Northeast Minnesota Wetland Mitigation Inventory & Assessment

Phase 1: Final Inventory Report

Prepared for:
The Board of Water and Soil Resources (BWSR**)**

January 2009

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BARR

4700 West 77th Street
Minneapolis, MN 55435-4803
Phone: (952) 832-2600
Fax: (952) 832-2601

Northeast Minnesota
Wetland Mitigation Inventory & Assessment
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Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 Executive Summary

The Northeast Minnesota Wetland Mitigation Inventory and Assessment Project is a two phase project to identify potential wetland mitigation opportunities located in northeastern Minnesota and analyze those opportunities to develop goals and priorities. Both phases of the project are designed to only address the technical aspects of wetland mitigation, analysis of policy related issues are beyond the scope of this project. Phase 1 is designed to identify potential wetland mitigation sites and inventory and assess mineland wetlands and Phase 2 will assess siting recommendations based on priorities, including but not limited to: mitigation types/methods, water quality, proximity to impaired waters, technical feasibility and wetland functions.

1.1 Inventory Results

The GIS analysis indicates approximately 8,400 potential wetland mitigation sites representing a total area of approximately 1,117,000 acres. When applying the typical regulatory credit for each mitigation method (indicated below) the credit potential drops to approximately 533,000 acres (less than half of the total potential).

- Restoration Credit: 50 – 100%
- Preservation Credit : 12.5%
- Enhancement Credit: 12.5%
- Creation Credit: 75%

To fully evaluate the true potential of available wetland mitigation in the study area, one must consider sites with high potential and landowner acceptance. Each of these factors was evaluated during the field verification analysis conducted as part of Phase I. When applying a factor of 13% and 11% for technical feasibility and landowner acceptance, respectively, the total available potential credit identified by the GIS analysis and field verification is approximately 8,000 acres or approximately 7% of the acreage identified by the GIS analysis. The breakdown of the GIS analysis by mitigation method is:

- Restoration = 7,500 acres
- Preservation/ENRV = 100 acres
- Enhancement = 100 acres
- Creation = 300 acres

1.2 Inventory Development Process

The purpose of Phase 1 is to gather baseline historical data to develop an initial understanding of the existing wetland resources and conduct a regional assessment of potential opportunities for wetland restoration, enhancement, preservation and creation within the 18 counties containing more than 80 percent of their historic wetlands. The Phase 1 report is intended to provide documentation of the process, methods, and results; including discussion of the project study area, the participants and outcomes of public outreach meeting, the inventory methodologies, the outcome of the study, and prioritization factors.

During Phase I of the project, a technical committee was convened to provide review and guidance over the inventory process. Wetland stakeholders were also consulted to gather feedback on the major components of the study and to provide information on local issues which could impact the success of the project.

Based on the technical committee and stakeholder feedback, four general categories of mitigation methods were evaluated: wetland restoration, preservation, enhancement, and creation. A GIS model analysis was conducted utilizing existing data sources to identify potential wetland mitigation opportunities within the project area. Potential wetland mitigation sites were identified throughout the study area.

Approximately three percent of the potential mitigation opportunities spread across 17 of the 18 counties have been evaluated in the field to determine the accuracy of the modeling methods and to sample landowner interest. The field verification was performed by Soil and Water Conservation Districts and other Local Government Units. Approximate locations of field verification sites for each mitigation method are shown in Figure 6. The results of the field efforts indicated approximately 13 percent of the sites evaluated had a high technical feasibility rating (Figure 7). However, landowners expressed interest in wetland mitigation only 11 percent of the time. Over 98 percent of the potential wetland mitigation acres identified are associated with wetland mitigation methods that would only qualify for partial credit ranging from 12.5 percent to 75 percent. In addition, more than 50 percent of the total potential mitigation acreage identified was on sites determined to be farmed wetlands, many of which may not qualify for credit or may only yield limited credit under state mitigation guidelines.

The mineland inventory study area includes a much smaller subset area encompassing the Mesabi Iron Range mining corridor that extends from west of Grand Rapids to south of Ely (Figure 2). The mineland water resources inventory analysis identified nearly 2,000 wetlands and water bodies covering nearly 23,000 acres. Approximately 4,000 acres of wetlands were identified that have developed on former minelands along with nearly 6,000 acres of mine pit waters and 13,000 acres of natural wetlands located adjacent to mine features.

A sample of approximately 6 percent of those water mineland features were field verified and their functions assessed using the Minnesota Routine Assessment Method for Evaluating Wetland Functions. Approximately 27 percent of the wetlands assessed were rated exceptional or high for vegetative diversity/integrity. All wetlands associated with uncategorized mine features and all mine pits were rated low or moderate for vegetative diversity/integrity. Over 95 percent of wetlands assessed were rated moderate or higher for wildlife habitat, maintenance of hydrologic regime, flood storage, and maintenance of downstream water quality. The results show that there is the potential for developing sustainable, quality wetlands on reclaimed minelands providing important functions and values.

Prioritization factors are a key component of the assessment and will be carried over into Phase 2. The technical committee and the stakeholder group concluded that it is important to have the ability to sort data by prioritization factors. The prioritization factors considered include: potential wetland mitigation types, wetland mitigation method, wetland mitigation site size, land ownership, landowner interest, water quality, proximity to impaired waters, technical feasibility, and watershed location. The potential wetland mitigation opportunities will be analyzed in the context of these prioritization factors during Phase 2 of the project.

2.0 Introduction

The Northeast Minnesota Wetland Mitigation and Assessment Project is a two phase project to identify potential wetland mitigation opportunities located in northeastern Minnesota and analyze those opportunities to develop goals and priorities. In 2006, interested parties from federal, state and local agencies; mining groups; consultants; environmental groups; wetland mitigation bankers; and others met as an ad hoc committee to discuss northeastern Minnesota's current and future wetland mitigation needs and challenges and to develop a wetland mitigation strategy (Strategy) to address those challenges.

Northeastern Minnesota faces unique challenges for wetland mitigation due to several factors, namely:

- The presence of extensive wetland resources,
- Approximately 57 percent of land is in public (federal and state) and tribal ownership,
- Few established wetland mitigation banks currently exist,
- A perceived lack of traditional wetland mitigation opportunities exist, and
- The need for approximately 550 acres of wetland mitigation is projected annually in the foreseeable future.

The ad hoc committee met numerous times over nearly two years to map out a Strategy. Several stakeholder meetings were held throughout the process to get input on the proposed strategy. The strategy included five main recommendations:

- Conduct a regional wetland mitigation inventory to determine the availability of wetland mitigation opportunities in the region.
- Conduct a regional mitigation siting study to summarize the results of the regional inventory and help to streamline mitigation planning in the region.
- Develop a northeastern Minnesota wetland bank cooperative – a third party to coordinate, promote, and develop wetland banking within the region.
- Compile up-to-date knowledge or research on non-traditional mitigation methods
- Update the National Wetlands Inventory for northeastern Minnesota

Following discussions with northeastern Minnesota legislators, a legislative bill was introduced to fund the regional wetland mitigation inventory and the mitigation siting study. In 2007, after receiving stakeholders' testimony the Legislature funded the inventory and the siting study recommendations through a two-year appropriation to the Board of Water and Soil Resources (BWSR) for 2008-2009.

This Phase 1 final inventory report to BWSR is intended to provide documentation of the first phase of the project, the wetland mitigation inventory. This report includes documentation of the process, methods, and results; including discussion of the project study area, the participants and outcomes of public outreach meetings, the inventory methodologies, the outcome of the study, and prioritization factors.

The project team consists of numerous organizations including: Barr Engineering Company (Barr), Community GIS Services, BWSR, numerous Soil and Water Conservation Districts (SWCD), and Local Government Units (LGU) in the region. Barr is the project leader working under the direction of BWSR. Community GIS Services provides GIS services for the project. The SWCDs, LGUs, and a consultant have conducted field assessment services under the direction of BWSR.

3.0 Project Purpose and Goals

3.1 Wetland Mitigation Inventory

The Strategy concluded that there were inherent difficulties in planning wetland mitigation in northeastern Minnesota due to a perceived shortage of traditional wetland mitigation opportunities compounded by significant future demand. Therefore, the primary purpose of the wetland mitigation inventory was to conduct a comprehensive search for potential wetland mitigation opportunities in each of the 18 counties identified as containing greater than 80 percent of their pre-settlement wetlands in northern Minnesota (Figure 1).

There is a growing concern for the protection of stream and lake water quality with an understanding of the important role wetlands play in watershed processes. Therefore, the wetland mitigation inventory has been conducted with a watershed emphasis to identify watershed and water quality improvement opportunities within the study area. Baseline data was collected to develop an initial understanding of the existing wetland resources and a regional assessment was conducted of potential opportunities for wetland restoration, enhancement, preservation and creation. The intent of this study is to use existing data to identify potential wetland mitigation opportunities and verify and assess the technical feasibility of a limited sampling of sites in the field.

3.2 Mineland Wetland Inventory and Assessment

Present and future mining operations have the potential to affect large areas of wetlands, thus requiring significant wetland mitigation. With the perceived lack of mitigation opportunities within the Mesabi Iron Range watersheds, wetland development on mining properties during reclamation can be one strategy to maintain wetland functions in the affected watersheds. Therefore, the purpose of the mineland inventory and assessment is to gain a better understanding of the potential for wetland development on reclaimed minelands by conducting an inventory of wetlands that have developed on former minelands and assessing the functions of those wetlands. The project team developed a preliminary inventory of potential wetland and water resources, reviewed it with the Technical Committee for further guidance, and embarked on field verification efforts to verify the existence of those resources and assess the wetland functions. The functions and values of a representative sample of wetlands identified were assessed in the field utilizing the Minnesota Routine Assessment Method for Evaluating Wetland Functions (MNRAM) Version 3.2.

4.0 Technical Committee

The project team assembled a Technical Committee to provide technical review and guidance of the inventory process. The Committee included representatives of BWSR, the Minnesota Department of Natural Resources (MNDNR), the University of Minnesota's Natural Resources Research Institute (NRRI), the U.S. Army Corps of Engineers (COE), the U.S. Fish and Wildlife Service (USFWS), the Minnesota Pollution Control Agency (MPCA), and the St. Louis County Land Department. A complete list of the Technical Committee is found in Appendix G.

The Technical Committee provided input on:

- Project Study Area,
- Data sources,
- GIS modeling and methodologies for evaluating mitigation sites,
- Mitigation methods to be evaluated,
- Regional needs and the prioritization of geographic areas to be studied,
- Field verification of GIS modeling data and collection protocols, and
- Mineland water resource GIS modeling and assessment methodologies.

5.0 Project Study Area

5.1 Wetland Mitigation Inventory

The scope of the project includes all 18 counties defined in the Wetland Conservation Act as containing greater than 80 percent of the historic wetland resources. Regulatory agencies also recognize Bank Service Areas, encompassing larger watershed areas as acceptable areas for utilizing wetland bank credits for compensatory wetland mitigation (Figure 1).

5.2 Mineland Wetland Inventory and Assessment

The mineland inventory study area includes a much smaller subset area encompassing the Mesabi Iron Range mining corridor that extends from west of Grand Rapids to south of Ely (Figure 2). The Mesabi Iron Range is active today with many mining operations currently underway and some currently developing and expanding. The inventory identified wetlands and water resources that have developed within the inactive portions of the mining study area. The Cuyuna Range was evaluated to determine if it would be appropriate for inclusion in the study area. It was determined to be invalid due to the fact that the mining methods utilized there were considerably different from those used today and would not provide valuable information for today's mining operations.

The potential extent of the mineland study area was initially identified as the area encompassing mine operations documented in the MNDNR 2007 mine features GIS layer. Those features were then outlined to develop a contiguous area. The final step in identifying the study area involved removing actively permitted mine operations (based on MNDNR data) from the previously defined area. The resulting study area encompasses approximately 192 square miles (Figure 2).

6.0 Data Sources

6.1 Inventory Data Sources

The following list of data sources were used to construct a geographic information system (GIS) model to identify and assess the wetland mitigation opportunities within the project study area. This information included the following data sets obtained from the Minnesota DNR Data Deli and county sources.

1. USGS 30-Meter digital elevation model (DEM)

Slope percentages were calculated for all counties and areas of 1% slope or less were extracted except St. Louis, Lake, and Cook counties where areas of 4% slope or less were extracted.

2. NRCS SSURGO 2.2 Soil Surveys

All hydric soils were extracted from the SURGO certified soil surveys. Database queries were run to identify the hydric soils and hydrologic soil groups. The resulting dataset is a hybrid of the hydric soils and hydrologic soil groups that have a water table within 1 foot of the ground surface during at least fifty percent of the growing season. Some counties within the project area did not have a completed soil survey at the time of the analysis. In those areas, geomorphology data was used as a substitute for hydric soil information.

3. MN DNR Geomorphology

Areas containing attributes of peat, alluvial, lacustrine, outwash plains, and flat areas such as marshes and bogs were identified in counties with incomplete soil surveys as a substitute for hydric soils.

4. USGS 2001 National Land Cover Data (NLCD)

Lowland attributes were identified and extracted from the dataset. These attributes included scrub shrub, woody wetlands, and emergent herbaceous wetlands.

5. MN DNR GAP Land Cover Data (Vector Data)

Lowland attributes were identified and extracted from the dataset. These attributes included lowland deciduous shrub, lowland evergreen shrub, floating aquatic, sedge meadow, broadleaf sedge/cattail, balsam fir mix, lowland black spruce, stagnant black spruce, tamarack, stagnant tamarack, lowland northern white cedar, stagnant northern white cedar, stagnant conifer, aspen/birch, black ash, lowland deciduous, lowland conifer/deciduous mix)

6. Manitoba Land Cover

Agriculture, development, gravel pits, and wetlands attributes were extracted from the dataset. These attributes included: cultivated land, grassland, development, gravel pits, and wetlands.

7. International Coalition Land Cover

Agriculture, development, gravel pits, and wetland attributes were extracted from the dataset. These attributes included: cultivated land, pasture and hay land, transitional agricultural land, grassland, development, gravel pits, and wetlands.

8. National Wetlands Inventory (NWI)

NWI systems of Palustrine and Riverine were extracted from the dataset.

9. FEMA Floodplains

100 and 500-year floodplains were identified and extracted from the dataset. Any floodplains that were categorized as being open water were excluded.

10. County Boundaries

11. Major Watershed Boundaries

Major watershed boundaries were identified and extracted from the dataset along with major basins also known as Wetland Bank Service Areas.

12. Property Ownership

Ownership was identified and divided into federal, state, county, private and private industrial.

13. Ditches and Streams

14. Aerial Photography

15. Invasive Species

The only available data for invasive species was point data received from the MNDNR for purple loosestrife.

16. Endangered and Threatened Species

17. Impaired Waters (including TMDL Streams, Lakes, and Wetlands)

Various attributes of the slope, hydric soils, land cover, NWI and floodplain data layers were selected to create a "potential historic wetland areas" base layer. Then other attributes were intersected with the base layer to identify the potential wetland mitigation opportunities. Available metadata for each dataset is provided in Appendix A. The methods and process of putting the data together is described Appendix B.

6.2 Potential Data Sources for Future Mitigation Planning

Several types of data pursued during the course of this study to assist in identifying potential wetland mitigation opportunities, were found to not be available. This lack of available data eliminated the potential for identifying opportunities related to several mitigation methods. These data sources

could prove valuable for future mitigation planning efforts, whether conducted at the local or regional level. Several of these data sources are described below:

1. Abandoned Infrastructure

   Roads, railroads, trails, or other infrastructure that is no longer utilized or is not planned for future use. This data could assist in identifying opportunities for wetland fill removal and restoration of wetlands.

2. Invasive Species Identification

   Remote sensing methods have been developed in Wisconsin and Michigan to identify reed canary grass, a nonnative, invasive species. Analysis of the study area using this methodology could provide the ability to more comprehensively identify wetlands degraded by invasive species.

3. Beaver Dam Inventory

   An inventory of beaver dams could assist in determining where more permanent restoration methods could be employed to ensure sustainable, characteristic wetland hydrology and related functions. In addition, this data could assis in identifying areas where the natural hydrology of high value wetlands has been altered (e.g., by impoundment and flooding or starving downstream wetlands of normal hydrology).

4. Entrenched Streams/Starved Floodplains

   Streams that have been significantly downcut due to upstream, human-induced hydrologic modifications can result in a reduction in hydrology to associated floodplain wetlands. Therefore, an inventory of such features could assist in identifying opportunities to restore upstream watershed characteristics and stream channel characteristics to restore floodplain wetlands.

5. State/County Forest Inventory

   Detailed forest inventory data based on field verification may provide more accurate identification of white cedar swamps as potential wetland preservation/enhancement sites.

6.3 Mineland Wetland Inventory and Assessment

The mineland wetland and water resource inventory started with the compilation of existing data to assist in identifying potential wetlands and water bodies. The following data sources were overlaid in GIS to identify potential wetland and water resources that have developed on former minelands:

- 2007 MNDNR Mine Features

  Active and inactive iron mining features such as pits, stockpiles and tailings basins located along the Mesabi Iron Range.

- 1997 Mesabi elevation contours

  Aerial topography commissioned by the MNDNR for the entire Mesabi Iron Range, including 5 foot contours

- Municipal Boundaries

- National Wetland Inventory

- 2006 Aerial Photography

  Orthorectified, color aerial topography taken in 2003, leaf-on with mature crops prior to harvest

Since the NWI was conducted in the late 1970s to early 1980s, that wetland mapping may no longer accurately depict wetlands that have developed on former minelands. Therefore, interpretation of recent aerial photography was utilized to augment the NWI data. A sample field map is shown in Figure 8.

7.0 Methods

7.1 Wetland Mitigation Inventory Methods

Wetland mitigation methods were identified and reviewed with the members of the Technical Committee. The project team and Technical Committee used Minnesota Rules MN 8420.0541 Actions Eligible for Credit and the proposed 2008-2009 Rule amendments as a guide in this process. The Committee provided many creative suggestions about potential mitigation methods which were divided into four general categories: restoration, preservation, enhancement, and creation. The approximate, maximum, allowable mitigation credit percentages are illustrated for each mitigation method in Table 7.

A search was conducted to identify existing digital data sources that would assist in identifying potential mitigation opportunities within each of the accepted methods. Opportunities for some of the suggested mitigation methods (e.g., abandoned roads and trails, entrenched streams/starved floodplains, beaver dams, etc.) could not be consistently identified because there was insufficient data available. Only existing digital data sources were used in compiling GIS data for the modeling.

7.1.1 Historic Wetland Identification

The GIS modeling analysis started with the development of a historic wetland layer. Six main data layers, indicative of historic wetland conditions, were layered in GIS and analyzed to document where features from multiple data sets overlapped (Appendix B). The purpose of this analysis was to identify likely historic wetland areas as a baseline for assisting with the identification of potential wetland mitigation opportunities. More overlapping data layers indicated a higher likelihood of historic wetland conditions.

Following the development of the historic wetland mapping layer, GIS modeling routines were established to identify potential wetland mitigation opportunities for each mitigation method. In general, the historic wetland layer was overlaid with other data to identify potential mitigation sites based on the criteria described in Appendix C. The Technical Committee recommended a minimum potential mitigation site size for the analysis. For restoration sites, a minimum size for polygons of 20 acres or more was recommended. For other methods, a five acre minimum size for sites was suggested. Potential wetland mitigation sites with 5 acres of potential or more, were identified and compiled during the GIS modeling. However, it is important to consider the feasibility of smaller potential mitigation sites for methods that only qualify for partial credit. For example, wetland

preservation is generally only allocated 12.5 percent credit for the area preserved, so a five acre site would only yield 0.6 acres of credit.

7.1.2 Wetland Mitigation Methods Evaluated

The following is a list of the mitigation methods that were evaluated and the general criteria utilized to identify potential mitigation sites:

- **Restoration of Wetlands:** Restoration of existing or former wetlands.
    - **Drained Wetlands** – wetlands with ditches greater than 2' deep spaced closer than 300' or tile drained (where hydrology has likely been removed)
    - **Partially Drained Wetlands** – wetlands with ditches less than 2' deep or with ditches greater than 300' apart (where hydrology has only partly been removed)
    - **Farmed Wetlands** – wetlands under agricultural production

- **Preservation (usually Exceptional Natural Resources Value [ENRV] wetlands):** Preservation of high value wetlands and upland buffers also requires some restoration of hydrology or vegetation and the presence of a demonstrable threat. Following are examples of some ENRV categories outlined in Actions Eligible for Credit in Minnesota Rules 8420.0541 that were identified in this study.

    - **White Cedar Swamps**
    - **Wetlands Adjacent to Trout Streams**
    - **Wetlands with Threatened & Endangered Species, Rare Communities**
    - **Outstanding Resource Value Waters**
    - **Scientific and Natural Areas (SNA's)**
    - **County and State Owned High Value Wetlands**

- **Enhancement:** Enhancement of diminished wetlands
    - **Enhancement of Wetland Within an Impaired Watershed** – degraded wetlands adjacent to streams within impaired watersheds.
    - **Water Quality / Habitat Enhancement –** Upland improvement to protect high value wetlands or wildlife habitat.
- **Creation:**
    - **Creation of Wetlands on Mineral Extraction Sites**

The data sources and approximate formulas for identifying potential wetland mitigation sites using GIS are briefly described in Appendix C.

7.1.3 Field Verification

Field verification was an effort to check the accuracy of the GIS model used to identify potential sites and an effort to evaluate the interest of landowners in developing wetland mitigation on their property. The Board of Water and Soil Resources contracted with Counties, Soil and Water Conservation District, and a consultant to conduct field verification of selected potential wetland mitigation sites identified by GIS modeling within each of the eighteen counties in the study area. A GIS map of polygons identifying individual wetland mitigation opportunities within each county and a list of prospective sites were generated along with data forms, instructions, guidance and handout materials for property owners.

Two training sessions were held to train prospective field verification staff to evaluate the sites consistently. Participants were instructed to review the prospective site list and choose random sites representing different mitigation methods in different watersheds across their county. In addition, participants were instructed to ask for permission from property owners to access their property in

order to evaluate the technical feasibility of each site and to assess landowner interest in potential future wetland mitigation on their property. Care was taken to protect the privacy of those landowners whom were not interested in conducting wetland mitigation.

7.2 Mineland Wetland Inventory and Assessment

Potential wetland and water resource features within former minelands were identified using the NWI, topography; MNDNR mine features data, aerial imagery interpretation and field delineation and verification. The MNRAM Version 3.2 was utilized to assess the following wetland functions:

- Vegetative Diversity
- Hydrologic Regime
- Storm Water Retention
- Downstream Water Quality
- Wetland Water Quality
- Shoreline Protection
- Fish, Wildlife, and Amphibian Habitat

An inventory of potential wetlands and water resources within the study area was generated based on the GIS layering of aerial photo imagery, topography, MNDNR mine features, NWI and other information. The wetlands and water resources identified were classified into four classes of incidental wetlands, those that have developed on artificial land surfaces resulting from various mining activities. In addition, two classes of natural wetlands were identified based on their proximity to mine features.

Incidental Wetlands and Water Resources

- Deepwater habitats within mine pits
- Wetlands within former tailings basins
- Wetland on former stockpiles
- Wetlands within other mine land features

Natural Wetlands

- Wetlands within 100 feet of a mine feature
- Wetlands within 500 feet of a mine feature

The wetland features were sampled across the Mesabi Range on former minelands ranging in location from west of Grand Rapids to inactive mines east of Babbitt. The primary focus was on wetlands and water resources that developed within former tailings basins, mine pits and impoundments. Both mine pits and impoundments have some potential for littoral area development. Wetlands are less likely to form on former stockpiles, and therefore, assessment efforts were reduced proportionally. Natural wetlands located near mining areas (within 100 feet and 500 feet of a mine feature) were also assessed to determine the effects of mining on wetland functions.

Artificial wetlands, essentially created through the mining process, within tailings basins and mine pits, on stockpiles and adjacent to impoundments were assessed to determine the functional capacity of wetlands developed in a reclaimed mine landscape. Natural wetlands were inventoried to verify their sustainability and evaluated to see how they function in close proximity to mining features such as tailings basins, stockpiles and mine pits. For example, wetlands often form within tailings basins due to the low permeability of the tailings. Wetlands also form where stockpiles block drainage and allow seepage water to accumulate.

8.0 Mitigation Types

Various wetland classification systems have been used in Minnesota, including: U.S. Fish and Wildlife Service (USFWS) Circular 39, USFWS Cowardin and Wetland Plant Communities (Eggers and Reed, 1997). Recognizing the need to have a consistent classification system, the Board of Water and Soil Resources (BWSR) and the U.S. Army Corps of Engineers (COE) have entered into a Memorandum of Understanding concerning wetlands and mitigation which classifies all wetlands using the Wetland Plant Communities Classification System. Therefore, all potential mitigation sites were evaluated using this method. Field sites were evaluated to determine the most likely mitigation method and the potential wetland community types that could be restored, preserved, enhanced or created on the site.

These 12 wetland community types include: shallow open water, deep marshes, shallow marshes, sedge meadows, wet meadows, open bogs, conifer bogs, conifer swamps, hardwood swamps, alder thickets, shrub carrs, and floodplain forests. A description of each of the twelve plant community types are described below. In addition, a table comparing plant community types with the Cowardin and Circular 39 classifications is included in Appendix D.

- Shallow, Open Water: These are plant communities with water depths generally less than 6.6 feet (2 meters). This community has submergent, floating and floating-leaved aquatic vegetation including pondweeds, water lilies, water milfoils, coontail and duckweeds. The hydrology is permanently inundated.

- Deep Marshes: Deep marshes typically have emergent plants growing in permanent to seasonal shallow water varying usually between six inches and 3 feet or more during the growing season. Deep marsh vegetation usually includes such species as cattails, hard stemmed bulrush, pickerel reed, giant bur-reed, Phragmites, wild rice, pondweeds and or water lilies. The hydrology is permanently to semi-permanently inundated.

- Shallow Marshes: Shallow marshes have soils that range from saturated to inundated, with standing water up to six inches in depth. Typical shallow marsh vegetation includes herbaceous emergent species such as cattails, bulrushes, arrowheads, lake sedges, duckweeds and grasses.

- Sedge Meadows: Sedge meadows are usually dominated by the sedges growing on saturated soils but may also include spike rushes, bulrushes, grasses and various forbs, such as asters, goldenrods, milkweed, and beggarticks. The hydrology may be supported by ground water or surface water runoff.

- Wet meadows: Wet meadows are more dominated by grasses such as reed canary grass and redtop grass and by forbs than sedges. Typical forbs may include giant sunflower, joe-pye weed, asters, nettles and jewelweed. The soils in wet meadows may have a seasonally high water table and be seasonally saturated at or near the surface.

- Open bogs: Open bogs are saturated wetlands on acid soils with are low in nutrients. For the most part bogs are carpeted with sphagnum moss growing over peat. Herbs and/or low shrubs of the heath family such as bog rosemary, Labrador tea, leatherleaf, small cranberry, large cranberry and even a few scattered tamarack or black spruce usually typify the bog landscape. Occasionally, insectivorous plants such as pitcher plants and sundews may be found. The hydrology is usually saturated to the surface through the growing season.

- Conifer bogs: Conifer bogs are similar to open bogs, except that the mature conifer species of at least six inches in diameter are dominant on a sphagnum moss mat. Tree species can include tamarack, black spruce and northern white cedar. Herbs and low shrubs species found in open bogs, which tolerate more shade, will be found here. The hydrology is usually saturated to the surface through the growing season.

- Shrub Carrs: Shrub carrs are communities of tall shrubs growing on saturated or seasonally flooded soils. They are usually dominated by various species of willows and dogwood. In addition, the ground cover will usually include some ferns, sedges, grasses and forbs of the sedge and wet meadow communities.

- Alder Thickets: Alder thickets are similar to shrub carrs except that speckled alder is more dominant. Other shrub species that may be found can include elderberry, winterberry and Spireas. Jewelweed, cinnamon fern, Canada bluejoint grass, manna grass, and hummock sedge are commonly found on these sites.

- Hardwood Swamps: Hardwood swamps are dominated by deciduous hardwood trees and have soils that are saturated much of the growing season and may even be inundated by as much as a foot of water at times. Red maple, black ash, American elm and yellow birch are

some of the dominant trees in a hardwood swamp. Occasionally, white cedar can be a subdominant species. Shrub species usually include alder and dogwoods.

- Conifer Swamps: Conifer swamps are forested wetlands that are usually dominated with conifer species such as northern white cedar, tamarack, black spruce, and balsam fir. The hydrology is also saturated like hardwood swamps and differs from conifer bogs in that a continuous sphagnum moss mat is not present.

- Floodplain Forests: Floodplain forests are dominated by deciduous trees and alluvial soils found along the floodplains of rivers and streams. The soils are inundated during flood events but are usually well drained for the rest of the growing season. Typical species found on these sites are black willow, silver maple, green ash, cottonwood, and American elm. Jewelweed and nettles can usually be found in the herbaceous layer while shrubs species may be limited due to frequent flooding.

9.0 Prioritization Factors

The identification of potential wetland mitigation sites was conducted in a manner that allowed for the compilation of possible prioritization factors that may be used to more effectively plan future mitigation based on review by the Technical Committee. It was determined that, in order to establish goals and priorities for mitigation during Phase 2, it is important to have the ability to sort the data by the following prioritization factors:

- Potential Wetland Mitigation Types – These types include the 12 Wetland Community Types described in Section 8. The possible wetland mitigation type was determined for sites that were evaluated in more detail through field verification.

- Wetland Mitigation Method –The most likely mitigation method was identified for each potential wetland mitigation site during the GIS modeling analysis, which was also verified for selected sites during field verification efforts. The methods include those specific actions described in the general categories of restoration, preservation, enhancement, and creation (Section7.2).

- Land Ownership – Ownership categories, including State, Tax-forfeit, County, Private and Private (Industrial) Lands were compiled during the GIS modeling analysis and were verified in more detail for selected sites during field verification. Tribal and Federal lands were not analyzed because conservation easements (required for mitigation) historically have not been possible on these lands.

- Water Quality/Impaired Waters – Wetlands play an important role in maintaining water quality. Therefore, the proximity of potential wetland mitigation sites to impaired streams or lakes or their watersheds was noted during the GIS modeling analysis, recognizing the role restored wetlands could play in moderating impairments.

- Technical Feasibility – The GIS modeling methods used to identify potential wetland mitigation sites could not assess technical feasibility. Therefore, the technical feasibility of selected sites was evaluated during field verification efforts (Appendix E).

- Watershed Location – The Wetland Conservation Act requires that wetland replacement be conducted within the project watershed, when feasible. Therefore, it was important to the Technical Committee to identify the major and minor watersheds, as well as the Wetland Bank Service Area in which each potential wetland mitigation site lies.

In addition to the prioritization factors described, other specific information related to each potential mitigation site was compiled. The information outlined below may assist in analyzing the data and determining mitigation goals and priorities.

- County Location – The Wetland Conservation Act currently gives some preference to replacing unavoidable wetland impacts within the county where the impacts occur. Some of the stakeholders also indicated a preference for maintaining wetland resources within each county. The GIS modeling analysis and field verification efforts were conducted on a county-by-county basis and the county location was compiled for all potential mitigation sites.

- Potential Wetland Mitigation Site Size – The potential acreage was identified for each site during the GIS modeling analysis and was verified during field verification efforts for selected sites.

- Landowner Interest – Landowner interest in wetland mitigation was assessed for selected sites during the field verification efforts (Appendix E).

10.0 Outcomes from Public Outreach Meeting

A public outreach meeting was held on July 10, 2008 in Grand Rapids, a centralized meeting location to the project study area. The purpose of the meeting was to communicate the project progress to stakeholders and solicit their input on the Inventory (Phase 1) and subsequent siting analysis (Phase 2). Attendees at the meeting included State Representative Tom Anzelc, who sponsored the Inventory legislation; County Commissioners; agency staff from the U.S. Army Corps of Engineers U.S. Fish and Wildlife Service, MNDNR, BWSR, MPCA, Soil and Water Conservation Districts, Counties, and Cities; the Natural Resources Research Institute; representatives from various mining companies; wetland banking groups; consultants; environmental groups; and private citizens. The meeting included a general session or project overview, and three breakout sessions in the second part of the meeting.

10.1 General Session – Project Background and Update

John Jaschke, BWSR's Executive Director opened the meeting and welcomed the attendees. Representative Tom Anzelc shared his vision for the Inventory. Brian Napstad, Aitkin County Commissioner and BWSR Board Member, shared his local perspective on the project. In this session, the attendees were briefed by BWSR staff on the project background and status. Following the general project discussion, three breakout sessions were provided for further public input on the project. These included: the Mineland Study, Mitigation and Siting Strategy, and the Field Verification sessions. Meeting notes for each breakout session are provided in Appendix F.

10.2 Mineland Breakout Session

This session discussed three key areas of the mineland wetland and water resource inventory and assessment: (1) the study area, (2) the assessment method, (3) the data sources upon which the study will be based, and (4) the field assessment process. The focus of this study was to conduct an evaluation of water resources on former minelands and therefore, no active mining areas were examined. The study area is the Mesabi Iron Range from west of Grand Rapids to east of Babbitt. The audience was able to ask questions and comment on the process.

10.3 Mitigation and Siting Breakout Session

This session focused on Phase 2 of the project, the Siting Study, emphasizing the following topics:

- Project goal is to identify wetland mitigation opportunities based on science rather than social, economic and other considerations

- It is understood that policy issues exist, which at some point may need to be addressed, most likely as a follow-up from the completed siting assessment

- There are recent and ongoing policy developments, which may impact actions eligible for credit (WCA Rule revision, BWSR/COE MOU, COE St Paul District Guidance, and National Mitigation Policy)

- Project information that could benefit regulatory programs include:

    - Detailed information on mitigation potential
    - Locations and quantity of mitigation sites
    - Additional banking opportunities
    - Possible recommendations for regulatory program changes

10.4 Field Verification Breakout Session

This session discussed the GIS model for identifying potential mitigation sites and explained the proposed field procedures and related technical information to assist the participants in the field verification of GIS data. In addition, this session was used as an opportunity to determine the level of interest on the part of local government units and Soil and Water Conservation Districts in participating in field verification efforts. The Soil and Water Conservation Districts and some Counties expressed their desire to participate in the field work.

Concern was expressed about protecting the privacy rights of the property owners that would be contacted. Therefore, no private properties were entered without the permission of the property owner. Efforts were made to the extent practicable, to protect the privacy of property owners not interested in wetland mitigation from unwanted future speculators.

11.0 Wetland Mitigation Inventory Results

11.1 Overall Wetland Mitigation Inventory Results

The results presented include a summarization of all potential wetland mitigation sites identified as having 20 acres of potential or more. However, the final geodatabase of potential wetland mitigation sites that will be available to the public will include all potential mitigation sites 5 acres in size or greater. The preliminary, potential, wetland mitigation area identified for all sites with 5 acres of potential or more (excluding drained wetlands and farmed wetlands) was over 1,192,000 acres.

A total of approximately 8,450 potential mitigation sites covering about 1,117,600 acres were identified across all mitigation methods in the GIS modeling (Table 6). Partially drained wetlands and farmed wetlands comprised about 88 percent of the total potential mitigation area. The majority of the area identified for those methods had over 100 acres of mitigation potential for each site. Drained wetlands made up less than two percent of the total area, and the majority of that area was comprised of individual sites with less than 100 acres of potential.

The wetland preservation methods made up less than six percent of the total potential wetland mitigation area (Table 6), including nearly 80 percent for high value wetlands on private, county or state land. White cedar swamps and riparian trout stream wetlands only comprised about 20 percent of the area. Wetland enhancement methods comprised approximately 3.5 percent of the total potential wetland mitigation area, fairly evenly split between invasive species and degraded wetlands within impaired watersheds (Table 6). Wetland creations made up only 1.5 percent of the total potential wetland mitigation area with nearly equal area of sites less than 100 acres in size and those over 100 acres (Table 6).

11.2 Wetland Mitigation Inventory Credits

The total area of potential wetland mitigation identified in the GIS modeling does not depict the true potential for wetland mitigation credits. The Wetland Conservation Act allows varying percentages of credit for areas of wetland restored, preserved, enhanced, or created. The credit allocation ranges from 12.5 percent for preservation and enhancement methods to 100 percent for drained wetlands. Partially drained wetlands are allowed up to 50 percent credit, farmed wetlands range from 0 to 100 percent credit (depending on the history seeded crops over the past 20 years) and wetland creations range up to 75 percent. In order to better understand the potential credits that might be associated with the areas identified, the total potential wetland mitigation area for each method was multiplied

by the maximum allowable credit percentage for that method (Table 7). The conversion results in a total of approximately 532,900 acres of probable wetland credits, slightly under 50 percent of the total (Table 7, Figure 3).

11.3 Field Verification Data Results

11.3.1 Technical Feasibility

To understand the true potential for wetland mitigation in the study area, one must also consider the technical feasibility. Partially drained wetlands in northeastern Minnesota can be difficult to restore because of relatively low credit potential (currently up to 25% and up to 50% under the proposed rules) and the lack of consensus on the allowable credit. Many wetlands in northeastern Minnesota have been partially drained by county, judicial, and private ditches. Since the construction of those ditches; many new land uses have developed that rely on that drainage. Restoring partially drained wetlands may not be feasible where infrastructure could be adversely affected. Depending on the type of agricultural practices, many farmed wetlands may not qualify for wetland mitigation credit due to the regulatory requirements, which typically require seeded crop production for at least 10 of the previous 20 years. Drained wetlands, which generally have the highest technical feasibility, comprise a relatively small acreage throughout the study area.

11.3.2 Technical Feasibility Ratings

Each of the sites selected for field verification were rated for overall wetland mitigation potential. The ratings of high, medium, low and no potential, were based on a variety of factors for each wetland method, including: whether there was any allowable credit according to the rules, potential conflicts with other landowners, potential for restoration of hydrology, etc. Other factors evaluated during field verification are included on the Field Verification Form provided in Appendix E.

Field verification of selected sites was conducted within 17 of the 18 study area counties. One county was not granted permission to access any of the targeted properties after 30 attempts to contact landowners. Approximately 225 sites (three percent) were assessed in the field including a representative sample of all wetland mitigation methods. The distribution of field verifications summarized by county is provided in Table 5. Wetland mitigation potential ratings are summarized in Tables 1, 3, and 4. All selected field verification sites are illustrated in Figure 6 along with the respective mitigation potential ratings for each wetland method reviewed. Figure 7 illustrates the field verified sites with high potential.

Approximately 13 percent of the sites evaluated on the ground were rated high potential for mitigation (Table 3). Nearly one-third (30 percent) of the sites viewed were considered as having medium potential for mitigation. A little more than one-third (40 percent) of the sites were rated low in potential. Approximately 14 percent were deemed to have no potential at all. Only six sites had no technical feasibility rating. The wetland mitigation opportunities most likely to be truly feasible opportunities are those rated as having high potential based on field verification. Therefore, assuming an even distribution of high potential across methods (which appears to be a reasonable assumption), a total of about 72,400 acres of mitigation credit would result (Figure 4).

Following is a summary of reasons given for the various mitigation site potential ratings.

Reasons for sites with a "High" rating included:

- Presence of a degraded wetland or special resource wetland
- Wetlands could easily be restored, enhanced, preserved or wetlands could be created.

Reasons for "Medium" ratings included:

- Potential conflicts between multiple landowners (shared ditch, different objectives)
- Some potential agricultural conflicts – cattle
- Invasive species such as buckthorn, reed canary grass were observed
- Ditches are not maintained
- Portions of the site were already wetland and not restorable

Reasons for "Low" ratings included:

- Active farmed area or conflicts with owners objectives
- Conflicts with restoring the hydrology – flooding roads or other infrastructure, or other farming operations
- Little potential to improve existing wetland
- Area observed did not appear to be restorable wetland
- Preservation areas – no observed imminent threat, no white cedar observed or no invasive species observed
- Low water table in gravel pits or it was deemed too costly to move material in order to create a wetland

Reasons for "No potential" ratings included:

- Unfarmed area for the last 20 years (no actions eligible for credit)
- Site high above the water table and well drained (upland)
- Site was drained by a publicly maintained ditch
- Site was a highly functional wetland
- Owner is interested in draining land
- No invasive species observed
- Area is already in a state park – no potential credit
- No white cedar observed, or in a highly developed area with homes

11.3.3 Landowner Interest

Landowner interest in developing wetland mitigation on their property is a key factor in the assessing the true potential for wetland mitigation in the study area. The field verification efforts were not able to consistently assess the overall landowner interest in wetland mitigation within all 18 counties. No data was collected in one county because no landowners granted field crews permission to access their property. Landowner interest was assessed for a total of 176 sites. Table 2 illustrates the overall landowner interest by county and Table 4 illustrates the overall interest by mitigation method. Landowners expressed interest in only 13 percent of the sites evaluated. Including the landowner interest factor to the calculation of high potential wetland mitigation credits, results in approximately 8,000 acres total (Figure 5). Therefore, understanding that the field verification efforts only sampled a small percentage of sites identified and that landowner interest may change with time, it is estimated that there may realistically be the potential to develop about 8,000 acres of wetland mitigation credits within the study area.

12.0 Mineland Data Results

12.1 Mineland Inventory Results

A total of 1,846 potential wetlands and water resources were identified through GIS analyses within the mineland study area covering nearly 23,000 acres (Table 8), which makes up about 20 percent of the study area. Approximately 4,000 acres of wetlands were identified that have developed on former minelands along with nearly 6,000 acres of mine pit waters and 13,000 acres of natural wetlands located adjacent to mine features. A target was set to assess 181 wetlands or approximately ten percent of the projected polygons across the entire Mesabi Iron Range with an emphasis on wetlands that have formed on mine features, particularly tailings basins. Due to time and access constraints, approximately 105 wetlands and water bodies (approximately 6 percent of the total), covering about 4,600 acres (about 20 percent of wetland area) were field verified and assessed using MNRAM Version 3.2 (Table 10).

12.2 Mineland Assessment Results

A total of 67 incidental wetlands (those that developed on artificial mine features) encompassing about 3,300 acres and 38 natural wetlands covering approximately 1,300 acres (located adjacent to mine features), were field checked and assessed using MNRAM, Version 3.2. The wetlands assessed included a sampling of each wetland type identified in the GIS inventory with the exception of wetlands that developed on stockpiles (Tables 8 and 10).

A total of 11 percent (12 wetlands) of assessed wetlands were rated exceptional for vegetative diversity/integrity, including 6 wetlands that developed on tailings basins and 6 natural wetlands adjacent to mine features (Tables 10 and 11). An additional 16 percent rated high for vegetative diversity/integrity and 50 percent rated moderate. All wetlands associated with uncategorized mine features and all deepwater habitats were rated low or moderate for vegetative diversity/integrity.

Approximately 12 percent of the wetlands were rated as having exceptional wildlife habitat split across all wetland classes assessed (Tables 9 and 11). An additional 84% of the wetlands were rated high or moderate for wildlife habitat. About 40 percent of the sites were rated as having high amphibian habitat, including all classes of wetlands assessed. Approximately 11 percent of the sites assessed, were rated as having exceptional wetland water quality with another 80 percent of the sites

were rated high or moderate. Over 95 percent of the wetlands assessed, were rated high or moderate for three hydrology and water quality related functions:

1. Maintenance of hydrologic regime
2. Flood storage
3. Maintenance of downstream water quality

The results of the mineland wetland inventory and assessments provide several findings that may be of value for planning mineland reclamation in the future:

- Given sufficient time, wetlands with high vegetative diversity can develop on mine features without intervention,
- Wetland development on minelands can provide valuable wildlife and amphibian habitat,
- With sustainable reclamation of vegetated watershed areas, the water quality and hydrologic regime in mineland wetlands can be adequately sustained to support wetland development,
- Wetlands in the mine landscape provide valuable protection for water quality and flooding, and
- Natural wetlands adjacent to mining landscapes can thrive as sustainable, high quality landscape features.

13.0 Summary

13.1 Wetland Mitigation Inventory

Potential wetland mitigation site size is an important consideration for technical and economic feasibility. The Technical Committee recommended a minimum potential mitigation site size for the analysis. For restoration sites, a minimum 20 acres of mitigation potential was recommended. For other methods, a minimum five acres of mitigation potential was suggested. Potential wetland mitigation sites with 5 acres of potential or more were identified and compiled during the GIS modeling. However, it is important to consider the feasibility of smaller potential mitigation sites for methods that only qualify for partial credit. For example, wetland preservation is generally only allocated 12.5 percent credit for the area preserved, so a five acre site would only yield 0.6 acres of credit. The results are presented for all mitigation methods identified to have at least 20 acres of mitigation potential, but the geodatabase that will be made available to the public will contain all potential wetland mitigation sites with at least 5 acres of potential.

A total of approximately 8,450 potential wetland mitigation sites with a total area of over 1 million acres were identified in GIS throughout the study area (Table 6). Potential wetland restoration sites, including drained wetlands, partially drained wetlands, and farmed wetlands, make up 89 percent of the total potential mitigation area. Farmed wetlands represent about 60 percent of the potential wetland mitigation area identified and partially drained wetlands make up nearly 28 percent of the area.

When applying the typical regulatory credit percentage to the potential wetland mitigation acreage for each method, the credit potential drops by more than one-half to approximately 532,900 acres (Table 7, Figure 3). Over 95 percent of the credit potential is within the three wetland restoration methods (i.e., drained wetlands, partially drained wetlands, and farmed wetlands). Since wetland preservation and enhancement methods are generally only allowed 12.5 percent credit, those potential mitigation methods only comprise about 2.5 percent of the credit potential.

To understand the true potential for wetland mitigation in the study area, one must also consider the technical feasibility. Partially drained wetlands in northeastern Minnesota can be difficult to restore because of relatively low credit potential (currently up to 25% and up to 50% under the proposed rules) and the lack of consensus on the allowable credit. Many wetlands in northeastern Minnesota have been partially drained by county, judicial, and private ditches. Since the construction of those

ditches; many new land uses have developed that rely on that drainage. Restoring partially drained wetlands may not be feasible where infrastructure could be adversely affected. Depending on the type of agricultural practices, many farmed wetlands may not qualify for wetland mitigation credit due to the regulatory requirements, which typically require seeded crop production for at least 10 of the previous 20 years. Drained wetlands, which generally have the highest technical feasibility, comprise a relatively small acreage throughout the study area.

Field verification efforts resulted in the inspection of 225 sites or approximately three percent of the total sites identified (that were at least 20 acres in size). The field mitigation assessments rated only 13 percent of the sites as having high potential (Table 3). Sites rated with high potential are those that would generally be targeted for mitigation projects and those that would have a high likelihood of success. Assuming that the field verification efforts are representative of the entire sample of sites identified, such that 13 percent of the total potential mitigation site area would be rated with high potential, the likely total mitigation credit area would be just over 72,400 acres (Figure 4). Farmed wetlands and partially drained wetlands make up 90 percent of the high potential mitigation acreage (Figure 4).

A transitive factor that must be kept in mind is landowner interest or willingness. Without interest by the landowner to change land use on their property (Tables 2 and 4), there is little potential for developing wetland mitigation. During field verification efforts, attempts were made to determine the landowner interest in wetland mitigation on approximately two percent of the total sites identified (that were at least 20 acres in size). The results of those efforts indicated that approximately 11 percent of those landowners were interested in wetland mitigation (Table 2). The probable magnitude of potential wetland mitigation credits is therefore affected by three factors that were considered in conducting the wetland mitigation inventory:

1. Regulatory credit

2. Technical feasibility

3. Landowner interest

Applying the regulatory credit for each method, applying the percentage of sites verified as having high potential, and applying the percentage of landowners that expressed an interest in wetland mitigation; results in an assessment of the overall potential for developing wetland mitigation credits. This analysis indicates that there could be the potential for 8,000 acres of wetland mitigation credits

within the study area (Figure 5). Restoration methods comprise approximately 93 percent of the total with preservation, enhancement, and creation methods together totaling less than 600 acres of potential credits.

13.2 Mineland Wetland Inventory and Assessment

A total of 1,846 potential wetlands and water resources were identified through GIS analyses within the mineland study area covering nearly 23,000 acres (Table 8). A total of 105 wetlands and water bodies, covering about 4,600 acres were field verified and assessed using MNRAM Version 3.2 (Table 10), including 67 incidental wetlands (those that developed on artificial mine features) and 38 natural wetlands (located adjacent to mine features).

Approximately 27 percent of the wetlands assessed were rated exceptional or high for vegetative diversity/integrity (Table 11). All wetlands associated with uncategorized mine features and all deepwater habitats were rated low or moderate for vegetative diversity/integrity. Over 95 percent of wetlands assessed were rated moderate or higher for wildlife habitat, maintenance of hydrologic regime, flood storage, and maintenance of downstream water quality. Wetlands that develop on reclaimed mine features and natural wetlands adjacent to mine landscapes can thrive as sustainable, high quality landscape features providing important functions and values.

Tables

Table 1: Field Verification Summary and Mitigation Site Potential Ratings by County

		Forms Returned	Site Potential				
	County	**Total Sites Reviewed**	**High**	**Medium**	**Low**	**None**	**No Info.**
1	Aitkin	16	1	3	11	0	1
2	Beltrami	9	3	3	1	2	0
3	Carlton	10	0	4	6	0	0
4	Cass	13	1	1	4	7	0
5	Clearwater	9	4	1	4	0	0
6	Cook	13	0	6	7	0	0
7	Crow Wing	12	6	3	2	1	0
8	Hubbard	15	1	3	6	5	0
9	Isanti	18	1	1	10	3	3
10	Itasca	18	3	5	7	3	0
11	Kanabec *	0	0	0	0	0	0
12	Koochiching	4	1	2	1	0	0
13	Lake	23	2	9	11	1	0
14	Lake of the Woods	8	0	6	2	0	0
15	Mille Lacs	10	1	0	9	0	0
16	Pine	16	3	7	5	1	0
17a	St. Louis North	5	1	1	1	0	2
17b	St. Louis South	17	2	4	3	8	0
18	Wadena	9	0	9	0	0	0
	Total Number	225	30	68	90	31	6
	Sites Targeted	207					
	Percent of Total	100%	13%	30%	40%	14%	3%

* No permissions granted for access to field verify data.

Table 2: Land Owner Interest Summary by County

	County	Total Sites Reviewed	Landowner Interest			
			Yes	Possibly	No	No Info.
1	Aitkin	16	0	11	0	5
2	Beltrami	9	2	4	3	0
3	Carlton	10	2	7	0	1
4	Cass	13	1	8	2	2
5	Clearwater	9	4	4	0	1
6	Cook	13	0	12	0	1
7	Crow Wing	12	6	3	1	2
8	Hubbard	15	0	1	14	0
9	Isanti	18	0	16	1	1
10	Itasca	18	2	4	5	7
11	Kanabec *	0	0	0	0	0
12	Koochiching	4	1	1	1	1
13	Lake**	0	0	0	0	0
14	Lake of the Woods	8	0	1	7	0
15	Mille Lacs**	0	0	0	0	0
16	Pine**	0	0	0	0	0
17	St. Louis North	5	0	0	2	3
18	St. Louis South	17	0	15	0	2
19	Wadena	9	1	1	7	0
	Total Number	176	19	88	43	26
	Percent of Total	100%	11%	50%	24%	15%

* No permissions granted for access to field verify data.

** Land owner interest was not surveyed in these counties.

Table 3: Field Verification of Site Potential by Mitigation Method

Mitigation Method (Model)								
			All Field Checked Site Potential By Method					
	RESTORATION	**Total Sites Reviewed**		**High**	**Medium**	**Low**	**None**	**No Info.**
1	DW- Drained Wetland	15		2	6	4	3	0
2	PDW -Partially Drained Wetland	4		1	0	2	1	0
3	FW - Farmed Wetland	68		11	21	25	11	0
	Total Restoration Sites	87		14	27	31	15	0
	Percentage of Restoration Sites	39%		16%	31%	36%	17%	0%
	PRESERVATION/ENRV							
4	WC - White Cedar	19		4	6	3	5	1
5	TS - Trout Streams	25		3	12	10	0	0
6	ENRVPVT - ENRV Private Lands	18		2	3	10	1	2
7	ENRVCS - ENRV County / State	15		2	4	6	2	1
	Total Preservation Sites	77		11	25	29	8	4
	Percentage of Preservation Sites	34%		14%	32%	38%	10%	5%
	ENHANCEMENT							
8	IS - Invasive Species	17		1	4	5	6	1
9	IW - Impaired Waters	20		2	4	14	0	0
	Total Enhancement Sites	37		3	8	19	6	1
	Percentage of Enhancement Sites	16%		8%	22%	51%	16%	3%
	CREATION							
10	GP - Creation Mineral Extraction	24		2	8	11	2	1
	Total Creation Sites	24		2	8	11	2	1
	Percentage of Creation Sites	11%		8%	33%	46%	8%	4%
	Total Number Sites	225		30	68	90	31	6
	Percentage of Total Sites	100%		13%	30%	40%	14%	3%

Table 4: Field Verification of Landowner Interest by Site Potential

	Mitigation Method (Site Potential)									
Landowner	**High**		**Medium**		**Low**		**None**		**Total**	
Interest	24	14%	52	29%	63	36%	37	21%	176	100%
Response	Responses	Percentage	Responses	Percentage	Responses	Percentage	Responses	Percentage	Responses	Percentage
Yes	9	38%	5	10%	5	8%	0	0%	19	11%
Possibly	10	42%	20	38%	38	60%	20	54%	88	50%
No	2	8%	19	37%	13	21%	9	24%	43	24%
No Information	3	13%	8	15%	8	11%	7	19%	26	15%
Total	24	100%	52	100%	64	100%	37	100%	176	100%

Table 5: Field Verification Summary by Method Inventoried by County

	Number of Sites Field Verified										
	Restoration			Preservation				Enhancement		Creation	Total
County	FW[1]	DW[2]	PDW[3]	ENRVCS[4]	ENRVPVT[5]	TS[6]	WC[7]	IW[8]	IS[9]	GP[10]	225
Aitkin	2	3	0	2	0	1	2	4	1	1	16
Beltrami	3	1	0	0	1	0	1	1	1	1	9
Carlton	6	0	0	0	0	0	0	3	0	1	10
Cass	10	0	0	0	0	0	1	0	0	2	13
Clearwater	4	1	0	0	0	0	1	2	0	1	9
Cook	0	0	0	1	3	7	0	0	0	2	13
Crow Wing	2	1	0	2	1	1	1	1	1	2	12
Hubbard	3	0	0	3	2	1	3	0	3	0	15
Isanti	7	3	0	0	4	0	0	0	3	1	18
Itasca	9	0	0	0	0	0	3	2	2	2	18
Kanabec[11]	0	0	0	0	0	0	0	0	0	0	0
Koochiching	1	1	1	0	0	0	0	0	0	1	4
Lake	0	0	0	2	4	7	4	3	1	2	23
Lake of the Woods	2	2	1	0	1	0	0	0	0	2	8
Mille Lacs	5	2	0	1	0	0	0	2	0	0	10
Pine	4	1	0	0	2	3	1	2	0	3	16
St. Louis North	1	0	1	0	0	1	1	0	0	1	5
St. Louis South	6	0	1	1	0	2	1	0	4	2	17
Wadena	4	0	0	2	1	1	0	0	1	0	9

[1] FW = farmed wetland

[2] DW = drained wetland

[3] FW = partially drained wetland

[4] ENRVCS = exceptional natural resource value wetlands on county or state land

[5] ENVRPVT = exceptional natural resource value wetlands on private lands

[6] TS = trout stream riparian wetlands

[7] WC = white cedar wetlands

[8] IW = wetlands within watersheds of impaired waters

[9] IS = wetlands with invasive species

[10] GP = gravel pit wetland creation

[11] No permissions granted for access to field verify data.

Table 6: Area of Potential Wetland Sites Summarized by Mitigation Method

Mitigation Method	Total # Sites	Total Area (ac)	% of Total Area[1]	Total Area of 20-100 Acre Sites[1] (ac)	Total Area of Sites Over 100 Acres [1] (ac)	Largest Site (ac)
Restoration						
Drained Wetlands	324	17,900	1.5%	11,200	6,700	700
Partially Drained	886	309,200	28%	25,800	283,400	21,400
Farmed Wetlands	5,316	669,500	60%	174,200	495,300	18,900
Subtotal	**6,526**	**996,600**	**89%**	**211,200**	**785,400**	**21,400**
Preservation /ENRV						
White Cedar	219	7,500	<1%	6,500	1,000	300
Trout Streams	142	6,900	<1%	5,000	1,900	300
Private ENRV	529	38,200	3%	18,400	19,800	4,200
County & State ENRV	179	13,300	1%	6,200	7,100	900
Subtotal	**1,069**	**65,900**	**6%**	**36,100**	**29,800**	**4,200**
Enhancement						
Invasive Species	137	16,700	1.5%	4,900	11,900	1,800
Impaired Waters	425	21,500	2%	14,500	7,000	1,100
Subtotal	**562**	**38,200**	**3.5%**	**19,400**	**18,900**	**1,800**
Creation						
Gravel - Subtotal	**292**	**16,900**	**1.5%**	**9,900**	**7,000**	**1,100**
Grand Total	**8,449**	**1,117,600**	**100%**	**276,600**	**841,100**	

[1]Totals may not add up due to rounding.

Table 7: Potential Wetland Credits by Mitigation Method

Mitigation Method	Total # Sites	Total Area[1] (ac)	Credit %[2]	Potential Credits[1] (ac)
Restoration				
Drained Wetlands	324	17,900	100%	17,900
Partially Drained	886	309,200	50%	154,600
Farmed Wetlands	5,316	669,500	50%	334,700
Subtotal[1]	**6,526**	**996,600**	**N/A**	**507,300**
Preservation /ENRV				
White Cedar	219	7,500	12.5%	940
Trout Streams	142	6,900	12.5%	860
Private ENRV	529	38,200	12.5%	4,800
County & State ENRV	179	13,300	12.5%	1,700
Subtotal[1]	**1,069**	**65,900**	**N/A**	**8,200**
Enhancement				
Invasive Species	137	16,700	12.5%	2,100
Impaired Water Enhancement	425	21,500	12.5%	2,700
Subtotal[1]	**562**	**38,200**	**N/A**	**4,800**
Creation				
Gravel – Subtotal[1]	**292**	**16,900**	75%	**12,600**
Grand Total	**8,449**	**1,117,600**	**N/A**	**532,900**

[1]Totals may not add up due to rounding.

[2] Credit percentages were based on current and proposed rules and indicates a maximum percentage. Actual percentage may be less based on site evaluations,

Table 8: Mineland Data Results

Wetland Class	Water Feature Area (acres)	Number of Wetland Polygons	Completed Assessments	Assessment Wetland Area (ac)
Waters Within Mine Pits	5,826	110	14	1,113
Wetlands on Stockpiles	85	38	0	0
Wetlands Within Other Mine Features	1,211	200	4	1,113
Wetlands Within Tailings Basins	2,721	430	49	1,076
Within 100 Feet of Mine Feature	10,393	602	28	1,262
Within 500 Feet of Mine Features	2,556	384	10	48
TOTAL	22,792	1,846	105	4,612

Table 9
Mineland Functional Assessment Results Summary

Wetland ID	Hydrologic Regime	Flood Storage	Downstream Water Quality	Wetland Water Quality	Shoreline Protection	Wildlife Habitat	Fishery Habitat	Amphibian Habitat	Aesthetics, Recreation, Education	Groundwater Interaction	Wetland Sensitivity to Stormwater
31-055-26-26-003-A	Moderate	High	Moderate	Moderate	Moderate	Moderate	High	Moderate	Moderate	Combination Discharge, Recharge	Moderate
31-055-26-27-005-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	High	Moderate	Combination Discharge, Recharge	High
31-055-26-28-005-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	High	Moderate	Combination Discharge, Recharge	High
31-055-26-28-006-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Exceptional
31-055-26-28-007-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	High	Moderate	Combination Discharge, Recharge	High
31-056-22-04-002-A	High	Moderate	Moderate	Moderate	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Combination Discharge, Recharge	Moderate
31-056-22-05-006-A	High	High	Moderate	Moderate	Not Applicable	Moderate	Not Applicable	Moderate	High	Recharge	Moderate
31-056-22-05-011-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
31-056-22-05-015-A	High	Moderate	Moderate	Exceptional	Not Applicable	Exceptional	Not Applicable	Moderate	Moderate	Recharge	Moderate
31-056-22-06-016-A	High	Moderate	Moderate	Exceptional	Not Applicable	Exceptional	Not Applicable	High	Moderate	Combination Discharge, Recharge	High
31-056-22-06-025-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	High
31-056-22-07-023-A	High	Moderate	Moderate	Moderate	Not Applicable	Moderate	Not Applicable	High	Moderate	Recharge	Moderate
31-056-22-16-011-A	High	High	High	High	Moderate	Exceptional	High	Low	High	Combination Discharge, Recharge	High
31-056-22-17-019-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	High	Moderate	Recharge	Moderate
31-056-22-17-024-A	High	High	High	High	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
31-056-22-17-025-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
31-056-22-17-026-A	Low	Low	Low	Low	Not Applicable	Low	Not Applicable	Not Applicable	Not Applicable	Recharge	
31-056-22-17-027-A	High	Moderate	Moderate	Moderate	Not Applicable	Moderate	Moderate	High	Moderate	Recharge	Moderate
31-056-22-17-030-A	High	Moderate	High	High	Moderate	Moderate	Not Applicable	High	Moderate	Combination Discharge, Recharge	Moderate
31-056-23-27-001-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Combination Discharge, Recharge	Exceptional
31-056-23-27-004-A	High	High	Moderate	Exceptional	Not Applicable	Exceptional	Not Applicable	High	Moderate	Recharge	High
31-056-25-14-002-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	High	Moderate	Combination Discharge, Recharge	Moderate
31-056-25-14-004-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	High	Moderate	Combination Discharge, Recharge	High
31-056-25-25-003-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	High	Moderate	Combination Discharge, Recharge	High
31-056-25-33-001-A	High	Moderate	Moderate	Exceptional	Not Applicable	High	Not Applicable	High	Moderate	Recharge	Moderate
31-056-25-33-003-A	High	Moderate	Moderate	Exceptional	Not Applicable	High	Not Applicable	High	Moderate	Recharge	Exceptional
31-056-25-36-004-A	High	High	High	Exceptional	Not Applicable	Exceptional	Not Applicable	Not Applicable	Moderate	Recharge	High
31-057-22-28-002-A	High	High	Moderate	High	Not Applicable	Moderate	Not Applicable	High	Moderate	Recharge	Moderate
31-057-22-30-003-A	High	High	High	High	Not Applicable	High	Not Applicable	Moderate	Moderate	Recharge	Moderate
31-057-22-30-009-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	High	Moderate	Recharge	Moderate
31-057-22-30-020-A	High	High	High	High	Not Applicable	High	Not Applicable	High	Moderate	Recharge	Moderate
31-057-22-32-007-A	Moderate	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Combination Discharge, Recharge	Moderate
31-057-22-32-008-A	High	High	Moderate	High	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
31-057-22-32-009-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-057-20-04-023-A	High	Moderate	High	Exceptional	Not Applicable	Exceptional	Not Applicable	High	Moderate	Recharge	Moderate
69-057-20-04-025-A	High	Moderate	High	High	Moderate	Moderate	Not Applicable	High	Moderate	Recharge	Moderate
69-057-20-04-027-A	High	High	High	Exceptional	Not Applicable	Exceptional	Not Applicable	Not Applicable	Moderate	Recharge	Moderate

Table 9
Mineland Functional Assessment Results Summary

Wetland ID	Hydrologic Regime	Flood Storage	Downstream Water Quality	Wetland Water Quality	Shoreline Protection	Wildlife Habitat	Fishery Habitat	Amphibian Habitat	Aesthetics, Recreation, Education	Groundwater Interaction	Wetland Sensitivity to Stormwater
69-057-20-08-001-A	Not Applicable	Low	Low	Low	Not Applicable	Low	Not Applicable	Not Applicable	Not Applicable	Recharge	
69-057-20-08-003-A	High	Moderate	Moderate	High	Moderate	High	Not Applicable	High	Moderate	Recharge	Moderate
69-057-20-08-019-A	High	High	High	High	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-057-20-08-020-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-057-20-09-008-A	High	High	High	High	Moderate	High	Moderate	Not Applicable	Moderate	Recharge	Moderate
69-057-20-17-014-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-057-21-11-005-A	Moderate	Low	Low	Low	Not Applicable	Low	Not Applicable	Not Applicable	Not Applicable	Recharge	
69-057-21-14-004-A	High	Moderate	High	High	Not Applicable	Exceptional	Not Applicable	High	Moderate	Recharge	Moderate
69-057-21-14-009-A	High	Moderate	High	High	Not Applicable	Moderate	Not Applicable	High	Moderate	Recharge	Moderate
69-057-21-15-004-A	High	Moderate	High	High	Not Applicable	High	High	High	Moderate	Recharge	Moderate
69-057-21-15-005-A	High	Moderate	High	High	Not Applicable	Moderate	High	Not Applicable	Moderate	Recharge	Moderate
69-057-21-22-008-A	High	Moderate	High	High	Not Applicable	High	High	High	Moderate	Recharge	Moderate
69-057-21-22-009-A	High	Moderate	High	High	Not Applicable	Moderate	Not Applicable	High	Moderate	Recharge	Moderate
69-057-21-22-010-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Exceptional
69-058-15-03-001-A	High	High	Moderate	High	Not Applicable	High	Not Applicable	High	Moderate	Recharge	Moderate
69-058-15-03-008-A	High	Moderate	Moderate	Moderate	Low	Moderate	High	Low	Moderate	Recharge	Moderate
69-058-16-10-003-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Combination Discharge, Recharge	Exceptional
69-058-16-17-001-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-058-16-17-003-A	High	High	High	High	Not Applicable	Moderate	Not Applicable	Not Applicable	Exceptional	Recharge	Exceptional
69-058-16-17-009-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Exceptional
69-058-16-17-010-A	High	Moderate	Moderate	Moderate	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Recharge	High
69-058-16-18-001-A	High	Moderate	Moderate	Moderate	Low	Moderate	Not Applicable	High	Moderate	Recharge	Moderate
69-058-16-19-014-A	High	High	High	Moderate	Moderate	Moderate	Not Applicable	High	Moderate	Combination Discharge, Recharge	High
69-058-17-05-002-A	Moderate	High	Moderate	Moderate	Moderate	Moderate	Not Applicable	Moderate	Moderate	Recharge	Moderate
69-058-17-06-002-A	Moderate	High	Moderate	Moderate	Not Applicable	Moderate	Moderate	Moderate	Moderate	Combination Discharge, Recharge	Moderate
69-058-17-06-003-A	Moderate	High	Moderate	High	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Recharge	Exceptional
69-058-17-06-004-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	High
69-058-17-08-001-A	Moderate	High	Moderate	Moderate	Moderate	Exceptional	Not Applicable	Moderate	Moderate	Combination Discharge, Recharge	Moderate
69-058-17-09-001-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Combination Discharge, Recharge	Exceptional
69-058-17-09-005-A	High	High	High	High	Not Applicable	Moderate	Not Applicable	High	Moderate	Recharge	High
69-058-17-16-003-A	Moderate	Moderate	Moderate	Moderate	Not Applicable	Moderate	Not Applicable	Moderate	Moderate	Recharge	High
69-058-17-21-010-A	Moderate	Moderate	Moderate	High	Not Applicable	Moderate	Not Applicable	Moderate	Moderate	Recharge	Moderate
69-058-17-21-011-A	High	High	Moderate	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	High
69-058-17-24-002-A	Moderate	Moderate	Moderate	Moderate	Not Applicable	Moderate	Not Applicable	Moderate	Low	Combination Discharge, Recharge	Moderate
69-058-17-25-005-A	Moderate	Moderate	Moderate	Moderate	Not Applicable	Moderate	Not Applicable	Moderate	Moderate	Recharge	Moderate
69-058-17-26-001-A	High	Moderate	Moderate	Moderate	Not Applicable	Moderate	Not Applicable	Moderate	Moderate	Recharge	High
69-058-17-26-002-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Exceptional

Table 9
Mineland Functional Assessment Results Summary

Wetland ID	Hydrologic Regime	Flood Storage	Downstream Water Quality	Wetland Water Quality	Shoreline Protection	Wildlife Habitat	Fishery Habitat	Amphibian Habitat	Aesthetics, Recreation, Education	Groundwater Interaction	Wetland Sensitivity to Stormwater
69-058-17-26-004-A	Moderate	Moderate	Moderate	Moderate	Not Applicable	Moderate	High	Low	High	Combination Discharge, Recharge	Moderate
69-058-17-34-001-A	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High	Moderate	Recharge	Moderate
69-058-17-35-004-A	High	High	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Exceptional
69-058-17-35-007-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Exceptional
69-058-17-35-008-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Exceptional
69-058-17-35-009-A	High	Moderate	Moderate	Exceptional	Low	Exceptional	High	High	Moderate	Recharge	High
69-058-19-09-003-A	High	Moderate	Moderate	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	High
69-058-19-09-004-A	High	Moderate	Moderate	High	Not Applicable	Moderate	Moderate	High	Moderate	Recharge	Moderate
69-058-19-09-005-A	High	Moderate	High	High	Not Applicable	High	High	High	Moderate	Recharge	Moderate
69-058-19-15-003-A	High	Moderate	Moderate	High	Not Applicable	High	High	High	Moderate	Recharge	Moderate
69-058-19-16-002-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	High	Moderate	Recharge	High
69-058-19-16-009-A	Moderate	High	Moderate	Moderate	Not Applicable	Moderate	Moderate	High	Moderate	Recharge	Moderate
69-058-19-19-001-A	High	Moderate	Moderate	High	Not Applicable	Moderate	Not Applicable	High	Moderate	Recharge	High
69-058-19-20-007-A	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Not Applicable	High	Moderate	Combination Discharge, Recharge	Moderate
69-058-19-20-010-A	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Not Applicable	Moderate	Moderate	Combination Discharge, Recharge	Moderate
69-058-19-29-013-A	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Not Applicable	High	Moderate	Combination Discharge, Recharge	Moderate
69-058-20-26-001-A	Moderate	High	High	High	Not Applicable	Moderate	Moderate	High	Moderate	Combination Discharge, Recharge	Moderate
69-058-20-32-001-A	High	Moderate	High	Exceptional	Not Applicable	Exceptional	Not Applicable	Not Applicable	Moderate	Recharge	High
69-058-20-32-003-A	High	Moderate	High	Exceptional	Not Applicable	Exceptional	Not Applicable	Not Applicable	Moderate	Combination Discharge, Recharge	High
69-058-20-32-004-A	High	High	High	Exceptional	Not Applicable	Exceptional	Not Applicable	Not Applicable	Moderate	Recharge	High
69-058-20-32-005-A	High	Moderate	High	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-058-20-33-010-A	High	High	High	High	Not Applicable	Moderate	Moderate	Not Applicable	Moderate	Recharge	Moderate
69-058-20-35-003-A	Low	Low	Low	Low	Not Applicable	Low	Not Applicable	Not Applicable	Not Applicable	Recharge	
69-058-20-35-006-A	High	High	High	High	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-058-20-35-007-A	High	High	High	High	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-058-20-35-011-A	High	Moderate	Moderate	High	Moderate	Moderate	Not Applicable	High	Moderate	Recharge	Moderate
69-058-20-35-013-A	Moderate	Moderate	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Recharge	Moderate
69-058-20-35-014-A	High	High	High	High	Not Applicable	Moderate	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-059-15-31-006-A	High	High	Moderate	High	Not Applicable	High	Not Applicable	Not Applicable	Moderate	Recharge	Moderate
69-060-12-06-004-A	High	Moderate	High	Moderate	Not Applicable	Moderate	Not Applicable	High	Moderate	Combination Discharge, Recharge	High
69-060-12-09-005-A	High	Moderate	Moderate	Moderate	Not Applicable	High	High	Moderate	High	Combination Discharge, Recharge	Moderate

Table 10
Mineland Assessment Vegetative Diversity/Integrity Results

WetlandID	Wetland Size (ac)	Circular 39	Weighted Average Vegetative Diversity/Integrity	Wetland Class
31-055-26-26-003-A	48.1	5	Low	Mine Pit
31-055-26-27-005-A	13.2	5, 4, 7	High	Tailings Basin
31-055-26-28-005-A	3.0	5, 4	High	Tailings Basin
31-055-26-28-006-A	7.4	7	High	Within 100 feet
31-055-26-28-007-A	4.8	4, 5	High	Tailings Basin
31-056-22-04-002-A	1.3	2	Low	Tailings Basin
31-056-22-05-006-A	5.0	5, 2, 3	Low	Tailings Basin
31-056-22-05-011-A	6.8	6, 3	Moderate	Within 100 feet
31-056-22-05-015-A	46.6	3, 7, 2	Exceptional	Tailings Basin
31-056-22-06-016-A	136.6	4, 3, 6	Exceptional	Tailings Basin
31-056-22-06-025-A	1.4	6	Moderate	Within 100 feet
31-056-22-07-023-A	7.2	3, 4	Low	Tailings Basin
31-056-22-16-011-A	1103.8	5, 6	Low	Other Mine Feature
31-056-22-17-019-A	6.6	6, 3	Moderate	Within 100 feet
31-056-22-17-024-A	0.8	3	Low	Within 100 feet
31-056-22-17-025-A	1.3	6, 3	Low	Tailings Basin
31-056-22-17-026-A	3.0		Not Rated	Tailings Basin
31-056-22-17-027-A	79.0	4, 5	Low	Tailings Basin
31-056-22-17-030-A	61.0	6, 3	Moderate	Within 100 feet
31-056-23-27-001-A	3.8	7	High	Within 100 feet
31-056-23-27-004-A	76.1	6, 5	Exceptional	Tailings Basin
31-056-25-14-002-A	13.6	3, 4	Moderate	Tailings Basin
31-056-25-14-004-A	6.7	6, 3	High	Within 500 feet
31-056-25-25-003-A	55.0	5	High	Tailings Basin
31-056-25-33-001-A	34.8	6, 3, 4	Exceptional	Tailings Basin
31-056-25-33-003-A	37.2	3, 5, 1	Exceptional	Tailings Basin
31-056-25-36-004-A	11.1	6	Exceptional	Within 500 feet
31-057-22-28-002-A	6.0	5, 2, 4	Moderate	Tailings Basin
31-057-22-30-003-A	8.6	6, 5	Moderate	Within 100 feet
31-057-22-30-009-A	12.0	5, 6	Moderate	Tailings Basin
31-057-22-30-020-A	237.5	5, 3, 7	Moderate	Tailings Basin
31-057-22-32-007-A	12.1	2	Moderate	Within 100 feet
31-057-22-32-008-A	1.5	3	Moderate	Tailings Basin
31-057-22-32-009-A	1.8	2	Moderate	Tailings Basin
69-057-20-04-023-A	2.4	3, 5	Exceptional	Within 100 feet
69-057-20-04-025-A	3.0	3	Moderate	Tailings Basin
69-057-20-04-027-A	2.3	3	Exceptional	Tailings Basin
69-057-20-08-001-A	0.3		Not Rated	Tailings Basin
69-057-20-08-003-A	4.3	3, 5	Moderate	Tailings Basin
69-057-20-08-019-A	3.5	3	Moderate	Tailings Basin
69-057-20-08-020-A	12.5	5, 3	Moderate	Tailings Basin
69-057-20-09-008-A	18.3	3	Moderate	Tailings Basin
69-057-20-17-014-A	21.5	3, 5	Moderate	Tailings Basin
69-057-21-11-005-A	100.6		Not Rated	Mine Pit
69-057-21-14-004-A	17.3	3	Moderate	Tailings Basin
69-057-21-14-009-A	3.2	3, 6	Moderate	Tailings Basin
69-057-21-15-004-A	6.9	3, 5, 6	Moderate	Tailings Basin
69-057-21-15-005-A	2.9	3	Moderate	Tailings Basin
69-057-21-22-008-A	30.8	3, 6, 5	Moderate	Tailings Basin
69-057-21-22-009-A	10.2	3, 6	Moderate	Tailings Basin
69-057-21-22-010-A	0.3	2	Moderate	Tailings Basin
69-058-15-03-001-A	3.0	6, 3	Moderate	Within 500 feet
69-058-15-03-008-A	119.2	5	Low	Mine Pit
69-058-16-10-003-A	675.0	8, 6	Moderate	Within 100 feet
69-058-16-17-001-A	2.9	6	Moderate	Within 100 feet
69-058-16-17-003-A	14.9	8	Low	Within 100 feet

Table 10
Mineland Assessment Vegetative Diversity/Integrity Results

WetlandID	Wetland Size (ac)	Circular 39	Weighted Average Vegetative Diversity/Integrity	Wetland Class
69-058-16-17-009-A	50.4	6, 7	Moderate	Within 100 feet
69-058-16-17-010-A	2.1	6	Moderate	Tailings Basin
69-058-16-18-001-A	43.0	5	Low	Mine Pit
69-058-16-19-014-A	91.0	6, 5, 4	Low	Within 100 feet
69-058-17-05-002-A	54.8	5	Low	Mine Pit
69-058-17-06-002-A	0.8	5	Moderate	Other Mine Feature
69-058-17-06-003-A	3.6	7	Moderate	Other Mine Feature
69-058-17-06-004-A	20.0	6	High	Within 100 feet
69-058-17-08-001-A	237.4	5	Low	Mine Pit
69-058-17-09-001-A	4.9	7	High	Within 100 feet
69-058-17-09-005-A	1.0	6, 3	Moderate	Tailings Basin
69-058-17-16-003-A	7.2	6, 4	Moderate	Tailings Basin
69-058-17-21-010-A	2.0	2, 3	Moderate	Within 500 feet
69-058-17-21-011-A	2.4	7, 6	High	Within 500 feet
69-058-17-24-002-A	23.6	5	Low	Mine Pit
69-058-17-25-005-A	9.5	5	Low	Mine Pit
69-058-17-26-001-A	1.3	6, 3	Low	Within 100 feet
69-058-17-26-002-A	3.4	7	High	Within 500 feet
69-058-17-26-004-A	216.5	5	Low	Mine Pit
69-058-17-34-001-A	31.3	5	Moderate	Mine Pit
69-058-17-35-004-A	5.7	8	High	Within 500 feet
69-058-17-35-007-A	5.5	8, 7	High	Within 500 feet
69-058-17-35-008-A	1.2	6, 8	High	Within 100 feet
69-058-17-35-009-A	68.8	5	Exceptional	Within 100 feet
69-058-19-09-003-A	2.0	6	High	Tailings Basin
69-058-19-09-004-A	8.0	4	Moderate	Tailings Basin
69-058-19-09-005-A	5.0	5	Moderate	Tailings Basin
69-058-19-15-003-A	5.0	5	Moderate	Other Mine Feature
69-058-19-16-002-A	1.0	2, 6	High	Within 500 feet
69-058-19-16-009-A	7.0	5	Moderate	Mine Pit
69-058-19-19-001-A	0.6	3	High	Tailings Basin
69-058-19-20-007-A	7.5	5	Moderate	Mine Pit
69-058-19-20-010-A	200.0	5	Moderate	Mine Pit
69-058-19-29-013-A	15.0	5	Moderate	Mine Pit
69-058-20-26-001-A	4.8	3	Moderate	Within 100 feet
69-058-20-32-001-A	3.0	6	Exceptional	Within 100 feet
69-058-20-32-003-A	1.6	6	Exceptional	Within 100 feet
69-058-20-32-004-A	6.6	5	Exceptional	Within 100 feet
69-058-20-32-005-A	1.9	3	Moderate	Tailings Basin
69-058-20-33-010-A	29.6	3	Moderate	Within 100 feet
69-058-20-35-003-A	14.9		Not Rated	Within 100 feet
69-058-20-35-006-A	3.5	3, 2	Moderate	Tailings Basin
69-058-20-35-007-A	7.2	3	Low	Tailings Basin
69-058-20-35-011-A	119.0	3	Moderate	Tailings Basin
69-058-20-35-013-A	13.8	3	Moderate	Within 100 feet
69-058-20-35-014-A	1.5	6, 3	Moderate	Tailings Basin
69-059-15-31-006-A	4.0	6, 3	Moderate	Tailings Basin
69-060-12-06-004-A	146.0	6, 7, 5, 4	Moderate	Within 100 feet
69-060-12-09-005-A	7.0	6, 5	Moderate	Within 500 feet
Total	4,612			

Table 11
Mineland Assessment Summary Statistics

105 Total Wetlands	Number of Sites / Functional Rating				
	Exceptional	High	Moderate	Low	NA Or None
Vegetative Diversity/Integrity	12	17	53	19	4
Hydrologic Regime	0	83	19	2	1
Flood Storage	0	41	60	4	0
Downstream Water Quality	0	51	50	4	0
Wetland Water Quality	12	55	34	4	0
Shoreline Protection	0	0	15	3	87
Wildlife Habitat	13	45	43	4	0
Fishery Habitat	0	10	8	1	86
Amphibian Habitat	0	42	15	3	45
Aesthetics, Recreation, Education	1	4	95	1	4
Wetland Sensitivity to Stormwater	13	25	63	0	4

105 Total Wetlands	Percentage of Sites / Functional Rating				
	Exceptional	High	Moderate	Low	NA Or None
Vegetative Diversity/Integrity	11%	16%	50%	18%	4%
Hydrologic Regime	0%	79%	18%	2%	1%
Flood Storage	0%	39%	57%	4%	0%
Downstream Water Quality	0%	49%	48%	4%	0%
Wetland Water Quality	11%	52%	32%	4%	0%
Shoreline Protection	0%	0%	14%	3%	83%
Wildlife Habitat	12%	43%	41%	4%	0%
Fishery Habitat	0%	10%	8%	1%	82%
Amphibian Habitat	0%	40%	14%	3%	43%
Aesthetics, Recreation, Education	1%	4%	90%	1%	4%
Wetland Sensitivity to Stormwater	12%	24%	60%	0%	4%

Figures

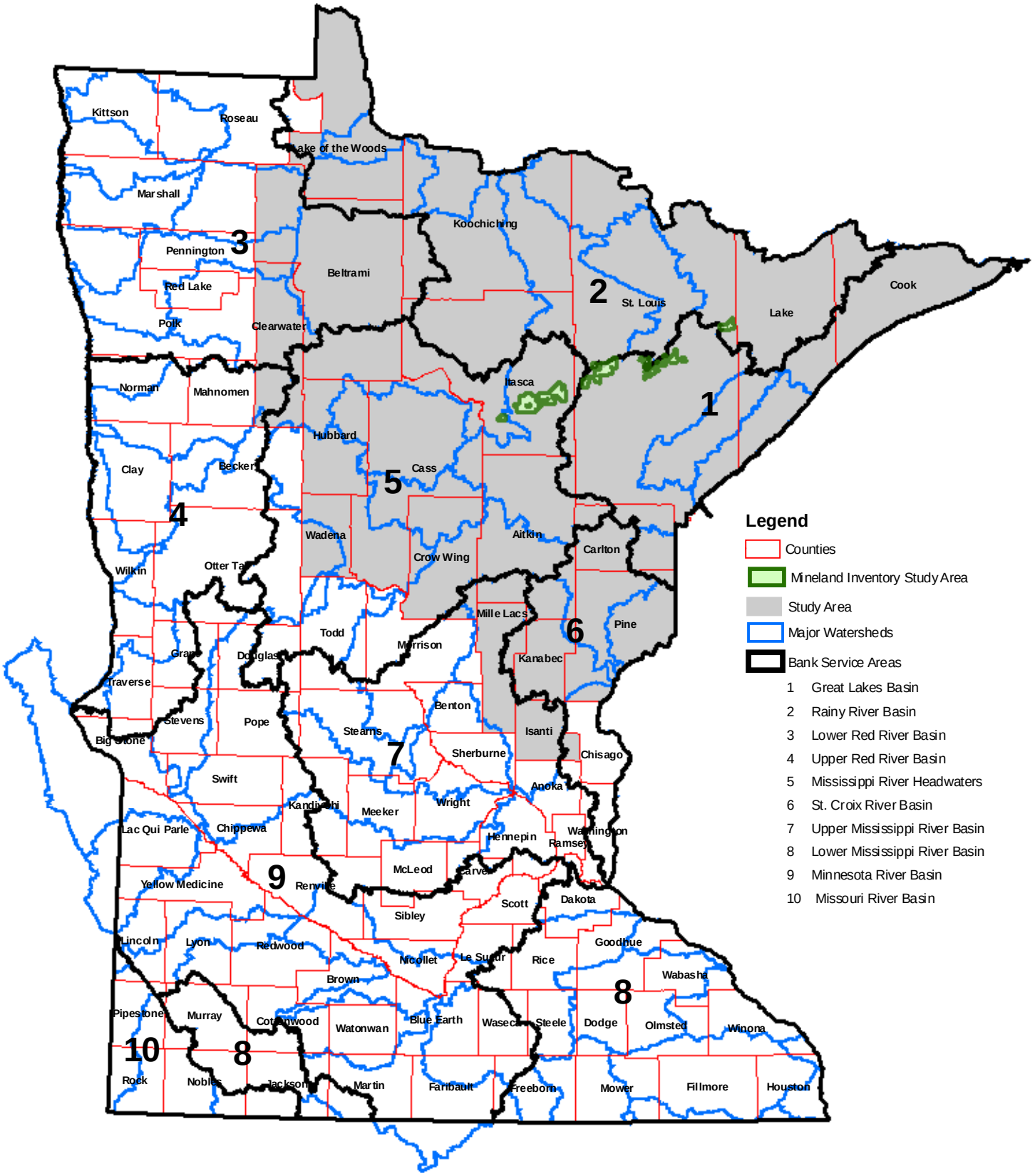
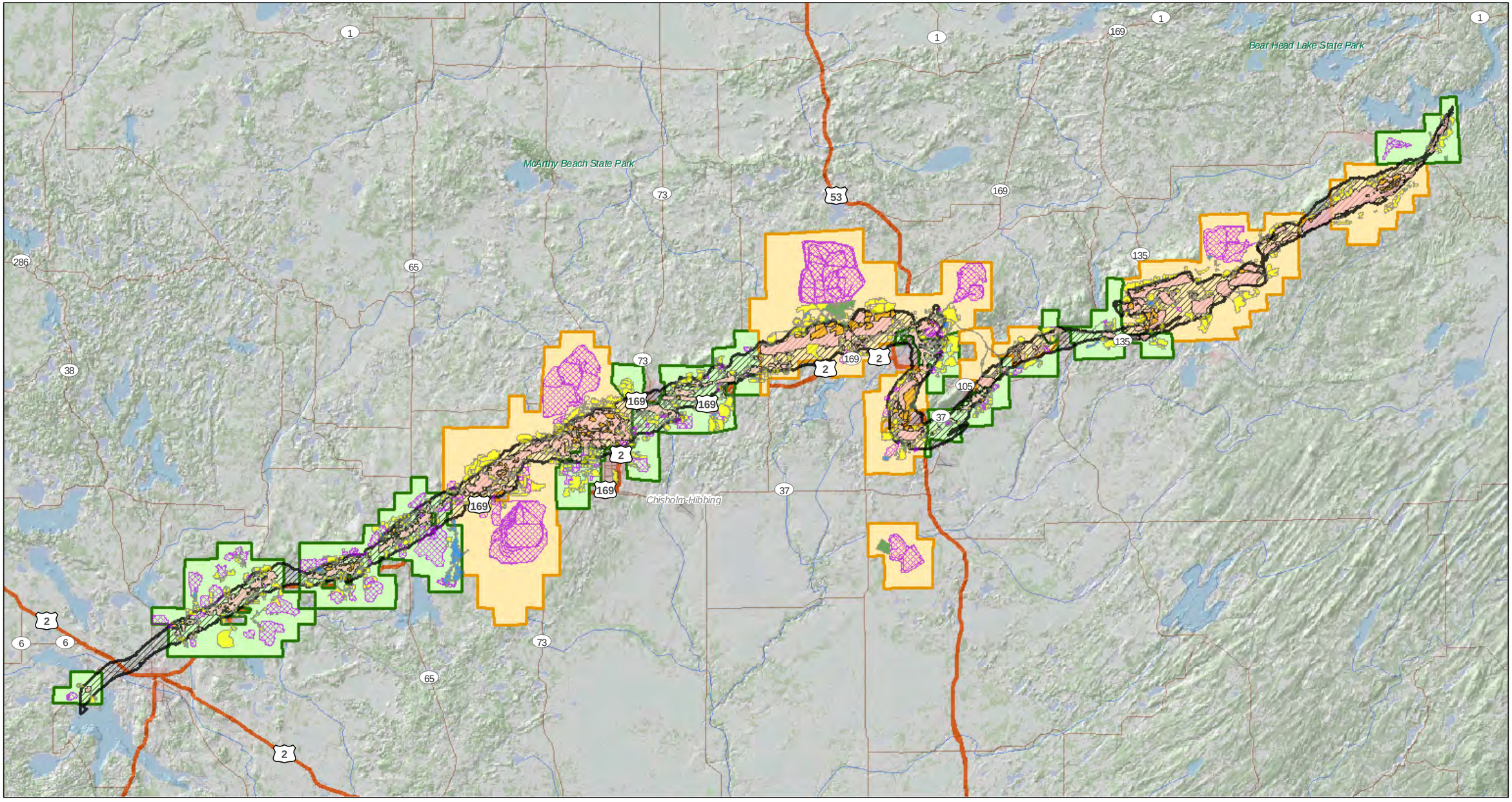


Figure 1

STUDY AREA
Northeast Wetland Mitigation
Inventory and Assessment Project



MNDNR 2007 Mine Features

- Other Feature; plant or shop area
- Stockpiles
- In-pit Stockpile
- Mining Related Water Feature
- Pits
- Tailings Basin
- Biwabik Iron Formation

Mineland Study Area

- Exclusions
- Study Area

0 3 6 12

Miles

Figure 2

MINELAND INVENTORY
STUDY AREA
Northeast Wetland Mitigation
Inventory and Assessment Project

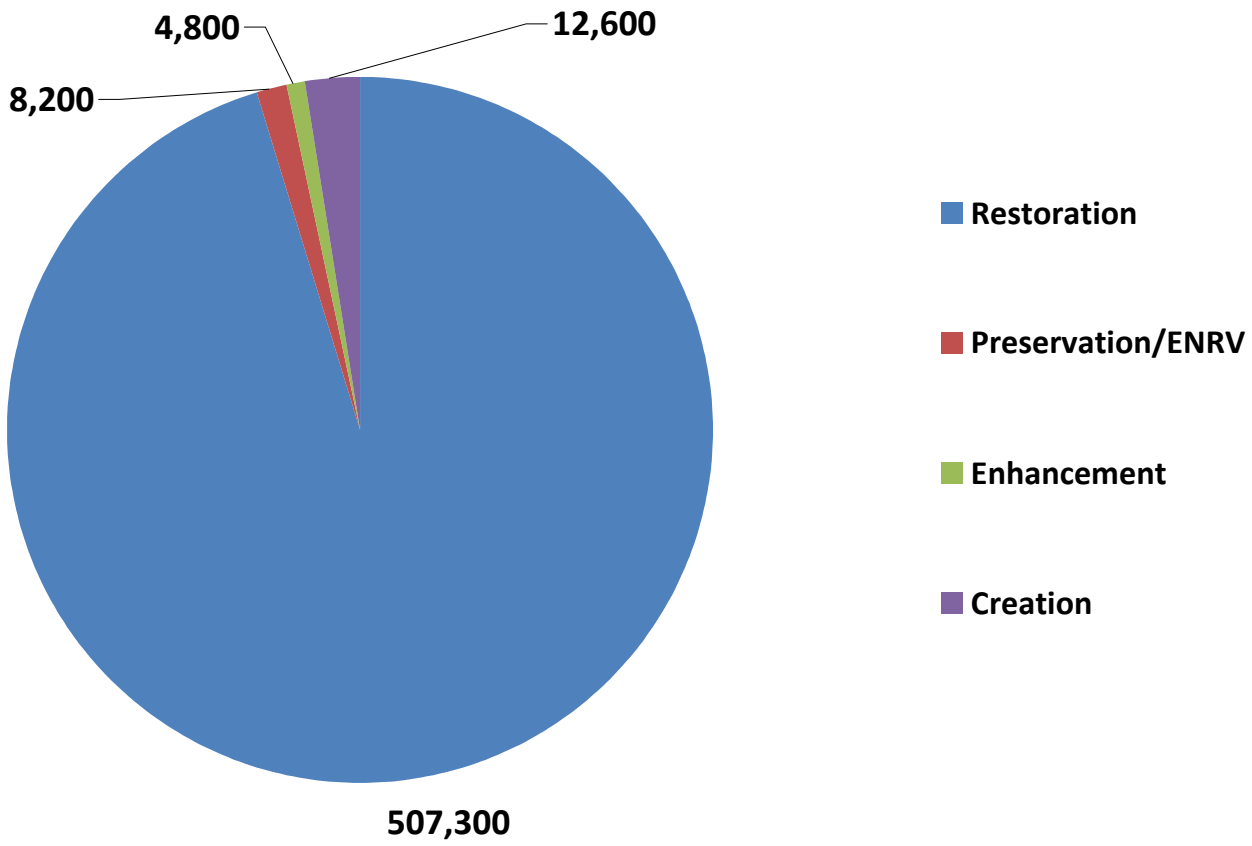


Figure 3
Potential Wetland Mitigation Credit (532,900 acres)
GIS Analysis

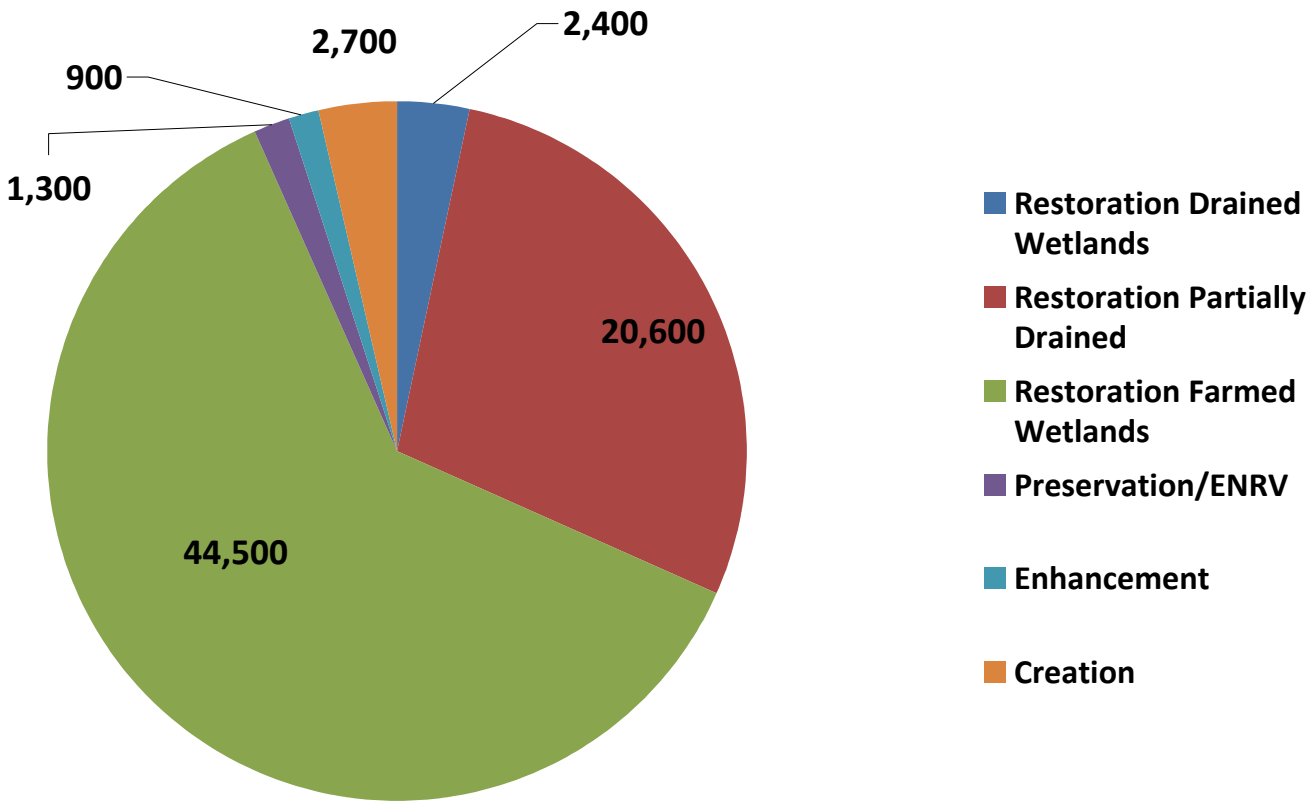


Figure 4
High Potential Wetland Mitigation Area (72,400 acres)
Summarized by Mitigation Method

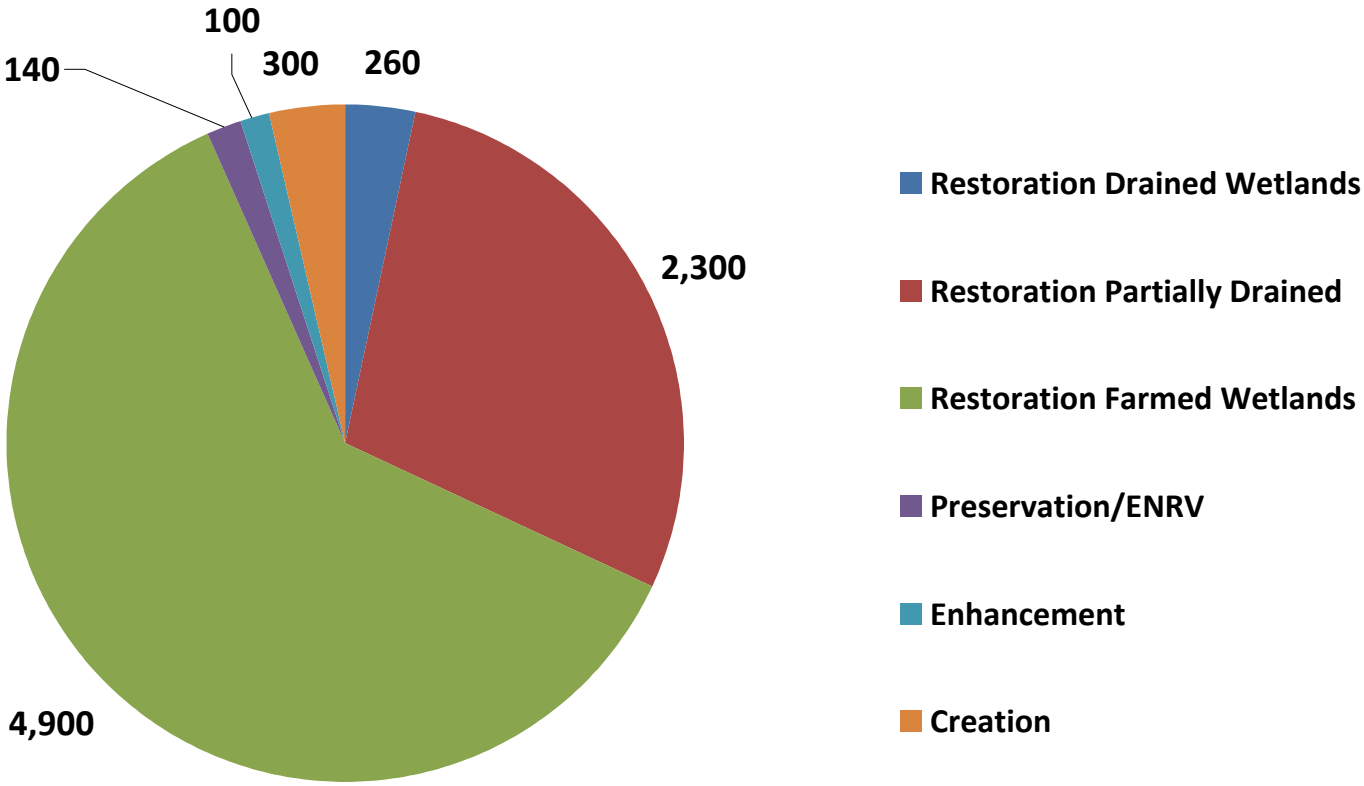


Figure 5
High Potential Mitigation Area and
Landowner Willingness (8,000 acres)

Figure 6. All Field Checked Potential Mitigation Sites

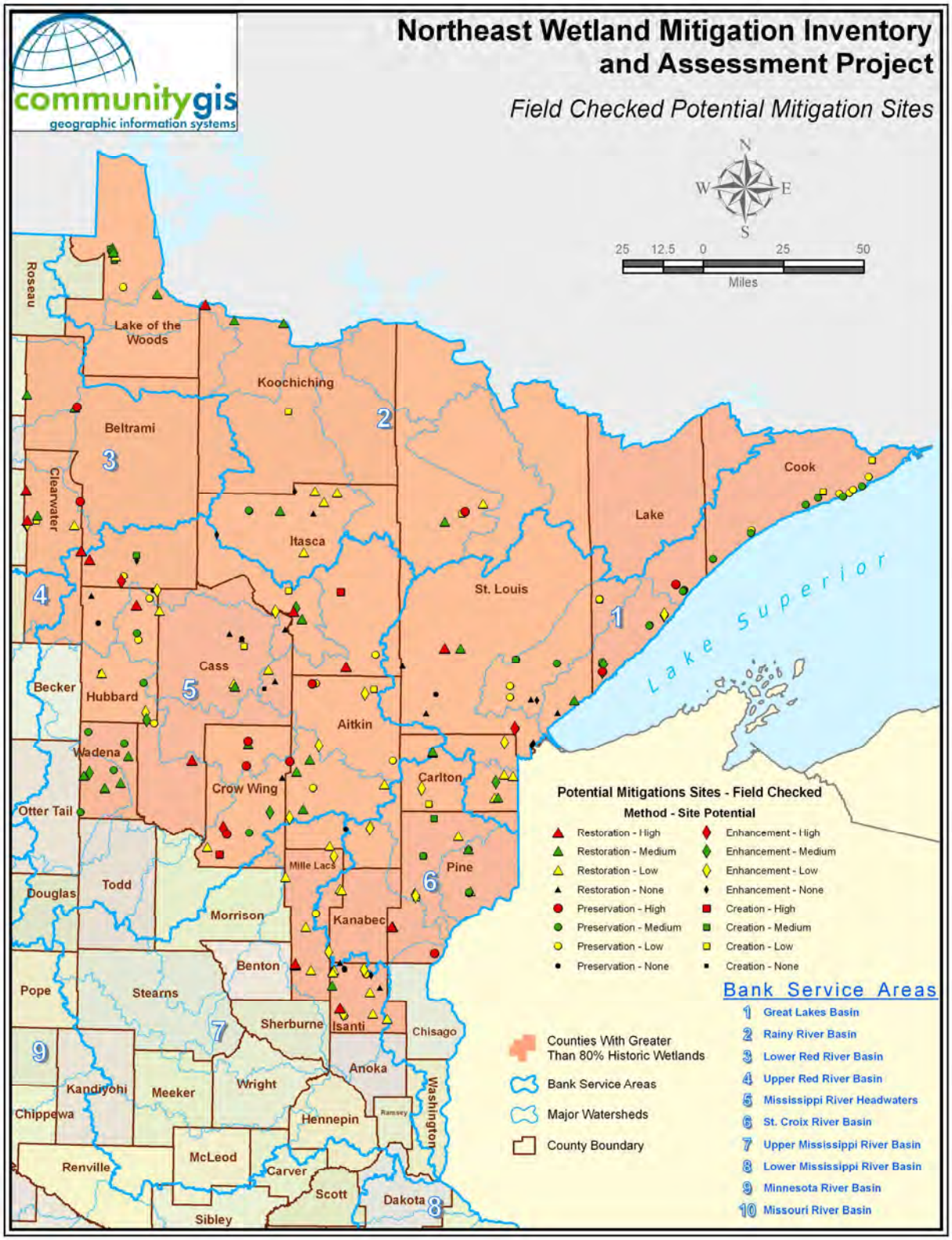


Figure 7. All Field Checked Mitigation Sites With High Potential

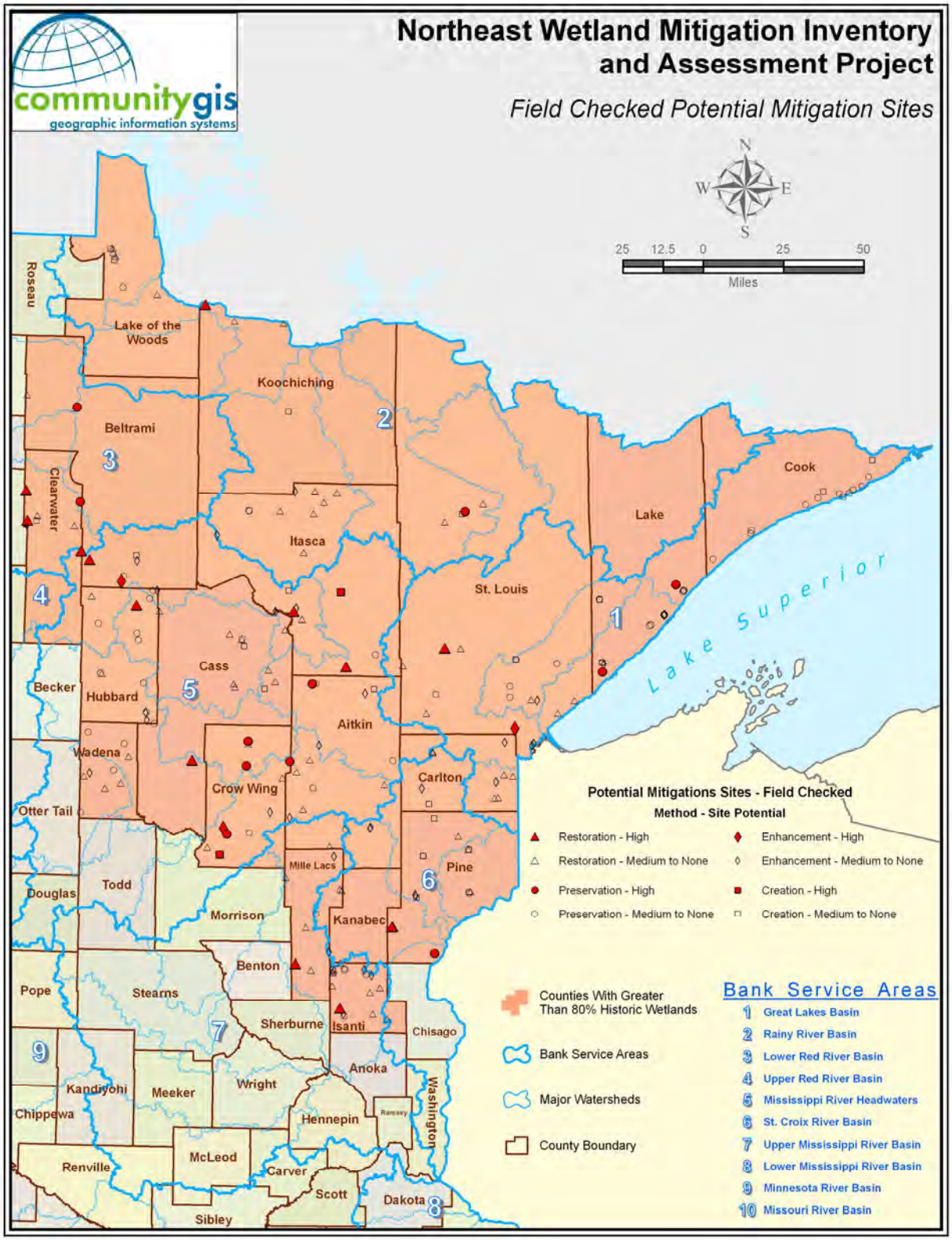
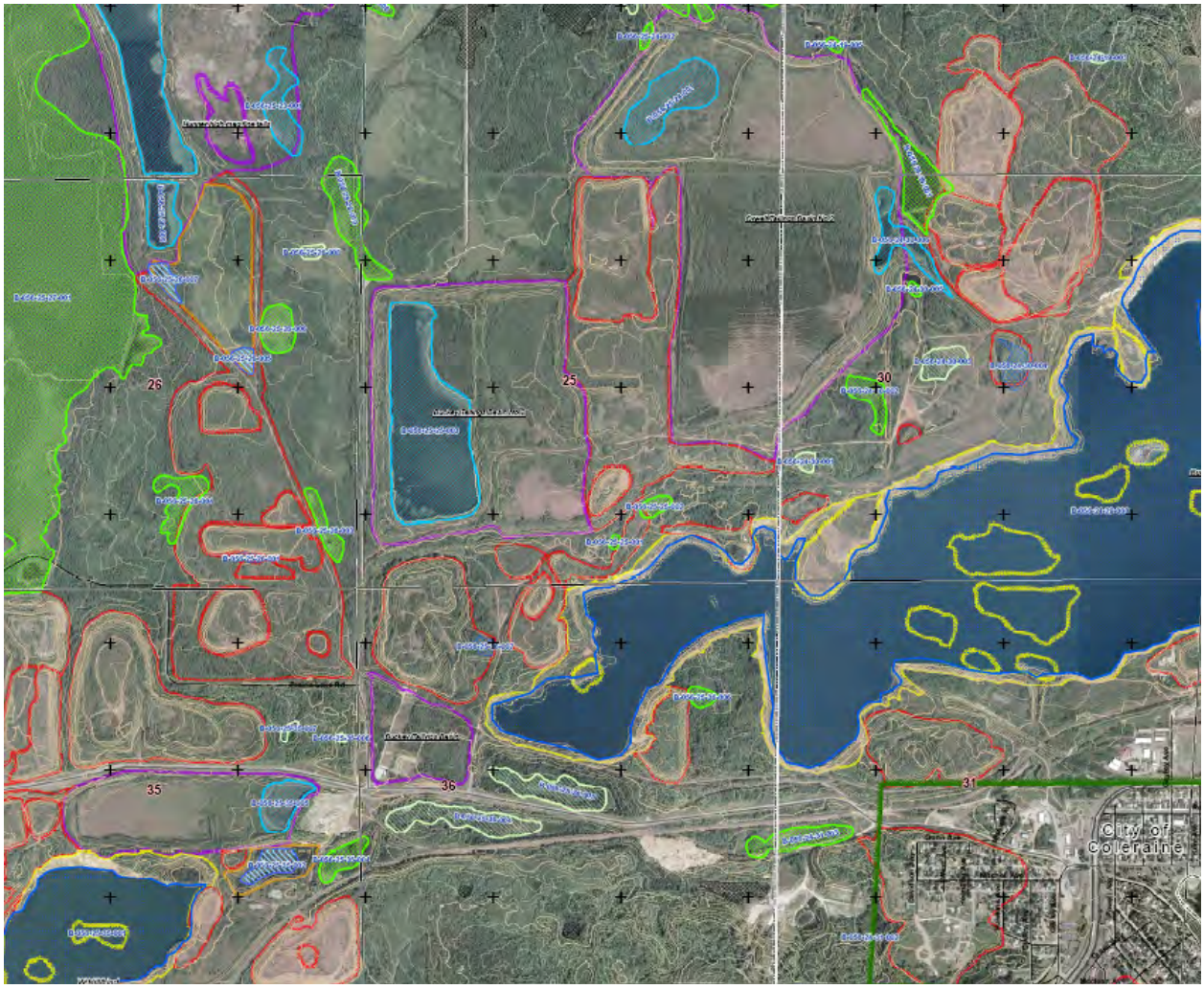


Figure 8: Sample Field Verification Map of Mineland Wetland Features



Cities
Study Area
10' Contours (Mesabi/NED)
50 Foot Contour
10 Foot Contour

Wetlands
Waters Within Mine Pits
Wetlands Within Tailings Basins
Wetlands on Stockpiles
Wetlands Within Other Mine Features
Within 100 Feet of Mine Feature
Within 500 Feet of Mine Features
Wetland Not Associated With Mine Feature

2007 DNR Mine Features
Other Mining Features
Pits
Stockpile
Tailings Basin

Appendices

Appendix A

Geographic Information System Metadata

Geographic Information System Metadata

The following is a list of the data layers used, the sources for the data and links to Metadata. Metadata was not available for all sources of information. When the data is released publicly by BWSR, the metadata for creating the model will be released at that time.

Data Layer	Source	Metadata Link, if available
DNR 24K Streams	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L260000072102
DNR GAP Data Tile Raster	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L390002710606
DNR GAP Land Cover Vector	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L280000150202
International Coalition Land Cover	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L250000102101
Manitoba Land Cover	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L250000112101
National Land Cover USGS	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L390005710606
MN Trout Streams	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L260000240202
Municipal Boundaries	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L390001310201
County Boundaries	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L220000030201
Major Watershed	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L260000210201
Minnesota Geomorphology	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L280000062101
Minnesota Impaired Lakes 2006	MPCA	http://www.pca.state.mn.us/water/tmdl/tmdl-maps.html
Minnesota 2006 Impaired Streams	MPCA	http://www.pca.state.mn.us/water/tmdl/tmdl-maps.html
Minnesota NHIS Polygon	DNR	http://www.dnr.state.mn.us/eco/nhnrp/nhis.html
Minnesota NHIS Point	DNR	http://www.dnr.state.mn.us/eco/nhnrp/nhis.html
Scientific Natural Areas SNA	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L220000150201
USGS DEM	USGS	http://seamless.usgs.gov/products/1arc.php

National Wetland Inventory NWI	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L260000162101
Mesabi Elevation Data	DNR Lands and Minerals	matt.oberhelman@dnr.state.mn.us
Mine Features Data	DNR Lands and Minerals	http://www.lmic.state.mn.us/gc/stds/metadata.htm
Most County Soil Data	NRCS	http://soildatamart.nrcs.usda.gov/SSURGOMetadata.aspx
Invasive Species Data	DNR	luke.skinner@dnr.state.mn.us
Fema Floodplains	DNR Data Deli	http://deli.dnr.state.mn.us/metadata.html?id=L260000102101

Soils Data Availability and Additional County Data Sources:

The following table illustrates which Minnesota Counties have completed soil surveys. In the case of unavailable soil data from the USDA – NRCS, geomorphology was substituted to identify potential hydric soils. In addition, some counties were able to provide ownership data and some timber inventory data to aid in the completion of the wetland inventory.

COUNTY NAME	SOILS DATA SOURCE	OWNERSHIP DATA SOURCE	COUNTY TIMBER INVENTORY PROVIDED?
Aitkin	USDA SOILS	COUNTY	YES
Beltrami	USDA SOILS	GAP	NO
Carlton	USDA SOILS	GAP	YES
Cass	USDA SOILS	GAP	NO
Clearwater	USDA SOILS	COUNTY	YES
Cook	GEOMORPHOLOGY	GAP	NO
Crow Wing	GEOMORPHOLOGY	COUNTY	YES
Hubbard	USDA SOILS	COUNTY	YES
Isanti	USDA SOILS	GAP	NO
Itasca	USDA SOILS	COUNTY	YES
Kanabec	USDA SOILS	GAP	NO
Koochiching	GEOMORPHOLOGY	COUNTY	NO
Lake	GEOMORPHOLOGY	COUNTY	YES
Lake of the Woods	USDA SOILS	GAP	NO
Mille Lacs	USDA SOILS	GAP	NO
Pine	GEOMORPHOLOGY	GAP	NO
St. Louis	USDA SOILS & GEOMORPHOLOGY	GAP	NO
Wadena	USDA SOILS	COUNTY	NO

Appendix B

Historic Wetland Identification Analysis

Historic Wetland Identification Analysis

The Wetland Identification Model was assembled by Community GIS Services by compiling the data from six main data categories described below. The purpose of this analysis was to identify likely historic wetland areas as a baseline for assisting with the identification of potential wetland mitigation opportunities.

1. USGS 30-Meter digital elevation model (DEM)

Slope percentages were calculated for all counties and areas of 1% slope or less were extracted except St. Louis, Lake, and Cook counties where areas of 4% slope or less were extracted.

2. NRCS SSURGO 2.2 Soil Surveys

All hydric soils were extracted from the SURGO certified soil survey. Database queries were run to identify the hydric soils and hydrologic group soil types. The resulting dataset is a hybrid of the hydric soils and hydrologic group soils that are less than or equal to 1 foot water table height during at least fifty percent of the growing season. Some counties within the project area did not have a completed soil survey at the time of the analysis. Geomorphology data (2a.) was used as a substitute for hydric soil information.

2a. MN DNR Geomorphology

Areas containing attributes of peat, alluvial, lacustrine, outwash plains, and flat areas such as marshes and bogs were identified in counties with incomplete soil surveys as a substitute for hydric soils.

3. USGS 2001 National Land Cover Data (NLCD)

Lowland attributes were identified and extracted from the dataset. These attributes included scrub shrub, woody wetlands, and emergent herbaceous wetlands.

4. MN DNR GAP Land Cover Data (Vector Data)

Lowland attributes were identified and extracted from the dataset. These attributes included lowland deciduous shrub, lowland evergreen shrub, floating aquatic, sedge meadow, broadleaf sedge/cattail, balsam fir mix, lowland black spruce, stagnant black spruce, tamarack, stagnant tamarack, lowland northern white cedar, stagnant northern white cedar, stagnant conifer, aspen/birch, black ash, lowland deciduous, lowland conifer/deciduous mix)

5. National Wetlands Inventory (NWI)

NWI systems of Palustrine and Riverine were extracted from the dataset.

6. FEMA Floodplains

100 and 500-year floodplains were identified and extracted from the dataset. Any floodplains that were categorized as being open water were excluded.

Historic Wetland Likelihood

The following wetland features were extracted from each parent dataset and assigned a flat value of 1. A spatial analysis was performed on the derived wetlands datasets. The data was layered in GIS with multiple overlapping data indicating the likely presence of historic wetland. The resulting polygon dataset contains attributes of each input dataset. A 'Score' field is added to the database that is calculated by adding the fields together resulting in a calculated value (or score) for each polygon. The higher the score, the higher likelihood that historic wetlands were present.

SLOPE	GAP	HYDRICSOIL	NLCD	NWI	FEMA	SCORE
1	0	1	0	1	1	4
0	1	1	1	1	1	5
1	1	1	1	1	1	6
0	0	0	0	1	0	1
1	1	1	1	1	1	6
0	1	1	0	1	0	3

Datasets utilized: In addition to the six data categories listed previously, the following data sets were utilized for all wetland mitigation methods for which GIS polygons were generated:

- Wetland mitigation method
- Historic Wetland Model layer values
- Ownership (private, tax forfeit, state, federal, tribal)
- Restoration area (acres)
- Wetland Banks Service Areas (6 of 10 in the state)
- Major watershed (81 in the state)
- Minor watershed (5,600 in the state)
- County

Data was then compiled by major wetland mitigation categories: restoration, enhancement, preservation and creation. Polygons were generated using selected features described on the following pages for each method. In some cases, no data was able to be found and consequently those methods were dropped from analysis.

Appendix C

Wetland Mitigation Opportunity Identification Analysis

Restoration Potential – GIS Mitigation Methods

1. **Drained Wetlands –**

   - Select from Historic Wetland Model values of 1 for slope and hydric soils, but values of 0 for NWI, NLCD, GAP, & FEMA layers
   - Intersect Historic Wetland Model selection with 300' buffer on ditch layer data (MnDot, MN DNR, and any known County ditch data)

2. **Farmed Wetlands -**

   - Select from Historic Wetland Model polygons with values of 1 for slope and hydric soils
   - Intersect Historic Wetland Model selection with areas containing cropland, grass land or shrub landcover attributes from the MN DNR GAP land cover and/or Manitoba / International data sets for agricultural land covers

   Dataset(s) Unique to this Method

   - Farmed wetlands would not need to have ditching or drainage. What sets this method apart from drained wetlands is the agricultural land uses.

3. **Partially Drained Wetlands**

   - Select from Historic Wetland Model polygons with values of 1 for slope, hydric soils, NWI and at least one of the land cover attributes. (GAP or NLCD)
   - Intersect Historic Wetland Model selection with 600' buffer on ditch layer data (MnDot, MN DNR, and any known County ditch data)
   - If a potential mitigation area intersects with a Scientific and Natural Area (SNA), the SNA's name will be added to the partially drained wetlands database
   - If a potential mitigation area intersects with an NWI wetland with a beaver modifier, then a beaver presence field name will be added to the partially drained wetlands database

   Dataset(s) Unique to this Method

   - SNA – could identify potential restoration opportunities intersecting or abutting an SNA, also helps to identify whether restoring hydrology could threaten or enhance an SNA.
   - Beaver Dams – Steve Eggers (COE) has proposed structures to permanently restore hydrology as a beaver dam does. This idea was directed at a specific area of drained peatlands in northern sections of St. Louis, Koochiching, Beltrami and Lake of the Woods Counties.

4. **Removal of fill -** Road abandonment was pursued in each county but no data was available – No further analysis of method was pursued

ENHANCEMENT POTENTIAL

5. **Invasive Species** –
   - Select Historic Wetland Model polygons with scores of 3 or higher
   - Intersect Historic Wetland Model selection with point data for purple loosestrife

   Dataset(s) Unique to this Method

   Database file of known purple loosestrife locations was obtained from MN DNR and converted into GIS point coverage. No other invasive species GIS data was received.

6. **Reforestation of Wetlands** – This was taken off the list of potential mitigation methods because it is not really a separate method but an estimation of restoration community.

7. **Impaired Waters Enhancement** -
   - Select Historic Wetland Model polygons with scores 3 or higher
   - Intersect Historic Wetland Model selection with 300-foot buffer on all streams within the impaired minor watershed
   - Intersect with human disturbance attributes – either through MN DNR GAP land cover and/or Manitoba / International data (agriculture, development, gravel pits, and grasslands)
   - Stream name and impairment type(s) were added into impaired waters enhancement database

   Dataset(s) Unique to this Method

   - Impaired Waters (MN PCA)

CREATION POTENTIAL

8. **Aggregate / Mining Pits** –
   - Select from Historic Wetland Model values of 1 for NWI or hydric soils
   - Intersect Historic Wetland Model selection with 300-foot gravel pit locations from the Manitoba land use data

   Dataset(s) Unique to this Method

   - Gravel pits/mines

PRESERVATION/ENHANCEMENT POTENTIAL

9. **White Cedar** –
   - Select Historic Wetland Model polygons with scores 3 or higher
   - Intersect Historic Wetland Model selection with white cedar polygons identified from county forest inventory data and GAP Land Cover data and apply 300-foot buffer
   - Intersect with human disturbances attributes - either through MN DNR GAP land cover and/or Manitoba / International data (agriculture, development, gravel pits, and grasslands) to identify potential threat and preservation opportunities
   - Add ownership as attributes in white cedar database

   Dataset(s) Unique to this Method

   - White cedar stands

10. **North Shore Trout Streams** –
    - Select Historic Wetland Model polygons with scores 3 or higher
    - Intersect with 300-foot buffer along all trout streams
    - Intersect with human disturbances attributes - either through MN DNR GAP land cover and/or Manitoba / International data (agriculture, development, gravel pits, and grasslands)
    - Add ownership as attributes in trout streams database

Dataset(s) Unique to this Method

- Trout streams

11. **Preservation of ENRV's (High Quality Wetlands, etc.)**–
    - Select Historic Wetland Model polygons with scores 3 or higher
    - Intersect Historic Wetland Model selection with Natural Heritage database for threatened and endangered species
    - Intersect Minnesota County Biological Survey for natural communities with biodiversity significance high or outstanding (if available)
    - Intersect with Scientific and Natural Areas (SNA)
    - Apply 300-foot buffer for (human disturbance layer – either through MN DNR GAP land cover and/or Manitoba / International data (agriculture, development, gravel pits, and grasslands) & municipal boundaries to identify potential or existing threats to resources
    - Intersect polygons with private property ownership

Dataset(s) Unique to this Method

- Natural Heritage Database
- MCBS Biodiversity Significance data
- SNAs

Preservation of County and State Land – This represents a new statute and is being incorporated into the rules. This provision is covered by #11 above as high value wetlands on county tax forfeit or state lands.

- Intersect polygons with county and state land ownership

MISCELLANEOUS CATEGORIES

12. **Beaver dams -** moved and consolidated with restoration of drained peatlands
13. **Entrenched Streams and Starved Floodplains and other categories listed under misc. –** no available digital GIS data – **no further analysis of method**

Appendix D

Wetland Mitigation Types

Wetland Mitigation Types

Wetland Plants and Plant Communities of Minnesota and Wisconsin (Eggers and Reed 1997), as modified by the BWSR and USACE Memorandum of Understanding (May 2007)	**Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979)**	**U.S. Fish and Wildlife Service Circular 39 (Shaw and Fredine 1971)**
Shallow, open water	Palustrine or lacustrine, littoral; aquatic bed; submergent, floating and floating leaved	Type 5: Inland open fresh water
Deep marsh	Palustrine or lacustrine, littoral; aquatic bed; submergent, floating and floating leaved; emergent persistent and nonpersistent	Type 4: Inland deep fresh marsh
Shallow marsh	Palustrine; emergent; persistent and nonpersistent	Type 3: Inland shallow fresh marsh
Sedge meadow	Palustrine; emergent; broad and narrow leaved persistent	Type 2: Inland fresh meadow
Fresh (wet) meadow	Palustrine; emergent; broad and narrow leaved persistent	Type 1: seasonally flooded basin or flat; Type 2: Inland fresh meadow
Wet to wet-mesic prairie	Palustrine; emergent; broad and narrow leaved persistent	Type 1: seasonally flooded basin or flat; Type 2: Inland fresh meadow
Calcareous fen	Palustrine; emergent; narrow-leaved persistent; scrub/shrub; broad-leaved deciduous	Type 2: Inland fresh meadow Type 6: Shrub swamp
Open bog or coniferous bog	Palustrine; moss/lichen; scrub/shrub; broad leaved evergreen, forested; needle-leaved evergreen and deciduous	Type 8: Bog
Shrub-carr or Alder thicket	Palustrine; scrub/shrub; broad-leaved deciduous	Type 6: Shrub swamp
Hardwood swamp or coniferous swamp	Palustrine; forested; broad leaved deciduous; needle-leaved evergreen and deciduous	Type 7: Wooded swamp
Floodplain forest	Palustrine; forested; broad leaved deciduous	Type 1: seasonally flooded basin or flat;
Seasonally flooded basin	Palustrine; flat; emergent; persistent and nonpersistent	Type 1: seasonally flooded basin or flat;

Appendix E

Field Verification Data Form

Field Verification Form – August 13, 2008

Form Instructions: This form is intended to assist in gathering information to assess the value of potential wetland mitigation opportunities within the northern Minnesota watersheds. It is intended to be a rapid field assessment with an estimated site visit time of 30 to 90 minutes utilizing map data provided along with field observations. This is not meant to be a detailed field characterization.

Reviewer (name)	Assessment Date:	Site Number:
Reviewer's Phone Number	**Site Location (township):**	**County (name)**

Note:* Do not complete field investigation unless landowner grants permission or data sheets can be accurately completed from a public road.

Date Landowner contacted _____ Access **Granted** □Yes □No □No Response □Other
Landowner interested in wetland mitigation? □Yes □No □Possibly**,** need more information.
Is the landowner willing to be contacted in the future regarding wetland banking? __Yes __No

Field Verification – Factors to consider in assessing a potential mitigation site:

1. **How many landowners are within the potential mitigation area (polygon)?** _____

2. **Actions eligible for credit, check the method that is likely to apply to the majority of the site:**
   - **a.** Restoration: □ Drained wetland (ditches >2' deep or ditches 300' apart or closer)
     □ Partially drained wetland (ditches <2' deep or ditches >300' apart)
     □ Farmed wetland (altered to produce crops, revert to wetland if farming stops)
   - **b.** Restoration/ Preservation: □ White cedar swamps □ Wetlands or buffers adjacent to trout waters
     □ Wetlands with T & E species, rare natural communities □ORV/SNA waters
     □Other ENRVs MN 8420.0548 □ County and State owned wetlands
   - **c.** Enhancement: □ Impaired water wetland enhancement (within watershed of impaired water)
     □ Water quality/habitat enhancement -upland improvement to protect high value wetland
   - **d.** Creation: □ Mineral extraction site

3. **Current site hydrology? Check all that apply.**
   □ Deep drainage ditches (ditches deeper than 2 feet resulting in some subsurface drainage)
   Approximate ditch spacing □ 0-300 ft □ 300-600 ft □ 1/4 mi □1/2 mi □ ≥1 mi
   Beaver dams present □ none □some (1-4) □ many >4
   □ Shallow surface ditching (ditches <2 feet deep draining only surface water)
   Approximate ditch spacing □ 0-300 ft □ 300-600 ft □ 1/4 mi □1/2 mi □ ≥1 mi
   Ditches maintained □Yes □No
   □ Drain tile (look for tile outlets into ditches surface inlet flags, etc.)
   □ Diking, dams, other structures (i.e. wild rice farming, other hydrologic control)
   □ Watershed diversion (i.e. cutoff ditches to divert flow around property or collection and routing of water to the property with control structures for flooding fields)
   □ Pumping (i.e. pump stations with electricity for flooding wild rice fields)
   □ Lowered outlet
   □ Is there upstream drainage through site from other wetlands, streams, ditches, lakes, etc.?

4. **What are the likely natural wetland types that could be restored, created, preserved or enhanced?**
   (This will depend on the method, site topography, local landscape, adjacent wetland communities, and soils.)

□Conifer swamps	□Shallow marsh	□Alder thickets	□Wet meadows

□Hardwood swamps	□Deep marsh	□Shrub carrs	□Sedge meadows
□Open bogs	□Conifer bogs	□Open water	

5. Approximate restoration area (acres) * Minimum size for agricultural areas 20 acres

□0-10	□10-20	□20-40	□40-100	□100-250	□250-500	□>500

6. Does the restoration or creation project have a potential to affect infrastructure?

a. Could the project affect public/utility infrastructure?

□Roads □Power lines □Phone lines □Pipe lines

b. Potential for flooding private property? □yes □no □don't know

7. What are the current land uses (restoration area and surrounding the site)? Check all that apply.

□ Residential □ Cultivated agriculture □ Hay, pasture □ Well
□ Forest □ Parks □ Transportation (roads, trails)
□ Peat mining □ Gravel quarry □ Utilities (gas, transmission)
□ Dumping/landfill □ Easements (CRP, WRP) □ Other _____

8. What is the existing vegetation on the site? Check up to 5 types. Estimate percentage of each (≥20%)

□ Undisturbed, native-dominated wetland vegetation _____% □ Row crops ____%
□ Dominated by altered wetland vegetation _____% □ Hay, pasture land ____%
□ Prevalence of invasive species _____% □ Other crops ____%
□ Prevalence of upland vegetation _____% □ CRP land ____%
Number of years seeded within past 20 years (if known) _____yrs □ Fallowed w/in 5-10yrs _____%

9. What is the estimated observed vegetation types present? (Percent of each ≥20%) Check up to 5.

□conifer swamp ____% □shallow marsh____% □alder thicket ____% □sedge meadow ____%
□hardwood swamp____% □deep marsh ____% □shrub carr ____% □wet meadow ____%
□open bog ____% □open water ____% □conifer bog ____%
□shrub upland ____% □upland forest ____% □grass upland ____%

10. Access to construct and maintain necessary restoration infrastructure?

□ Public roads	□Private roads	□ Trails	□ None apparent	□ Winter road

11. Are there other observed conflicting interests for this site (on-site or nearby)?

□ Peat resources	□ Gravel resources	□ Timber resources	□ Agriculture	□ Livestock grazing

12. Photo Documentation: For each photo taken, describe in detail below:

Photo Type		Descriptor Examples		Photo Type		Descriptor Examples
Azimuth required	**Abbreviations**			**Azimuth required**	**Abbreviations**	
General landscape	GLS	Project view		Invasive Species	INV	Species, Common Names
Wetland landscape	WLS	Eggers/Reed types		Noxious Weeds	NOX	Species, Common Names
Upland landscape	ULS	Upland		Water Control Structure	WCS	Outlet, Control Box
Vegetation	VEG			Wildlife	Wild	Nest box
Area of Concern	AOC	Mowing, Dumps, etc.		Recreational use	REC	Deer Stand
Threatened/Endangered	T/E	Species, Common Names				

Photo type	Descriptor	Azimuth	Comments
1.			
2.			
3.			
4.			

1. Circle the site's overall mitigation potential.

High Medium Low No Potential

2. Reasons why.

3. Other site observations and comments?

Field Notes

Appendix F

Public Outreach Meeting Notes

Meeting Notes
Mining Issues Breakout Session
July 10, 2008

Organizations Represented

Corps of Engineers, SWCDs, Iron Range Resources, U.S. Fish and Wildlife Service, BWSR, DNR Minerals, Mining Companies, County Commissioners, Wetland Bankers Association.

Breakout Session Presentation Summary

Approximately 25 representatives from the organizations cited above participated in the breakout session.

Mr. Jacobson covered three areas of the Mining Wetland Assessment Study: (1) the study area, (2) the assessment method, and (3) the geo-database sources upon which the study will be based.

The study area is the Mesabi Iron Range from west of Grand Rapids to Ely. While portions of the Cuyuna Iron Range were examined for inclusion, the type of mining and resulting landscape did not appear to lend itself to providing valuable information regarding the development of wetlands on former minelands.

The study will take place on FORMER MINELANDS, with no active mining areas to be examined.

GIS Analysis

Base layer will be the DNR, Division of Minerals 2007 Mine Features. Potential wetland features will be delineated using the NWI, imagery interpretation and field delineation and verification employing a formal field Functional Assessment.

Functional Assessment

Minnesota Routine Assessment Method, Version 3.2

Functions Evaluated:

- Vegetative Diversity
- Hydrologic Regime
- Storm Water Retention
- Water Quality (focus on W.Q. within the retaining basin)
- Shoreline Protection
- Fish, Wildlife, and Amphibian Habitat
- Mine Pit Water resources

Participant Comments

Comment: How will the Functional Analysis be accomplished: representative sample or each specific potential mitigation site?

Answer: Each site for which access can be secured will be analyzed.

Comment: Be careful and do not engage in a broad interpretation of sites not actually examined.

Answer: Access to these potential sites is critical and could be a significant challenge.

Comment: You do not have to investigate each site but include enough sites and examples to build a functional analysis model.

Answer: Our charge is to do actual and specific assessment on these inactive sites. We will be starting the field work in August.

Comment: Who will be doing the on-site assessments?

Answer: Barr employees with the MSHA training.

Comment: What kind of sites will you be identifying?

Answer:
Existing wetlands that have formed on tailings basins
Mine pits that have potential for littoral area development
Impoundments, although those are not as valuable
Existing wetlands that may be valuable for future reclamation
Wetland banking opportunities and
Determining the potential for restoration and enhancement.

Comment: What areas of the Range are not covered by the study?

Answer: Areas where there is an active permit to mine. Many of the wetlands within the areas we will investigate are exempt from the WCA, including many sites where wetlands have already developed.

Comment: The Laurentian Vision Partnership coalition is very interested in promoting wetland restoration as a part of planning for the post-mining landscape and land uses. The Laurentian Vision meets quarterly and should be a part of this study process.

Answer: We will meet with the Laurentian Vision and solicit their participation.

Comment: A new mining technique that reworks old tailings for magnetic and semi-magnetic iron units is underway. This process will remove 20-30 per cent of the tailings by volume and could improve wetland development of these old tailings basins.

Answer: We are aware of this technology and agree that it might be a valuable contribution to wetland development and a good demonstration model.

Comment: If you can't get access, you could use low level aerial inspections to do the ground truthing.

Answer: Nothing really can replace on-the-ground analysis and being on the site is essential for the Assessment protocol.

Comment: Why are you less interested in impoundments for wetland development?

Answer: Impoundments are usually deeper water that will have to be modified to provide a shallower environment. But this could be utilized in future enhancement activity.

Comment: Mineral and Iron Unit ownership is so complex and varied. For example, the stockpiles and tailings basins are in some cases personal property not associated with surface or mineral ownership. You should have some representatives of the fee owners involved with this study.

Answer: That is a good idea and we will contact those associations of fee holders.

Comments after formal adjournment:

- "The Mining Study should have an advisory group of its own since the Iron Range issues in wetland mitigation are really unique and need to communicate with so many different landowners and interests."
- "I wonder how many of the potential mitigation sites will be subject to future mining expansion?"
- "Can any of these sites get permanent easements for mitigation when even the tailings now are being mined?"
- "Access to these areas will be really difficult."

Meeting Notes
Mitigation and Siting Breakout Session
July 10, 2008

Breakout Session Presentation Summary

Approximately 20 stakeholders participated in the session. Participants included:

- County Commissioners
- MPCA
- Industry (Mining,
- SWCD's
- NRRI
- Bankers
- Others

The overview presentation for the Mitigation and Siting Breakout Session emphasized the following topics:

- Project goal is to identify wetland mitigation opportunities based on science rather than social, economic and other considerations
- It is understood that policy issues exist, which at some point may need to be addressed, most likely as a follow-up from the completed siting assessment
- There are recent and ongoing policy developments, which may impact actions eligible for credit (WCA Rule revision, BWSR/COE MOU, COE St Paul District Guidance, and National Mitigation Policy)
- Project information that could benefit regulatory programs include:
    - Detailed information on mitigation potential
    - Locations and quantity of mitigation sites
    - Additional banking opportunities
    - Possible recommendations for regulatory program changes

The participants in the session were asked the following series of questions:

- Does the study address the wetland mitigation issues in NE Minnesota? If not, what is missing?
- What policy issues generate the most concern/discussion?
- What role should the public sector take in addressing mitigation needs? The private sector?
- What are the priority mitigation types?
- What is a reasonable site size for mitigation and banking sites?
- What effect does land ownership have?
- What are the water quality improvement needs for impaired waters & watersheds in your county?
- What are the significant regional and local siting issues?
- What groups/organizations should be represented on the Mitigation Siting Advisory Committee?

Stakeholder Feedback

The feedback received can be categorized as policy and technical related. Overall, there is a concern that the policy issues need to be addressed at some point, most likely once the final report is sent to the BWSR Board and Wetland Committees. While policy issues dominated the discussion, feedback on the presentation questions was noteworthy. A summary of both technical and policy issues is outlined below.

Technical Issues	**Policy/Prioritization Suggestions**
A sector for Public Infrastructure projects should be included	Must evaluate the social and economic impacts of targeting mitigation in areas important to the local economy
Address river watershed impacts and mitigation opportunities, while this is beyond the scope of the study mitigation opportunities will exist near rivers.	Ability of the counties to accommodate wetland mitigation to accommodate a local economy
Policy forums likely to change actions eligible for credit, this is being accounted for in the development of this project.	Science becomes less clear when most of a specific watershed is outside of the study area, along border waters (ability to make improvements is limited), ability to be ecologically based
Look at land use changes, this should be accounted for during the GIS modeling process	Wetland functional assessments should be done on potential mitigation sites, this is beyond the scope of this study.
Prioritization roles exist for public and private sectors may different and should be accounted for.	Public value is different in parts of the state which should influence priorities, no specific comments on the prioritization factors
Conservation practices should be identified during the GIS process if records exist.	Attempt to identify the level of impact a large wetland complex could sustain before a loss of function and values would actually occur
The Corps should be a more active participant in reviewing the technical aspects of the project	

Suggestions for the Siting Advisory Committee included:

- COE
- Counties (NCLUB)
- DNR
- LGU's
- SWCDs
- Agricultural
- Industry
- Mining
- Pulp & Paper
- Bankers
- 1 or 2 Key Environmental Organizations (MCEA)
- DEED
- Fish & Wildlife Service
- IRR
- NRRI

Follow-up Items

- Identify the Advisory Committee members
- Include public infrastructure projects as sector in the siting analysis
- Document breakout session in summary memo under Work Order 1 deliverable
- Expand upon prioritization factors based on comments received

Meeting Notes
Field Verification and Siting Analysis
July 10, 2008

Breakout Session Presentation Summary

Approximately 20 Stakeholders participated in the session. Participants included:

- BWSR
- USFWS
- SWCD's (Approximately 8-10)
- MN DNR
- Others

The Presentation discussed the following topics:

- Ground truthing (field verification)of the GIS modeling results
- Cooperative assistance needed from the SWCD's to verify modeling results
- Forms and maps to aid in the field
- Estimated field time per on-site visit is expected to be 60-90 minutes
- How the GIS modeling was generated
- Additional digital data was requested from the SWCD's if available – invasive species locations, digital ditch information, and mitigation opportunities

Stakeholder Feedback

- Almost all SWCD's present expressed an interest in participating in the ground truthing effort.
- At least one SWCD was interested in receiving the mitigation site potential data in GIS format, although many preferred receiving site information in hard copy through the mail.
- MNDNR suggested that some work could be done from the office looking at color IR photos to help speed up the field review time.
- There was a question about verifying the model and the validity of the work, if the property owner wasn't interested or would not agree to allow a site visit.
- There was also a concern about protecting the privacy of the property owner from unwanted contacts from speculators.
- One SWCD wanted to know whether or not they could pursue development of a wetland mitigation project on a site identified as having good potential during the ground truthing effort. If this is allowed, there will be a need to provide information back to BWSR because of Phase II.

Tasks Remaining

- Identification of all participating SWCD's and which counties will need to be ground truthed by others.
- Set up training of the SWCD's very soon
- Complete the GIS analyses for each of the Counties to identify opportunities

- Identify if ground truthing efforts will extend beyond >80 % boundaries and if so by whom
    - The USFWS has a restorable wetlands layer for Polk and Morrison counties that could be compared against the GIS model developed in this project
- Discuss how to review and assess the data that comes in.
    - Where does the data go and to whom?
    - Will it need to be entered into a database?

Issues:

1) Landowner interest is an important component of the inventory process. Further discussion on this is needed and it may require need to modify the data form and incorporate some guidance for the training in August.

2) The issue of data confidentiality also came up. Can landowners be protected from unwanted contacts from speculators, etc? Rick Dahlman (MNDNR Forestry) has had significant experience doing forestry BMP audits on private lands and had some insight on how to deal with this issue. Rick is willing to share MNDNR's experience and methods of dealing with landowner privacy issues.

Appendix G

Technical Committee Members

Technical Committee Meeting Participants

Member	Representing
Dale Krystosek	Board of Water & Soil Resources (BWSR)
Joan Weyandt	Board of Water & Soil Resources (BWSR)
David G. Holmbeck	Department of Natural Resources (Con Con Lands)
Bill Schnell	Department of Natural Resources (Forestry)
Doug Norris	Department of Natural Resources (Ecological Services)
Brian Frederickson	Pollution Control Agency
Steve Eggers	U.S. Army Corps of Engineers
Nick Rowse	U.S. Fish and Wildlife Service
Brian Huberty	U.S. Fish and Wildlife Service
Tom Malterer	University of MN, Natural Resources Research Institute
Kurt Johnson	University of MN, Natural Resources Research Institute
Jason Meyer	St. Louis County Land Department
Gary Walton	Botany Consultant
Mark Jacobson	Barr Engineering Company
Keith Hanson	Barr Engineering Company
Tom Tri	Barr Engineering Company
Tony Kroska	Community GIS Services
John Kubiak	Community GIS Services

Appendix H

Field Verification Pictures - Inventory

Drained wetland (low potential)

Farmed wetland (medium potential)

Drained wetland (high potential)

Farmed wetland (low potential)

White cedar preservation (medium potential)

Trout stream preservation (low potential)

Trout Stream preservation (medium potential)

ENRV Private – preservation (medium potential)

ENRV County-State preservation (medium potential)

Creation wetland (medium potential)

Enhancement – impaired waters (low potential)

Creation wetland (low potential)

Appendix I

Field Verification Pictures – Mineland Analysis

Mine Pit Lake (low diversity)

Former Tailings Basin (moderate diversity)

Former Tailings Basin (exceptional diversity)

Former Tailings Basin (low diversity)

Wetlands within 100’(exceptional diversity)

Wetlands within 500’ (high diversity)

Wetlands within 100’ (low diversity)

Wetlands within 500’ (moderate diversity

Other Mine Features (high diversity/ moderate diversity)