS TO SCALE
–REMOVAL AND DITCH WIDTHS EXAGGERATED
–DITCH DEPTHS TO SCALE



2 TYPICAL CROSS SECTION – FIELDS N01 & N02



3 TYPICAL CROSS SECTION – FIELDS N04, N05 & N06



4 TYPICAL CROSS SECTION – FIELDS N02, N03 & N05

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Checked	MAJ
Designed	MAJ
Approved	MAJ

POLYMET

ZIM SOD WETLAND MITIGATION PLANS
ZIM, MINNESOTA

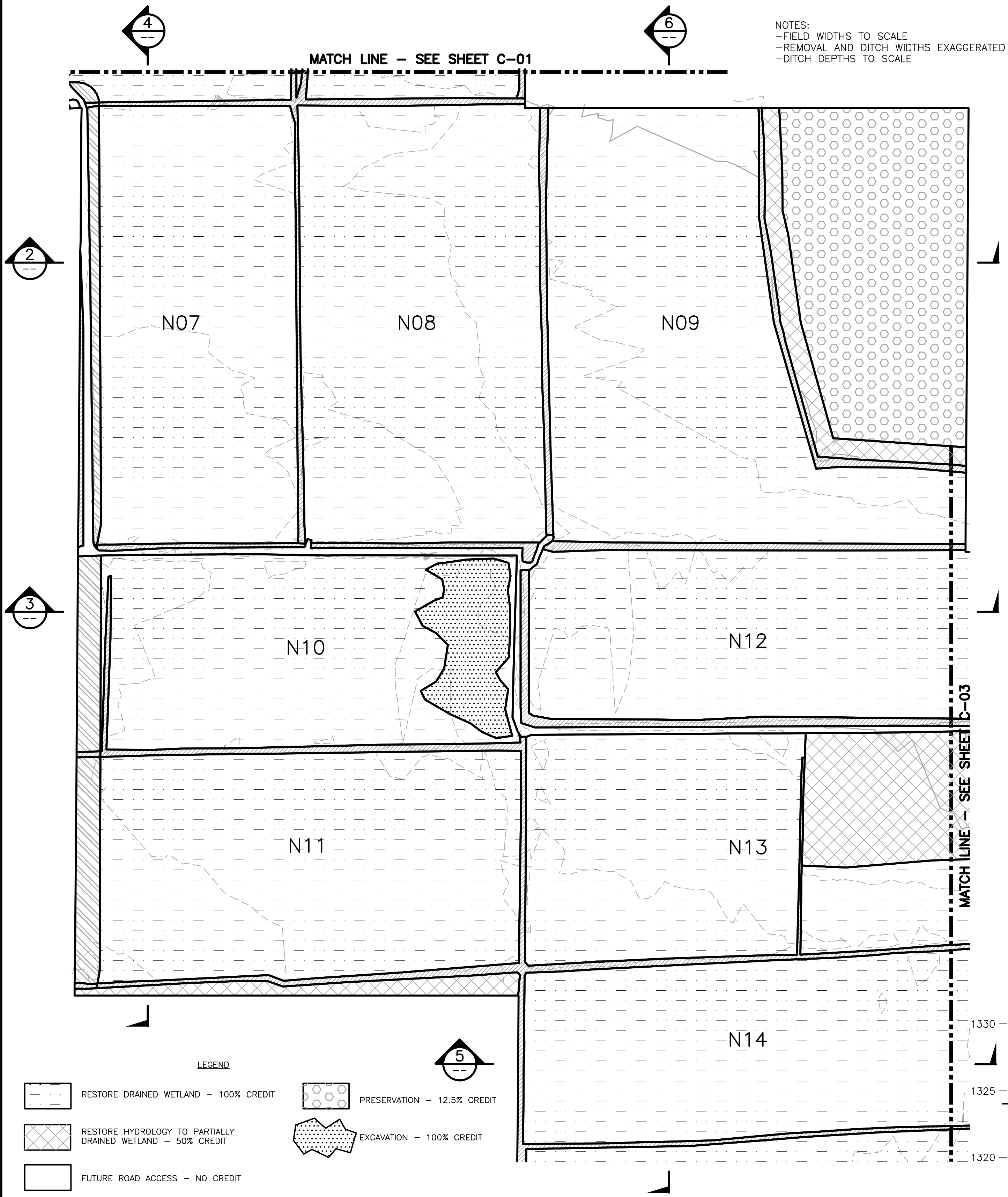
NORTH UNIT–NORTH AREA PLAN DETAILS AND TYPICAL CROSS SECTIONS

BARR PROJECT No. 23690862
CLIENT PROJECT No.
DWG. No. C–01
REV. No. A

NOTES:
-FIELD WIDTHS TO SCALE
-REMOVAL AND DITCH WIDTHS EXAGGERATED
-DITCH DEPTHS TO SCALE

LEGEND

- ▒ REMOVE
- ▨ FILL

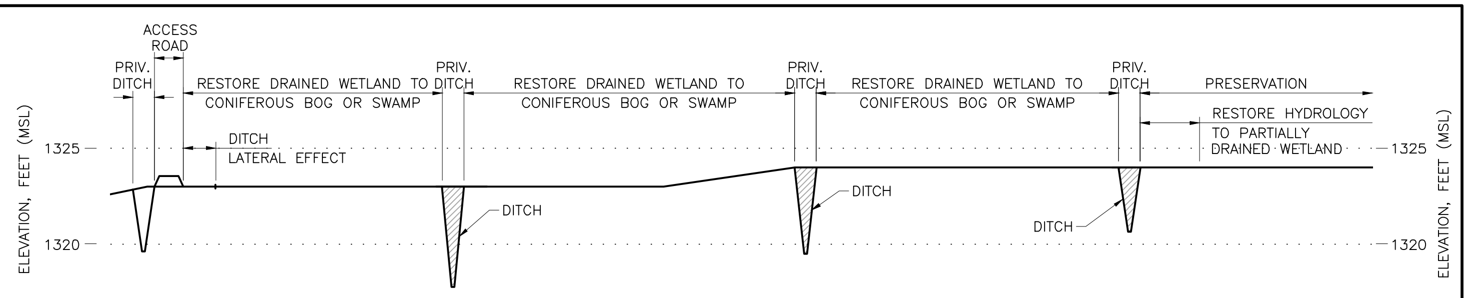


LEGEND

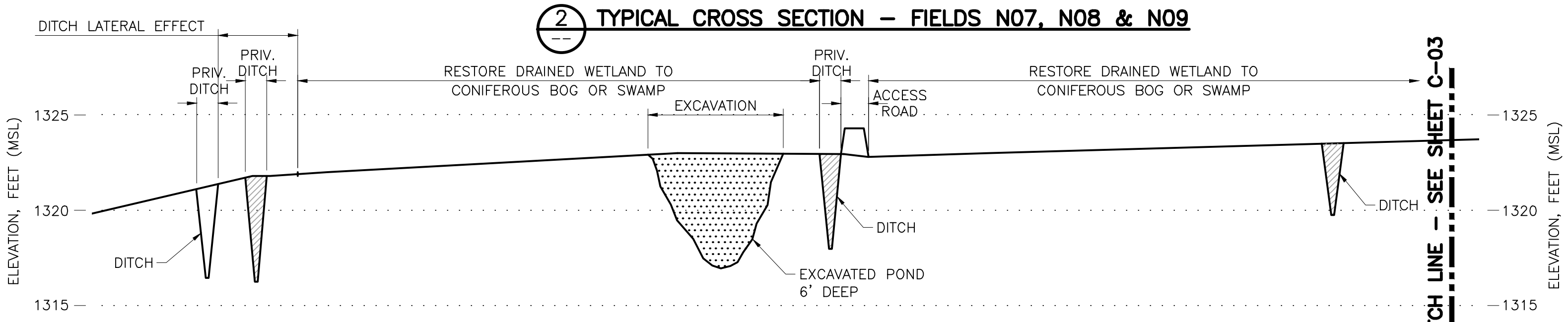
- ☐ RESTORE DRAINED WETLAND – 100% CREDIT
- ▦ RESTORE HYDROLOGY TO PARTIALLY DRAINED WETLAND – 50% CREDIT
- ☐ FUTURE ROAD ACCESS – NO CREDIT
- ▨ DITCH FILL – 50% CREDIT
- ▧ DITCH LATERAL EFFECT – 25% CREDIT
- ○ PRESERVATION – 12.5% CREDIT
- ▒ EXCAVATION – 100% CREDIT

1 PLAN: NORTH UNIT-SW AREA

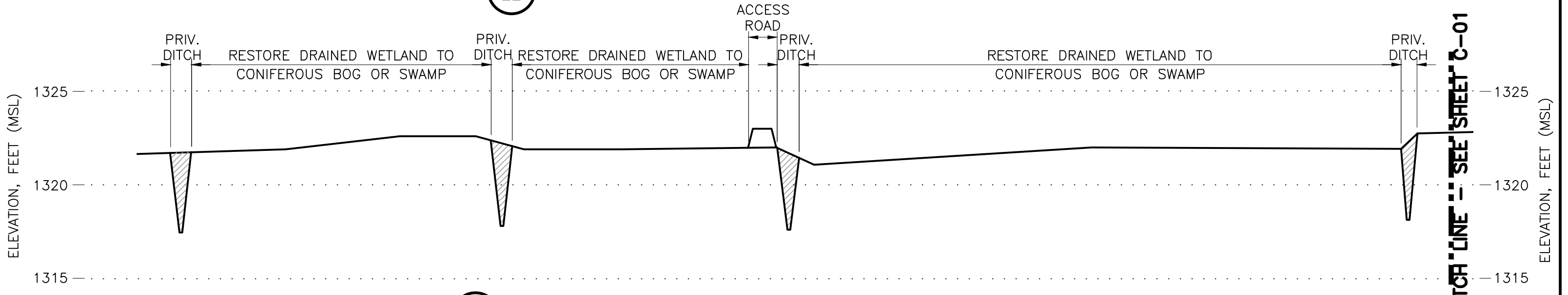
0 200 400
SCALE IN FEET



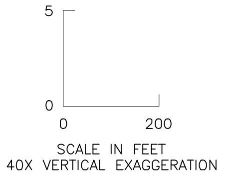
2 TYPICAL CROSS SECTION – FIELDS N07, N08 & N09



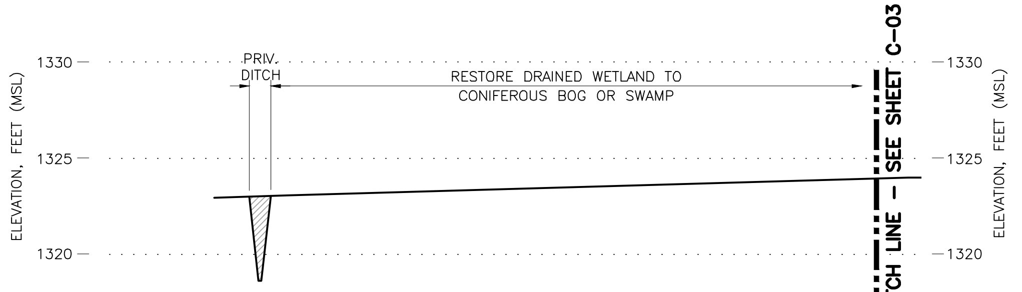
3 TYPICAL CROSS SECTION – FIELDS N10 & N12



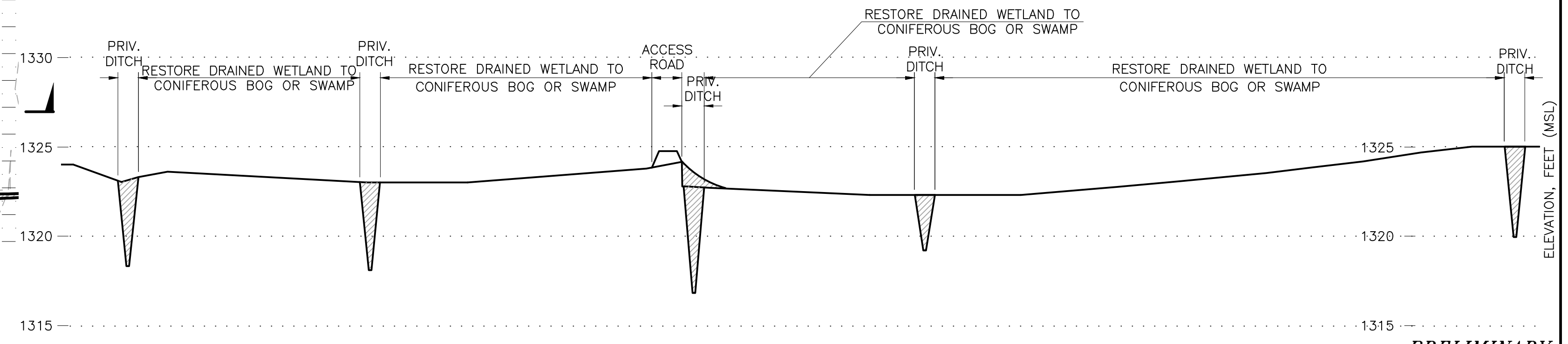
4 TYPICAL CROSS SECTION – FIELDS N07, N10 & N11



SCALE IN FEET
40X VERTICAL EXAGGERATION



5 TYPICAL CROSS SECTION – FIELD N14



6 TYPICAL CROSS SECTION – FIELDS N09, N12, N13 & N14

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ZIM SOD WETLAND MITIGATION PLANS
ZIM, MINNESOTA

NORTH UNIT-SW PLAN DETAILS
AND TYPICAL CROSS SECTIONS

BARR PROJECT No. 23690862
CLIENT PROJECT No.
DWG. No. C-02
REV. No. A

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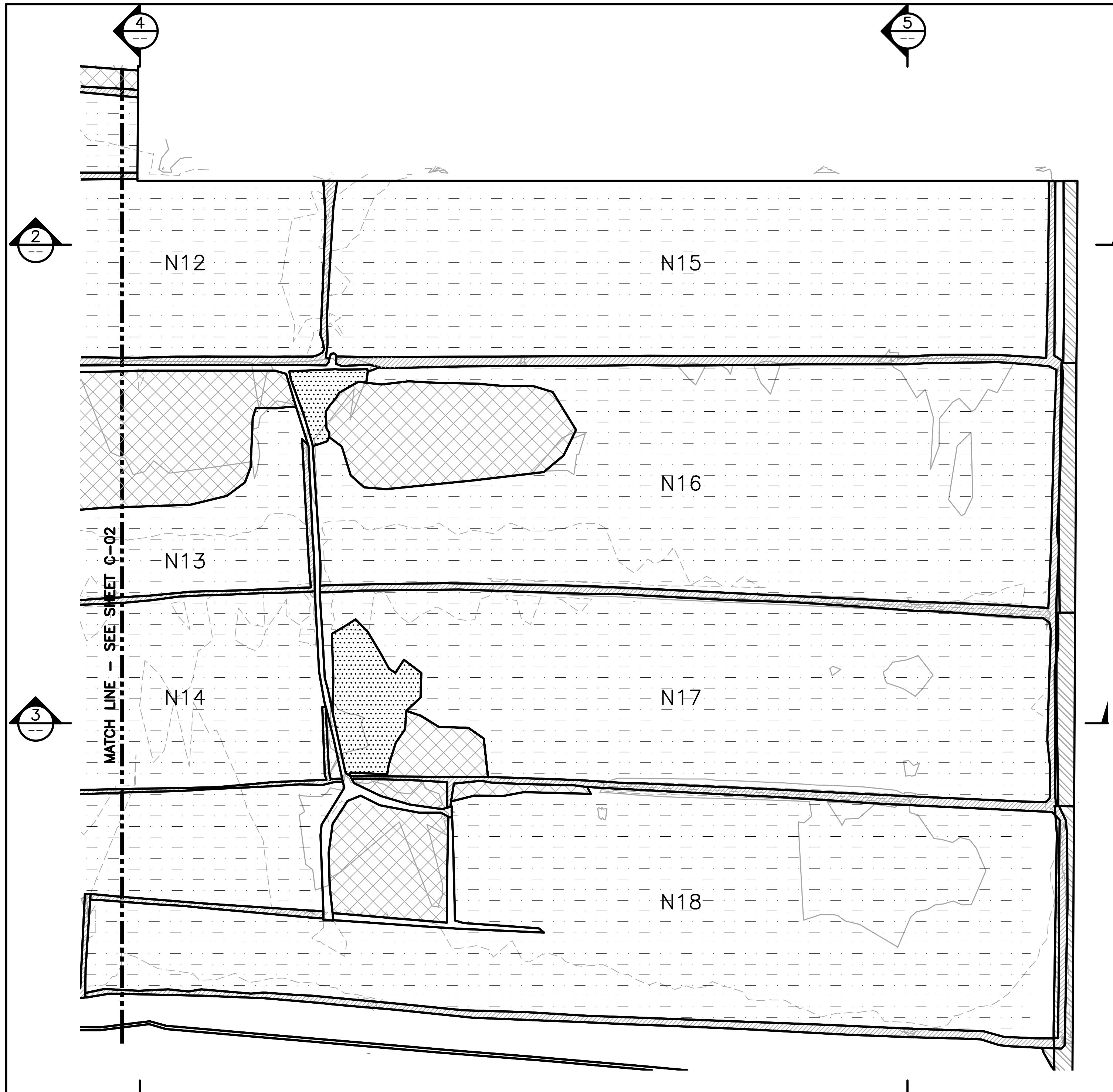


1 PLAN: NORTH UNIT-SE AREA

0 200 400
SCALE IN FEET

LEGEND

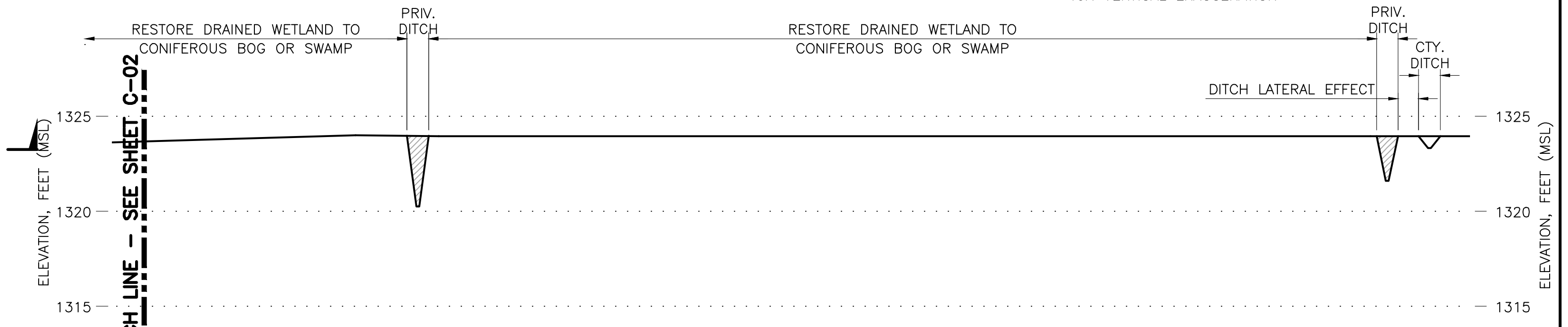
- ▭ RESTORE DRAINED WETLAND – 100% CREDIT
- ▦ RESTORE HYDROLOGY TO PARTIALLY DRAINED WETLAND – 50% CREDIT
- ☐ FUTURE ROAD ACCESS – NO CREDIT
- ▨ DITCH FILL – 50% CREDIT
- ▧ DITCH LATERAL EFFECT – 25% CREDIT
- ⁘ PRESERVATION – 12.5% CREDIT
- ⁙ EXCAVATION – 100% CREDIT

LEGEND

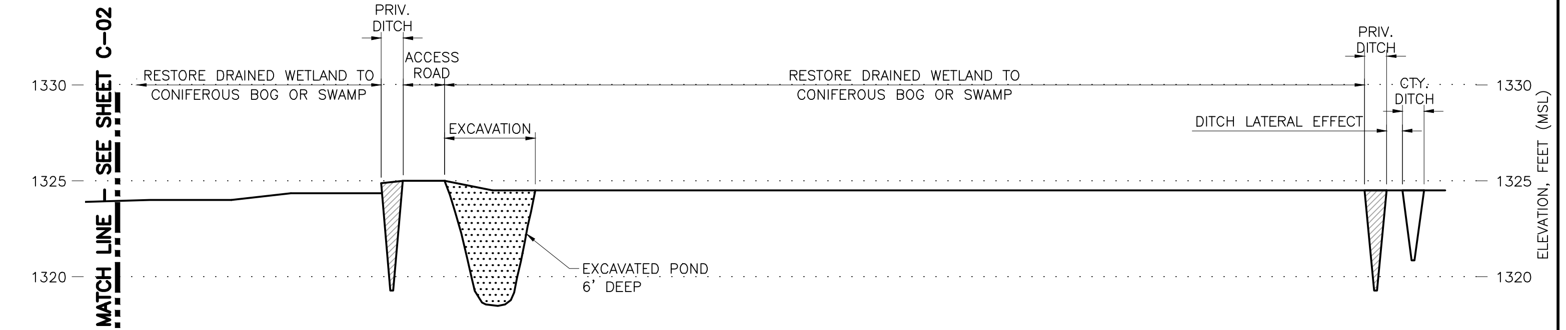
- ⁘ REMOVE
- ▨ FILL

NOTES:
–FIELD WIDTHS TO SCALE
–REMOVAL AND DITCH WIDTHS EXAGGERATED
–DITCH DEPTHS TO SCALE

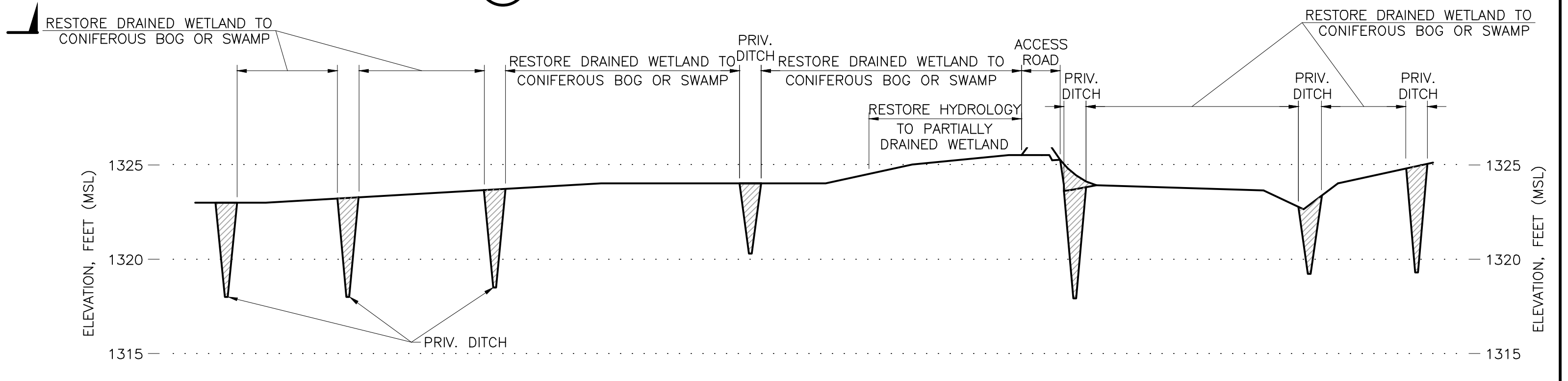
5
0
0 200
SCALE IN FEET
40X VERTICAL EXAGGERATION



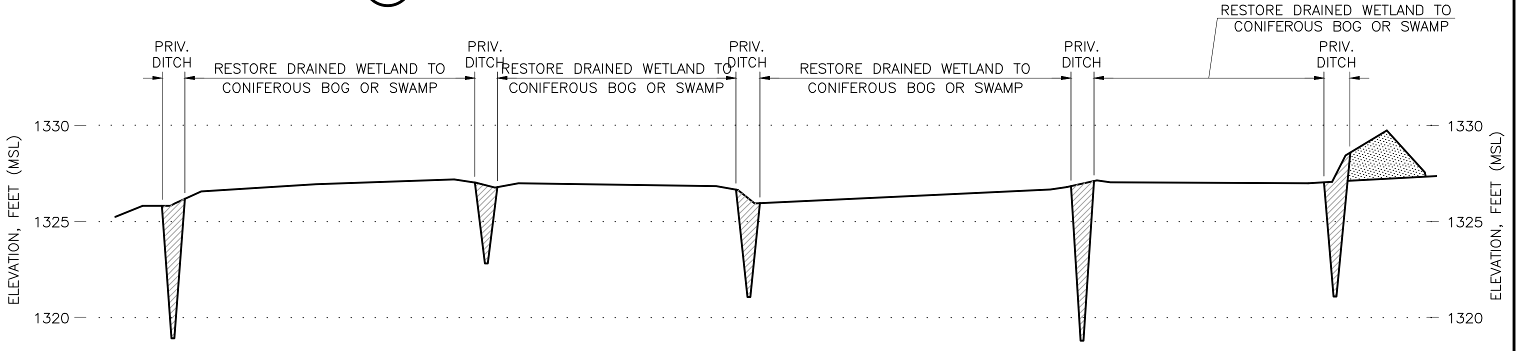
2 TYPICAL CROSS SECTION – FIELDS N12 & N15



3 TYPICAL CROSS SECTION – FIELDS N14 & N17



4 TYPICAL CROSS SECTION – FIELDS N12, N13, N14 & N18



5 TYPICAL CROSS SECTION – FIELDS N15, N16, N17 & N18

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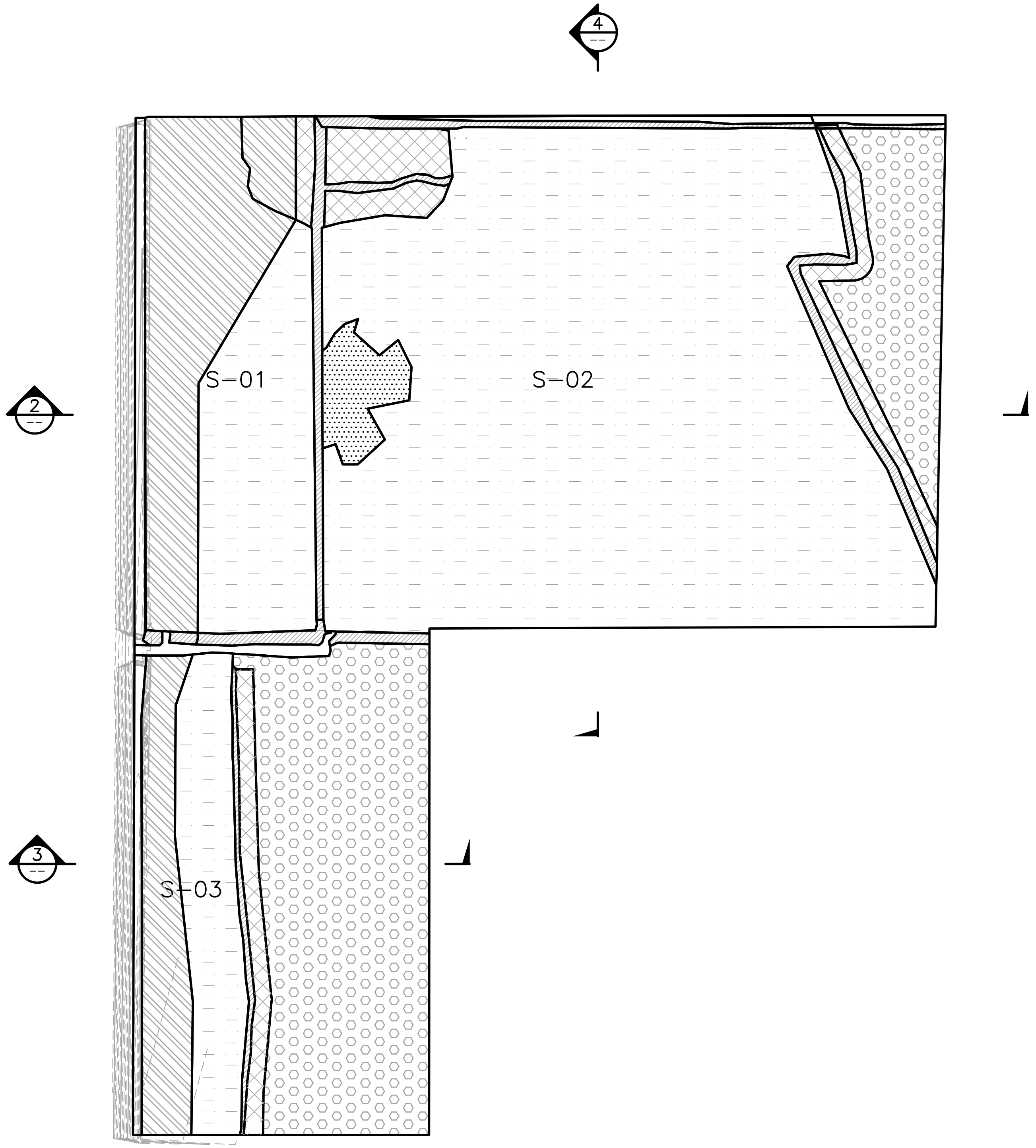
ZIM SOD WETLAND MITIGATION PLANS
ZIM, MINNESOTA

NORTH UNIT-SE AREA PLAN DETAILS AND TYPICAL CROSS SECTIONS

BARR PROJECT No.
23690862
CLIENT PROJECT No.

DWG. No. C-03
REV. No. A



1 PLAN: SOUTH UNIT

0 200 400
SCALE IN FEET

LEGEND

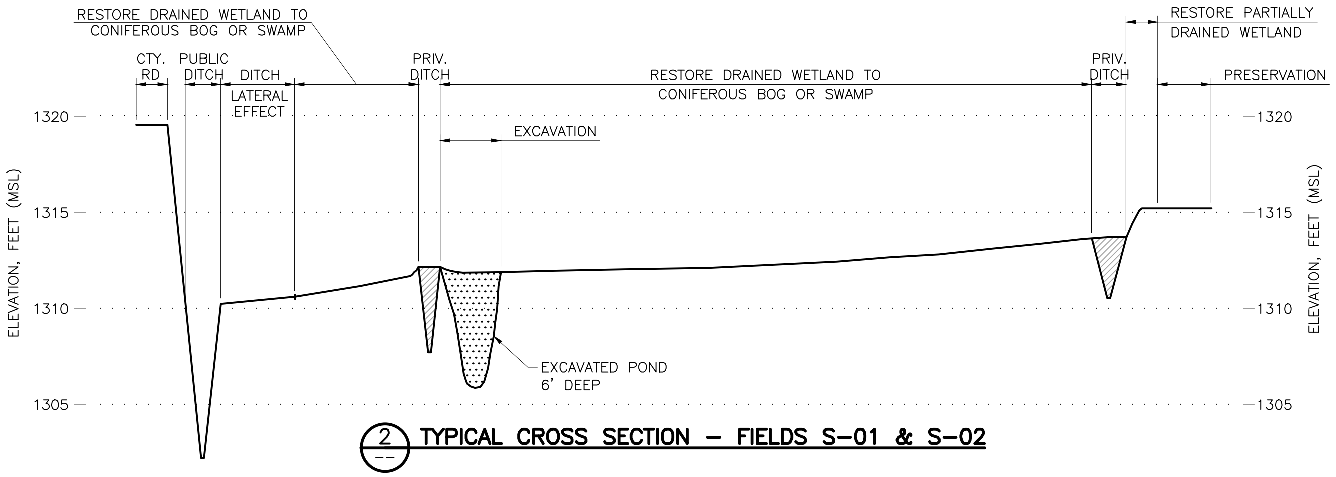
▭	RESTORE DRAINED WETLAND – 100% CREDIT
▨	RESTORE HYDROLOGY TO PARTIALLY DRAINED WETLAND – 50% CREDIT
▭	FUTURE ROAD ACCESS – NO CREDIT
▨	DITCH FILL – 50% CREDIT
▨	DITCH LATERAL EFFECT – 25% CREDIT
○	PRESERVATION – 12.5% CREDIT
▨	EXCAVATION – 100% CREDIT

5
0
0 200
SCALE IN FEET
40X VERTICAL EXAGGERATION

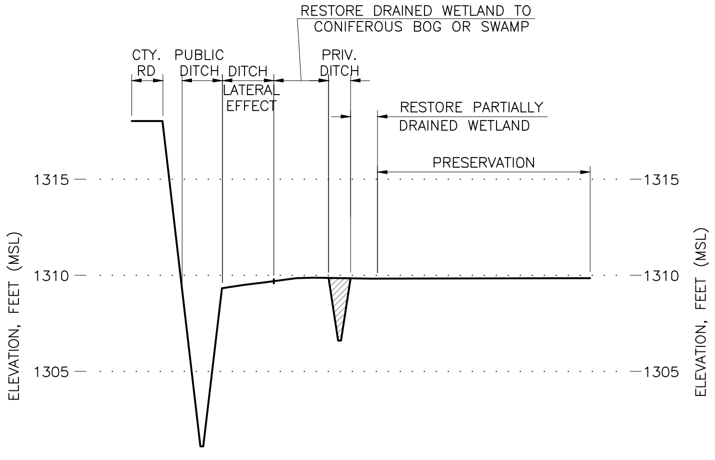
LEGEND

▨	REMOVE
▨	FILL

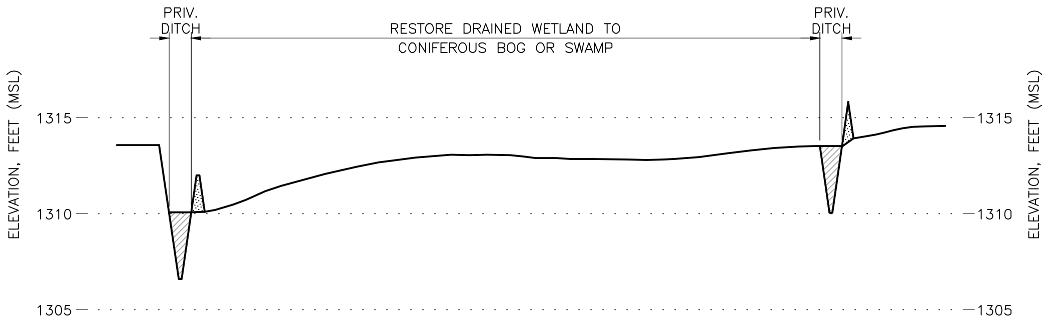
NOTES:
–FIELD WIDTHS TO SCALE
–REMOVAL AND DITCH WIDTHS EXAGGERATED
–DITCH DEPTHS TO SCALE



2 TYPICAL CROSS SECTION – FIELDS S–01 & S–02



3 TYPICAL CROSS SECTION – FIELD S–03



4 TYPICAL CROSS SECTION – FIELD S–02

PRELIMINARY DRAFT

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ZIM SOD WETLAND MITIGATION PLANS
ZIM, MINNESOTA

SOUTH UNIT PLAN DETAILS
AND TYPICAL CROSS SECTIONS

BARR PROJECT No. 23690862
CLIENT PROJECT No.
DWG. No. C–04
REV. No. A

Appendix C

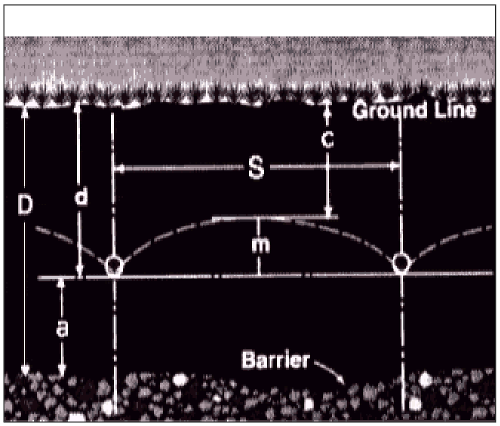
Ditch Lateral Effect Calculations

USDA United States Department of Agriculture
Natural Resources Conservation Service
NRCS Helping People Help the Land

Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 2 ft
D = 6 ft
f = 0.5
s = 0.1 in
m0 = 2 ft
m = 1 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 4 ft
de = 3.9804477 ft
f ' = 0.5083333
re = 1 ft

Final Results

S = 105 ft
Le = 52.5 ft

Compute Reset Help
About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null
Reset Name

Session # : 2
Time: 13:08
Date: 11../../index.html16../../index.html2011

Notes

`Greenwood soils, 2 ft deep ditch`

Last Modified: 10/28/2011

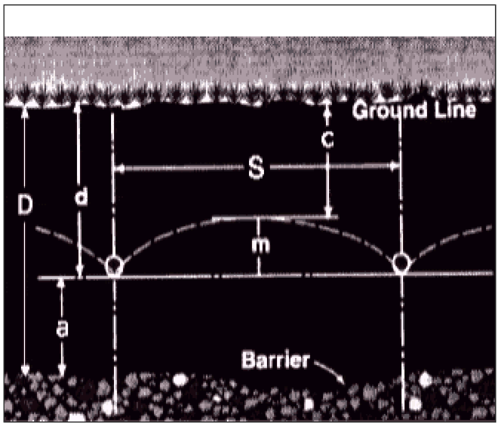
USDA United States Department of Agriculture
Natural Resources Conservation Service

NRCS Helping People Help the Land

Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 2.5 ft | **D** = 6 ft

f = 0.5 | **s** = 0.1 in

m_0 = 2.5 ft | **m** = 1.5 ft

t = 14 days | ● Ditch (any size)

○ **Tile** **t** = N/A **in** | ○ **Drain tube** **n** = N/A **in**

K = 3.3 **in/h** | ☐ **Calculate K** N/A

Intermediary Results

a = 3.5 ft | d_e = 3.5215556 ft

f ' = 0.5083333 | r_e = 1 ft

Final Results

S = 120 ft | L_e = 60 ft

Compute | Reset | Help | About

Hydrology Tools Main Page | **Ellipse Equation** | **Hooghoudt Equation** | **Kirkham's Equation**

User Name : null

Reset Name

Session # : 2

Time: 13:08

Date:

11../../index.html16../../index.html2011

Notes

`Greenwood soils, 2.5 ft deep ditch`

Last Modified: 10/28/2011

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Natural Resources Conservation Service

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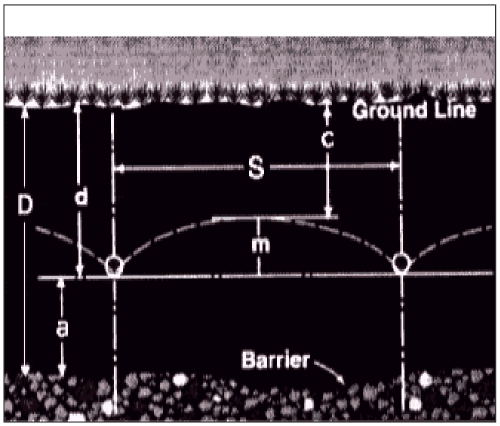
Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 3 ft
D = 6 ft
f = 0.5
s = 0.1 in
m_0 = 3 ft
m = 2 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 3 ft
d_e = 3.0419656(ft
f ' = 0.5083333;
r_e = 1 ft

Final Results

S = 131 ft
L_e = 65.5 ft

Compute Reset Help
About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null
Reset Name

Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

Greenwood soils, 3 ft deep ditch

Last Modified: 10/28/2011

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Natural Resources Conservation Service

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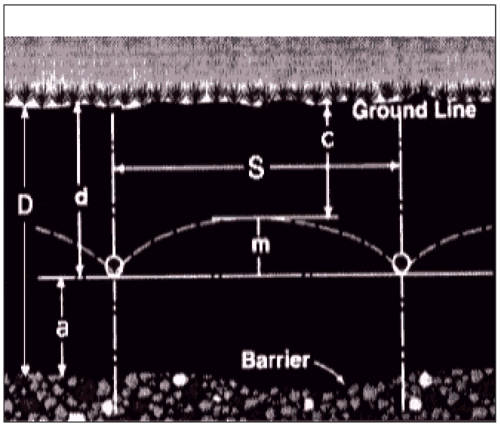
Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 3.5 ft
D = 6 ft
f = 0.5
s = 0.1 in
m_0 = 3.5 ft
m = 2.5 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 2.5 ft
d_e = 2.5489006(ft
f ' = 0.5083333:
r_e = 1 ft

Final Results

S = 140 ft
L_e = 70 ft

Compute Reset Help
About

Hydrology Tools Main Page	Ellipse Equation	Hooghoudt Equation	Kirkham's Equation

User Name : null

Reset Name

Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

`Greenwood soils, 3.5 ft deep ditch`

Last Modified: 10/28/2011

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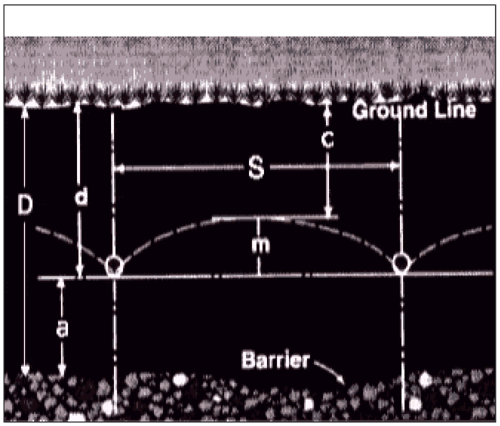
Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 4 ft
D = 6 ft
f = 0.5
s = 0.1 in
m_0 = 4 ft
m = 3 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 2 ft
d_e = 2.0458183 ft
f ' = 0.5083333
r_e = 1 ft

Final Results

S = 147 ft
L_e = 73.5 ft

Compute Reset Help About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null
Reset Name
Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

`Greenwood soils, 4 ft deep ditch`

Last Modified: 10/28/2011

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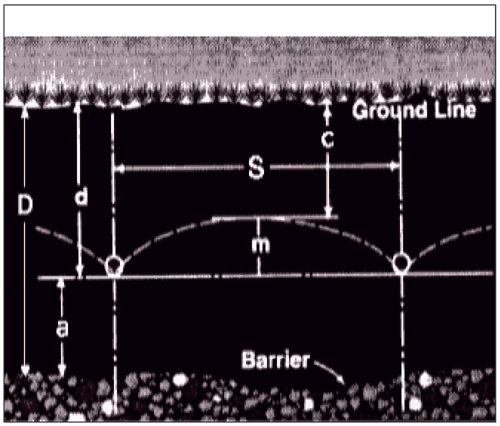
Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d	= 4.5 ft	D	= 6 ft
f	= 0.5	s	= 0.1 in
m_0	= 4.5 ft	m	= 3.5 ft
t	= 14 days	● Ditch (any size)	
○ Tile t = N/A in		○ Drain tube n = N/A in	
K	= 3.3 in/h	☐ Calculate K N/A	

Intermediary Results

a	= 1.5 ft	d_e	= 1.5361268: ft
f '	= 0.5083333:	r_e	= 1 ft

Final Results

S	= 151 ft	L_e	= 75.5 ft

Compute Reset Help
About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null
Reset Name

Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

Greenwood soils, 4.5 ft deep ditch

Last Modified: 10/28/2011

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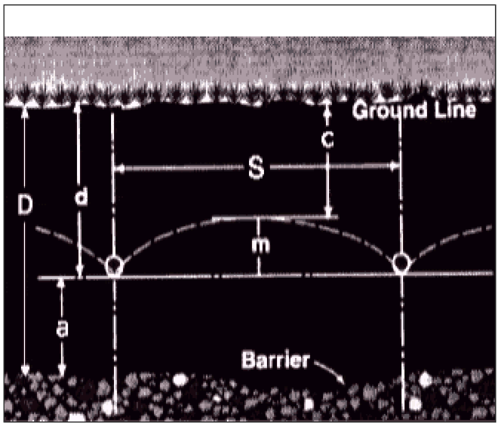
Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 5 ft
D = 6 ft
f = 0.5
s = 0.1 in
m_0 = 5 ft
m = 4 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 1 ft
d_e = 1.0225763(ft
f ' = 0.5083333:
r_e = 1 ft

Final Results

S = 155 ft
L_e = 77.5 ft

Compute Reset Help
About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null
Reset Name
Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

Greenwood soils, 5 ft deep ditch

Last Modified: 10/28/2011

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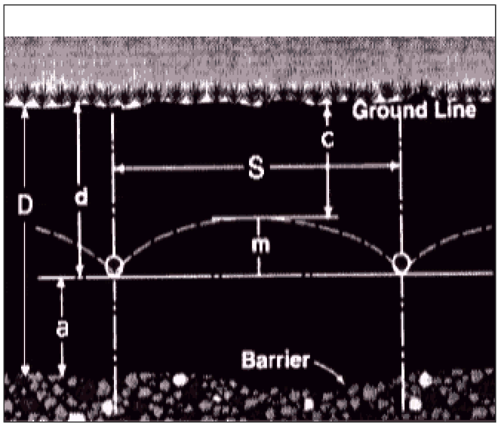
Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 5.5 ft
D = 6 ft
f = 0.5
s = 0.1 in
m_0 = 5.5 ft
m = 4.5 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 0.5 ft
d_e = 0.5084167 ft
f ' = 0.5083333;
r_e = 1 ft

Final Results

S = 156 ft
L_e = 78 ft

Compute Reset Help About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null
Reset Name

Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

`Greenwood soils, 5.5 ft deep ditch`

Last Modified: 10/28/2011

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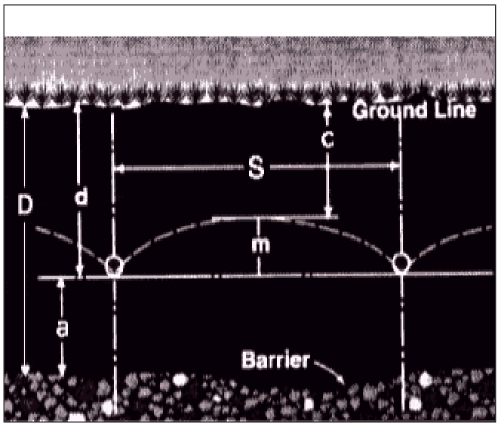
Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 6.5 ft
D = 8 ft
f = 0.5
s = 0.1 in
m_0 = 6.5 ft
m = 5.5 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 1.5 ft
d_e = 1.5258023 ft
f ' = 0.5083333:
r_e = 1 ft

Final Results

S = 210 ft
L_e = 105 ft

Compute Reset Help About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null

Reset Name

Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

`Greenwood soils, 6.5 ft deep ditch`

Last Modified: 10/28/2011

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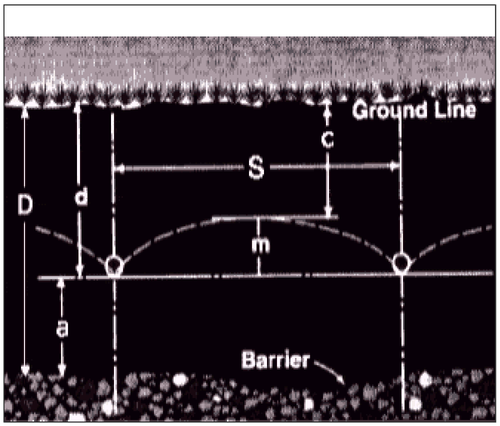
Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 8 ft
D = 12 ft
f = 0.5
s = 0.1 in
m_0 = 8 ft
m = 7 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 4 ft
d_e = 3.9932493 ft
f ' = 0.5083333
r_e = 1 ft

Final Results

S = 308 ft
L_e = 154 ft

Compute Reset Help About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null
Reset Name

Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

`Greenwood soils, 8 ft deep ditch`

Last Modified: 10/28/2011

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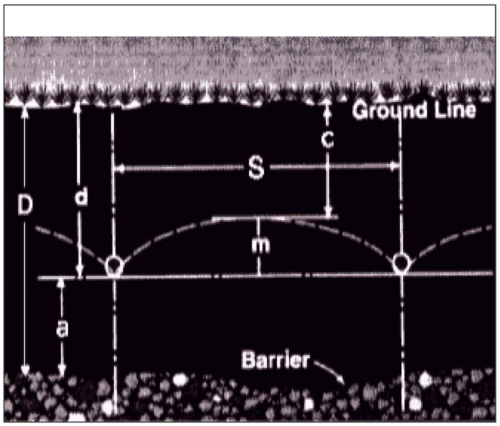
Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 9 ft
D = 12 ft
f = 0.5
s = 0.1 in
m_0 = 9 ft
m = 8 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 3.3 in/h
☐ Calculate K
N/A

Intermediary Results

a = 3 ft
d_e = 3.0172010 ft
f ' = 0.5083333
r_e = 1 ft

Final Results

S = 318 ft
L_e = 159 ft

Compute Reset Help
About

Hydrology Tools Main Page	Ellipse Equation	Hooghoudt Equation	Kirkham's Equation

User Name : null

Reset Name

Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

```
Greenwood soils, 9 ft deep ditch
```

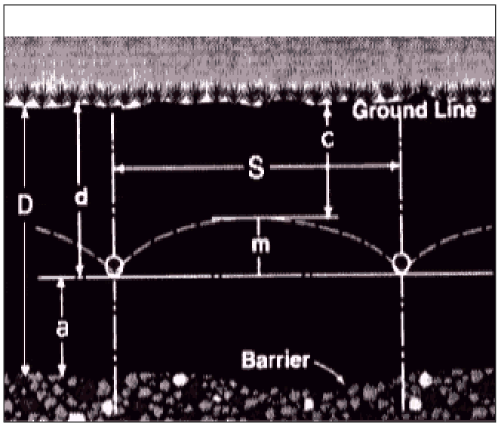
Last Modified: 10/28/2011

USDA United States Department of Agriculture
Natural Resources Conservation Service
NRCS Helping People Help the Land

Identifying Wetland Boundaries

Schilfgaarde_java.html

van Schilfgaarde Equation



Example tile drainage system

Input Parameters

d = 9 ft
D = 12 ft
f = 0.16
s = 0.1 in
m0 = 9 ft
m = 8 ft
t = 14 days
● Ditch (any size)
○ Tile
t = N/A in
○ Drain tube
n = N/A in
K = 7.7 in/h
☐ Calculate K
N/A

Intermediary Results

a = 3 ft
de = 3.0064528 ft
f ' = 0.1683333
re = 1 ft

Final Results

S = 842 ft
Le = 421 ft

Compute Reset Help About

Hydrology Tools Main Page | Ellipse Equation | Hooghoudt Equation | Kirkham's Equation

User Name : null
Reset Name
Session # : 2
Time: 13:08
Date:
11../../index.html16../../index.html2011

Notes

`Wabuse soils, 9 ft deep ditch`

Last Modified: 10/28/2011

Appendix D

Wetland Data Forms

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 35
Township: 55
Range: 18
Sampling Point: #01 S03

Land Form: Terrace
Local Relief: None
Slope %:
Soil Map Unit Name: Greenwood Soils B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: up

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation Yes Soil Yes Hydrology Yes significantly disturbed?
Are vegetation No Soil No Hydrology No naturally problematic?
Are "normal circumstances" present? Yes

Eggers & Reed (primary): Upland
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? No
Is the sampled area within a wetland? No

Remarks (explain any answers if needed): This is a sod field - Owl Field -with a managed drainage system and managed vegetation. Soil sample was taken in the field

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

	Sapling/Shrub Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

	Herb Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Poa pratensis	99	Yes	FAC
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	99		

	Woody Vine Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	0	X 1	0
FACW Species	0	X 2	0
FAC Species	99	X 3	297
FACU Species	0	X 4	0
UPL Species	0	X 5	0
Column Totals:	99	(A)	297 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks: (include photo numbers here or on a separate sheet) Edge of sod field across ditch. Vegetation across ditch is tamarack, trembling aspen, willow sp. And reed canary

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #01 S03

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 10	10yr 2/1						fibric peat	
2.	10 - 20	10yr 2/1						fibric peat	5% had bright fibers
3.	20 - 28	10yr 2/1						fibric peat	15% bright fibers
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☑ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) (LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): *Type:* ________ *Depth (inches):* -

Hydric soil present? Yes

Remarks: Soil was moist but not saturated.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):** ________

Water table present? ☐ **Water Table Depth (inches):** ________

Saturation present? (includes capillary fringe) ☐ **Saturation Depth (inches):** ________

Wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Brightly colored peat fibers at 10-20" 10yr 5/8 5% - 15% below 20" tiled field

11/23/2011 1:47:55 PM

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site:	Zim Sod	*Applicant/Owner:*	Zim Sod	*City/County:*	St. Louis	*State:*	MN	*Sampling Date:*	11/18/10
Investigator(s):	TPT	*Section:*	35	*Township:*	55	*Range:*	18	*Sampling Point:*	#02 East of S03
Land Form:	Terrace	*Local Relief:*	None	*Slope %:*		*Soil Map Unit Name:*	Greenwood Soils B14A		
Subregion (LRR):	K	*Latitude:*		*Longitude:*		*Datum:*			

NWI/Cowardin Classification:

Circular 39 Classification: 6

Are climatic/hydrologic conditions on the site typical for this time of year? Yes *(If no, explain in remarks)*

Are vegetation No *Soil* No *Hydrology* No *significantly disturbed?*

Are vegetation No *Soil* No *Hydrology* No *naturally problematic?*

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Shrub-Carr

Eggers & Reed (secondary):

Eggers & Reed (tertiary):

Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Yes
Hydric soil present?	Yes
Wetland hydrology present?	Yes
Is the sampled area within a wetland?	Yes

Remarks (explain any answers if needed): Comparable wetland behind Owl field on the back side of the pipeline r/w

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum *(Plot Size:)*	***Absolute % Cover***	***Dominant Species?***	***Indicator Status ****
1.	Larix laricina	10	Yes	FACW
2.		0		
3.		0		
4.		0		
	Total Cover:	10		

	Sapling/Shrub Stratum *(Plot Size:)*			
1.	Betula pumila	15	Yes	OBL
2.	Rubus idaeus ssp. strigosus	20	Yes	FACW
3.		0		
4.		0		
5.		0		
	Total Cover:	35		

	Herb Stratum *(Plot Size:)*			
1.	Phalaris arundinacea	15	Yes	FACW
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	15		

	Woody Vine Stratum *(Plot Size:)*			
1.		0		
2.		0		
	Total Cover:	0		

**** In USFWS Region 3***

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**4**	***(A)***
Total Number of Dominant Species Across All Strata:	**4**	***(B)***
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	***(A/B)***

Prevalence Index Worksheet:

	Total % Cover of:		***Multiply by:***	
OBL Species	15	X 1	15	
FACW Species	45	X 2	90	
FAC Species	0	X 3	0	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	**60**	(A)	**105**	(B)

Prevalence Index = B/A = **1.75**

Hydrophytic Vegetation Indicators:

Yes	***Rapid Test for Hydrophytic Vegetation***
Yes	***Dominance Test is >50%***
Yes	***Prevelance Index ≤ 3.0 [1]***
No	***Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)***
No	***Problematic Hydrophytic Vegetation [1] (Explain)***

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #02 East of S03

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 4	10yr 2/1						Fibric peat	saturated to surface
2.	4 - 9	10yr 2/1						Fibric peat	
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains ***[2] Location: PL=Pore Lining, M=Matrix.***

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☐ *Histosol (A1)*
☐ *Histic Epipedon (A2)*
☑ *Black Histic (A3)*
☐ *Hydrogen Sulfide (A4)*
☐ *Stratified Layers (A5)*
☐ *Depleted Below Dark Surface (A11)*
☐ *Thick Dark Surface (A12)*
☐ *Sandy Mucky Mineral (S1)*
☐ *Sandy Gleyed Matrix (S4)*
☐ *Sandy Redox (S5)*

☐ *Stripped Matrix (S6)*
☐ *Dark Surface (S7) (LRR R, MLRA 149B)*
☐ *Polyvalue Below Surface (S8) (LRR R, MLRA 149B)*
☐ *Thin Dark Surface (S9) (LRR R, MLRA 149B)*
☐ *Loamy Mucky Mineral (F1) (LRR K, L)*
☐ *Loamy Gleyed Matrix (F2)*
☐ *Depleted Matrix (F3)*
☐ *Redox Dark Surface (F6)*
☐ *Depleted Dark Surface (F7)*
☐ *Redox Depressions (F8)*

Indicators for Problematic Hydric Soils [3]:

☐ *2 cm Muck (A10) (LRR K, L, MLRA 149B)*
☐ *Coast Prairie Redox (A16) (LRR K, L, R)*
☐ *5 cm Mucky Peat or Peat (S3) (LRR K, L, R)*
☐ *Dark Surface (S7) (LRR K, L)*
☐ *Polyvalue Below Surface (S8) (LRR K, L)*
☐ *Thin Dark Surface (S9) (LRR K, L)*
☐ *Iron-Manganese Masses (F12) (LRR K, L, R)*
☐ *Piedmont Floodplain Soils (F19) (MLRA 149B)*
☐ *Mesic Spodic (TA6) (MLRA 144A, 145, 149B)*
☐ *Red Parent Material (TF2)*
☐ *Very Shallow Dark Surface (TF12)*
☐ *Other (explain in soil remarks)*

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): ***Type:*** ***Depth (inches):*** -

Hydric soil present? Yes

Remarks: Peat has brightly colored fibers 15% 10yr 5/8 below 4 inches

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☑ *Surface Water (A1)*
☐ *High Water Table (A2)*
☑ *Saturation (A3)*
☐ *Water Marks (B1)*
☐ *Sediment Deposits (B2)*
☐ *Drift Deposits (B3)*
☐ *Algal Mat or Crust (B4)*
☐ *Iron Deposits (B5)*
☐ *Inundation Visible on Aerial Imagery (B7)*
☐ *Sparsely Vegetated Concave Surface (B8)*

☐ *Water-Stained Leaves (B9)*
☐ *Aquatic Fauna (B13)*
☐ *Marl Deposits (B15)*
☐ *Hydrogen Sulfide Odor (C1)*
☐ *Oxidized Rhizospheres on Living Roots (where not tilled) (C3)*
☐ *Presence of Reduced Iron (C4)*
☐ *Recent Iron Reduction in Tilled Soils (C6)*
☐ *Thin Muck Surface (C7)*
☐ *Other (explain in remarks)*

Secondary Indicators (minimum of two required)

☐ *Surface Soil Cracks (B6)*
☐ *Drainage Patterns (B10)*
☐ *Moss Trim Lines (B16)*
☐ *Dry-Season Water Table (C2)*
☐ *Crayfish Burrows (C8)*
☐ *Saturation Visible on Aerial Imagery (C9)*
☐ *Stunted or Stressed Plants (D1)*
☐ *Geomorphic Position (D2)*
☐ *Shallow Aquitard (D3)*
☐ *Microtopographic Relief (D4)*
☐ *FAC-Neutral Test (D5)*

Field Observations:

Surface water present? ☑ ***Surface Water Depth (inches):*** 0
Water table present? ☐ ***Water Table Depth (inches):***
Saturation present? (includes capillary fringe) ☑ ***Saturation Depth (inches):*** 0

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ ***Aerial Photo*** ☐ ***Monitoring Well*** ☐ ***Stream Gauge*** ☐ ***Previous Inspections***

Hydrology Remarks: Saturated to surface

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site:	Zim Sod	*Applicant/Owner:*	Zim Sod	*City/County:*	St. Louis	*State:*	MN	*Sampling Date:*	11/18/10
Investigator(s):	TPT	*Section:*	26	*Township:*	55	*Range:*	18	*Sampling Point:*	#03 East of S02
Land Form:	Terrace	*Local Relief:*	None	*Slope %:*		*Soil Map Unit Name:*	Greenwood Soils B14A		
Subregion (LRR):	K	*Latitude:*		*Longitude:*		*Datum:*			

NWI/Cowardin Classification:

Circular 39 Classification: 7

Are climatic/hydrologic conditions on the site typical for this time of year? Yes *(If no, explain in remarks)*

Are vegetation No *Soil* No *Hydrology* No *significantly disturbed?*

Are vegetation No *Soil* No *Hydrology* No *naturally problematic?*

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Coniferous Swamp

Eggers & Reed (secondary):

Eggers & Reed (tertiary):

Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Yes	*Remarks (explain any answers if needed):* There is some ditching within 100 feet of this sample.
Hydric soil present?	Yes	
Wetland hydrology present?	Yes	
Is the sampled area within a wetland?	Yes	*If yes, optional Wetland Site ID:*

VEGETATION

		Absolute % Cover	***Dominant Species?***	***Indicator Status ****
Tree Stratum	***(Plot Size:)***			
1.	Larix laricina	90	Yes	FACW
2.	Picea mariana	3	No	FACW
3.		0		
4.		0		
	Total Cover:	**93**		
Sapling/Shrub Stratum	***(Plot Size:)***			
1.	Ledum groenlandicum	50	Yes	OBL
2.	Rubus idaeus ssp. strigosus	15	Yes	FACW
3.		0		
4.		0		
5.		0		
	Total Cover:	**65**		
Herb Stratum	***(Plot Size:)***			
1.	Sphagnum sp.	90	Yes	
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	**90**		
Woody Vine Stratum	***(Plot Size:)***			
1.		0		
2.		0		
	Total Cover:	**0**		

**** In USFWS Region 3***

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**3**	**(A)**
Total Number of Dominant Species Across All Strata:	**4**	**(B)**
Percent of Dominant Species That Are OBL, FACW or FAC:	**75.00%**	**(A/B)**

Prevalence Index Worksheet:

Total % Cover of:		**Multiply by:**	
OBL Species	50	X 1	50
FACW Species	108	X 2	216
FAC Species	0	X 3	0
FACU Species	0	X 4	0
UPL Species	0	X 5	0
Column Totals:	**158**	(A)	**266** (B)
		Prevalence Index = B/A =	**1.68**

Hydrophytic Vegetation Indicators:

Yes	**Rapid Test for Hydrophytic Vegetation**
Yes	**Dominance Test is >50%**
Yes	**Prevelance Index ≤ 3.0 [1]**
No	**Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)**
No	**Problematic Hydrophytic Vegetation [1] (Explain)**

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #03 East of S02

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 18	10yr 2/1						Fibric peat	
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains **[2] Location: PL=Pore Lining, M=Matrix.**

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** ______ **Depth (inches):** -

Hydric soil present? Yes

Remarks: Saturated at 6" below surface

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☑ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)
☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):** ______
Water table present? ☐ **Water Table Depth (inches):** ______
Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 6

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: There was a ditch approximately 100' away.

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 26
Township: 55
Range: 18
Sampling Point: #04 S01

Land Form: Terrace
Local Relief: None
Slope %:
Soil Map Unit Name: Greenwood soils B14A

Subregion (LRR): K
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: up

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation Yes Soil Yes Hydrology Yes significantly disturbed?

Are vegetation No Soil No Hydrology No naturally problematic?

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Upland
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? No
Is the sampled area within a wetland? No

Remarks (explain any answers if needed): Tile drained sod field

If yes, optional Wetland Site ID:

VEGETATION

	Absolute % Cover	Dominant Species?	Indicator Status *
Tree Stratum (Plot Size:)			
1.	0		
2.	0		
3.	0		
4.	0		
Total Cover:	0		
Sapling/Shrub Stratum (Plot Size:)			
1.	0		
2.	0		
3.	0		
4.	0		
5.	0		
Total Cover:	0		
Herb Stratum (Plot Size:)			
1. Poa pratensis	99	Yes	FAC
2.	0		
3.	0		
4.	0		
5.	0		
6.	0		
7.	0		
8.	0		
Total Cover:	99		
Woody Vine Stratum (Plot Size:)			
1.	0		
2.	0		
Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply by:	
OBL Species	0	X 1	0	
FACW Species	0	X 2	0	
FAC Species	99	X 3	297	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	99	(A)	297	(B)
Prevalence Index = B/A =			3.00	

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

Vegetation adjacent to field - 30% populus trem. With aspen understory 30%, willow sp15% and rubus sp15%. Reed canarygrass 30%

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #04 S01

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 9	10yr 2/2						loamy sand	
2.	9 - 20	10yr 4/2	70	10yr 4/6	30			sandy loam	
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☐ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)

☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☑ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): Type: Depth (inches): -

Hydric soil present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**
Water table present? ☐ **Water Table Depth (inches):**
Saturation present? (includes capillary fringe) ☐ **Saturation Depth (inches):**

Wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Tile Drained soil

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 26
Township: 55
Range: 18
Sampling Point: #05 S01

Land Form:
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood soils B14A

Subregion (LRR): K
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: up

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation Yes Soil Yes Hydrology Yes significantly disturbed?

Are vegetation No Soil No Hydrology No naturally problematic?

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Upland
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? No
Is the sampled area within a wetland? No

Remarks (explain any answers if needed): Tile drained sod field

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

	Sapling/Shrub Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

	Herb Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Poa pratensis	99	Yes	FAC
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	99		

	Woody Vine Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:		
OBL Species	0	X 1	0	
FACW Species	0	X 2	0	
FAC Species	99	X 3	297	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	99	(A)	297	(B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #05 S01

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 16	10yr 2/1						Fibric peat	
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☑ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) (LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): Type: Depth (inches): -

Hydric soil present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**

Water table present? ☐ **Water Table Depth (inches):**

Saturation present? (includes capillary fringe) ☐ **Saturation Depth (inches):**

Wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Tile Drained field

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site:	Zim Sod	Applicant/Owner:	Zim Sod	City/County:	St. Louis	State:	MN	Sampling Date:	11/18/10
Investigator(s):	TPT	Section:	11	Township:	55	Range:	18	Sampling Point:	#06 N18 in Tamaracks
Land Form:		Local Relief:		Slope %:		Soil Map Unit Name:	Greenwood soils B14A		
Subregion (LRR):	K	Latitude:		Longitude:		Datum:			

NWI/Cowardin Classification:

Circular 39 Classification: 7

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation No Soil No Hydrology No significantly disturbed?

Are vegetation No Soil No Hydrology No naturally problematic?

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Coniferous Swamp

Eggers & Reed (secondary):

Eggers & Reed (tertiary):

Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Yes
Hydric soil present?	Yes
Wetland hydrology present?	Yes
Is the sampled area within a wetland?	Yes

Remarks (explain any answers if needed): Tamarack island west end of Elk field

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Larix laricina	30	Yes	FACW
2.		0		
3.		0		
4.		0		
	Total Cover:	30		

	Sapling/Shrub Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Larix laricina	30	Yes	FACW
2.	Cornus sericea ssp. sericea	30	Yes	FACW
3.	Rubus idaeus ssp. strigosus	15	Yes	FACW
4.		0		
5.		0		
	Total Cover:	75		

	Herb Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	0		

	Woody Vine Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:		
OBL Species	0	X 1	0	
FACW Species	105	X 2	210	
FAC Species	0	X 3	0	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	105	(A)	210	(B)
		Prevalence Index = B/A =	2.00	

Hydrophytic Vegetation Indicators:

Yes	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #06 N18 in Tamaracks

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 16	10yr 2/1						Fibric peat	Saturated at 12"
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)

☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): *Type:* ____ *Depth (inches):* -

Hydric soil present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)

☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**

Water table present? ☐ **Water Table Depth (inches):**

Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 12

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: This stand may be affected by tile drainage in adjacent sod fields.

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10
Investigator(s): MAJ
Section: 11
Township: 55
Range: 18
Sampling Point: #07 Center of N09
Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood B14A
Subregion (LRR): k
Latitude:
Longitude:
Datum:
NWI/Cowardin Classification: upland
Circular 39 Classification: upland
Eggers & Reed (primary): Upland
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):
Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)
Are vegetation Yes Soil Yes Hydrology Yes significantly disturbed?
Are vegetation No Soil No Hydrology No naturally problematic?
Are "normal circumstances" present? Yes

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Yes
Hydric soil present?	Yes
Wetland hydrology present?	No
Is the sampled area within a wetland?	No

Remarks (explain any answers if needed): Tile drained sod field. Middle of Bear Paw field.

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

	Sapling/Shrub Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

	Herb Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Poa pratensis	95	Yes	FAC
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	95		

	Woody Vine Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	0	X 1	0
FACW Species	0	X 2	0
FAC Species	95	X 3	285
FACU Species	0	X 4	0
UPL Species	0	X 5	0
Column Totals:	95	(A)	285 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #07 Center of N09

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 10	10yr2/1						hemic peat	
2.	10 - 32	10yr2/1						fibric peat	woody frags at 18"
3.	32 - 36	10yr2/1						hemic peat	moist at 36" not sat
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains **[2] Location: PL=Pore Lining, M=Matrix.**

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☑ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) (LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

Restrictive Layer (if present): Type: Depth (inches): -

Hydric soil present? Yes

Remarks: not saturated

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**

Water table present? ☐ **Water Table Depth (inches):**

Saturation present? (includes capillary fringe) ☐ **Saturation Depth (inches):**

Wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Soil moist at 34-36 but not saturated.

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 11
Township: 55
Range: 18
Sampling Point: #08 N16 west end

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood soils B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: 7

Eggers & Reed (primary): Coniferous Swamp
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

Are climatic/hydrologic conditions on the site typical for this time of year? Yes *(If no, explain in remarks)*

Are vegetation No *Soil* No *Hydrology* No *significantly disturbed?*

Are vegetation No *Soil* No *Hydrology* No *naturally problematic?*

Are "normal circumstances" present? Yes

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? Yes
Is the sampled area within a wetland? Yes

Remarks (explain any answers if needed): West end of Moosehorn field.

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum *(Plot Size:)*	***Absolute % Cover***	***Dominant Species?***	***Indicator Status ****
1.	Larix laricina	30	Yes	FACW
2.		0		
3.		0		
4.		0		
	Total Cover:	30		

	Sapling/Shrub Stratum *(Plot Size:)*	***Absolute % Cover***	***Dominant Species?***	***Indicator Status ****
1.	Larix laricina	80	Yes	FACW
2.	Picea mariana	10	No	FACW
3.	Chamaedaphne calyculata	5	No	OBL
4.		0		
5.		0		
	Total Cover:	95		

	Herb Stratum *(Plot Size:)*	***Absolute % Cover***	***Dominant Species?***	***Indicator Status ****
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	0		

	Woody Vine Stratum *(Plot Size:)*	***Absolute % Cover***	***Dominant Species?***	***Indicator Status ****
1.		0		
2.		0		
	Total Cover:	0		

** In USFWS Region 3*

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			**Multiply by:**	
OBL Species	5	X 1	5	
FACW Species	120	X 2	240	
FAC Species	0	X 3	0	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	125	(A)	245	(B)
Prevalence Index = B/A =			1.96	

Hydrophytic Vegetation Indicators:

Yes	**Rapid Test for Hydrophytic Vegetation**
Yes	**Dominance Test is >50%**
Yes	**Prevelance Index ≤ 3.0 [1]**
No	**Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)**
No	**Problematic Hydrophytic Vegetation [1] (Explain)**

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #08 N16 west end

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 6	10yr 2/1						Fibric peat	moist
2.	6 - 21	10yr 2/1						Fibric peat	saturated
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☑ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) (LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

Restrictive Layer (if present): **Type:** **Depth (inches):** -

Hydric soil present? Yes

Remarks: Saturated at -6"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**

Water table present? ☐ **Water Table Depth (inches):**

Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 6

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Saturated at -6"

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 11
Township: 55
Range: 18
Sampling Point: #09 N16

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood soils B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: up

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation Yes Soil Yes Hydrology Yes significantly disturbed?
Are vegetation No Soil No Hydrology No naturally problematic?
Are "normal circumstances" present? Yes

Eggers & Reed (primary): Upland
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? No
Is the sampled area within a wetland? No

Remarks (explain any answers if needed): Tile drained sod field - in Moosehorn field

If yes, optional Wetland Site ID:

VEGETATION

		Absolute % Cover	Dominant Species?	Indicator Status *
Tree Stratum	(Plot Size:)			
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	**0**		
Sapling/Shrub Stratum	(Plot Size:)			
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	**0**		
Herb Stratum	(Plot Size:)			
1.	Poa pratensis	99	Yes	FAC
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	**99**		
Woody Vine Stratum	(Plot Size:)			
1.		0		
2.		0		
	Total Cover:	**0**		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**1**	(A)
Total Number of Dominant Species Across All Strata:	**1**	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply by:	
OBL Species	0	X 1	0	
FACW Species	0	X 2	0	
FAC Species	99	X 3	297	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	**99**	(A)	**297**	(B)

Prevalence Index = B/A = **3.00**

Hydrophytic Vegetation Indicators:

No	**Rapid Test for Hydrophytic Vegetation**
Yes	**Dominance Test is >50%**
Yes	**Prevelance Index ≤ 3.0 [1]**
No	**Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)**
No	**Problematic Hydrophytic Vegetation [1] (Explain)**

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #09 N16

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 18	10yr 2/1						Fibric peat	very moist @ 12"
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☑ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) (LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): Type: Depth (inches): -

Hydric soil present? Yes

Remarks: Very moist at 12" but not saturated

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**

Water table present? ☐ **Water Table Depth (inches):**

Saturation present? (includes capillary fringe) ☐ **Saturation Depth (inches):**

Wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Very moist at 12" but not saturated - tile drained field

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 11
Township: 55
Range: 18
Sampling Point: #10 N07

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood soils B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: up

Eggers & Reed (primary): Upland
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation Yes Soil Yes Hydrology Yes significantly disturbed?

Are vegetation No Soil No Hydrology No naturally problematic?

Are "normal circumstances" present? Yes

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? No
Is the sampled area within a wetland? No

Remarks (explain any answers if needed): Tile Drained Field (Otter field) with a managed drainage system and managed vegetation.

If yes, optional Wetland Site ID:

VEGETATION

Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	0		
2.	0		
3.	0		
4.	0		
Total Cover:	0		

Sapling/Shrub Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	0		
2.	0		
3.	0		
4.	0		
5.	0		
Total Cover:	0		

Herb Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1. Poa pratensis	99	Yes	FAC
2.	0		
3.	0		
4.	0		
5.	0		
6.	0		
7.	0		
8.	0		
Total Cover:	99		

Woody Vine Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	0		
2.	0		
Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	100.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply by:	
OBL Species	0	X 1	0	
FACW Species	0	X 2	0	
FAC Species	99	X 3	297	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	99	(A)	297	(B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #10 N07

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 12	10yr 2/1						Fibric peat	
2.	12 - 20	10yr 2/1						Fibric peat	bright fibers10%
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☑ *Histosol (A1)*
- ☐ *Histic Epipedon (A2)*
- ☐ *Black Histic (A3)*
- ☐ *Hydrogen Sulfide (A4)*
- ☐ *Stratified Layers (A5)*
- ☐ *Depleted Below Dark Surface (A11)*
- ☐ *Thick Dark Surface (A12)*
- ☐ *Sandy Mucky Mineral (S1)*
- ☐ *Sandy Gleyed Matrix (S4)*
- ☐ *Sandy Redox (S5)*
- ☐ *Stripped Matrix (S6)*
- ☐ *Dark Surface (S7) (LRR R, MLRA 149B)*
- ☐ *Polyvalue Below Surface (S8) (LRR R, MLRA 149B)*
- ☐ *Thin Dark Surface (S9) (LRR R, MLRA 149B)*
- ☐ *Loamy Mucky Mineral (F1) (LRR K, L)*
- ☐ *Loamy Gleyed Matrix (F2)*
- ☐ *Depleted Matrix (F3)*
- ☐ *Redox Dark Surface (F6)*
- ☐ *Depleted Dark Surface (F7)*
- ☐ *Redox Depressions (F8)*

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils [3]:

- ☐ *2 cm Muck (A10) (LRR K, L, MLRA 149B)*
- ☐ *Coast Prairie Redox (A16) (LRR K, L, R)*
- ☐ *5 cm Mucky Peat or Peat (S3) (LRR K, L, R)*
- ☐ *Dark Surface (S7) (LRR K, L)*
- ☐ *Polyvalue Below Surface (S8) (LRR K, L)*
- ☐ *Thin Dark Surface (S9) (LRR K, L)*
- ☐ *Iron-Manganese Masses (F12) (LRR K, L, R)*
- ☐ *Piedmont Floodplain Soils (F19) (MLRA 149B)*
- ☐ *Mesic Spodic (TA6) (MLRA 144A, 145, 149B)*
- ☐ *Red Parent Material (TF2)*
- ☐ *Very Shallow Dark Surface (TF12)*
- ☐ *Other (explain in soil remarks)*

Restrictive Layer (if present): ***Type:*** ______ ***Depth (inches):*** -

Hydric soil present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ *Surface Water (A1)*
- ☐ *High Water Table (A2)*
- ☐ *Saturation (A3)*
- ☐ *Water Marks (B1)*
- ☐ *Sediment Deposits (B2)*
- ☐ *Drift Deposits (B3)*
- ☐ *Algal Mat or Crust (B4)*
- ☐ *Iron Deposits (B5)*
- ☐ *Inundation Visible on Aerial Imagery (B7)*
- ☐ *Sparsely Vegetated Concave Surface (B8)*
- ☐ *Water-Stained Leaves (B9)*
- ☐ *Aquatic Fauna (B13)*
- ☐ *Marl Deposits (B15)*
- ☐ *Hydrogen Sulfide Odor (C1)*
- ☐ *Oxidized Rhizospheres on Living Roots (where not tilled) (C3)*
- ☐ *Presence of Reduced Iron (C4)*
- ☐ *Recent Iron Reduction in Tilled Soils (C6)*
- ☐ *Thin Muck Surface (C7)*
- ☐ *Other (explain in remarks)*

Secondary Indicators (minimum of two required)

- ☐ *Surface Soil Cracks (B6)*
- ☐ *Drainage Patterns (B10)*
- ☐ *Moss Trim Lines (B16)*
- ☐ *Dry-Season Water Table (C2)*
- ☐ *Crayfish Burrows (C8)*
- ☐ *Saturation Visible on Aerial Imagery (C9)*
- ☐ *Stunted or Stressed Plants (D1)*
- ☐ *Geomorphic Position (D2)*
- ☐ *Shallow Aquitard (D3)*
- ☐ *Microtopographic Relief (D4)*
- ☐ *FAC-Neutral Test (D5)*

Field Observations:

Surface water present? ☐ ***Surface Water Depth (inches):*** ______

Water table present? ☐ ***Water Table Depth (inches):*** ______

Saturation present? (includes capillary fringe) ☐ ***Saturation Depth (inches):*** ______

Wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ ***Aerial Photo*** ☐ ***Monitoring Well*** ☐ ***Stream Gauge*** ☐ ***Previous Inspections***

Hydrology Remarks: Tile drained field

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 11
Township: 55
Range: 18
Sampling Point: #11East of N06

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood soils B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: 8

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation No Soil No Hydrology No significantly disturbed?

Are vegetation No Soil No Hydrology No naturally problematic?

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Coniferous Bog
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? Yes
Is the sampled area within a wetland? Yes

Remarks (explain any answers if needed): East of Mallard field

If yes, optional Wetland Site ID:

VEGETATION

Tree Stratum (Plot Size:)

		Absolute % Cover	Dominant Species?	Indicator Status *
1.	Larix laricina	30	Yes	FACW
2.		0		
3.		0		
4.		0		
	Total Cover:	30		

Sapling/Shrub Stratum (Plot Size:)

		Absolute % Cover	Dominant Species?	Indicator Status *
1.	Larix laricina	10	Yes	FACW
2.	Picea mariana	10	Yes	FACW
3.	Betula pumila	10	Yes	OBL
4.	Ledum groenlandicum	25	Yes	OBL
5.	Rubus idaeus ssp. strigosus	10	Yes	FACW
	Total Cover:	65		

Herb Stratum (Plot Size:)

		Absolute % Cover	Dominant Species?	Indicator Status *
1.	Sphagnum sp.	30	Yes	
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	30		

Woody Vine Stratum (Plot Size:)

		Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	6	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	85.71%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL Species	35	X 1	35
FACW Species	60	X 2	120
FAC Species	0	X 3	0
FACU Species	0	X 4	0
UPL Species	0	X 5	0
Column Totals:	95	(A)	155 (B)

Prevalence Index = B/A = 1.63

Hydrophytic Vegetation Indicators:

Yes	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #11East of N06

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 12	10yr 2/1						Fibric peat	saturated at 4"
2.	12 - 18	10yr 2/1						Fibric peat	10% bright fibers
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)

☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): Type: Depth (inches): -

Hydric soil present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☑ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**
Water table present? ☐ **Water Table Depth (inches):**
Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 4

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Saturation at -4"

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 3
Township: 55
Range: 18
Sampling Point: #12 N of N01

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood soils B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: 8

Are climatic/hydrologic conditions on the site typical for this time of year? Yes *(If no, explain in remarks)*

Are vegetation No *Soil* No *Hydrology* No *significantly disturbed?*
Are vegetation No *Soil* No *Hydrology* No *naturally problematic?*
Are "normal circumstances" present? Yes

Eggers & Reed (primary): Coniferous Bog
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Yes
Hydric soil present?	Yes
Wetland hydrology present?	Yes
Is the sampled area within a wetland?	Yes

Remarks (explain any answers if needed): North of Bald eagle field

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum *(Plot Size:)*	***Absolute % Cover***	***Dominant Species?***	***Indicator Status ****
1.	Picea mariana	60	Yes	FACW
2.	Larix laricina	40	Yes	FACW
3.		0		
4.		0		
	Total Cover:	100		

	Sapling/Shrub Stratum *(Plot Size:)*			
1.	Salix sp.	15	Yes	FAC
2.	Ledum groenlandicum	35	Yes	OBL
3.	Rubus idaeus ssp. strigosus	15	Yes	FACW
4.		0		
5.		0		
	Total Cover:	65		

	Herb Stratum *(Plot Size:)*			
1.	Sphagnum sp.	20	Yes	
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	20		

	Woody Vine Stratum *(Plot Size:)*			
1.		0		
2.		0		
	Total Cover:	0		

** In USFWS Region 3*

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**5**	***(A)***
Total Number of Dominant Species Across All Strata:	**6**	***(B)***
Percent of Dominant Species That Are OBL, FACW or FAC:	**83.33%**	***(A/B)***

Prevalence Index Worksheet:

	Total % Cover of:		***Multiply by:***	
OBL Species	35	X 1	35	
FACW Species	115	X 2	230	
FAC Species	15	X 3	45	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	**165**	(A)	**310**	(B)

Prevalence Index = B/A = **1.88**

Hydrophytic Vegetation Indicators:

Yes	***Rapid Test for Hydrophytic Vegetation***
Yes	***Dominance Test is >50%***
Yes	***Prevelance Index ≤ 3.0 [1]***
No	***Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)***
No	***Problematic Hydrophytic Vegetation [1] (Explain)***

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #12 N of N01

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 18	10yr 2/1						Fibric peat	sat to surface
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)
☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

Restrictive Layer (if present): **Type:** ______ **Depth (inches):** -

Hydric soil present? Yes

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☑ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)
☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):** ______
Water table present? ☐ **Water Table Depth (inches):** ______
Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 0

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Saturated to surface

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): TPT
Section: 11
Township: 55
Range: 18
Sampling Point: #13 E of N02

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood soils B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: 7

Eggers & Reed (primary): Coniferous Swamp
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

Are climatic/hydrologic conditions on the site typical for this time of year? Yes *(If no, explain in remarks)*

Are vegetation No *Soil* No *Hydrology* No *significantly disturbed?*
Are vegetation No *Soil* No *Hydrology* No *naturally problematic?*
Are "normal circumstances" present? Yes

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? Yes
Is the sampled area within a wetland? Yes *If yes, optional Wetland Site ID:*

Remarks (explain any answers if needed): East of Osprey field

VEGETATION

	Tree Stratum *(Plot Size:)*	***Absolute % Cover***	***Dominant Species?***	***Indicator Status ****
1.	Picea mariana	90	Yes	FACW
2.		0		
3.		0		
4.		0		
	Total Cover:	**90**		

	Sapling/Shrub Stratum *(Plot Size:)*			
1.	Ledum groenlandicum	25	Yes	OBL
2.	Chamaedaphne calyculata	10	Yes	OBL
3.	Cornus sericea ssp. sericea	10	Yes	FACW
4.	Betula pumila	10	Yes	OBL
5.		0		
	Total Cover:	**55**		

	Herb Stratum *(Plot Size:)*			
1.	Sphagnum sp.	30	Yes	
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	**30**		

	Woody Vine Stratum *(Plot Size:)*			
1.		0		
2.		0		
	Total Cover:	**0**		

**** In USFWS Region 3***

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**5**	***(A)***
Total Number of Dominant Species Across All Strata:	**6**	***(B)***
Percent of Dominant Species That Are OBL, FACW or FAC:	**83.33%**	***(A/B)***

Prevalence Index Worksheet:

Total % Cover of:			***Multiply by:***	
OBL Species	45	X 1	45	
FACW Species	100	X 2	200	
FAC Species	0	X 3	0	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	**145**	(A)	**245**	(B)
Prevalence Index = B/A =			**1.69**	

Hydrophytic Vegetation Indicators:

Yes	***Rapid Test for Hydrophytic Vegetation***
Yes	***Dominance Test is >50%***
Yes	***Prevelance Index ≤ 3.0 [1]***
No	***Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)***
No	***Problematic Hydrophytic Vegetation [1] (Explain)***

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #13 E of N02

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 12	10yr 2/1						Fibric peat	
2.	12 - 22	10yr 2/2						Fibric peat	
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)

☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): Type: Depth (inches): -

Hydric soil present? Yes

Remarks: Saturated to surface

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☑ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**
Water table present? ☐ **Water Table Depth (inches):**
Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 0

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Saturated to surface

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod *Applicant/Owner:* Zim Sod *City/County:* St. Louis *State:* MN *Sampling Date:* 11/18/10

Investigator(s): TPT *Section:* 11 *Township:* 55 *Range:* 18 *Sampling Point:* #14 E of N13

Land Form: Terrace *Local Relief:* *Slope %:* *Soil Map Unit Name:* Greenwood soils B14A

Subregion (LRR): K *Latitude:* *Longitude:* *Datum:*

NWI/Cowardin Classification: *Circular 39 Classification:* 7

Are climatic/hydrologic conditions on the site typical for this time of year? Yes *(If no, explain in remarks)*

Are vegetation No *Soil* No *Hydrology* No *significantly disturbed?*

Are vegetation No *Soil* No *Hydrology* No *naturally problematic?*

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Coniferous Swamp

Eggers & Reed (secondary):

Eggers & Reed (tertiary):

Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes

Hydric soil present? Yes

Wetland hydrology present? Yes

Is the sampled area within a wetland? Yes

Remarks (explain any answers if needed):

If yes, optional Wetland Site ID:

VEGETATION

Tree Stratum *(Plot Size:)*	***Absolute % Cover***	***Dominant Species?***	***Indicator Status ****
1. Larix laricina	40	Yes	FACW
2.	0		
3.	0		
4.	0		
Total Cover:	**40**		
Sapling/Shrub Stratum *(Plot Size:)*			
1. Larix laricina	60	Yes	FACW
2. Rubus idaeus ssp. strigosus	15	Yes	FACW
3.	0		
4.	0		
5.	0		
Total Cover:	**75**		
Herb Stratum *(Plot Size:)*			
1.	0		
2.	0		
3.	0		
4.	0		
5.	0		
6.	0		
7.	0		
8.	0		
Total Cover:	**0**		
Woody Vine Stratum *(Plot Size:)*			
1.	0		
2.	0		
Total Cover:	**0**		

**** In USFWS Region 3***

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**3**	***(A)***
Total Number of Dominant Species Across All Strata:	**3**	***(B)***
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	***(A/B)***

Prevalence Index Worksheet:

Total % Cover of:		***Multiply by:***		
OBL Species	0	X 1	0	
FACW Species	115	X 2	230	
FAC Species	0	X 3	0	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	**115**	(A)	**230**	(B)

Prevalence Index = B/A = **2.00**

Hydrophytic Vegetation Indicators:

Yes	***Rapid Test for Hydrophytic Vegetation***
Yes	***Dominance Test is >50%***
Yes	***Prevelance Index ≤ 3.0 [1]***
No	***Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)***
No	***Problematic Hydrophytic Vegetation [1] (Explain)***

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #14 E of N13

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	**Matrix**		**Redox Features**					
	(inches)	**Color (moist)**	**%**	**Color (moist)**	**%**	**Type [1]**	**Loc [2]**	**Texture**	**Remarks**
1.	0 - 8	10yr 2/1						Fibric peat	
2.	8 - 18	10yr 2/1						Fibric peat	Saturated to 8"
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☑ *Histosol (A1)*
- ☐ *Histic Epipedon (A2)*
- ☐ *Black Histic (A3)*
- ☐ *Hydrogen Sulfide (A4)*
- ☐ *Stratified Layers (A5)*
- ☐ *Depleted Below Dark Surface (A11)*
- ☐ *Thick Dark Surface (A12)*
- ☐ *Sandy Mucky Mineral (S1)*
- ☐ *Sandy Gleyed Matrix (S4)*
- ☐ *Sandy Redox (S5)*
- ☐ *Stripped Matrix (S6)*
- ☐ *Dark Surface (S7) (LRR R, MLRA 149B)*
- ☐ *Polyvalue Below Surface (S8) (LRR R, MLRA 149B)*
- ☐ *Thin Dark Surface (S9) (LRR R, MLRA 149B)*
- ☐ *Loamy Mucky Mineral (F1) (LRR K, L)*
- ☐ *Loamy Gleyed Matrix (F2)*
- ☐ *Depleted Matrix (F3)*
- ☐ *Redox Dark Surface (F6)*
- ☐ *Depleted Dark Surface (F7)*
- ☐ *Redox Depressions (F8)*

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils [3]:

- ☐ *2 cm Muck (A10) (LRR K, L, MLRA 149B)*
- ☐ *Coast Prairie Redox (A16) (LRR K, L, R)*
- ☐ *5 cm Mucky Peat or Peat (S3) (LRR K, L, R)*
- ☐ *Dark Surface (S7) (LRR K, L)*
- ☐ *Polyvalue Below Surface (S8) (LRR K, L)*
- ☐ *Thin Dark Surface (S9) (LRR K, L)*
- ☐ *Iron-Manganese Masses (F12) (LRR K, L, R)*
- ☐ *Piedmont Floodplain Soils (F19) (MLRA 149B)*
- ☐ *Mesic Spodic (TA6) (MLRA 144A, 145, 149B)*
- ☐ *Red Parent Material (TF2)*
- ☐ *Very Shallow Dark Surface (TF12)*
- ☐ *Other (explain in soil remarks)*

Restrictive Layer (if present): *Type:* ______ *Depth (inches):* -

Hydric soil present? Yes

Remarks: Saturated to 8"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ *Surface Water (A1)*
- ☐ *High Water Table (A2)*
- ☑ *Saturation (A3)*
- ☐ *Water Marks (B1)*
- ☐ *Sediment Deposits (B2)*
- ☐ *Drift Deposits (B3)*
- ☐ *Algal Mat or Crust (B4)*
- ☐ *Iron Deposits (B5)*
- ☐ *Inundation Visible on Aerial Imagery (B7)*
- ☐ *Sparsely Vegetated Concave Surface (B8)*
- ☐ *Water-Stained Leaves (B9)*
- ☐ *Aquatic Fauna (B13)*
- ☐ *Marl Deposits (B15)*
- ☐ *Hydrogen Sulfide Odor (C1)*
- ☐ *Oxidized Rhizospheres on Living Roots (where not tilled) (C3)*
- ☐ *Presence of Reduced Iron (C4)*
- ☐ *Recent Iron Reduction in Tilled Soils (C6)*
- ☐ *Thin Muck Surface (C7)*
- ☐ *Other (explain in remarks)*

Secondary Indicators (minimum of two required)

- ☐ *Surface Soil Cracks (B6)*
- ☐ *Drainage Patterns (B10)*
- ☐ *Moss Trim Lines (B16)*
- ☐ *Dry-Season Water Table (C2)*
- ☐ *Crayfish Burrows (C8)*
- ☐ *Saturation Visible on Aerial Imagery (C9)*
- ☐ *Stunted or Stressed Plants (D1)*
- ☐ *Geomorphic Position (D2)*
- ☐ *Shallow Aquitard (D3)*
- ☐ *Microtopographic Relief (D4)*
- ☐ *FAC-Neutral Test (D5)*

Field Observations:

Surface water present? ☐ ***Surface Water Depth (inches):*** ______

Water table present? ☐ ***Water Table Depth (inches):*** ______

Saturation present? (includes capillary fringe) ☑ ***Saturation Depth (inches):*** 8

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ ***Aerial Photo*** ☐ ***Monitoring Well*** ☐ ***Stream Gauge*** ☐ ***Previous Inspections***

Hydrology Remarks: Saturated to within 8" - may have some lateral effect from adjacent sod fields

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): MAJ
Section: 11
Township: 55
Range: 18
Sampling Point: #15 NE Corner of N08

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification: upland
Circular 39 Classification: upland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation Yes Soil Yes Hydrology Yes significantly disturbed?

Are vegetation No Soil No Hydrology No naturally problematic?

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Upland
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? No
Is the sampled area within a wetland? No

Remarks (explain any answers if needed): Tile drained sod field. NE corner of Red Fox field.

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

	Sapling/Shrub Stratum (Plot Size:)			
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

	Herb Stratum (Plot Size:)			
1.	Poa pratensis	95	Yes	FAC
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	95		

	Woody Vine Stratum (Plot Size:)			
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW or FAC: 100.00% (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply by:	
OBL Species	0	X 1	0	
FACW Species	0	X 2	0	
FAC Species	95	X 3	285	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	95	(A)	285	(B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #15 NE Corner of N08

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 36	10yr2/1						fibric peat mostly	some hemic below 30"
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)

☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

Restrictive Layer (if present): Type: Depth (inches): -

Hydric soil present? Yes

Remarks: Saturated at 34"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**
Water table present? ☐ **Water Table Depth (inches):**
Saturation present? (includes capillary fringe) ☐ **Saturation Depth (inches):**

Wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks:

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): MAJ
Section: 11
Township: 55
Range: 18
Sampling Point: #16 NW Corner of N12

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood Soils B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification: upland
Circular 39 Classification: upland

Are climatic/hydrologic conditions on the site typical for this time of year? Yes *(If no, explain in remarks)*

Are vegetation Yes *Soil* Yes *Hydrology* Yes *significantly disturbed?*

Are vegetation No *Soil* No *Hydrology* No *naturally problematic?*

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Upland
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? No
Is the sampled area within a wetland? No

Remarks (explain any answers if needed): Tile drained sod field

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum *(Plot Size:)*	**Absolute % Cover**	**Dominant Species?**	**Indicator Status ***
1.		0		
2.		0		
3.		0		
4.		0		
	Total Cover:	0		

	Sapling/Shrub Stratum *(Plot Size:)*	**Absolute % Cover**	**Dominant Species?**	**Indicator Status ***
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

	Herb Stratum *(Plot Size:)*	**Absolute % Cover**	**Dominant Species?**	**Indicator Status ***
1.	Poa pratensis	95	Yes	FAC
2.		0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	95		

	Woody Vine Stratum *(Plot Size:)*	**Absolute % Cover**	**Dominant Species?**	**Indicator Status ***
1.		0		
2.		0		
	Total Cover:	0		

*** In USFWS Region 3**

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	**1**	**(A)**
Total Number of Dominant Species Across All Strata:	**1**	**(B)**
Percent of Dominant Species That Are OBL, FACW or FAC:	**100.00%**	**(A/B)**

Prevalence Index Worksheet:

Total % Cover of:			**Multiply by:**	
OBL Species	0	X 1	0	
FACW Species	0	X 2	0	
FAC Species	95	X 3	285	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	**95**	(A)	**285**	(B)

Prevalence Index = B/A = **3.00**

Hydrophytic Vegetation Indicators:

No	**Rapid Test for Hydrophytic Vegetation**
Yes	**Dominance Test is >50%**
Yes	**Prevelance Index ≤ 3.0 [1]**
No	**Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)**
No	**Problematic Hydrophytic Vegetation [1] (Explain)**

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #16 NW Corner of N12

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 36	10yr2/1						fibric & hemic peat	woody frags 30-36"
2.	-								
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)

☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): Type: ________ Depth (inches): -

Hydric soil present? Yes

Remarks: Nearly saturated @ 36" but not above

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☐ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):** ____
Water table present? ☐ **Water Table Depth (inches):** ____
Saturation present? (includes capillary fringe) ☐ **Saturation Depth (inches):** ____

Wetland hydrology present? No

Describe Recorded Data:

Recorded Data: ☐ Aerial Photo ☐ Monitoring Well ☐ Stream Gauge ☐ Previous Inspections

Hydrology Remarks:

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): MAJ
Section: 11
Township: 55
Range: 18
Sampling Point: #17 S of SW corner of N14

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: 7

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation No Soil No Hydrology No significantly disturbed?
Are vegetation No Soil No Hydrology No naturally problematic?
Are "normal circumstances" present? Yes

Eggers & Reed (primary): Coniferous Swamp
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? Yes
Is the sampled area within a wetland? Yes

Remarks (explain any answers if needed): South of Porcupine field

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Larix laricina	60	Yes	FACW
2.	Picea mariana	20	Yes	FACW
3.		0		
4.		0		
	Total Cover:	80		
	Sapling/Shrub Stratum (Plot Size:)			
1.		0		
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		
	Herb Stratum (Plot Size:)			
1.	Calamagrostis canadensis	10	No	OBL
2.	Sphagnum sp.	60	Yes	
3.	Carex lasiocarpa	10	No	OBL
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	80		
	Woody Vine Stratum (Plot Size:)			
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	66.67%	(A/B)

Prevalence Index Worksheet:

	Total % Cover of:		Multiply by:	
OBL Species	20	X 1	20	
FACW Species	80	X 2	160	
FAC Species	0	X 3	0	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	100	(A)	180	(B)
Prevalence Index = B/A =			1.80	

Hydrophytic Vegetation Indicators:

Yes	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #17 S of SW corner of N14

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 8	10yr2/1						hemic peat	
2.	8 - 36	10yr2/1						fibric peat	
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)

☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): **Type:** **Depth (inches):** -

Hydric soil present? Yes

Remarks: saturated to surface, waterlogged at surface.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☑ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):**
Water table present? ☐ **Water Table Depth (inches):**
Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 0

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Saturated to surface, waterlogged at surface

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): MAJ
Section: 11
Township: 55
Range: 18
Sampling Point: #18 W of N14/Elsner Rd

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: 6

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation No Soil No Hydrology No significantly disturbed?

Are vegetation No Soil No Hydrology No naturally problematic?

Are "normal circumstances" present? Yes

Eggers & Reed (primary): Shrub-Carr
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present? Yes
Hydric soil present? Yes
Wetland hydrology present? Yes
Is the sampled area within a wetland? Yes

Remarks (explain any answers if needed): West of Porcupine field

If yes, optional Wetland Site ID:

VEGETATION

	Tree Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Larix laricina	10	Yes	FACW
2.		0		
3.		0		
4.		0		
	Total Cover:	10		

	Sapling/Shrub Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Salix sp.	0		FAC
2.		0		
3.		0		
4.		0		
5.		0		
	Total Cover:	0		

	Herb Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Calamagrostis canadensis	20	Yes	OBL
2.	Spirea alba	15	Yes	NI
3.	Sphagnum sp.	30	Yes	
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	65		

	Woody Vine Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	50.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:		
OBL Species	20	X 1	20	
FACW Species	10	X 2	20	
FAC Species	0	X 3	0	
FACU Species	0	X 4	0	
UPL Species	0	X 5	0	
Column Totals:	30	(A)	40	(B)

Prevalence Index = B/A = 1.33

Hydrophytic Vegetation Indicators:

No	Rapid Test for Hydrophytic Vegetation
No	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #18 W of N14/Elsner Rd

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth	Matrix		Redox Features					
	(inches)	Color (moist)	%	Color (moist)	%	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 10	10yr2/1						hemic peat	
2.	10 - 36	10yr2/1						mostly fibric peat	
3.	-								
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

☑ Histosol (A1)
☐ Histic Epipedon (A2)
☐ Black Histic (A3)
☐ Hydrogen Sulfide (A4)
☐ Stratified Layers (A5)
☐ Depleted Below Dark Surface (A11)
☐ Thick Dark Surface (A12)
☐ Sandy Mucky Mineral (S1)
☐ Sandy Gleyed Matrix (S4)
☐ Sandy Redox (S5)

☐ Stripped Matrix (S6)
☐ Dark Surface (S7) (LRR R, MLRA 149B)
☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
☐ Loamy Mucky Mineral (F1) (LRR K, L)
☐ Loamy Gleyed Matrix (F2)
☐ Depleted Matrix (F3)
☐ Redox Dark Surface (F6)
☐ Depleted Dark Surface (F7)
☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils [3]:

☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
☐ Coast Prairie Redox (A16) (LRR K, L, R)
☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
☐ Dark Surface (S7) (LRR K, L)
☐ Polyvalue Below Surface (S8) (LRR K, L)
☐ Thin Dark Surface (S9) (LRR K, L)
☐ Iron-Manganese Masses (F12) (LRR K, L, R)
☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
☐ Red Parent Material (TF2)
☐ Very Shallow Dark Surface (TF12)
☐ Other (explain in soil remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present): *Type:* ____ *Depth (inches):* -

Hydric soil present? Yes

Remarks: saturated at 6"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)
☐ High Water Table (A2)
☑ Saturation (A3)
☐ Water Marks (B1)
☐ Sediment Deposits (B2)
☐ Drift Deposits (B3)
☐ Algal Mat or Crust (B4)
☐ Iron Deposits (B5)
☐ Inundation Visible on Aerial Imagery (B7)
☐ Sparsely Vegetated Concave Surface (B8)

☐ Water-Stained Leaves (B9)
☐ Aquatic Fauna (B13)
☐ Marl Deposits (B15)
☐ Hydrogen Sulfide Odor (C1)
☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
☐ Presence of Reduced Iron (C4)
☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Thin Muck Surface (C7)
☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

☐ Surface Soil Cracks (B6)
☐ Drainage Patterns (B10)
☐ Moss Trim Lines (B16)
☐ Dry-Season Water Table (C2)
☐ Crayfish Burrows (C8)
☐ Saturation Visible on Aerial Imagery (C9)
☐ Stunted or Stressed Plants (D1)
☐ Geomorphic Position (D2)
☐ Shallow Aquitard (D3)
☐ Microtopographic Relief (D4)
☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):** ____
Water table present? ☐ **Water Table Depth (inches):** ____
Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 6

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: saturated at 6 inches

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WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Zim Sod
Applicant/Owner: Zim Sod
City/County: St. Louis
State: MN
Sampling Date: 11/18/10

Investigator(s): MAJ
Section: 11
Township: 55
Range: 18
Sampling Point: #19 Wetland East of N09

Land Form: Terrace
Local Relief:
Slope %:
Soil Map Unit Name: Greenwood B14A

Subregion (LRR): k
Latitude:
Longitude:
Datum:

NWI/Cowardin Classification:
Circular 39 Classification: 8

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (If no, explain in remarks)

Are vegetation No Soil No Hydrology No significantly disturbed?
Are vegetation No Soil No Hydrology No naturally problematic?
Are "normal circumstances" present? Yes

Eggers & Reed (primary): Coniferous Bog
Eggers & Reed (secondary):
Eggers & Reed (tertiary):
Eggers & Reed (quaternary):

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic vegetation present?	Yes	Remarks (explain any answers if needed):	East of Bear Paw field
Hydric soil present?	Yes		
Wetland hydrology present?	Yes		
Is the sampled area within a wetland?	Yes	If yes, optional Wetland Site ID:	

VEGETATION

	Tree Stratum (Plot Size: 30 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Larix laricina	75	Yes	FACW
2.	Picea mariana	15	No	FACW
3.		0		
4.		0		
	Total Cover:	90		

	Sapling/Shrub Stratum (Plot Size: 15 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Cornus sericea ssp. sericea	5	No	FACW
2.	Rubus idaeus	10	Yes	FACU
3.	Ledum groenlandicum	30	Yes	OBL
4.		0		
5.		0		
	Total Cover:	45		

	Herb Stratum (Plot Size: 5 ft radius)	Absolute % Cover	Dominant Species?	Indicator Status *
1.	Calamagrostis canadensis	15	Yes	OBL
2.	Sphagnum sp.	0		
3.		0		
4.		0		
5.		0		
6.		0		
7.		0		
8.		0		
	Total Cover:	15		

	Woody Vine Stratum (Plot Size:)	Absolute % Cover	Dominant Species?	Indicator Status *
1.		0		
2.		0		
	Total Cover:	0		

* In USFWS Region 3

Dominance Test Worksheet:

Number of Dominant Species That Are OBL, FACW or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of Dominant Species That Are OBL, FACW or FAC:	75.00%	(A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:		
OBL Species	45	X 1	45	
FACW Species	95	X 2	190	
FAC Species	0	X 3	0	
FACU Species	10	X 4	40	
UPL Species	0	X 5	0	
Column Totals:	150	(A)	275	(B)
Prevalence Index = B/A =			1.83	

Hydrophytic Vegetation Indicators:

Yes	Rapid Test for Hydrophytic Vegetation
Yes	Dominance Test is >50%
Yes	Prevelance Index ≤ 3.0 [1]
No	Morphological Adaptations [1] (provide supporting data in vegetation remarks or on a separate sheet)
No	Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil & wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic vegetation present? Yes

Remarks:
(include photo numbers here or on a separate sheet)

WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

SOIL

Sampling Point: #19 Wetland East of N09

Profile Description: (Describe to the depth needed to document the indicator or confirm the abscence of indicators).

	Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type [1]	Loc [2]	Texture	Remarks
1.	0 - 10	10yr2/1						hemic peat	
2.	10 - 32	10yr2/1						fibric peat	
3.	32 - 36	10yr2/1						hemic peat	
4.	-								
5.	-								
6.	-								

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (applicable to all LRRs, unless otherwise noted)

- ☑ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR R, MLRA 149B)
- ☐ Polyvalue Below Surface (S8) (LRR R, MLRA 149B)
- ☐ Thin Dark Surface (S9) (LRR R, MLRA 149B)
- ☐ Loamy Mucky Mineral (F1) (LRR K, L)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Indicators for Problematic Hydric Soils [3]:

- ☐ 2 cm Muck (A10) (LRR K, L, MLRA 149B)
- ☐ Coast Prairie Redox (A16) (LRR K, L, R)
- ☐ 5 cm Mucky Peat or Peat (S3) (LRR K, L, R)
- ☐ Dark Surface (S7) (LRR K, L)
- ☐ Polyvalue Below Surface (S8) (LRR K, L)
- ☐ Thin Dark Surface (S9) (LRR K, L)
- ☐ Iron-Manganese Masses (F12) (LRR K, L, R)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149B)
- ☐ Mesic Spodic (TA6) (MLRA 144A, 145, 149B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (explain in soil remarks)

Restrictive Layer (if present): Type: ____ Depth (inches): -

Hydric soil present? Yes

Remarks: saturated to surface

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (where not tilled) (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (explain in remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
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- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface water present? ☐ **Surface Water Depth (inches):** ____

Water table present? ☐ **Water Table Depth (inches):** ____

Saturation present? (includes capillary fringe) ☑ **Saturation Depth (inches):** 0

Wetland hydrology present? Yes

Describe Recorded Data:

Recorded Data: ☐ **Aerial Photo** ☐ **Monitoring Well** ☐ **Stream Gauge** ☐ **Previous Inspections**

Hydrology Remarks: Saturated to surface

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