RS20T Wetland Mitigation Plan

Prepared for
PolyMet Mining Inc.

January 15, 2008

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PolyMet Mining

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1.0 Introduction

On behalf of PolyMet Mining, Inc. (PolyMet), Barr Engineering Co. has prepared this wetland restoration plan to provide compensatory wetland mitigation to replace unavoidable wetland impacts associated with PolyMet's NorthMet Project. The project site is located in the St. Louis River #3 major watershed and a total of 854 acres of wetland impacts are proposed. The compensatory mitigation activities described in this report include those planned within one property located near Hinckley, Minnesota in Pine County, one property located near Aitkin, Minnesota in Aitkin County, and several on-site mitigation projects planned during closure. This compensatory wetland mitigation plan includes the restoration of 1,123 acres of wetlands and the establishment and preservation of 202 acres of upland buffer within the two properties along with 175 acres of wetland establishment at the project site.

The Hinckley location is the site of an active sod production facility that encompasses approximately 511 acres of land, on which, 313 acres of wetland restoration and 79 acres of upland buffer preservation is proposed (Figure 6). The Hinckley site is located in the Snake River #36 major watershed. PolyMet has entered into an option agreement with the landowner formalizing the landowner's intent to allow the restoration activities.

The Aitkin location is the site of an active sod production facility that encompasses approximately 1,070 acres of land, on which, 810 acres of wetland restoration and 123 acres of upland buffer preservation is proposed (Figure 9). The Aitkin site is located in the Mississippi River-Brainerd #10 major watershed. PolyMet has entered into an option agreement with the landowner formalizing the intent to conduct wetland restoration activities.

At the project site, four distinct efforts are planned to establish wetlands. The establishment of wetlands is planned in the emergency basin, on the closed tailings basin, in the area of the surge stockpile and around the perimeter of the east mine pit. These activities are generally planned during closure activities within the different areas.

This report includes discussions of the restoration sites, construction activities, vegetation establishment and management activities, wetland restoration goals, performance standards, schedules, and monitoring plans. Preliminary wetland restoration plans were most recently submitted to the U.S. Army Corps of Engineers (Corps) and Minnesota Department of Natural Resources (MDNR) Division of Lands and Minerals in August 2007. This plan was developed to comply with

Wetland Conservation Act rules (Minnesota Rules Chapter 8420) as administered by the Minnesota Department of Natural Resources – Division of Lands and Minerals, Section 404 of the Clean Water Act as administered by the U.S. Army Corps of Engineers, and Minnesota Rules 7050.0186 (wetland mitigation) as administered by the Minnesota Pollution Control Agency.

Permanent Conservation Easements similar to the example provided in Appendix F will be prepared and recorded to cover the wetland restoration and associated upland buffer areas within one year after starting the restoration activities at each site.

2.0 Wetland Mitigation Planning

The wetland mitigation planning efforts have proceeded in general accordance with the Wetland Conservation Act wetland replacement siting rules and the Corps guidelines to first replace on-site, then within the same watershed or county, and finally, within adjacent watersheds as described in the following sections. Additional, comprehensive wetland mitigation planning information will be submitted under separate cover.

2.1 Wetland Mitigation Study Limits

The PolyMet project lies within the headwaters of the St. Louis River major watershed in St. Louis County (Figure 1). At the time the wetland mitigation study was commenced, the Corps had distributed a draft "Ecological Rationale for St. Paul District's Compensatory Mitigation Ratios in Minnesota" (Corps, 2004). The Corps (2004) had identified preliminary Bank Service Areas (BSA) to assist in evaluating acceptable compensatory mitigation opportunities for unavoidable wetland losses. The PolyMet project lies within Bank Service Area #1, which encompasses the watersheds tributary to Lake Superior (Figure 1). Given the difficulty in finding suitable compensation sites in the Lake Superior watershed, the St. Paul District considered accepting banking credits from within the Rainy River watershed, defined as Bank Service Area #2. The wetland replacement siting rules within the Wetland Conservation Act (WCA) give preference to adjacent Bank Service Areas. The other Bank Service Areas that are adjacent to the St. Louis River watershed are Bank Service Areas #5 and #6. These watersheds encompass the upper Mississippi River and St. Croix watersheds. Therefore, the initial wetland mitigation study scope was identified as Bank Service Areas 1, 2, 5, and 6, focused on the areas containing greater than 80 percent of their historic wetland resources as defined in the WCA (Figure 1).

2.2 Wetland Mitigation Opportunity Analysis

A survey of wetland mitigation banking credits available within the study area was conducted initially to determine if suitable credits were available for purchase. It was determined that insufficient credits were available to satisfy the compensatory mitigation requirements for the project. Next, on-site wetland mitigation potential was considered. It was determined that there will be potential for developing wetland resources during the later stages of the project and during reclamation, however, given the 20-year schedule for the project and the current stage of mine planning, a specific plan for on-site mitigation could not be developed at this time. On-site mitigation

activities are discussed in Section 3. Finally, the potential for developing compensatory wetland mitigation was evaluated within the study area.

A Geographic Information System (GIS) analysis was performed to identify potential wetland mitigation sites within the defined study area. The primary goal of this analysis was to identify large, potentially drained wetlands located primarily on private or tax-forfeit land within the study area so that more detailed ground investigations could proceed. The identification of sites was established by overlaying and evaluating numerous existing spatial data sources (primarily from public domain sources) to identify those sites with the greatest potential. Some of the data sources utilized include:

1. Geomorphology/soil types (Loesch, 1997),
2. Land ownership (separated by county/state/federal and private ownership) (MLMIC, 1983),
3. Land slope/Digital Elevation Model (MLMIC, 1999),
4. Streams/Ditches (MNDNR 1980),
5. Major watersheds
6. Land Cover (Loesch, 1998)

The geomorphology data is 1:100,000 scale data describing a wide variety of conditions related to surficial geology within a hierarchical classification scheme that was devised for use within Minnesota (Loesch, 1997). The geology data include geomorphic association, glacial phase, topographic expression, and sedimentary association/rock type. The land ownership data includes federal, state, county, city, tax-forfeited, and private land, by 40-acre parcels (MLMIC, 1983). The digital elevation model was split into three slope classes: 0-1 percent (high likelihood of wetlands), 1-3 percent (moderate likelihood of wetlands), and >3 percent (diminished likelihood of wetlands) (MLMIC, 1999). The stream data is a mapping of natural watercourses and ditches by the MDNR at a 1:24,000 scale (MNDNR 1980). The land cover data consists of land use – land cover mapping divided into 16 classes based on 30-meter resolution satellite imagery from June 1995 to June 1996 (Loesch, 1998).

The analysis was conducted by establishing specific filtering criteria to identify potential wetland mitigation sites. The general filtering criteria included the following:

1. Land slopes of ≤ 1 percent slope based on an analysis of the USGS 30-meter digital elevation model,
2. Areas mapped as peat or lacustrine geomorphology,
3. Private or county tax-forfeit property,

4. Areas within 1.1 miles of a ditch, and ultimately
5. Areas meeting all of the above criteria with at least 100 contiguous acres.

The analysis was initially limited to sites with more than 100 acres of wetland mitigation potential due to the anticipated difficulties in planning numerous, small wetland mitigation projects and the desire to identify opportunities that were realistically feasible. In addition, it was felt that the PolyMet project represented an opportunity to restore large wetland systems that may provide greater public and ecological benefit that are typically not available to smaller projects.

This GIS analysis resulted in the development of a polygon data layer which contained nearly 900 areas with the highest potential for mitigation in the study area. This analysis resulted in several significant findings. First, a large proportion of the study area is in State, Federal, or tribal ownership, and therefore was determined to represent minimal potential for a private enterprise to conduct compensatory wetland mitigation. Second, many of the large wetland systems within the study area have not been affected by historic drainage or other significant alteration. Third, much of the study area is characterized by surface geology that is not indicative of large wetland systems prone to be easily drained. The majority of the Arrowhead region, including Cook, Lake, and much of St. Louis Counties, is mapped with surface geology typified by steep, igneous bedrock terranes; rolling till plains; and rolling to undulating areas of supraglacial drift (Loesch, 1997). These geomorphological associations are also typically associated with steeper land slopes containing few drained wetlands.

2.3 Bank Service Area #1

The potential wetland mitigation areas identified within the St. Louis River watershed (Figure 2) were then evaluated in more detail by reviewing National Wetland Inventory maps, plat maps, recent aerial photographs, USGS topography, and subwatershed divides to find the sites with the highest potential. One general area appeared to have the most suitable characteristics; the area around Meadowlands and Floodwood (Figure 2). Two contiguous areas in this region, covering approximately 270 square miles are mapped as level peat.

A total of 27 potential wetland mitigation sites were identified in the study area (Figures 2 and 3) with a high likelihood of feasibility, including 10 within Bank Service Area #1. The sites with high potential identified in Bank Service Area #1 were then evaluated further by conducting site visits and meetings with various regulatory agencies. All of the sites except one were determined to not be feasible and prudent due to many different factors including: private property, public roads, and active gravel operations that could be hydrologically impacted by wetland restoration; insufficient wetland drainage; existing public ditches that could not be abandoned; potentially contaminated soils; and/or unwilling landowners.

The primary, preferred wetland mitigation site, Site 8362 (Figure 4), was chosen for several reasons, including:

1. Limited private land ownership within and adjacent to the primary area with wetland mitigation potential,
2. The lack of roads or other public infrastructure that could be affected by wetland mitigation,
3. The presence of multiple outlets from the wetland to the St. Louis River and the close proximity of the river,
4. The density of ditching within the wetland, and
5. The apparent lack of flow through the wetland from upstream.

2.4 Bank Service Area #5

In addition to the potential sites in Bank Service Area #1, 17 potential wetland mitigation sites located in Bank Service Area #5 (Figure 3) were evaluated to determine the relative potential for mitigation, the level of risk and uncertainty, and the likely costs. The majority of the sites in Bank Service Area #5 were located in the northern part of Aitkin County with a few in Itasca, Pine, and Carlton Counties. Most of the 17 priority sites in BSA #5 were evaluated in more detail and many did not appear to have significant potential for several reasons including: unwilling landowners, significant adjacent private properties that would be hydrologically impacted by wetland restoration, insufficient agricultural history, insufficient wetland drainage, considerable existing upstream drainage through the site, or active pursuit of the properties by others.

2.5 Site 8362

Since Site 8362 was located within the same watershed as the project, had the greatest potential for wetland restoration with apparently limited peripheral issues, and contained the potential to restore bog wetlands similar to those proposed for impact; this site was selected for further study. Site 8362 is an approximately 3,900 acre, partially drained wetland site containing a combination of raised

open bog and raised black spruce bog wetlands. The site is located northeast of the Town of Floodwood and west of the Town of Meadowlands in St. Louis County. Approximately 640 acres of the site are owned by the State of Minnesota with the remainder designated as tax-forfeit land.

In 2005-2006, PolyMet structured an agreement with St. Louis County as the first step in pursuing a wetland mitigation project at the site. Discussions were started with the State of Minnesota in 2006 to advance efforts to secure the rights to conduct wetland restoration activities on the State-owned portion of the site. PolyMet conducted studies of the site from 2005 to 2006 as part of the 20-year wetland mitigation planning efforts for the project.

There are 12 outlets from the site that are either natural streams or ditches. In addition, the site has a pattern of ditches that are located one-half mile to one mile apart within the interior of the bog. It was determined that hydrologic restoration of this site would require blocking and filling ditches, logging of trees along the ditches and restoration of bog vegetation. The restoration potential of the site was discussed with Federal, State and local authorities on several occasions during the study. Numerous site visits, town meetings, and agency meetings were held in order to better understand potential conflicts associated with the development of a restoration plan. The site has been utilized by local residents for hunting, tree-topping and recreation. Several potential issues were raised by local residents and peatland hydrology experts during these meetings and discussions. The agencies requested a more detailed study plan to better document the hydrology of the site, the specific extent of hydrologic drainage, the extent of soil subsidence along the ditches, the presence of demonstrable threats to support wetland preservation credits, and other issues raised by the agencies and the public.

The site was chosen as a high priority because it presented an opportunity to restore primarily Type 8, bog wetlands, which are the primary type of wetland that will be impacted by the project and it is located in the same watershed as the project site. Before implementation of a plan to restore wetlands at the site, the agreement with St. Louis County required the completion of several actions:

1. The public ditch system would have to be abandoned through the ditch abandonment process,
2. The State Legislature would have to pass special legislation allowing a permanent conservation easement to be placed over the restored and protected wetland area, and
3. The State would have to enter into an agreement allowing wetland restoration activities to be conducted on the State-owned land.

However, these required actions could not be undertaken until a wetland restoration plan was approved by State and Federal regulatory agencies. In order to complete sufficient planning to

support the development of a wetland restoration plan suitable for regulatory approval, a 1-2 year study was going to be needed to develop the information requested by the regulatory authorities.

Further pursuit of wetland restoration activities at Site 8362 was halted for a number of reasons that rendered the site impracticable:

1. District Court nullified PolyMet's agreement with St. Louis County in April 2007, thereby not allowing any further study of the site.
2. Lack of local support, in fact, broad opposition from local residents.
3. Extensive hydrologic monitoring and evaluation to document the degree of drainage at the site to support the proposed mitigation credits. This would have required long-term monitoring to adequately demonstrate the drainage and there was uncertainty regarding the outcome of such monitoring. Such monitoring activities were no longer allowed after April 2007 due to the District Court action.
4. Preservation credits would only be allowed where there is a demonstrable threat that could be eliminated, i.e., peat mining, tree-topping, ATV activity. There is only about 400 acres of documented minable peat and the County had indicated they were unlikely to agree to limit tree-topping activities. Therefore, the ability to show a demonstrable threat that would meet regulatory criteria appeared unlikely.
5. Even if the agreement with the County were reestablished, that agreement still required that PolyMet go through ditch abandonment proceedings in District Court with public hearings that would likely be opposed by local residents.
6. The agreement with the County (were it to be reinstated) also required receiving legislative authorization to place a permanent conservation easement over the restoration area. The likelihood of that was uncertain.

With Site 8362 no longer a feasible mitigation option, pursuit of the high priority sites identified in Bank Service Area #5 was initiated along with the continued search for existing bank credits, wetland banks in various stages of planning, and various other potential wetland mitigation opportunities located in central and northwestern parts of Minnesota. During these efforts, two properties were identified with willing landowners that had the potential to accomplish compensatory wetland mitigation for nearly the entire project. One site is located in Aitkin County and one site in Pine County. These sites are described in more detail in the remainder of this report.

3.0 Wetland Impact and Mitigation Summary

The NorthMet Project is expected to result in unavoidable impacts to 854 acres of wetlands during the life of the project (Table 1). Detailed wetland impacts proposed for the various activities associated with the project are provided in Table 2. A summary of wetland impacts proposed within various portions of the project classified by Eggers and Reed (1997) wetland types is provided in Table 3. Approximately 40 acres of impact have been avoided by combining the Overburden and Category 1/2 Waste Rock Stockpiles. A total of 550 acres of impacts are proposed in coniferous bogs and 76 acres in open bogs. A total of 76 acres of impacts are proposed in Type 6 wetlands, including 67 acres in alder thicket communities and 9 acres in shrub carr communities. Type 7 forested wetlands represent the wetland type with the next most abundant impacts, including 63 acres of coniferous swamp and 20 acres of hardwood swamp. Type 2 wetlands are expected to result in 43 acres of impacts including 28 acres in sedge meadow communities and 15 acres in wet meadow communities. Type 3, shallow marsh wetlands comprise 26 acres of impact. Impacts to Type 4 deep marsh and Type 5 open water wetland communities along with deepwater habitats each comprise less than 1 acre. No direct wetland impacts are anticipated associated with the tailings basin drain system since the drains and pump station are planned to be constructed on the lower, existing tailings dam bench.

The unavoidable wetland impacts projected during the first five years total 702 acres (Table 4). A summary of wetland impacts proposed during the first 5 years within various portions of the project are classified by Eggers and Reed (1997) wetland types in Table 5. A total of 445 acres of impacts are proposed in coniferous bogs and 46 acres in open bogs. A total of 70 acres of impacts are proposed in Type 6 wetlands, including 61 acres in alder thicket communities and 9 acres in shrub carr communities. Type 7 forested wetlands represent the wetland type with the next most abundant impacts, including 63 acres of coniferous swamp and 15 acres of hardwood swamp. Type 2 wetlands are expected to result in 41 acres of impacts including 27 acres in sedge meadow communities and 15 acres in wet meadow communities. Impacts to shallow marsh wetlands represent 21 acres during the first 5 years.

The overall wetland mitigation strategy for the project is to replace unavoidable wetland impacts in-kind where possible and ahead of the impacts when feasible. The compensatory wetland mitigation for the project includes the restoration of 1,123 acres of wetland and preservation of 202 acres of upland buffer on two sod farms, one located in Aitkin County and one in Pine County; along with the

creation and restoration of approximately 175 acres of wetland at the project site during closure (Table 1).

Because the two primary wetland mitigation sites included in this plan are located outside of the project watershed and the on-site mitigation is planned for completion at the end of the project, all mitigation associated with this plan will be conducted at a ratio of 1.25:1 or 1.5:1 in accordance with Corps guidance. Assuming the restoration is successfully conducted one full growing season ahead of the impacts, replacement in-kind will be credited at a 1.25:1 ratio and replacement out-of-kind will be credited at a 1.5:1 ratio. Should in-kind compensatory mitigation be deemed unsuccessful such that an equal area of in-kind replacement is not provided for the impacts, those impacts will be replaced at a 1.5:1 ratio.

The tabulation of total project wetland impacts compensated by the proposed wetland mitigation is provided in Table 1 and the tabulation of impacts compensated during the first 5-years of the project is provided in Table 4. The 1,123 acres of off-site wetland restoration proposed in the mitigation plan (Tables 1 and 6) are expected to provide direct compensatory wetland mitigation for 834 acres of projected impacts, an average replacement ratio of 1.35:1 excluding consideration of upland buffer (Table 6). A total of 202 acres of upland buffer areas are proposed to be established with native vegetation around the wetland restoration areas. In accordance with Corps guidelines, credit for the upland buffer areas is proposed at a 1:4 ratio, resulting in 51 acres of wetland credit (Table 1). Including the proposed upland buffer, the proposed off-site wetland mitigation is expected to compensate for 885 acres of proposed wetland impacts, which exceeds the 854 acres of planned impacts by 31 acres (Table 6). It is planned that the additional compensatory wetland mitigation would be held in reserve for use in the event: additional wetland impacts result from changes during the project life, to compensate for mitigation that may not develop as planned, to compensate for mitigation not conducted in advance, or as banked credits for future use.

The closure plan for the site was designed to create and restore 175 acres of wetlands that would function as a reserve. The closure plan includes:

- 30 acres of created wetlands at the emergency basin
- 75 acres of created wetlands in the tailings basin at closure
- 30 acres of created wetlands at the mine stockpile areas after removal of the temporarily stored lean ore surge stockpile and overburden processing area
- 40 acres of wetland development within the east and central pits after backfilling

In order to adequately track the timing of wetland mitigation construction and wetland impacts, a structured accounting system may be needed to determine the required mitigation ratios. This information could be provided in the MDNR Permit to Mine annual report. The annual report could include a tabulation of wetland mitigation that was constructed, including the dates when construction was completed and wetland impacts that occurred by December 31 of each year. This information would be submitted using the schedule for the Permit to Mine annual report, typically within one month after the end of the year.

4.0 Wetland Mitigation Goals

To the degree feasible, the primary goal of the wetland mitigation plan for PolyMet is to restore high quality wetland communities (Eggers and Reed, 1997) of the same types as those impacted by the project. While it is not practicable to replace all impacted wetland types with an equivalent area of in-kind wetland due to site limitations, technical feasibility, and other considerations; the goal of the mitigation plan is to replace the wetland types in-kind to the degree practicable in order to replace lost wetland functions and values. A summary of the acreage of each targeted wetland restoration community and the projected wetland community impacts are provided in Table 1. A total of 1,123 acres of wetland restoration is proposed (Figures 6 and 9), including 12 wetland community types that are planned to replace all impacts in-kind, with the exception of 210 acres of coniferous bog (Table 1).

A summary of the targeted wetland communities planned within each off-site location is provided in Table 7. The specific hydrologic regime characteristics planned for each wetland community are included in Table 8. Detailed descriptions of the targeted wetland communities within the wetland restoration area are provided in the following sections.

4.1 Seasonally Flooded

A total of 20 acres of seasonally flooded depressional wetland is planned in one area at the Hinckley site (Figure 6). Seasonally flooded wetlands typically form in shallow depressions that may or may not be located within a floodplain. The seasonally flooded community is targeted for a dominance of annual species with considerable variation depending on climatic conditions and season. The typical species that are expected include: smartweeds, beggarticks, nut-grasses, and wild millet. The seasonally flooded wetland is expected to be inundated for a few weeks or less each year, typically following snowmelt and heavy summer rainfall events. The wetland is expected to have a water table below the ground surface for much of the growing season.

4.2 Fresh Wet Meadow

A total of 61 acres of wet meadow wetland is planned in one area at the Hinckley site, two areas at the Aitkin site, and will likely be part of two on-site closure projects (Tables 1 and 7, Figures 6 and 9). Wet meadows typically form in the transition zone from upland to aquatic systems, often intergrading into sedge meadows and shrub carr. The wet meadow community is targeted for a dominance of native grasses and perennial forbs, although sedges, rushes, ferns, and some shrubs

may also be present. Woody plants should only be present as scattered individuals or small groups. The muck soils are typically saturated close to the surface for much of the growing season with occasional short-term inundation during floods or following snowmelt.

4.3 Sedge Meadow

A total of 87 acres of sedge meadow wetland is planned in four areas of the Hinckley site and one area within the Aitkin site (Table 7, Figures 6 and 9). Sedge meadows typically form with a slightly wetter landscape position than wet meadows, with saturation near the surface typical and shallow inundation of 2-3 inches common, particularly early in the growing season. The sedge meadow community is targeted for a dominance of primarily native sedges, however, grasses such as Canada bluejoint and manna grass may be present along with scattered perennial forbs and some shrubs. The muck soils are typically saturated close to the surface for most of the growing season with shallow inundation common for long periods of time.

4.4 Shallow Marsh

A total of 148 acres of shallow marsh wetland is planned in one area within the Hinckley site, two areas within the Aitkin site, and will likely play a role in three of the on-site closure projects (Tables 1 and 7, Figures 6 and 9). Shallow marshes typically form where more inundation up to 6 inches in depth is present for long periods of time. The shallow marsh community is targeted for a dominance of primarily native emergent vegetation. Based on natural vegetation establishment observed in the farmed fields prior to herbicide treatments, it is expected that arrowhead, bur-reed, water plantain, sedges, cattails, pickerelweed, and bulrushes will form the dominant species. Some grasses, forbs, and shrubs may develop on suitable microsites, but are not expected to be dominant. The shallow marsh restoration areas contain muck soils, with hydrology planned to range from saturation to the surface with up to 6 inches of inundation for much of the growing season.

4.5 Deep Marsh

A total of 84 acres of deep marsh wetland is planned in two areas within the Aitkin site and should be part of two on-site closure projects (Tables 1 and 7, Figure 9). Deep marshes are typically present between shallow marshes and open water communities with 6 inches to 36 inches of inundation present throughout the growing season. The deep marsh community is targeted for a mix of emergent, floating-leaved, and submergent vegetation. Based on natural vegetation establishment in nearby areas of similar hydrology, it is expected that water-lily, pondweed, duckweed, arrowhead, bur-reed, water plantain, wild rice, cattails, pickerelweed, and bulrushes will form the dominant

species. Other submergent, floating-leaved, and emergent species are likely to develop. All of the deep marsh restoration areas contain muck soils.

4.6 Shallow, Open Water

A total of 10 acres of shallow, open water wetland is projected in one of the on-site closure projects (Table 1). Shallow, open water communities are permanently inundated and will have water depths typically ranging from 36 inches to 60 inches throughout the growing season. The vegetation is expected to be composed primarily of floating, floating-leaved, and submergent vegetation, likely to include: water-lilies, pondweeds, duckweeds, coontail, and water milfoil.

4.7 Shrub Carr

A total of 171 acres of shrub carr wetland is planned in five locations at the Hinckley site and one area of the Aitkin site (Table 7, Figures 6 and 9). Shrub carr communities are typically saturated close to the surface for much of the growing season with occasional short-term inundation during floods and following snowmelt, particularly where a hummocky surface is present. The vegetation is expected to be composed of at least 50 percent areal coverage of shrubs, including primarily willow, meadowsweet, and dogwood. The understory vegetation is expected to be composed of grasses such as Canada bluejoint and manna grass along with scattered, perennial forbs. The tree coverage is variable in shrub carr wetlands, typically with less than 25 percent coverage of trees taller than six feet. The majority of the shrub carr restoration areas contain muck soils, however portions of two planned shrub carr wetlands have some mineral soils at the Hinckley site (Areas 9 and 21, Figure 6).

4.8 Alder Thicket

A total of 140 acres of alder thicket wetland is planned in four locations at the Aitkin site, one area within the Hinckley site, and is likely to be a component of one on-site closure project (Tables 1 and 7, Figures 6 and 9). Alder thicket communities are typically saturated close to the surface for much of the growing season with occasional short-term inundation during floods and following snowmelt, particularly where a hummocky surface is present. The vegetation is expected to be composed of at least 50 percent areal coverage of shrubs, including primarily speckled alder with some willow, meadowsweet, and dogwood. The understory vegetation is expected to be composed of grasses such as Canada bluejoint and manna grass along with scattered, perennial forbs. The tree canopy is expected to be less than 25 percent coverage of trees taller than six feet. The majority of the alder thicket restoration areas contain muck soils, however portions of one planned alder thicket wetland at the Aitkin site has some mineral soil (Area 6, Figure 9).

4.9 Hardwood Swamp

A total of 66 acres of hardwood swamp wetland is planned in two locations at the Hinckley site and one location at the Aitkin site (Table 7, Figures 6 and 9). Hardwood swamps are typically dominated by black ash, but other tree species such as quaking aspen, balsam poplar and yellow birch may develop. Shrub layer cover is expected to be variable with black ash common, along with mountain maple, and swamp red currant likely. Herbaceous plants may include various grasses, sedges, ferns, and forbs suited to the microtopography present. The hardwood swamp communities are planned in the transition zones between the peat wetlands and uplands. In mature hardwood swamps (older then 75 years) the tree canopy ranges from interrupted to continuous in coverage (50 to 100 percent cover). At the Hinckley site, the hardwood swamp restoration area #11 at the Hinckley site is primarily underlain by peat soils and the partially drained, existing hardwood swamp, restoration area #19, contains a mix of peat and mineral soils. The majority of the hardwood swamp restoration area at the Aitkin site is underlain by mineral soils (Appendix E, Transect 6).

4.10 Coniferous Swamp

A total of 98 acres of coniferous swamp wetland is planned in one location at the Hinckley site and one location at the Aitkin site (Table 7, Figures 6 and 9). Tamarack-dominated coniferous swamp is the targeted community in this wetland restoration plan. While tamarack is targeted as the dominant tree species, black spruce and balsam fir may also be present. Shrub layer cover is expected to be considerable, and may be composed of species such as: speckled alder, winterberry, Labrador tea, blueberries, and the various tree species. The groundlayer is expected to be variable, and may include mosses, grasses, sedges, ferns, and forbs suited to the microtopography present. In coniferous swamps the tall shrub layer coverage is variable and the tree canopy is patchy to interrupted (25 to 75 percent cover). The planned coniferous swamp restoration areas are predominantly underlain by muck soils.

4.11 Open Bog

A total of 74 acres of open bog wetland is planned in one area of the Aitkin site (Table 7, Figure 9). The restoration of open bog communities is somewhat experimental in nature as few such projects have been conducted and monitored (particularly in Minnesota) for a sufficient amount of time to determine realistic goals and performance criteria. Open bogs are composed of a groundlayer of living sphagnum moss growing over a layer of acid peat. Herbaceous plants and the low shrubs of the heath family (Ericaceae) are also typically present. Scattered immature or stunted trees may be present (black spruce or tamarack) but will not be part of the active restoration efforts for the open

bog wetland. The mature bog surface is typically fairly level terrain, with pronounced hummock and hollow microtopography, receiving nutrients only from precipitation and limited internal runoff. The Aitkin site appears to be well suited for bog restoration with the presence of peat soils and primarily precipitation-driven hydrology.

Layers of sphagnum can isolate the bog from the influence of nutrient enriched groundwater, and create an environment characterized by high acidity and low oxygen and nutrient levels. Plant diversity is very low in open bogs but includes characteristic and distinctive specialists. The vegetation is expected to be composed of herbaceous plants, including bog sedge, tawny cottongrass, three-way sedge, broad-leaved cattail over a nearly continuous mat of sphagnum mosses (*Sphagnum* spp.). The shrub cover in a typical bog would be composed primarily of leatherleaf, bog rosemary, small cranberry, and large cranberry. The entire open bog restoration area contains peat soils.

4.12 Coniferous Bog

A total of 339 acres of coniferous bog wetland is planned in one area at the Hinckley site and one area at the Aitkin site (Table 7, Figures 6 and 9). The restoration of coniferous bog communities is somewhat experimental in nature as we are unaware of any such projects in Minnesota, making it a challenge to determine realistic goals and performance criteria. The hydrology of coniferous bogs is primarily controlled by direct precipitation (rainfall and snowmelt) and the soils are saturated to the surface throughout the growing season. The Aitkin site appears to be well-suited to bog restoration since it is supported primarily by precipitation. The hydrology at the Hinckley site is supported by some surface water flow from an upstream wetland complex in addition to precipitation.

The plant community composition and structure of coniferous bogs is similar to open bogs except black spruce and/or tamarack trees are the dominant species with patchy coverage ranging from 25 to 75 percent cover. Sphagnum moss is the dominant groundlayer species, with sedges, cottongrass, and blueberry that can tolerate shaded conditions often being present under the tree canopy. In the open areas, shrubs of the heath family (Ericaceae) may be present. The coniferous bog restoration areas contain peat soils.

Considerable efforts were expended from 2005-2007 to plan the restoration of bog wetlands at Site 8362 (described in Section 2.4) and numerous other sites that were evaluated. With the loss of Site 8362 as a viable mitigation option, the opportunities for replacing bog habitats in-kind became much more limited. The final two sites selected for compensatory wetland mitigation provided the opportunity to restore 11 of the 12 impacted wetland types in-kind. However, due to the specific site

conditions necessary for planning viable bog restoration, suitable characteristics are present on approximately 414 acres of the mitigation sites. Some of the specific site conditions suitable for bog restoration include:

1. Presence of peat soils
2. Primarily precipitation driven hydrology
3. The potential to restore a saturated hydrologic regime
4. Flat land slopes
5. A buffer of other wetland communities or upland communities between the bog and features such as roads
6. Size – large enough area to reestablish a viable, self-sustaining ecosystem

Instead of trying to force bog restoration into areas of the mitigation sites that are not well suited, we felt it best to plan bog restoration where the natural conditions are best suited to maximizing the potential for success. The presence of mineral soils in some areas of both mitigation sites limits the potential extent of bog communities. There are also lower topographic areas on each mitigation site that are expected to develop with standing water that is not conducive to bog restoration. A wide buffer of other wetland habitats are planned around each proposed bog area to minimize the potential effects of roads, dikes, and ditches. A few small pocket areas with some suitable characteristics were also ruled out because the edge affects may limit the ability to develop viable, self-sustaining bog communities. The logistical and physical constraints of restoring nine other impacted wetland types also limited the total area of bog habitats that could be reasonably planned.

5.0 Wetland Mitigation Performance Standards

Performance standards have been developed for each wetland community type targeted in the wetland restoration plan to guide the restoration activities and to determine success. The performance criteria include measures to evaluate whether or not the hydrology and vegetation meet the plan goals. Several measures of acceptable hydrologic regime characteristics for each wetland community are included in Table 8. Should the performance standards not be met during the five year monitoring period (eight years for the shrub communities and twenty years for the forested, and bog communities), a proposal will be submitted to the Corps and the MDNR Division of Lands and Minerals describing the corrective actions proposed and an implementation schedule.

5.1 General Performance Standards

Several general performance standards apply to all wetland restoration areas:

1. More than 50 percent of the vegetation in each wetland shall be facultative (FAC, FAC+) or wetter (FACW, OBL).

2. Invasive and/or non-native vegetation shall not comprise more than 5 percent cumulative areal coverage within any wetland community at the end of the eighth full growing season for shrub communities; at the end of the twentieth full growing season for the forested, and bog communities; and at the end of the fifth full growing season for all other communities. Invasive and non-native vegetation include, but are not limited to the following: reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), hybrid cattail (*Typha x glauca*), common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*Rhamnus frangula*), and Canada thistle (*Cirsium arvense*) (Shaw, 2000). Also included are species listed as non-native on the MDNR Minnesota Native Plant List, dated June 25, 2002.

3. Reference wetlands will be identified for the proposed restoration communities prior to beginning monitoring of the restored wetlands. The location and general characteristics of each reference wetland will be included in the final, detailed wetland monitoring plan for regulatory review and approval prior to the start of monitoring.

5.2 Seasonally Flooded

1. Herbaceous vegetation shall cumulatively comprise at least 80 percent areal cover by the end of the second growing season, except when hindered by seasonal inundation.

2. Shrub and tree vegetation shall comprise less than 50 percent areal cover by the end of the fifth full growing season.

3. Total areal vegetative cover shall be more than 95 percent after the fifth full growing season, except when hindered by seasonal inundation.

4. There shall be at least 10 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns, except when hindered by inundation.

5.3 Fresh Wet Meadow

1. Herbaceous vegetation shall cumulatively comprise at least 80 percent areal cover by the end of the second full growing season.

2. Shrub and tree vegetation shall comprise less than 50 percent areal cover by the end of the fifth full growing season.

3. Total areal vegetative cover shall be more than 95 percent after the fifth full growing season.

4. There shall be at least 10 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns by the end of the fifth full growing season.

5.4 Sedge Meadow

1. Herbaceous vegetation shall comprise at least 70 percent areal cover by the end of the second full growing season.

2. Shrub and tree vegetation shall cumulatively comprise less than 30 percent areal cover by the end of the fifth full growing season.

3. Total areal vegetative cover shall be more than 90 percent after the fifth full growing season.

4. Sedge species shall be dominant by the end of the fourth full growing season; most of which, should be the genus *Carex*, but also may include spike-rushes, bulrushes, and nut-grasses. Grasses, forbs, and true rushes may comprise the remaining herbaceous cover.

5.5 Shallow Marsh

1. Emergent vegetation shall comprise at least 50 percent areal cover by the end of the fifth full growing season.

2. Shrub and tree vegetation shall comprise less than 30 percent areal cover by the end of the fifth full growing season.

3. At least three native aquatic species (e.g. bur-reeds, arrowheads, plantain, bulrushes, wild rice, sedges, cattail) shall be the dominant vegetation after the fifth full growing season unless a community of low diversity, but high integrity (e.g. arrowhead, lake sedge) is present.

5.6 Deep Marsh

1. Emergent vegetation shall comprise at least 25 percent areal cover by the end of the fifth full growing season.

2. Submergent, floating, and floating-leaved vegetation shall comprise more than 30 percent areal cover by the end of the fifth full growing season.

3. Open water with submergent, floating, and floating-leaved vegetation, but without emergent vegetation, may comprise up to 75 percent of each wetland at the end of the fifth full growing season.

4. At least three native aquatic species (e.g. water-lilies, pondweeds, duckweeds, bur-reeds, arrowheads, plantain, bulrushes, wild rice, sedges, cattail) shall be the dominant vegetation after the fifth full growing season unless a community of low diversity, but high integrity (e.g. bulrushes, arrowhead, lotus, wild rice) is present.

5.7 Shallow, Open Water

1. Emergent vegetation may comprise up to 10 percent areal cover by the end of the fifth full growing season.

2. Aquatic bed communities shall comprise greater than 30 percent coverage of the open water area and be dominated by 3 or more species of native aquatic plants such as pondweeds, water lilies, bladderworts, wild celery, duckweed, water crowfoots, native milfoils, etc.; or communities with low diversity but high integrity (e.g., beds of wild celery) by the end of the fifth full growing season.

3. Open water (without emergent vegetation) may comprise up to 100 percent of each wetland at the end of the fifth full growing season.

5.8 Shrub Carr

1. There shall be at least 300 shrubs/acre or greater than 15 percent areal shrub coverage, including primarily willow, meadowsweet, and dogwood seedlings by the end of the second full growing season.

2. Characteristic shrub vegetation (primarily willow and dogwood species) shall comprise more than 25 percent areal cover by the end of the fifth full growing season.

3. Characteristic shrub vegetation (primarily willow and dogwood species) shall comprise more than 50 percent areal cover by the end of the eighth full growing season.

4. Herbaceous vegetation shall form in the understory such that the total areal vegetative cover shall be more than 90 percent by the end of the fifth full growing season.

5. There shall be at least 2 species of native shrubs and 6 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns by the end of the eighth full growing season.

5.9 Alder Thicket

1. There shall be at least 300 shrub seedlings/acre or greater than 15 percent areal shrub coverage, including primarily speckled alder with some willow, meadowsweet, and dogwood seedlings by the end of the second full growing season.

2. Characteristic shrub vegetation (primarily speckled alder with some willow and dogwood species) shall comprise more than 25 percent areal cover by the end of the fifth full growing season.

3. Characteristic shrub vegetation (primarily speckled alder with some willow and dogwood species) shall comprise more than 50 percent areal cover by the end of the eighth full growing season.

4. Herbaceous vegetation shall form in the understory such that the total areal vegetative cover shall be more than 90 percent by the end of the fifth full growing season.

5. There shall be at least 2 species of native shrubs and 6 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns by the end of the eighth full growing season.

5.10 Hardwood Swamp

1. There will be at least 300 tree seedlings/acre present by the end of the second full growing season including primarily black ash, but some quaking aspen, balsam poplar, and yellow birch may be present.

2. The shrub coverage will be at least 30 percent areal coverage at the end of the fifth full growing season including primarily swamp red currant, black ash or other shrub species present in the reference wetland.

3. The herbaceous plant coverage will comprise at least 20 percent areal cover in the open areas, including at least 4 characteristic grass, sedge, fern and/or forb species at the end of the third full growing season.

4. The herbaceous plant coverage will comprise at least 50 percent areal cover in the open areas by the end of the tenth full growing season.

5. At the end of the fifth full growing season, the living tree component will contain within 30 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

6. At the end of the tenth full growing season, the living tree component will contain within 20 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

7. At the end of the twentieth full growing season, the living tree component will contain within 10 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

5.11 Coniferous Swamp

1. There will be at least 300 tree seedlings/acre present by the end of the second full growing season after tree establishment efforts are complete. Tree species will be primarily tamarack, but some black spruce, balsam fir, black ash, or other tree species found in the reference wetland may be present.

2. The shrub coverage will be at least 25 percent areal coverage at the end of the fifth full growing season which may include speckled alder, winterberry, Labrador tea, leatherleaf, and blueberry.

3. The herbaceous plant coverage will comprise at least 20 percent areal cover, including at least 4 characteristic grass, sedge, fern and/or forb species at the end of the third full growing season.

4. The herbaceous plant coverage will comprise at least 50 percent areal cover in the open areas by the end of the tenth full growing season.

5. At the end of the fifth full growing season, the living tree component will contain within 30 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

6. At the end of the tenth full growing season, the living tree component will contain within 20 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

7. At the end of the twentieth full growing season, the living tree component will contain within 10 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

5.12 Open Bog

1. There will be some evidence of creeping snowberry, bog rosemary, and/or small cranberry present by the end of the fourth full growing season. However, given the experimental nature of restoring an open bog community, no quantitative measures are suggested.

2. There will be at least 20 percent sphagnum moss coverage by the end of the fifth full growing season.

3. There will be at least 40 percent sphagnum moss coverage by the end of the tenth full growing season.

4. There will be at least 50 percent sphagnum moss coverage by the end of the twentieth full growing season.

5. The herbaceous plant coverage (not including mosses) will be at least 60 percent by the end of the tenth full growing season and 50 percent by the end of the twentieth full growing season with bog sedge, cottongrass, or other characteristic reference wetland species comprising the dominant species.

5.13 Coniferous Bog

1. There will be at least 300 stems per acre of black spruce, tamarack, or other tree species characteristic of the reference wetland by the end of the fifth full growing season.

2. The shrub coverage will be at least 30 percent areal coverage at the end of the fourth full growing season including species characteristic of the reference wetland such as bog laurel, Labrador tea, leatherleaf, creeping snowberry, and small cranberry.

3. There will be at least 20 percent coverage of sphagnum moss species by the end of the fifth full growing season.

4. There will be at least 40 percent sphagnum moss coverage by the end of the tenth full growing season.

5. There will be at least 50 percent sphagnum moss coverage by the end of the twentieth full growing season.

6. The herbaceous plant coverage (not including mosses) will be at least 60 percent by the end of the tenth full growing season and 50 percent by the end of the twentieth full growing season in the open areas with bog sedge, cottongrass, or other characteristic reference wetland species present.

7. At the end of the fifth full growing season, the living tree component will contain within 30 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of primarily black spruce and tamarack, however, other tree species similar to those present in the reference wetland may also be present.

8. At the end of the tenth full growing season, the living tree component will contain within 20 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

9. At the end of the twentieth full growing season, the living tree component will contain within 10 percent of the tree density in a reference wetland(s) of similar type. The tree species will be composed of tree species similar to those present in the reference wetland.

5.14 Upland Buffer

1. Existing upland buffer communities composed of primarily native species will be managed so that no more than 10 percent areal cover of exotic or non-native invasive vegetation is present.

2. Herbaceous vegetation shall cumulatively comprise at least 80 percent areal cover in non-forested buffer areas and 50 percent cover in forested buffer areas by the end of the second full growing season.

3. There shall be at least 10 species of native, non-invasive grasses, sedges, rushes, forbs, or ferns by the end of the second full growing season in non-forested buffer areas.

4. Shrub and tree vegetation shall comprise less than 50 percent areal cover by the end of the fifth full growing season in non-forested buffer areas.

5. Total areal vegetative cover shall be more than 95 percent after the fifth full growing season dominated by warm-season grasses and late successional forbs in non-forested buffer areas.

6. There should be no more than 10 percent areal cover of exotic, non-native invasive vegetation at any time during the monitoring period.

6.0 Wetland Restoration Site Description

6.1 Hinckley Wetland Mitigation Site Description

The Hinckley wetland mitigation plans include the restoration of 313 acres of wetland and the preservation of 79 acres of upland buffer on a sod farm (Figure 6). The wetland restoration site is located in Section 5, Township 39 North, Range 22 West, Pine County, Minnesota (Figure 5). The site is located in the Snake River #36 major watershed and Bank Service Area #6 (Figure 1). The National Wetland Inventory map for the wetland restoration area is provided in Figure 8.

6.1.1 Geology and Soils

Patterson and Knaeble (2001) mapped the surficial geology within the restoration area as primarily peat and organic-rich sediment deposited in marshes and shallow lakes during the Holocene and Late Pleistocene. An area of silty and sandy sediment deposited in shallow water is also mapped within the southeast corner of the Hinckley wetland restoration site over sandy deposits (Patterson and Knaeble, 2001). Knaeble, et al. (2001) show the presence of Glacial Lake Grantsburg encompassing the proposed Hinckley wetland restoration site during the period when the Grantsburg sublobe of the Des Moines lobe advanced into Pine County from the southwest. During that period, till and lake sediment were deposited over much of southern Pine County, including the proposed wetland restoration site (Knaeble, et al., 2001).

County Well Index boring logs in the vicinity of the restoration site indicate deposits of primarily clayey gravel with layers of sand with bedrock (primarily sandstone) at depths ranging from 80 feet to 130 feet. The soils within the wetland restoration areas are mapped in the Soil Survey of Pine County, Minnesota (Simmons, et al., 1941) as primarily peat soils throughout approximately the northern three-fourths of the site with mineral soils mapped along the south and east sides of the property. The Natural Resources Conservation Service has conducted a more detailed mapping of the soils within the site, and a preliminary mapping of the soils was obtained from the public record as part of another project, however, it is not in a format that can be readily published. The preliminary NRCS soil mapping indicates that the majority of the site is Markey muck within the northern three-fourths of the site and most of Areas 22 and 9 (Figure 6). Areas 11 and 12, located east of the railroad tracks are mapped as Cathro muck (Figure 6). The non-hydric mineral soils are mapped primarily within proposed upland buffer Areas 7, 13, 14, 17, 18, and 23 (Figure 6). The majority of the upstream watershed area is also mapped as peat soils. The water table appears to be near the

surface throughout much of the general area, as indicated by the large wetland complexes underlain by peat soils.

6.1.2 Topography

The topographic relief is minimal throughout the site. A topographic survey of the site was completed and a one-foot contour map was created from the data (Appendix A). Detailed survey data indicates ground elevations on the wetland restoration site range from about 985 feet MSL to 1000 feet MSL with elevations in the ditches down to 979 feet MSL and on the dikes up to 1004 feet MSL. The gradient in the wetland restoration area ranges from flat to about 1 percent.

6.1.3 Climate and Hydrology

The average annual precipitation for Hinckley, based on the current 30-year normal period 1971-2000 is 31.2 inches (NRCS, 2007). A water budget completed by Lindholm et al. (1974) for the Snake River watershed calculated general runoff in the watershed to be 8.5 inches based on annual, average precipitation of 28.93 inches from the normal period 1939-1968. The wetland restoration site is located near the middle of the Snake River watershed, for which the water budget was calculated. While the average annual runoff value calculated by Lindholm et al. (1974) may not accurately reflect runoff conditions in all areas of the watershed, it provides a reasonable estimate for computing an order-of-magnitude water volume that might be expected to discharge from various portions of the watershed.

6.1.4 Hydrology

A total of approximately 6,360 acres of upstream watershed area drains to and through the Hinckley site (Figure 7). The primary drainage feature affecting the site is an unnamed tributary that carries discharge from the 5,634 acre upstream drainage area. The portion of this tributary that runs along the north and west side of the restoration site is a designated county ditch. It appears that the county ditch was constructed prior to 1939 (Figure 13) and the same areas of the site that are in sod production today have been farmed since prior to 1939, with the exception of the northeast corner. Based on review of the 1991 aerial photograph (Figure 16), it appears that the northeast corner of the site had not been cultivated as of 1991. While not confirmed, it has been reported that much of Area 3 (Figure 6) was put into production in about 1997. The north tributary drainage splits at the wetland restoration site with a portion discharging to Pokegama Creek approximately 4.5 miles east and the other discharging to Mud Creek approximately 0.7 miles downstream of the site (Figure 7).

Hydrology will be restored within the majority of the proposed wetland restoration areas by reestablishing the natural discharge flow pathways from the large wetland complexes located north of the farm. As the farm was developed, starting in the early 1900's, a ditch system was constructed to intercept that discharge and either route it around the farm or utilize it for irrigation/water supply. Those natural flow paths will be restored to the planned restoration areas.

6.2 Aitkin Wetland Mitigation Site Description

The Aitkin wetland mitigation plans include the restoration of 810 acres of wetland and the preservation of 123 acres of upland buffer on a sod farm (Figure 9). The wetland restoration site is located in Section 6, Township 47 North, Range 26 West; and Section 1, Township 47 North, Range 27 West, Aitkin County, Minnesota. The site is located in the upper portion of the Mississippi River-Brainerd #10 major watershed and Bank Service Area #5 (Figure 1). The National Wetland Inventory map for the wetland restoration area is provided in Figure 11.

6.2.1 Geology and Soils

Oakes and Bidwell (1968) mapped the surficial geology within the restoration area as glacial lake peat deposits, silts, sands and clays with flat topography. The property is located in an area of extensive peat deposits in the glacial Lake Upham area. County Well Index boring logs in the vicinity of the restoration site indicate layered deposits of primarily clay and sand to a depth of 150 feet or more below the surficial soils. The soils within the wetland restoration areas are mapped in the Soil Survey of Aitkin County, Minnesota (NRCS, 1999) as primarily muck soils, including the Cathro (Map Unit 1983), Sago (Map Unit 532), and Sax (Map Unit 1154) soil series (Figure 12). Mineral hydric soils including: Baudette silt loam (Map Unit 1982), Spooner silt loam (Map Unit 147), Sandwick loamy sand (Map Unit 625), and Waukenabo fine sandy loam (Map Unit 759) are mapped within portions of the site (Figure 12). The legend for the Soil Survey of Aitkin County is provided in Appendix D.

All soils mapped within the wetland restoration areas are hydric. The majority of the entire land area located upstream of the wetland restoration site is also mapped as hydric soils, and includes predominantly muck and peat soils in the large wetland complexes and mineral hydric soils in the mesic forested areas. The water table appears to be near the surface throughout much of the general area, as indicated by the large wetland complexes underlain by muck and peat soils.

Soil profiles and water table information were collected during fieldwork conducted on April 25, 2007 and June 5-6, 2007. A topographic survey was completed for the site and a one-foot contour

map was created from the data (Appendix B). The survey data along with soil information was used to create stratigraphic fence diagrams that show the complexity of the soils in the area. The water table information collected during the field survey was also plotted on the diagrams (Figures A2-A9, Appendix E). A discussion of the site, based on the fieldwork, is presented in the following sections.

6.2.1.1 East Area Soils

Soil borings were completed on the east side of the property and showed that deep organic soils were present across the majority of Fields 17, 18, 21, 22, and 23 (Figure A1, Appendix E). Soils that have an organic layer that is 16 or more inches thick (within the upper 32 inches of soil) are classified as Histosols. These soils are typically found in the areas likely to have been the wettest historically. These soils are in areas that are poorly to very poorly drained with long periods of saturation in their undisturbed state. The depth of peat and/or muck at the sites ranged from 16 inches to more than 48 inches in depth, typically underlain by either sand or fine textured materials (e.g., clay, silt, silt loam, etc.). These profiles are described at sites 1-4, 7, 8, 18-21, and 24 (Figure A1, Appendix E).

Soils with an organic layer that is more than eight inches but less than 16 inches in depth have a histic epipedon. These soils are typically formed under somewhat poorly drained conditions with frequent periods of high water tables. The depth of peat and/or muck at these sites ranges from 6 to 15 inches in depth, and is typically underlain by either fine sand, silt, clay, and/or clay loam soils. These profiles are described at sites 5, 6, 16, and 17 (Figure A1, Appendix E).

The remainder of the sites have mineral soil profiles that typically contain up to seven different textural horizons within 36 to 42 inches below the soil surface. The textures throughout the profiles include fine sand, loam, silt, clay, clay loam, loamy fine sand, fine sandy loam, fine sandy clay loam, and fine sandy clay. The presence of multiple strata within 3 to 4 feet of soil indicates these soils were created in near-shore conditions with little wave action so that finer textured materials settle out over time. These profiles are generally formed under poorly drained conditions with periods of short inundation. All the profiles were classified as hydric except sites 10, 11, and 12, which are located in the northeast area (upland buffer Area 13, Figure 9) at elevations above 1202 feet MSL (Appendix E).

6.2.1.2 West Area Soils

Soil borings were completed on the west side of the property in Fields 2, 6, 8, 9, 10, and 11 (Figure A-1 to A-9, Appendix E). These borings show that organic soils are present to a depth of at least 15 inches below the soil surface. In addition, soil samples were collected throughout the west area of the

property for a seedbank germination project. A walk-over of the west area during the collection of soil samples indicated that organic soils were present throughout the ditch system and the sod fields.

The soil survey indicates that nearly the entire area is mapped as Cathro muck, which typically has peat and/or muck to a depth of 16-51 inches below the soil surface. There are two areas of mapped mineral soil, Spooner silty loam, in the northwest and southwest areas. This series is typically a poorly drained soil that formed from glaciolacustrine parent material and it is classified as hydric. Soils in this area typically formed under poorly to very poorly drained conditions with long periods of saturation.

6.2.2 Topography

The topographic relief is fairly minimal throughout the site. The USGS quadrangle topography indicates an elevation of 1205 feet MSL in the west-central portion of the farm area to an elevation of 1204 feet MSL in the east-central portion of the farm. The USGS topography does not show any contours through most of the fields. Detailed survey data indicates ground elevations in the wetland restoration areas ranging from 1196 feet MSL to 1201 feet MSL with elevations on the dikes up to 1213 feet MSL. The gradient in the wetland restoration area ranges from flat to about 1.5 percent in the northwest and northeast corners of the site. The gradient in the wetland complex located north of the restoration area appears to be about 1.5 feet per mile or 0.03%.

6.2.3 Climate

The average annual precipitation for Aitkin, based on the current 30-year normal period 1971-2000 is 28.9 inches (NRCS, 2007). A water budget completed by Oakes and Bidwell (1968) for the Mississippi River headwaters watershed calculated general runoff in the watershed to be 5.34 inches based on annual, average precipitation of 25.33 inches. The wetland restoration site is located in the downstream portion of the Mississippi River headwaters watershed, for which the water budget was calculated. While the average annual runoff value calculated by Oakes and Bidwell (1968) may not accurately reflect runoff conditions in all areas of the watershed, it provides a reasonable estimate for computing an order-of-magnitude water volume that might be expected to discharge from various portions of the watershed.

6.2.4 Hydrology

The Mississippi River Diversion Channel (Diversion Channel), constructed in the 1950s to prevent flood damages to the city of Aitkin, is located on the north side of the property (Figure 10). The flood channel diverts a portion of the Mississippi River flows downstream to lower portion of the river

during high flows. A flood study was published for the Aitkin County area in 1981 (FEMA, 1981) in which specific flood elevations were determined for the Aitkin project area. The 10-year flood elevation for the site is approximately 1200.5 feet MSL and the 100-year flood elevation for the site is approximately 1203 feet MSL. The flood channel also intercepts the Little Willow River and carries its discharge to the Mississippi River. It appears that the Diversion Channel may also intercept some surface and subsurface drainage from the north that may have historically made its way to the restoration property. However, based on a review of historic topography maps and aerial photographs, it appears that the drainage area affecting the wetland restoration property may be limited. There is an artesian well located near the central part of the property that will flow freely when not restricted. However, the specifications of that well are unknown. It does indicate that there is a general upward groundwater head gradient at some depth at the site. The Mississippi River abuts the east side of the property. The existing contributing watershed area to the restoration site is currently confined to the site itself and there is no upstream drainage that enters the site (Figure 10).

The primary drainage features affecting the farm are surface ditches spaced approximately every 700 feet with the fields contoured to drain to the ditches. There are four outlets from the west part of the property; two in the northwest part (one north through the Diversion Channel dike and one through the west dike), one in the southeast corner, and another near the center of the east side (Sheets C-01 and C-02, Appendix A). These outlets range in elevation from 1193.6 feet MSL in the northwest to 1195 feet MSL in the east and southeast, generally 5-7 feet below the field elevations. There is a small county ditch located west of the property. The west half of the property is bordered by dikes on the north and west sides. The north dike ranges in elevation from about 1205 feet MSL to 1210 feet MSL. The west dike ranges in elevation from about 1200 feet MSL to about 1204 feet MSL. County Highway 1 acts as a dike along the east and south sides of the west part of the property ranging in elevation from about 1205 feet MSL to more than 1207 feet MSL.

There are two outlets from the east half of the property; one in the northwest corner discharging to the Diversion Channel and one along the east side discharging to the Mississippi River. These outlets range in elevation from 1194.4 feet MSL in the northwest corner to 1196.2 feet MSL in the east, generally 5-6 feet below the field elevations (Sheet C-02, Appendix A). The east outlet has an adjustable control structure that can be modified to control water levels. The east half of the property is bordered by a dike on the north side ranging in elevation from about 1205 feet MSL to 1213 feet MSL. County Highway 1 acts as a dike on the west side, ranging in elevation from about 1205 feet MSL to more than 1207 feet MSL. The south side of the east half is bordered by a dike that ranges in elevation from about 1201 feet MSL to 1205 feet MSL. The east side of the east half is bordered by

391st Lane which ranges in elevation from about 1202 feet MSL in the south to 1205 feet MSL in the north.

Review of the 1940 aerial photograph indicates that much of the Aitkin property was under agricultural production at that time and some of the drainage ditches had already been constructed (Figure 14). The 1991 aerial photograph (Figure 15) shows the site during the years of wild rice production, which apparently extended from as early as the late 1950's until about 1998 when the site was converted for sod production. Hydrology will be restored within the majority of the proposed wetland restoration areas by reconnecting the site to the Diversion Channel with surface overflows/inlets, filling the drainage ditches, and blocking or raising outlet structures to historic elevations to the degree feasible. The detailed construction plans are described in Section 7.

6.2.4.1 East Area Hydrology

During the site soil and water investigation on June 5 and 6, 2007, the depth of each borehole and the depth to the water table were measured after the soil profile description was completed. The boreholes were left open and the water table was rechecked after 15-21 hours. There was no rainfall during this time period. Only three sites recorded a water table upon the initial measurement (Figure A1, Appendix E); Site 3 at a depth of 32 inches, Site 18 at a depth of 39 inches, and Site 22 at a depth of 36 inches. The water table at these three sites was located in fine sand or at a fine sand and clay boundary.

A water table was recorded at 11 sites during the second round of measurements. The boreholes generally had collapsed 0-10 inches depending on the soil texture at the bottom of the borehole (clay, sand, etc.). The water table was measured at 27-41 inches below the soil surface (Figures A2-A9 Appendix E). Five transects were completed in the east half of the site that show the soil stratigraphy and the water table (Figure A1: Transects 1, 2, 3, 5, 6/4, Appendix E). The water table was observed in most ditches on the property, with the wider and deeper ditches conveying a greater amount of surface water. Typically the water table rose near the ditches, but as the distance increased from the ditch, the water table flattened out or disappeared to a depth greater than the sampling depth (Figures A2-A7 Appendix E). There is an area at the north end of Field 17 where approximately 1-2 feet of topsoil has been removed from the deep organic soils, resulting in occasional inundation. The excavation area appears to have altered the hydrology by establishing a collection area for runoff and by exposing and/or resulting in more compacted subsoils, thereby allowing the area to pond surface water (Figures 6/4-1 and 6/4-2 Appendix E).

Because the east area is dominated by organic soils or hydric mineral soils, this area was formed under very poorly to poorly drained conditions. Typical water tables should range from one foot above to one foot below the soil surface for organic soils and 0.5-1.5 feet (6-18 inches) below the soil surface for mineral soils under unaltered conditions. The placement of drainage ditches on the property has altered the hydrology of the site so that the drainage class for the current soils on the site range from well drained to somewhat poorly drained soil, rather than the typical poorly drained to very poorly drained classes.

6.2.4.2 West Area Hydrology

The ground elevations in the west area range from a low area at 1196-1199 feet MSL in the northwest corner to generally 1200-1201 feet MSL throughout the remainder of the area. There are typically ditches on at least three sides of each field so that no spot on the ground is more than 350 feet away from a ditch. The presence of the current ditch system, in place since about 1998, and a much more extensive ditch system historically, has significantly altered the hydrology throughout the site. The west area is dominated by organic soils that historically developed with a water table that ranged from one foot above to one foot below the soil surface. There is an apparent water table within most ditches in the west area, but not beneath the fields. The exception is the ditch located at the north side of Field 9, which was dry on June 6, 2007. Transect 7 (Figure A8, Appendix E) shows the same trend for the water table as Transects 1, 2, and 3 on the east side of County Highway 1. The soils along these transects on the west and east sides are typically organic soils underlain by loam or sand with a ditch located to the south.

Soil borings were conducted in the west area on April 25, 2007 to determine peat depths and document the presence of the water table within the peat or upper part of the mineral soil horizon. Soil borings SB-1 through SB-9 (Figure A-1, Appendix E) were completed to depths ranging from 18-32 inches, or until frost was encountered. Peat depths ranged from 15 inches to greater than 28 inches (Table 1, Appendix E) in the west half and no water table was encountered within the mineral soils, which were located at depths of 20-32 inches (where frost was not present). Given that no water table was observed in the sub-surface mineral soils during the wetter portion of the water year (starting October 1 through about May is the typical period of soil moisture recharge), and that it was a slightly wetter than normal water year; it was expected that if wetland hydrology were to be present, it should have been present on April 25, 2007. Because the ditches, organic soil, and elevations are similar to the east side, the high water table on the west side appears to be at least two feet below its normal pre-drainage conditions throughout the area.

7.0 Wetland Restoration Plan

The two proposed off-site wetland restoration sites are both currently operated as sod production facilities, which require considerable control over the hydrology of the site. The hydrology at each site is controlled by a series of ditches throughout each farm, typically surrounded by a system of dikes with outlet structures through the perimeter dikes. Water levels in the ditches are typically maintained approximately 3-5 feet below the field elevations to ensure an aerated rooting zone without soil saturation. The goal for each step in the restoration process is to continually progress toward the final goal of establishing a variety of wetland communities with the appropriate hydrology and dominated by characteristic native vegetation within each community.

7.1 Hinckley Wetland Restoration Construction Plan

The ultimate objective of the Hinckley restoration plan is to restore the hydrologic connection between the upstream watersheds and the restoration site and disable the internal drainage system within the site. The hydrology will be restored utilizing broad, rock-lined weirs, eliminating culverts that would otherwise require perpetual maintenance to establish specific hydrologic conditions that will meet the goals and performance standards described in Sections 4 and 5.

The restoration process will start with activities to restore the hydrology. The restoration construction plans are provided in Appendix A. Prior to constructing the surface inlets and outlets, silt fence/barrier will be installed downstream of the restoration areas within the primary outlet ditches. Before restoration work begins within the site, the water flow from the upstream watershed will be temporarily blocked to prevent flooding during construction. In general, the proposed outlet modifications will be constructed first, then moving upstream within the site, culverts will be removed and internal ditches will be filled in accordance with the plans. The final step will be to reestablish the connections to upstream watersheds. The final connection to upstream watersheds will be sequenced by first constructing the inlet weirs and lastly, filling the exterior ditch (Appendix A).

The inflow/outflow weirs will be constructed by lowering sections of dike to the elevations shown on the plans (Appendix A) within approximately a 20 foot bottom width with 20H:1V slopes connecting into the top of the established dike. Each overflow would then be covered with 1/2-inch to 4-inch rock over geotextile fabric to a depth of 12 inches and extending up the sides of the overflow 1-2 feet in elevation. The rock will also extend on the upstream and downstream slopes. Organic or mineral hydric soils removed from the dike during construction will be utilized to fill the interior field ditches

where practical. After the water supply has been reestablished, efforts will be focused on establishment of the targeted wetland communities as described in Section 7.3.

7.2 Aitkin Wetland Restoration Construction Plan

The ultimate objective of the Aitkin restoration plan is to restore the hydrology within the restoration site by removing the internal drainage system and constructing outlets to establish specific hydrologic conditions that will meet the goals and performance standards described in Sections 4 and 5. The hydrology will be restored utilizing broad, rock-lined weirs, eliminating culverts with the exception of the culverts crossing County Highway 1 and the east outlet crossing 391st Lane.

The restoration process will start with activities to restore the hydrology. The restoration construction plans are provided in Appendix B. Prior to constructing the surface inlets and outlets, silt fence/barrier will be installed downstream of the restoration areas within the primary outlet ditches. A ring dike will first be constructed around the homestead property that is excluded from the restoration plans. The dike will be constructed to elevation 1202 feet MSL to prevent surface flooding.

The proposed outlet modifications will be constructed next, then moving upstream within the site, culverts will be removed and internal ditches will be filled in accordance with the plans. The step will involve raising the dikes and land area as shown on the plans (Appendix B) to prevent flooding of neighboring properties. The west dike will be raised to elevation 1202 feet MSL. The land along the south and southeast corner of the west half will be raised to elevation 1201 feet MSL to prevent water from the restoration area from entering the County Highway 1 drainage system. A berm will be constructed to elevation 1203 feet MSL around the proposed bog areas to protect them from Mississippi River flooding during flood events with a 100-year return frequency or shorter based on modeling data from FEMA (1981).

An inlet/outlet will be constructed through the diversion dike on the west half of the property with an overflow elevation of 1200 feet MSL (Sheets C-01 and C-03). This will allow the diversion channel to spill into the site during high flows and will allow the site to drain, maintaining saturated soil conditions over the majority of the area. An inlet/outlet will be constructed through the diversion dike on the east half of the property with an overflow elevation of 1201 feet MSL (Sheets C-02 and C-04, Appendix B). This will allow the diversion channel to spill into the site during high flows and will allow the site to drain, maintaining saturated soil conditions over the majority of the restoration area.

The inflow/outflow weirs will be constructed by lowering sections of dike to the elevations shown on the plans (Appendix A) within approximately a 20 foot bottom width with 20H:1V slopes connecting into the top of the established dike. Each overflow would then be covered with 1/2-inch to 4-inch rock over geotextile fabric to a depth of 12 inches and extending up the sides of the overflow 1-2 feet in elevation. The rock will also extend on the upstream and downstream slopes. The culverts under County Highway 1 connecting the east and west parts of the site will not be modified and therefore will allow water movement between them. The culverts that cross County Highway 1 near the south part of the site will also remain in place to maintain drainage from the road generally as it currently exists. The east outlet across 391st Lane will be reconstructed with a concrete weir and pipe with a control elevation of 1201 feet MSL (Sheet C-02, Appendix B). The organic or mineral hydric soils removed from the dike during construction would be utilized to fill the interior field ditches where practical. After the water supply has been reestablished, efforts will be focused on establishment of the targeted wetland communities as described in Section 7.3.

7.3 Vegetation Restoration/Management

An adaptive management program is proposed to guide the development of the restored wetlands to the targeted conditions. The vegetative restoration community types proposed in the off-site wetland restoration areas are shown on Figures 6 and 9 and are summarized in Tables 1 and 7. The vegetative restoration of each non-forested, non-bog wetland community will be conducted to promote the establishment of characteristic native species that are present in the seed bank or that may be transported to the area from adjacent wetlands. By reestablishing the hydrologic connection to upstream wetlands as the first restoration activity at the Hinckley site, one of the primary seed transport mechanisms will be restored to assist in the development of wetland communities native to the area. The process for restoration of the wetlands is designed to meet the goals described in Section 4 and the performance objectives described in Section 5 in the most effective manner.

The goal of the restoration is to provide a setting and conditions in which the restoration areas will be restored to naturally self-sustaining and functioning wetlands to the extent feasible. The proposed wetland communities have been planned in areas that appear to match the natural hydrologic characteristics of each community type. However, during the restoration process, it is expected that the defined areas and wetland communities may change to some degree and the plan will allow for adaptation to the conditions.

Where feasible, reference wetlands will be identified in the vicinity of the sites for each restoration community type that represent an approximation of the wetland communities anticipated after

restoration. It is recognized that this process cannot be accomplished within a year or two, but will take time, and therefore, short-term interim goals are also included in the performance standards.

7.3.1 General Site Preparation

Prior to or concurrent with conducting hydrologic restoration activities, existing, non-native and invasive vegetation will be removed from the restoration sites through mechanical means or herbicide application. Sod will be cut using traditional, mechanical methods and will be removed from the site to establish bare soil. The soil will be lightly harrowed to loosen the soil surface. Areas where sod had previously been removed and vegetation has started to grow will be assessed to determine the most appropriate vegetation management treatments. Treatment methods that may be used include mowing (for annual weeds), selective herbicide application (for broadleaf weeds or non-native or invasive grasses), or broad-spectrum herbicide application (for areas where limited desirable species are present).

7.3.2 Natural Regeneration - Seasonally Flooded, Wet Meadow, Sedge Meadow, Shallow Marsh, Deep Marsh, Shrub Carr and Alder Thicket Communities

The proposed vegetation establishment and maintenance activities anticipated to meet the goals of the plan are listed for the conditions described as appropriate to the restoration schedule:

1. **Presence of reed canary grass or other non-native grasses.** Spray Sethoxydim herbicide at label rates in late fall (after desirable native vegetation has senesced) within wetland restoration areas containing more than 20 percent areal coverage of reed canary grass or other non-native or invasive grasses and all dikes and ditch slopes adjacent to the wetland restoration areas. The purpose of this treatment is to kill reed canary grass and other actively growing non-native grasses while desirable native plants are dormant. Other restoration projects have had considerable success using this treatment recently.

2. **Presence of broadleaf weeds.** Spray perimeter dikes and slopes adjacent to wetland restoration areas and other areas where warranted with a broadleaf herbicide (e.g. Transline) at recommended rates targeting stinging nettle, Canada thistle, and other broadleaf non-native species.

3. **Revegetate berms and dikes**. Seed ditch banks and dikes with BWSR Berm Mix No. 2 at 30 pounds/acre (Table 9).

4. **Hydrologic restoration and monitoring.** Construct hydrologic restoration activities as described in Sections 7.1 and 7.2 within 4 weeks after initial herbicide application where invasive or non-native vegetation is a concern. Monitor water levels in restored wetlands to determine if target hydrology is present.

5. **Presence of annual weeds**. Where annual weeds are present, mow seeded areas to 6-8 inch height with low ground-pressure mower to prevent any annual weeds present from going to seed.

6. **Vegetation characterization.** Characterize vegetation establishing in each wetland restoration area in June and August of each year to determine necessary management and establishment procedures. Vegetation characterization will include documenting all species present and the approximate areal coverage of each species by conducting meandering surveys within each wetland restoration area as described in Section 8.

7. **General weed control**. Continue treatments 1, 2, and 5 annually until reed canary grass, stinging nettle, Canada thistle and other non-native or invasive species are adequately controlled (see list in Section 5.1).

8. **Site specific treatment.** Spot spray wetland restoration areas two times annually to control reed canary grass and other perennial non-native or invasive species for up to 8 years in shrub communities, 20 years in bog and forested communities, and 5 years in other communities following initial restoration. Extensive treatments may not be needed after a sustainable wetland dominated by characteristic native vegetation is established such that the performance standards described in Section 5 are achieved.

9. **Weed control.** Conduct a spring burn in the sedge meadow and wet meadow communities after the second or third growing season to kill weed seed and promote germination of native plants, assuming that there is sufficient fuel for burning and assuming that there are no concerns with fire management due to climate conditions or potential for peat fires.

10. **Shallow and deep marsh weed control.** Should narrow-leaved cattails, hybrid cattails or other invasive, non-native emergent species become denser than described in the performance standards, control measures will be implemented. A herbicide approved for use over water may be wick-applied selectively to the species in need of control.

7.3.3 Seeding/Planting - Seasonally Flooded, Wet Meadow, Sedge Meadow, Shallow Marsh, Deep Marsh, Shrub Carr and Alder Thicket Communities

Diverse, native wetland vegetation is expected to develop in the restoration wetlands from the existing seedbank and from the wetland vegetation that surrounds the wetland restoration sites (both through vegetative propagation and through seed transport) or by other seed dispersal methods. At the end of the second growing season, a detailed assessment of seed bank re-establishment will be conducted within the wetland areas. Based upon the results of the assessment as per the performance standards in Section 5, areas that have not met the requirements will be seeded as follows:

1. **Sedge and wet meadow** areas that do not have adequate wetland vegetation cover or appropriate species established after the second full growing season will be seeded in the fall of the second full growing season with appropriate seed mixes. Seed mixes will be submitted for review and approval prior to seeding. Example seed mixes that may be considered are included in Appendix C.

2. **Shallow and deep marsh drawdown vegetation development.** Shallow and deep marsh communities that have not developed adequate species diversity and cover after the second full growing season may be drawn down to expose the soils and promote vegetation development.

3. **Emergent fringe seeding.** After the second full growing season, shallow and deep marsh fringe areas that have not had adequate wetland vegetation cover established will be drawn down to expose the soils and the emergent wetland fringe will be seeded with a mix similar to the Emergent Mixed Height seed mix provided in Appendix C at a rate of 5 lbs/acre.

4. **Shrub carr communities.** Shrub carr wetlands that do not meet the performance standards after the second full growing season will be planted with locally collected dormant cuttings of willow and dogwood species, which will be staked in the fall or spring at approximately 1 grouping of 3 stems per 400 square feet.

5. **Alder thicket communities.** Alder thicket wetlands that do not meet the performance standards by the end of the second full growing season will be seeded with alder seed. In addition, locally collected dormant cuttings of willow and dogwood species will be staked in the fall or spring at approximately 1 grouping of 3 stems per 1,000 square feet.

7.3.4 Hardwood and Coniferous Swamp

1. Surface preparation
    a. Existing vegetation will be removed from the site by mechanical removal or herbicide treatment.
    b. The peat surfaces will be lightly harrowed to loosen soil surface.
2. Herbaceous seeding
    a. Hardwood swamp communities will be seeded with lake sedge (*Carex lacustris*), manna grass (*Glyceria sp.*), Canada bluejoint grass (*Calamagrostis canadensis*), and marsh marigold (*Caltha palustris*) at an appropriate seeding rate (to be determined).
    b. Coniferous swamp communities will be seeded with lake sedge (*Carex lacustris*), manna grass (*Glyceria sp.*), and hop sedge (*Carex lupulina*), at an appropriate seeding rate (to be determined).
3. Tree Establishment
    a. The hardwood swamp communities will be planted with approximately 400 black ash seedlings/acre in a clumped distribution that will cover approximately 25 percent of each planned community area.
    b. Coniferous swamp communities will be established by direct seeding tamarack at a rate of 4 oz/acre. As tamarack seed does not exhibit dormancy it will be planted in the spring.
    c. If tree densities do not appear to be on a trajectory to meet the performance standards after the third full growing season, bare root seedlings of black ash (in the hardwood swamp communities) and tamarack (in the coniferous swamp communities) will be interplanted to achieve a stem density that exceeds that of the reference wetland by 25 percent in order to achieve the performance standards assuming 25 percent mortality

7.3.5 Open and Coniferous Bog – Restoration Methodology

The *Sphagnum* restoration methods planned for the PolyMet wetland mitigation sites have been largely planned based on methods presented in the Peatland Restoration Guide (Quinty and Rochefort, 2003). Numerous attempts were made to obtain information from bog restoration projects conducted in Minnesota by the Natural Resources Research Institute, however little information could be located. The study by Johnson, et al. (2000) to evaluate the effects of planting time, mulch application, and planting of companion *Carex* species on the establishment of *Sphagnum* mosses was evaluated and considered in the development of this plan.

1. Surface preparation
    a. Existing vegetation will be removed from the site by mechanical removal or herbicide treatment.
    b. Loose sod remnants and peat will be removed to form a smooth soil surface.

c. Where specified, a perimeter berm will be constructed surrounding the bog restoration areas.

2. Trees – Direct Seeding for Coniferous Bog
   a. Tamarack will be established by direct seeding at a rate of 4 oz/acre; as tamarack seed does not exhibit dormancy it will be planted in the spring prior to the *Sphagnum* fragment spreading.
   b. Black spruce will be direct seeded at 2 oz/acre (50,000 seeds) with a hand rotary seeder in the spring prior to *Sphagnum* fragment spreading. The seed will be mixed with sawdust or vermiculite to ensure a uniform seeding rate.
   c. If tree densities do not appear to be on a trajectory to meet the performance standards after the third full growing season, bare root seedlings of tamarack and black spruce will be interplanted to achieve a stem density that exceeds that of the reference wetland by 25 percent in order to achieve the performance standards assuming 25 percent mortality.

4. Sphagnum collection
   a. Based on current research, the appropriate amount of Sphagnum plant material needed for application at the restoration site, is the equivalent of what can be collected from an area approximately 1/10 the size of the restoration area.
   b. A suitable site or sites will be selected in the fall prior to harvesting and a detailed characterization of each collection site will be submitted to the Corps and MDNR for review and approval. Preliminary candidate sites include suitable areas of the project mine site and Site 8362 located near Floodwood (Figure 4). It is expected that the project mine site may be suitable for providing up to half of the donor Sphagnum, while the remainder may be collected at the Floodwood site. Additional potential donor sites located closer to the restoration sites will be evaluated prior to construction. Assuming that half of the donor material can be obtained from the project mine site, approximately an additional 20 acres of donor bog area will be utilized at the Floodwood site.
   c. Plant material will be collected in late fall, winter, or early spring before the frost has melted. Sphagnum fragments collected in late fall or winter will be stored over winter for use the following spring.
   d. The top 4-6 inches of the sphagnum surface will be shredded with a Rotovator or other equipment to shred surface vegetation. Shredded Sphagnum vegetation will be windrowed using a dozer or back-scraper and will be loaded in trucks using a front-end loader.
   e. The plant material will be transported to the restoration site and stockpiled close to the restoration area to minimize multiple hauls.

5. Sphagnum spreading
    a. The plant fragments will be spread over the bog restoration site with a standard box manure spreader, ideally in early spring over frozen ground.
    b. The restoration site soil surfaces will be covered with a uniform 1 – 5 cm thick, fluffy layer of plant fragments.

6. Straw spreading
    a. Clean, fresh, straw mulch will be applied over plant fragments as soon as possible after plant spreading (the same day) to improve growing conditions for plant fragments by creating a wetter and cooler air layer at the peat surface.
    b. Attempts will be made to utilize equipment that allows straw to be spread without traveling on top of plant fragments, such as a sideways straw bale spreader with a mulch pass made after plant spreading from adjacent areas not yet completed.
    c. Straw application rate: 2,500 lbs/ac, 10 to 12 - 4 foot diameter round bales or 7 to 8 - 5 foot diameter round bales per acre.

7. Fertilizer application
    a. Slow-release phosphate rock fertilizer (P_2O_5) will be applied to approximately one-half of the bog restoration areas with a conic spreader at 17.5 pounds/acre available phosphate to provide adequate nutrients to favor a rapid establishment of the sphagnum mat. Since current research is not conclusive regarding the benefits of fertilizer, it will only be applied to one-half of the bog restoration areas at the Aitkin site to determine the effectiveness of this treatment and the potential for deleterious effects of promoting invasive vegetation establishment. The fertilization plan for the bog restoration at the Hinckley site will be determined based on the results observed at the Aitkin site.
    b. Equipment that allows fertilizer to be spread by traveling on top of plant fragments and straw mulch will be used, such as with a conic spreader pulled behind an all terrain vehicle, after mulch spreading has been completed.

8. Shrubs for Open and Coniferous Bog
    a. Shrub species will be planted as bare root in the fifth year if volunteer shrub densities do not meet the performance criteria after the fourth full growing season. Target shrub species in the open bog communities will include bog rosemary (*Andromeda glaucophylla*), creeping snowberry (*Gaultheria hispidula*), and small cranberry (*Vaccinium oxycoccus*). Target shrub species in the coniferous bog communities will include leatherleaf (*Chamaedaphne calyculata*), bog laurel

(*Kalmia polifolia*), Labrador tea (*Ledum groenlandicum*), creeping snowberry and small cranberry.

7.3.6 Upland Area Management

Vegetation in the existing upland areas will be managed to promote natural succession of the existing plant communities. Each of the plant cover layers – ground, shrub and tree layers – will be managed to promote the ecological integrity and function of native plant communities. The primary maintenance activity will be control of non-native invasive species such as, but not limited to buckthorn, honeysuckle and garlic mustard. Protecting the site from further disturbances and allowing natural colonization and successional processes will maintain ecosystem biodiversity and structure.

Maintenance activities will include:

- Monitoring sites to identify and anticipate problems with invasive species before they reach problem proportions. Particular attention will be paid to edges of the upland sites.
- Removing or treating with appropriate herbicides all non-native or invasive plant species when found; timing/season of treatment will be based upon best practices for control of the species.
- Seeding or planting of appropriate native species based on the target communities.

8.0 Wetland Restoration and Management Schedule

The following schedule represents a preliminary plan of the expected activities that may be involved in restoring wetlands at the Hinckley and Aitkin sites. However, with an adaptive management perspective, it should be recognized that the timing of specific establishment and management activities are likely to change as the restoration work progresses. The overall schedule for restoration activities at the Hinckley and Aitkin sites is to complete the restoration work within the first 4 years of the project. Within the first year after permit issuance, the Year 1 restoration work will be completed within the Aitkin site. Within 2 to 3 years after permit issuance, the Year 1 restoration work will be completed within the northern half of the Hinckley site, including all areas that ultimately discharge from the east side of the site. The Year 1 restoration activities within the southern half of the Hinckley site will be completed within 4 years after permit issuance. The remaining restoration activities will generally follow the conceptual schedule provided below.

The wetlands restored as mitigation for the PolyMet project will require regular management to become established. This is critical in the first five to ten years and should be recognized as integral to the wetland mitigation success. Management will include both eliminating non-native and invasive species, creating ideal conditions for the native plants to flourish, and seeding/planting to supplement natural regeneration. Weeds can establish quickly as the wetlands develop because the ground is bare at the time of restoration. Some weeds are very aggressive and will out-compete the desirable wetland seedlings. Therefore, weed removal and careful monitoring is important during the early stages of the restoration. As native plants grow and spread over the years, and as thatch builds, the site will become less vulnerable to weed species. Removal of weeds does continue to be important during the first five to ten years to ensure that the native plant communities become established. Structures constructed to control hydrology within the restoration areas will be inspected annually during the 20 year monitoring period established and repairs will be made to maintain the goals of the plan. After final certification of the restored wetlands by the appropriate regulatory agencies, the land owner of each site will be required by the *Permanent Conservation Easements* that will be recorded after completion of construction (examples provided in Appendix F), to regularly inspect and maintain those structures to sustain the goals of the approved plan.

8.1 Year 1

8.1.1 Fall/Winter

1. Remove existing sod from restoration areas and apply herbicide to areas where undesirable natural regeneration has begun.

2. Construct berms (around bog areas and excluded homestead area at Aitkin site) and fill ditches as shown on the plans.

3. Complete hydrologic restoration construction as described in Sections 7.1 and 7.2 and as shown on the wetland restoration plans.

4. Spray Sethoxydim (grass-selective) and Transline (broad-leaf) herbicides on dikes and dike slopes adjacent to restoration areas.

5. Seed dike and dike slopes with BWSR Berm Mix No. 2.

6. Spray restoration fields containing at least 20 percent areal coverage of non-native or invasive grass species with Sethoxydim.

7. Seed herbaceous species as described in Sections 7.3.3 and 7.3.4.

8. Harvest sphagnum material and store at site as described in Section 7.3.5.

8.1.2 Spring/Summer

1. Monitor water levels in restored wetlands.

2. Seed tamarack, black spruce, and plant black ash during late winter/early spring in appropriate communities as described in Sections 7.3.4 and 7.3.5.

3. Prepare soil surface in planned bog communities so that it is smooth and firm. Distribute sphagnum in late winter/early spring followed immediately by mulch and fertilizer application.

4. Characterize vegetation in restoration areas in June and August followed by development of specific management objectives for the remainder of the year based on the findings.

5. Mow seasonally flooded, sedge meadow, and wet meadow wetlands in spring if annual weeds are present.

6. Apply grass-selective and broad-leaf herbicide to dikes and dike slopes where non-native or invasive species are present.

7. Spot spray wetland restoration areas to eliminate non-native or invasive species.

8.2 Year 2

8.2.1 Fall – End of First Full Growing Season

1. Complete monitoring report, including documentation of wetland establishment activities completed during the previous year conducted in comparison to the plan and recommended actions for the following year.

2. Monitor water levels in restored wetlands.

3. Apply herbicides as necessary to control non-native and invasive species in all communities.

8.2.2 Spring/Summer

1. Monitor water levels in restored wetlands.

2. Spray grass-selective and broad-leaf herbicides (typically in early June) on dikes and dike slopes adjacent to restoration areas where non-native or invasive grass and forb species are present before seed production is complete.

3. Characterize vegetation in restoration areas in June and August followed by development of specific management objectives for the remainder of the year based on the findings.

4. Spot spray or wick-apply wetland restoration areas with Rodeo or other appropriate herbicide to eliminate non-native or invasive species.

5. Mow seasonally flooded, sedge meadow, and wet meadow wetlands if annual weeds are present prior to seed production.

8.3 Year 3

8.3.1 Fall – End of Second Full Growing Season

1. Complete monitoring report, including documentation of wetland establishment activities completed during the previous year conducted in comparison to the plan and recommended actions for the following year. Make recommendations for permanent water level control adjustments that may be needed for restored wetlands to better promote vegetation development that meets performance standards.

2. Monitor water levels in restored wetlands.

3. Apply herbicides as necessary to control non-native and invasive species in all communities.

4. If shrub development does not conform to performance standards, conduct shrub staking or seeding.

5. If species diversity or vegetative cover development in sedge meadow or wet meadow communities does not conform to performance standards, conduct seeding.

6. If marsh communities do not meet performance standards, draw down water levels and seed fringe areas.

8.3.2 Spring/Summer

1. Monitor water levels in wetlands.

2. Spray grass-selective and broad-leaf herbicides (typically in early June) on dikes and dike slopes adjacent to restoration areas where non-native or invasive grass and forb species are present before seed production is complete, reseed if bare soils are present.

3. If shrub development does not conform to performance standards, conduct shrub staking or seeding.

4. Characterize vegetation in restoration areas in June and August followed by development of specific management objectives for the remainder of the year based on the findings.

5. Spot spray or wick-apply wetland restoration areas with Rodeo to eliminate non-native or invasive species.

6. If non-native or invasive species are present in the sedge meadow or wet meadow communities, conduct a spring burn.

8.4 Years 4-5

Many of the management activities described for Year 3 will be continued in Years 4 and 5 along with the monitoring activities. If tree development in hardwood swamp, coniferous swamp, and coniferous bog communities does not conform with performance standards, seedlings will be planted as described in Sections 7.3.4 and 7.3.5. If shrub development in coniferous and open bog communities does not conform with performance standards, shrub seedlings will be planted as described in Section 7.3.5. The monitoring report completed after the fifth growing season will assess whether or not restored, wetland communities (with the exception of shrub, forested, and bog communities) are in conformance with performance standards such that the 5-year monitoring would be sufficiently complete.

8.5 Years 6-20

Because establishment of shrub, forested, and bog wetland communities can take longer, active management and monitoring will be conducted for eight years within shrub communities and twenty years in forested and bog communities. Many of the management activities described for Years 4-5 will be continued in Years 6-20 along with the monitoring activities.

9.0 Wetland Mitigation Monitoring

The wetland restoration area will be monitored for at least five years (eight years for shrub communities and twenty years for forest and bog communities) beginning in the first full growing season after beginning hydrologic restoration to document the progress and condition of the wetland communities at the mitigation sites. For wetlands other than shrub, forest, and bog communities, monitoring reports will be prepared each year in years 1 through 5 following construction. For shrub communities, monitoring reports will be prepared and submitted in years 1, 2, 3, 5, and 8 following construction. For forested and bog communities, monitoring reports will be prepared and submitted in years 1, 2, 3, 5, 10, and 20 following construction. The monitoring report completed after the final growing season will assess whether or not the restored wetlands are in conformance with performance standards. Future wetland mitigation plans will be submitted for review and approval to address mitigation wetlands that are not in conformance with the performance standards.

Hydrologic parameters will be evaluated in the mitigation areas more intensively during the first two years and then at a level appropriate to the hydrologic characteristics of each area thereafter. Any significant modifications to the monitoring frequency proposed herein will be described in a revised monitoring plan to be submitted for review and approval prior to implementation. In addition to monitoring the restored wetlands, one reference wetland of each wetland restoration community type (if available) will be monitored within the general area of the restoration site, in areas with relatively natural hydrologic conditions. A monitoring plan will be submitted for review and approval that will include proposed locations of reference wetlands prior to implementing the monitoring program. Continuous recording wells will be utilized to the extent feasible.

9.1 Hydrologic Monitoring Years 1-2

9.1.1 Shallow Marsh, Deep Marsh, and Open Water Communities

Hydrologic monitoring in these inundated wetland communities will be conducted using staff gages placed within each restored wetland area. Water elevations will be recorded once per week during the first 10 weeks of the growing season and twice monthly through the remainder of the growing season.

9.1.2 All Other Communities

Hydrologic monitoring in these generally saturated wetland communities will be conducted using shallow wells placed within each restored wetland area. Water elevations will be recorded once per

week during the first 10 weeks of the growing season and twice monthly through the remainder of the growing season.

9.2 Hydrologic Monitoring Years 3-20

9.2.1 Shallow Marsh; Deep Marsh; and Shallow, Open Water Communities

If the monitoring conducted during Years 1-2 indicate a stable and consistent hydrologic regime similar to the reference wetlands, water elevations will be recorded monthly throughout the growing season during Years 3-5. In wetlands where water elevation fluctuations differ substantially from the reference wetlands, water elevations will be recorded once per week during the first 10 weeks of the growing season and twice monthly through the remainder of the growing season during Years 3-5.

9.2.2 All Other Communities

If the monitoring conducted during Years 1-2 indicate a stable and consistent hydrologic regime similar to the reference wetlands, water elevations will be recorded once per week during the first 6 weeks of the growing season and monthly throughout the remainder of the growing season during Years 3-5 for sedge and wet meadow communities and Years 3-8 for the shrub, forest, and bog communities.

In wetlands where water elevation fluctuations differ substantially from the reference wetlands, water elevations will be recorded once per week during the first 10 weeks of the growing season and twice monthly through the remainder of the growing season during Years 3-5 for sedge and wet meadow communities and Years 3-8 for shrub, forest, and bog communities. Hydrologic monitoring in the forested and bog communities will continue in years 9-20 utilizing recording wells with water levels recorded approximately once every 4 hours during the growing season and downloaded approximately once per month.

9.3 Vegetation Monitoring

A detailed vegetation survey will be conducted once per year (typically August) in each wetland mitigation community, as well as the reference wetland communities, to evaluate the success of the restoration during the appropriate monitoring period for each community type. A time meander search will randomly sample 20 percent of each wetland restoration community with the exception of the deep marsh and open water communities. Vegetation monitoring within the submergent zones of deep marsh and open water communities will be conducted from 1-2 representative locations within each community using the hook/rake method. This sampling method involves anchoring a boat at the sampling location, throwing a hook or rake in each of 4 directions from the sampling location and

dragging the hook approximately 2 meters across the bottom to gather vegetation. Each species and density of plant growth will be documented for each throw and that data will be averaged for the 4 throws at each sampling location. Documentation photographs will also be taken in August from fixed reference points around each restored wetland area.

9.4 Monitoring Report

A monitoring report will be prepared annually during the 5-year monitoring period for all except the shrub, forested, and bog communities. Annual monitoring reports will be prepared following growing seasons 1, 2, 3, 5, and 8 following restoration for the shrub communities and following growing seasons 1, 2, 3, 5, 10, and 20 for the forested and bog communities. The report will describe the status of the wetland mitigation, summarize the results of the vegetative and hydrologic monitoring, and discuss management activities and corrective actions conducted during the previous year, and activities planned for the following year. The report will be submitted to the MDNR and Corps by December 31 of each year. The annual report will include the following information at a minimum:

- A brief description of the wetland mitigation area, including location, size, vegetative and hydrologic monitoring data, current wetland types and desired wetland types.

- Preparation of an as-built survey within the first year after construction is complete along with a comparison of the as-built survey to the approved plans. This as-built survey will be prepared upon the completion of establishing the permanent overflow structures, which may not be completed during the first year.

- A summary of water level measurements taken to date and a determination whether the hydrology in the wetlands meets the design elevations and wetland hydrology criteria as defined in the performance standards.

- Vegetation survey information, including species and percent areal coverage within each restored wetland community and a determination of whether the vegetation meets the performance criteria.

- A map of the various plant communities present within the restoration areas will be prepared as distinctly different communities develop.

- Color photographs of the wetland mitigation sites taken in August of each year at designated photo-reference points.

- A summary of management activities and/or corrective actions conducted in the wetlands during the previous year and activities planned for the following year.

10.0 References

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Tables

Table 1: Summary of Total Project Wetland Impacts and Mitigation
by Eggers and Reed Classification
January 15, 2008
PolyMet Mining Company

Wetland Type	Aitkin Wetland Mitigation Area (acres)	Hinckley Wetland Mitigation Area (acres)	On-Site Wetland Mitigation (acres)	Wetland Mitigation Total (acres)	Proposed Project Wetland Impacts (acres)	Proposed 5-Year Wetland Impacts (acres)	Total Wetland Impacts Compensated[1] (ac)
Deepwater					0.5	0.5	0.0
Type 1 Seasonally Flooded	0.0	20.1	0.0	20.1	0.0	0.0	13.4
Type 2 Fresh (Wet) Meadow	21.8	14.3	25.0	61.1	14.6	14.6	42.7
Type 2 Sedge Meadow[2]	47.1	39.9	0.0	87.0	28.1	26.8	61.7
Type 3 Shallow Marsh	86.9	1.4	60.0	148.3	25.6	21.1	102.3
Type 4 Deep Marsh	33.6	0.0	50.0	83.6	0.2	0.2	55.8
Type 5 Shallow, Open Water	0.0	0.0	10.0	10.0	0.05	0.05	6.7
Type 6 Shrub-Carr	83.9	87.1	0.0	171.0	9.1	9.1	115.2
Type 6 Alder Thicket	82.8	27.4	30.0	140.2	66.9	61.2	102.4
Type 7 Hardwood Swamp[3]	52.6	13.2	0.0	65.8	20.1	15.0	46.5
Type 7 Coniferous Swamp	89.1	8.4	0.0	97.5	63.1	63.1	73.4
Type 8 Open Bog	74.2	0.0	0.0	74.2	76.1	45.6	59.4
Type 8 Coniferous Bog	238.2	101.2	0.0	339.4	549.7	444.6	271.5
Upland Buffer	123.1	79.2	0.0	202.3			50.6
Upland Total	**123.1**	**79.2**	**0.0**	**202.3**			**50.6**
Wetland Total	**810.2**	**313.0**	**175.0**	**1298.2**	**854.1**	**701.8**	**951.0**
Total	**933.3**	**392.2**	**175.0**	**1500.5**	**854.1**	**701.8**	**1001.5**

[1] Assumes 1.25:1 replacement for the same wetland types and 1.5:1 for different types.

[2] The total restoration area includes 0.8 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

[3] The total restoration area includes 6.1 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

Table 2: Total Project Wetland Impact Detail
Revised November 26, 2007
NorthMet Mine/PolyMet Mining Co.

Project Area	Wetland ID	Dominant Circular 39 Type	Total Wetland Area (acres)	Projected Direct Wetland Impacts (acres)	Projected Indirect Wetland Impacts (acres)	Dominant Community Type	Vegetative Diversity/ Integrity	Overall Wetland Quality	Disturbance Level	Disturbance Type	Wetland Origin	Field Delineated	Impact Type (Direct/Indirect)
Mine Site	1	3	0.42	0.00	0.00	shallow marsh	Moderate	Moderate	High	Impounded	Natural	Y	Direct
Mine Site	3	3	0.35	0.00	0.00	shallow marsh	Moderate	Moderate	High	Impounded	Natural	N	Direct
Mine Site	5	2	0.61	0.61	0.00	wet meadow	High	High	Low		Natural	Y	Direct
Mine Site	6	3	0.62	0.00	0.00	shallow marsh	Moderate	Moderate	High	Impounded	Natural	Y	Direct
Mine Site	7	2	0.07	0.00	0.00	wet meadow	Moderate	Moderate	High	Impounded	Natural	N	Direct
Mine Site	8	2	6.16	4.87	1.29	sedge meadow	Moderate	Moderate	High	Impounded/Fill	Natural	Y	Direct/Indirect
Mine Site	9	3	1.84	0.04	0.00	shallow marsh	High	High	Moderate	Impounded	Natural	Y	Direct
Mine Site	10	2	1.17	0.00	0.00	sedge meadow	High	High	Low		Natural	Y	Direct
Mine Site	11	8	8.88	0.00	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	12	6	227.92	0.00	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	13	2	5.03	0.19	0.00	wet meadow	High	High	High	Impounded	Natural	Y	Direct
Mine Site	14	2	0.33	0.33	0.00	wet meadow	High	High	Low		Natural	Y	Direct
Mine Site	15	8	2.79	0.00	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	16	3	0.31	0.11	0.00	shallow marsh	High	High	Low		Natural	Y	Direct
Mine Site	18	3	18.89	18.89	0.00	shallow marsh	High	High	Moderate	Impounded	Natural	Y	Direct
Mine Site	19	3	1.68	1.68	0.00	shallow marsh	High	High	Low		Natural	Y	Direct
Mine Site	20	2	21.89	21.07	0.82	sedge meadow	High	High	Low		Natural	N	Direct/Indirect
Mine Site	22	3	8.71	0.00	0.00	shallow marsh	High	High	Low		Natural	Y	Direct
Mine Site	24	6	0.80	0.80	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	25	8	1.95	0.00	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	27	8	1.07	1.07	0.00	black spruce bog	Moderate	Moderate	High	Road Fill	Natural	Y	Direct
Mine Site	29	3	12.01	2.34	0.00	shallow marsh	High	High	Low		Natural	Y	Direct
Mine Site	32	8	69.89	64.40	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	33	6	23.91	7.41	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	34	6	0.99	0.99	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	37	6	2.39	2.39	0.00	shrub carr	High	High	Low		Natural	N	Direct
Mine Site	43	6	8.33	8.08	0.22	alder thicket	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	44	6	3.27	1.98	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	45	6	30.58	16.89	5.17	alder thicket	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	47	8	0.54	0.54	0.00	open bog	High	High	Low		Natural	Y	Direct
Mine Site	48	8	98.45	38.74	18.17	cedar bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	51	6	2.91	2.91	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	52	6	3.88	3.88	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	53	6	132.33	2.68	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	54	6	10.24	0.00	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	55	6	3.91	3.91	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	56	8	2.79	0.00	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	57	7	83.83	54.70	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site	58	6	33.28	0.00	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	60	6	5.95	5.95	0.00	alder thicket	High	High	Low		Natural	Y	Direct
Mine Site	61	7	0.45	0.00	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site	62	8	12.13	0.00	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	64	7	0.31	0.00	0.00	forested swamp	High	High	Low		Natural	N	Direct
Mine Site	68	7	20.05	7.55	0.00	forested swamp	High	High	Low		Natural	N	Direct
Mine Site	72	7	1.38	0.59	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site	74	7	6.12	6.12	0.00	hardwood swamp	High	High	Low		Natural	Y	Direct
Mine Site	76	8	3.38	2.42	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	77	8	13.00	7.86	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	78	8	0.81	0.81	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	79	8	2.39	0.00	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	80	8	0.29	0.29	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	81	7	1.68	1.68	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site	82	8	61.52	58.31	3.11	coniferous bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	83	8	21.78	3.69	0.00	open bog	High	High	Low		Natural	Y	Direct
Mine Site	84	8	8.76	1.33	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	85	8	1.41	1.41	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	86	8	2.47	2.47	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	88	8	5.57	4.96	0.61	coniferous bog	High	High	Low		Natural	N	Direct/Indirect
Mine Site	90	8	189.35	70.13	5.42	open bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	95	8	2.54	2.54	0.00	black spruce bog	High	High	Low		Natural	N	Direct
Mine Site	96	8	17.29	15.34	1.95	black spruce bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	97	8	3.53	0.75	2.78	black spruce bog	High	High	Low		Natural	N	Direct/Indirect

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Mine Site	98	8	15.49	15.49	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	99	8	1.40	0.55	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	100	8	605.59	119.24	1.53	coniferous bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	101	8	15.09	7.18	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	103	8	125.89	106.88	19.01	tamarack bog	High	High	Low		Natural	Y	Direct/Indirect
Mine Site	104	8	3.57	3.57	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	105	8	19.80	0.00	0.00	black spruce bog	High	High	Moderate	Logged	Natural	Y	Direct
Mine Site	107	8	65.80	42.51	0.00	black spruce bog	High	High	Low		Natural	Y	Direct
Mine Site	109	6	6.03	6.03	0.00	alder thicket	High	High	Low	Partly cleared	Natural	Y	Direct
Mine Site	114	8	89.76	0.73	0.00	coniferous bog	High	High	Low		Natural	Y	Direct
Mine Site	120	3	0.58	0.58	0.00	shallow marsh	Moderate	Moderate	Moderate	Impounded	Natural	Y	Direct
Mine Site	200	7	7.26	6.36	0.00	hardwood swamp	High	High	Low		Natural	Y	Direct
Mine Site	201	2	13.48	13.48	0.00	wet meadow	High	High	Low		Natural	Y	Direct
Mine Site	202	7	242.30	5.67	0.00	coniferous swamp	High	High	Low		Natural	Y	Direct
Mine Site Subtotal	**59**		**2,429**	**784.0**	**60.1**		**56/59 High 3/59 Moderate**	**56/59 High 3/59 Moderate**					
Railroad	R-1	2	1.05	0.00	0.00	wet meadow	High	High	Moderate	Road fill	Natural		
Railroad	R-2	3	1.65	0.00	0.00	shallow marsh	High	High	Moderate	Road fill	Natural		
Railroad	R-3	7	0.63	0.10	0.00	hardwood swamp	High	High	Moderate	Road fill	Natural		
Railroad	R-4	6	3.50	0.17	0.00	shrub carr	High	High	Low		Natural		
Railroad	R-5	3	24.41	0.00	0.00	shallow marsh	High	High	Moderate	Impounded	Natural		
Railroad	R-6	3	10.42	0.00	0.00	shallow marsh	High	High	Low		Natural		
Railroad	R-7	6	12.14	0.00	0.00	shrub carr	High	High	Moderate	Impounded	Natural		
Railroad	R-8	6	3.00	0.00	0.00	shrub carr	High	High	Moderate	Impounded	Natural		
Railroad Subtotal	**8**		**56.80**	**0.3**	**0.00**		**2/2 High**	**2/2 High**					
Tailings Basin Drain System				0.0	0.0							N	
Tailings Basin Subtotal				**0.0**	**0.0**								
Dunka Road & Water Pipeline	4000	3		0.78	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4001	3		0.45	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4002	3		0.30	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4003	3		0.47	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4004	3		0.01	0.00	shallow marsh	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4005	4		0.25	0.00	deep marsh	Moderate	Moderate	Moderate	impounded	Natural	Y	Direct
Dunka Road & Water Pipeline	4006	5		0.05	0.00	open water	Moderate	Moderate	Moderate	impounded	Natural	Y	Direct
Dunka Road & Water Pipeline	4007	6		0.88	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4008	6		1.28	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4009	6		0.03	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4010	6		0.68	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4011	6		1.27	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4012	6		0.06	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4013	6		0.92	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4014	6		0.29	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct

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Dunka Road & Water Pipeline	4015	6		0.19	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4016	6		0.48	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4017	6		0.04	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4018	6		0.20	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4019	6		0.27	0.00	shrub carr	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4021	7		0.45	0.00	coniferous swamp	High	HIgh	Low		Natural	Y	Direct
Dunka Road & Water Pipeline	4023	deepwater		0.45	0.00	deepwater	High	HIgh	Low		Natural	Y	Direct
Water Pipeline Subtotal				**9.8**	0.00		**20/22 High 2/22 Moderate**	**20/22 High 2/22 Moderate**					
Project Total			**2486.0**	**794.0**	**60.1**								

Table 3: Summary of Total Project Wetland Impacts by Eggers & Reed Type [1]
Revised November 26, 2007
NorthMet Mine/PolyMet Mining Inc.

Project Area	Circular 39	1	2	2	3	4	5	6	6	7	7	8	8	
	Eggers and Reed Wetland Classification	**Deepwater**	**Fresh (Wet) Meadow**	**Sedge Meadow**	**Shallow Marsh**	**Deep Marsh**	**Shallow, Open Water**	**Shrub-Carr**	**Alder Thicket**	**Hardwood Swamp**	**Coniferous Swamp**	**Open Bog**	**Coniferous Bog**	**Wetland Total**
Mine Site	Direct (acres)	0.0	14.6	25.9	23.6	0.0	0.0	2.4	61.5	20.0	62.6	70.7	502.5	784.0
	Indirect (acres)	0.0	0.0	2.1	0.0	0.0	0.0	0.0	5.4	0.0	0.0	5.4	47.2	60.1
	Total (acres)	0.0	14.6	28.1	23.6	0.0	0.0	2.4	66.9	20.0	62.6	76.1	549.7	844.1
	# wetlands	0	1	16	1	0	0	4	2	6	1	2	26	59
Raillroad	(acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.10	0.00	0.00	0.00	0.3
	# wetlands	0	0	0	0	0	0	1	0	1	0	0	0	2
Tailings Basin Drain System	(acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	# wetlands													
Dunka Road/Water Pipeline	(acres)	0.5	0.0	0.0	2.0	0.2	0.05	6.6	0.0	0.0	0.4	0.0	0.0	9.8
	# wetlands	1	0	0	4	1	1	13	0	0	1	0	0	21
Total	(acres)	0.5	14.6	28.1	25.6	0.2	0.05	9.1	66.9	20.1	63.1	76.1	549.7	854.1

Table 4: Summary of 5-Year Wetland Impacts and Mitigation
by Eggers and Reed Classification[1]
November 26, 2007
PolyMet Mining Company

Wetland Type	Aitkin Wetland Mitigation Area (acres)	Hinckley Wetland Mitigation Area (acres)	Wetland Mitigation Total (acres)	Proposed Project Wetland Impacts (acres)	Proposed 5-Year Wetland Impacts (acres)	5-Year Wetland Impacts Compensated[2] (acres)
Deepwater	0.0	0.0	0.0	0.5	0.5	0.0
Type 1 Seasonally Flooded	0.0	0.0	0.0	0.0	0.0	0.0
Type 2 Fresh (Wet) Meadow	21.8	14.3	36.1	14.6	14.6	26.0
Type 2 Sedge Meadow[3]	47.1	5.4	52.5	28.1	26.8	38.7
Type 3 Shallow Marsh	86.9	0.0	86.9	25.6	21.1	61.4
Type 4 Deep Marsh	33.6	0.0	33.6	0.2	0.2	22.4
Type 5 Shallow, Open Water	0.0	0.0	0.0	0.05	0.05	0.0
Type 6 Shrub-Carr	83.9	38.9	122.8	9.1	9.1	83.1
Type 6 Alder Thicket	82.8	27.4	110.2	66.9	61.2	82.4
Type 7 Hardwood Swamp[4]	52.6	0.0	52.6	20.1	15.0	37.8
Type 7 Coniferous Swamp	89.1	0.0	89.1	63.1	63.1	67.8
Type 8 Open Bog	74.2	0.0	74.2	79.8	45.6	59.4
Type 8 Coniferous Bog	238.2	101.2	339.4	546.0	444.6	271.5
Upland Buffer	123.1	11.4	134.5			33.6
Upland Total	**123.1**	**11.4**	**134.5**			**33.6**
Wetland Total	**810.2**	**187.2**	**997.4**	**854.1**	**701.8**	**750.5**
Total	**933.3**	**198.6**	**1131.9**	**854.1**	**701.8**	**784.1**

[1] Assumes restoration of the entire Aitkin site and the northern half of the Hinckley site within the first 5 years of the project.

[2] Assumes 1.25:1 replacement for the same wetland types and 1.5:1 for different types.

[3] The total restoration area includes 0.8 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

[4] The total restoration area includes 6.1 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

Table 5: Summary of 5-Year Project Wetland Impacts by Eggers & Reed Type [1]
Revised November 26, 2007
NorthMet Mine/PolyMet Mining Inc.

Project Area	Circular 39	1	2	2	3	4	5	6	6	7	7	8	8	
	Eggers and Reed Wetland Classification	**Deepwater**	**Fresh (Wet) Meadow**	**Sedge Meadow**	**Shallow Marsh**	**Deep Marsh**	**Shallow, Open Water**	**Shrub-Carr**	**Alder Thicket**	**Hardwood Swamp**	**Coniferous Swamp**	**Open Bog**	**Coniferous Bog**	**Wetland Total**
Mine Site	Direct (acres)	0.0	14.6	26.8	19.1	0.0	0.0	2.4	61.2	14.9	62.6	45.6	444.6	691.7
	Indirect (acres)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total (acres)	0.0	14.6	26.8	19.1	0.0	0.0	2.4	61.2	14.9	62.6	45.6	444.6	691.7
	# wetlands	0	4	2	8	0	0	1	15	3	6	5	28	72
Raillroad	(acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.10	0.00	0.00	0.00	0.3
	# wetlands	0	0	0	0	0	0	1	0	1	0	0	0	2
Tailings Basin Drain System	(acres)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	# wetlands													
Dunka Road/Water Pipeline	(acres)	0.5	0.0	0.0	2.0	0.2	0.05	6.6	0.0	0.0	0.4	0.0	0.0	9.8
	# wetlands	1	0	0	5	1	1	13	0	0	1	0	0	22
Total	(acres)	0.5	14.6	26.8	21.1	0.2	0.05	9.1	61.2	15.0	63.1	45.6	444.6	701.8

Table 6: Summary of Off-Site Wetland Mitigation
January 15, 2008
PolyMet Mining Company

Wetland Type	Aitkin Wetland Mitigation Area (acres)	Hinckley Wetland Mitigation Area (acres)	Off-Site Wetland Mitigation Total (acres)	Proposed Project Wetland Impacts (acres)	Total Wetland Impacts Compensated[1] (ac)
Deepwater				0.5	0.0
Type 1 Seasonally Flooded	0	20.1	20.1	0.0	13.4
Type 2 Fresh (Wet) Meadow	21.8	14.3	36.1	14.6	26.0
Type 2 Sedge Meadow[2]	47.1	39.9	87.0	28.1	61.7
Type 3 Shallow Marsh	86.9	1.4	88.3	25.6	62.3
Type 4 Deep Marsh	33.6	0.0	33.6	0.2	22.4
Type 5 Shallow, Open Water	0.0	0.0	0.0	0.05	0.0
Type 6 Shrub-Carr	83.9	87.1	171.0	9.1	115.2
Type 6 Alder Thicket	82.8	27.4	110.2	66.9	82.4
Type 7 Hardwood Swamp[3]	52.6	13.2	65.8	20.1	46.5
Type 7 Coniferous Swamp	89.1	8.4	97.5	63.1	73.4
Type 8 Open Bog	74.2	0.0	74.2	76.1	59.4
Type 8 Coniferous Bog	238.2	101.2	339.4	549.7	271.5
Upland Buffer	123.1	79.2	202.3		50.6
Upland Total	**123.1**	**79.2**	**202.3**		**50.6**
Wetland Total	**810.2**	**313.0**	**1123.2**	**854.1**	**834.3**
Total	**933.3**	**392.2**	**1325.5**	**854.1**	**884.9**

[1] Assumes 1.25:1 replacement for the same wetland types and 1.5:1 for different types.

[2] The total restoration area includes 0.8 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

[3] The total restoration area includes 6.1 acres of partially drained wetland at Hinckley, credited at 50 percent of the area.

Table 7: Wetland Mitigation Target Community Summary
PolyMet Mining Company

Restoration Area ID	Area (acres)	Circ 39 Wetland Type	Eggers & Reed Classification
Aitkin Wetland Restoration Site			
1	21.6	Type 4	Deep Marsh
2	36.2	Type 3	Shallow Marsh
3	47.1	Type 2	Sedge Meadow
4	14.7	Type 2	Wet Meadow
5	23.4		Upland
6	55.6	Type 6	Alder Thicket
7	74.2	Type 8	Open Bog
8	83.9	Type 6	Shrub Carr
9	238.2	Type 8	Coniferous Bog
10	23.1		Upland
11	7.1	Type 2	Wet Meadow
12	89.1	Type 7	Coniferous Swamp
13	71.4		Upland
14	12.0	Type 4	Deep Marsh
15	50.7	Type 3	Shallow Marsh
16	52.6	Type 7	Hardwood Swamp
17	27.2	Type 6	Alder Thicket
18	1.4		Upland
19	3.8		Upland
Hinckley Wetland Restoration Site			
1	21.1	Type 6	Shrub Carr
2	4.2		Upland
3	27.4	Type 6	Alder Thicket
4	5.4		Upland
5	14.3	Type 2	Wet Meadow
6	101.2	Type 8	Coniferous Bog
7	1.7		Upland
8	5.4	Type 2	Sedge Meadow
9	44.1	Type 6	Shrub Carr
10	22.2	Type 2	Sedge Meadow
11	10.1	Type 7	Hardwood Swamp
12	8.4	Type 7	Coniferous Swamp
13	9.7		Upland
14	23.0		Upland
15	1.4	Type 3	Shallow Marsh
16	20.1	Type 1	Seasonally Flooded
17	3.9		Upland
18	15.7		Upland
19[1]	3.1	Type 7	Hardwood Swamp
20[1]	0.4	Type 2	Sedge Meadow
21	4.1	Type 6	Shrub Carr
22	11.9	Type 2	Sedge Meadow
23	15.6		Upland
24	12.3	Type 6	Shrub Carr
25	5.5	Type 6	Shrub Carr
Upland Total	202.3		
Wetland Total	1123.2		

[1] Area shown is the 50 percent credit proposed for restoring existing, partially drained wetland.

Table 8: Wetland Mitigation Target Hydrology
PolyMet Mining Company

Circular 39	Eggers and Reed Wetland Classification	Target Hydrology (inches)	Target Hydroperiod (days)[1]	Storm Event Flooding Tolerance (depth in./days)[2]
1	Seasonally Flooded	24 to -12	>15	30/45
2	Fresh (Wet) Meadow	0 to -6	>60	12/15
2	Sedge Meadow	3 to -6	>120	6/7
3	Shallow Marsh	0 to 6	>60	18/30
4	Deep Marsh	6 to 36	>140	48/30
6	Shrub-Carr	6 to -6	>30	12/15
6	Alder Thicket	6 to -6	>30	12/15
7	Hardwood Swamp	0 to -6	>60	12/30
7	Coniferous Swamp	0 to -6	>60	6/30
8	Open Bog	0 to -6	>90	6/30
8	Coniferous Bog	0 to -6	>90	6/30

[1]Time during the growing season, under normal conditions, in which target hydrology is present
[2]Water depth tolerance in response to 10-year return period storm event

Table 9: Berm and Dike Upland Seed Mix
PolyMet Mining Company

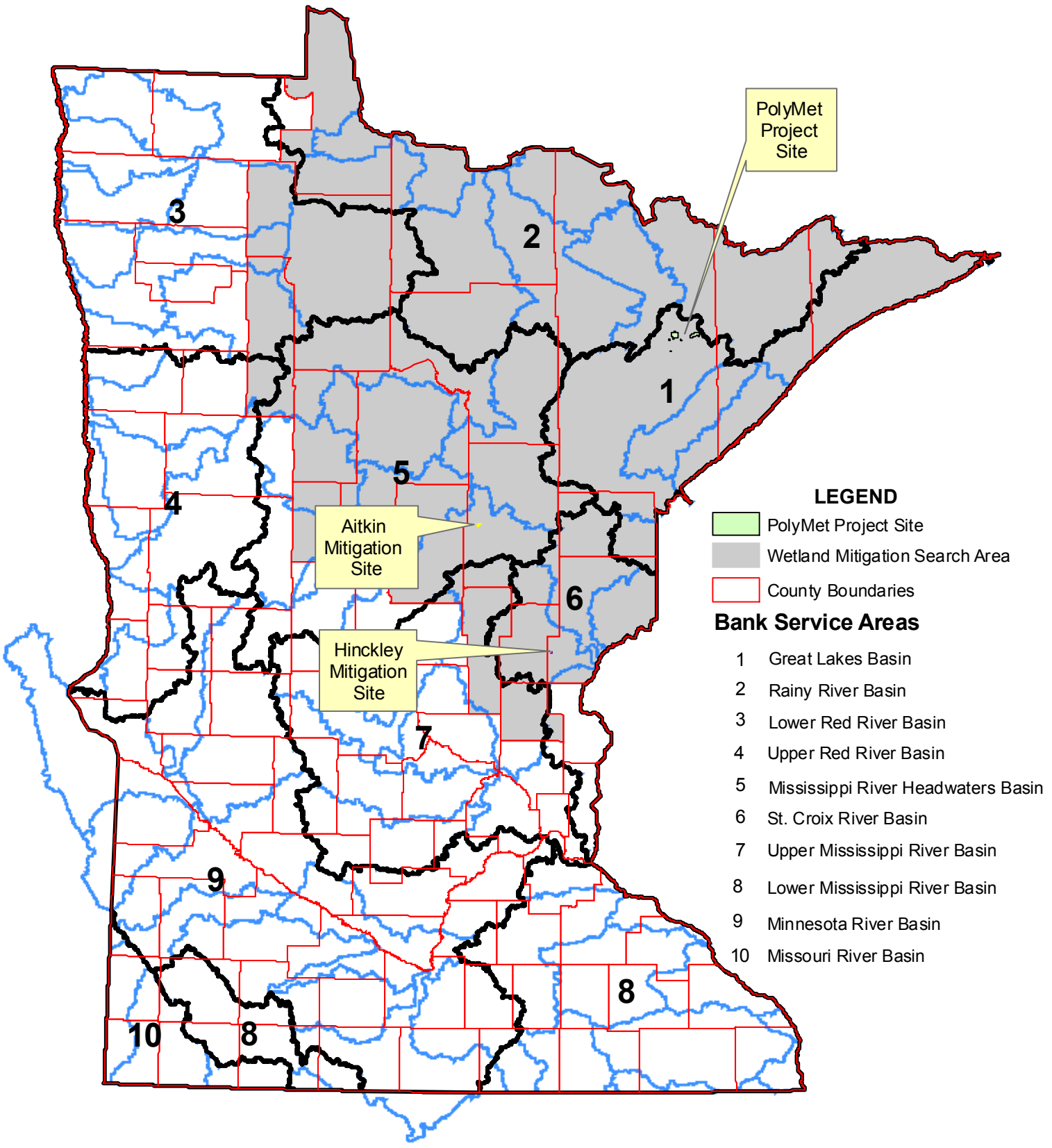
BWSR Berm Mix No. 2

Common Name	Botanical Name	% of Mix
Slough grass, American	*Beckmannia syzigachne*	4.0
Oats or Winter wheat*	*Avena sativa or Triticum aestivum*	40.0
Grama, sideoats	*Bouteloua curtipendula*	6.0
Wild-rye, Canadian	*Elymus canadensis*	6.0
Wild-rye, Virgina	*Elymus virginicus*	8.0
Wheat-grass, slender	*Elymus trachycaulus*	10.0
Rye-grass, annual	*Lolium italicum*	8.0
Switchgrass	*Panicum virgatum*	2.0
Bluestem, little	*Schizachyrium scoparium*	8.0
Bluegrass, fowl	*Poa palustris*	8.0
	Total:	100.0

Rate: 30.0 PLS lbs/acre

***Note:** Oats are used in spring plantings and winter wheat in fall plantings

Figures



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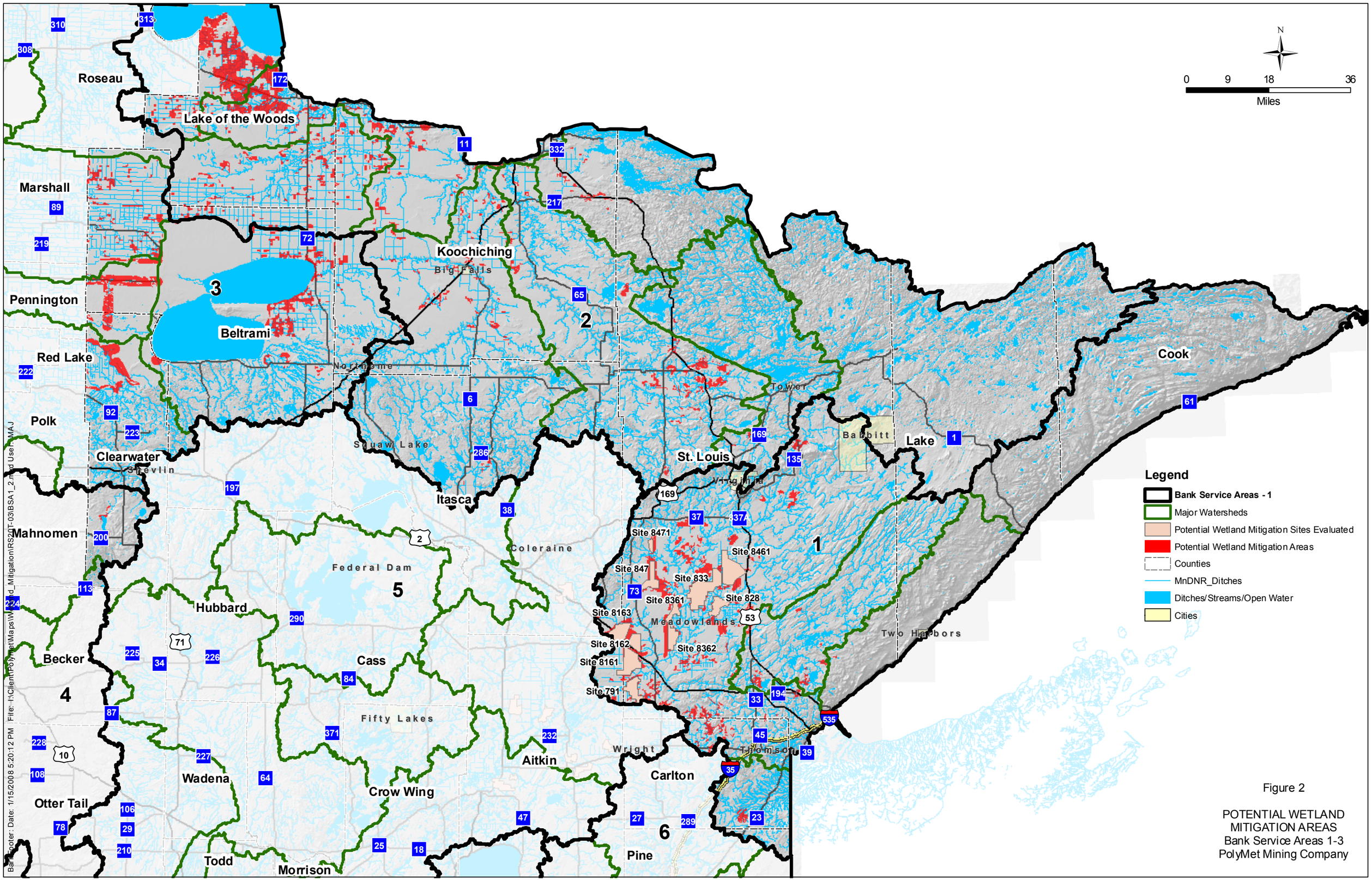
N

0 12.5 25 50 75 Miles

Figure 1

WETLAND MITIGATION SEARCH AREA AND BANK SERVICE AREAS
PolyMet Mining Company


N
0 9 18 36
Miles
Roseau
Lake of the Woods
Marshall
Pennington
Red Lake
Polk
Clearwater
Mahnomen
Becker
Hubbard
Beltrami
Koochiching
Big Falls
Cass
Itasca
Coleraine
Federal Dam
Squaw Lake
Nortonme
Fifty Lakes
Wadena
Crow Wing
Todd
Morrison
Otter Tail
Aitkin
Wright
Carlton
Pine
St. Louis
Meadowlands
Tower
Babbitt
Lake
Cook
Two Harbors
Thomson
1
2
3
4
5
6
Site 8471
Site 8461
Site 847
Site 833
Site 8361
Site 828
Site 8163
Site 8162
Site 8362
Site 8161
Site 791
Legend
Bank Service Areas - 1
Major Watersheds
Potential Wetland Mitigation Sites Evaluated
Potential Wetland Mitigation Areas
Counties
MnDNR_Ditches
Ditches/Streams/Open Water
Cities
Figure 2
POTENTIAL WETLAND MITIGATION AREAS
Bank Service Areas 1-3
PolyMet Mining Company
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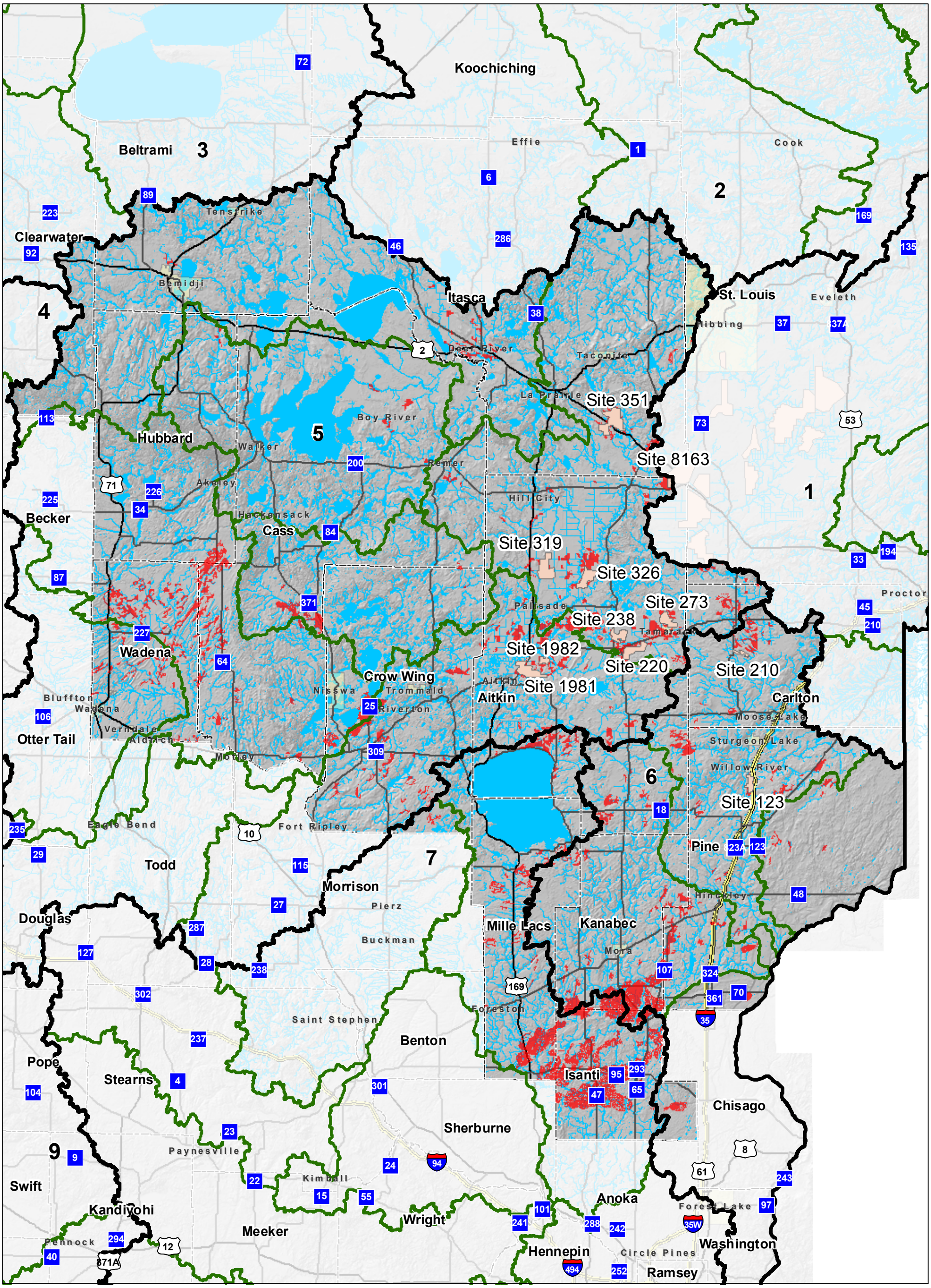

Legend

- Bank Service Areas - 5
- Major Watersheds
- Potential Mitigation Sites Evaluated
- Potential Wetland Mitigation Areas
- Counties
- Open Water/Ditches/Streams
- Cities
- >80 Percent Historic Wetlands

N

0 5 10 15 20 25

Miles

Figure 3

POTENTIAL WETLAND MITIGATION AREAS
Bank Service Areas 5-7
PolyMet Mining Company

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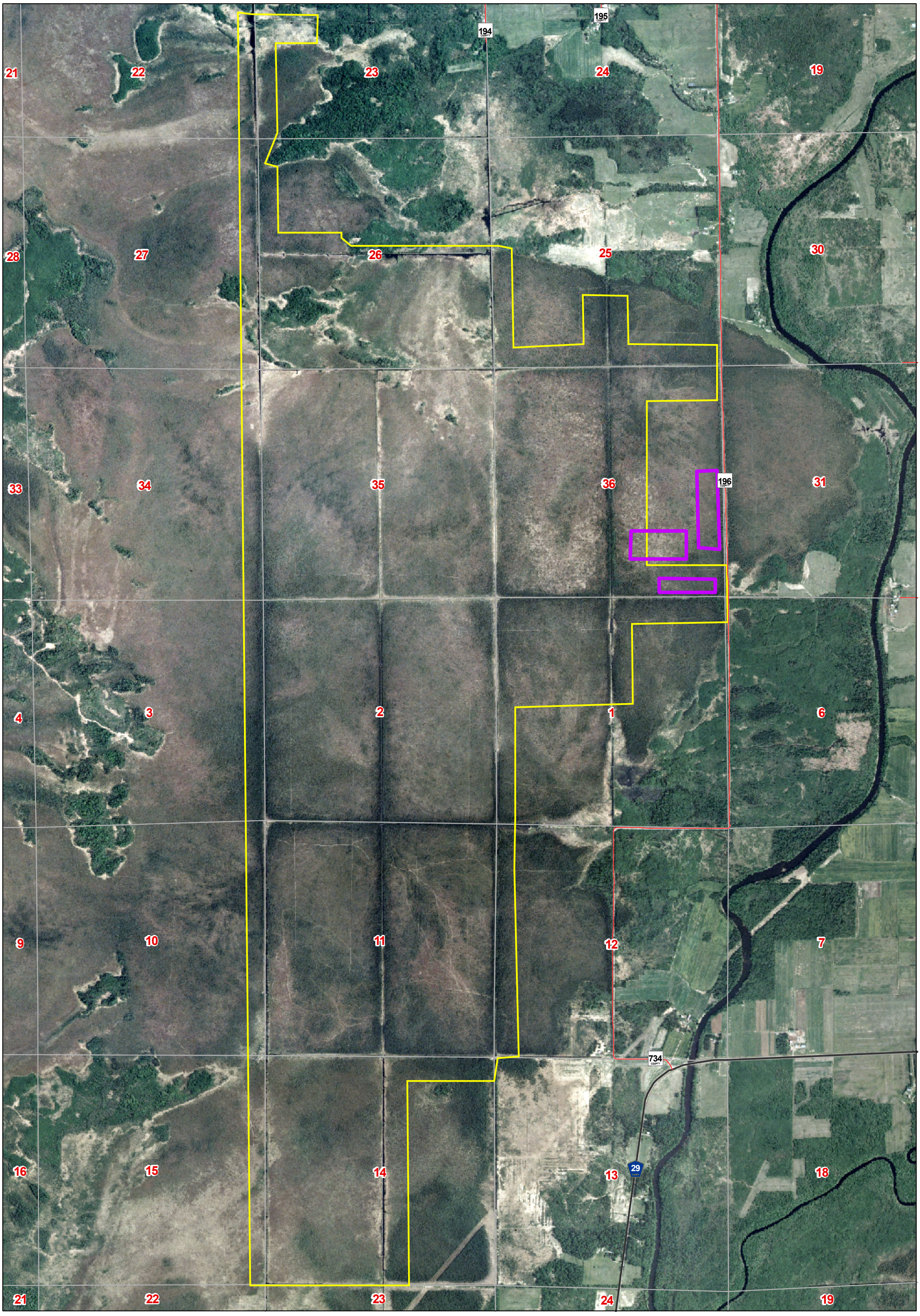

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Legend

- Potential Sphagnum Donor Sites - 46 acres
- Wetland Restoration Area Studied
- Sections

N

Feet

2,000 0 2,000 4,000 6,000

Figure 4

SITE 8362
NorthMet Mine/PolyMet Mining Co.
St. Louis County, Minnesota

Hinckley Wetland Restoration Site

Hinckley
Brook Park
Quamba
Henriette
Pokegama Lake
Cross Lake
Pine City
Snake River
Grasston
Rock Creek

48
23
35
361
107
324
70

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Legend

- Approximate Property Boundaries
- Limited Access
- Highway
- Major Road
- Local Road
- Minor Road
- Other Road

N

Miles
0 1 2 3

Figure 5

LOCATION MAP
Hinckley Wetland Mitigation Site
PolyMet Mining Company
Pine County

31
32
6
5
4
8
9
#1
21.1 ac
Shrub Carr
#2
4.2 ac
Upland
#3
27.4 ac
Alder Thicket
#4
5.4 ac
Upland
#5
14.3 ac
Wet Meadow
#6
101.2 ac
Coniferous Bog
#7
1.7 ac
Upland
#8
5.4 ac
Sedge Meadow
#9
44.1 ac
Shrub Carr
#10
22.2 ac
Sedge Meadow
#11
10.1 ac
Hardwood Swamp
#12
8.4 ac
Coniferous Swamp
#13
9.7 ac
Upland
#14
23 ac
Upland
#15
1.4 ac
Shallow Marsh
#16
20.1 ac
Seasonally Flooded
#17
3.9 ac
Upland
#18
15.7 ac
Upland
#19
6.1 ac
Hardwood Swamp
#20
0.8 ac
Sedge Meadow
#21
4.1 ac
Shrub Carr
#22
11.9 ac
Sedge Meadow
#23
15.6 ac
Upland
#24
12.3 ac
Shrub Carr
#25
5.5 ac
Shrub Carr

Legend

- Approximate Property Boundaries
- 1-Foot Topography
- Public Land Survey

Wetland Restoration Types

Eggers & Reed Classification

- Seasonally Flooded
- Shrub Carr
- Alder Thicket
- Coniferous Bog
- Coniferous Swamp
- Hardwood Swamp
- Wet Meadow
- Sedge Meadow
- Shallow Marsh
- Upland

0 250 500 1,000 1,500 Feet

Figure 6

WETLAND RESTORATION AND
UPLAND BUFFER AREAS
Hinckley Wetland
Mitigation Site
PolyMet Mining
Pine County, Minnesota

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5634 acres

963 acres

586 acres

28 acres

113 acres

Legend

- Drainage Areas
- Approximate Property Boundaries

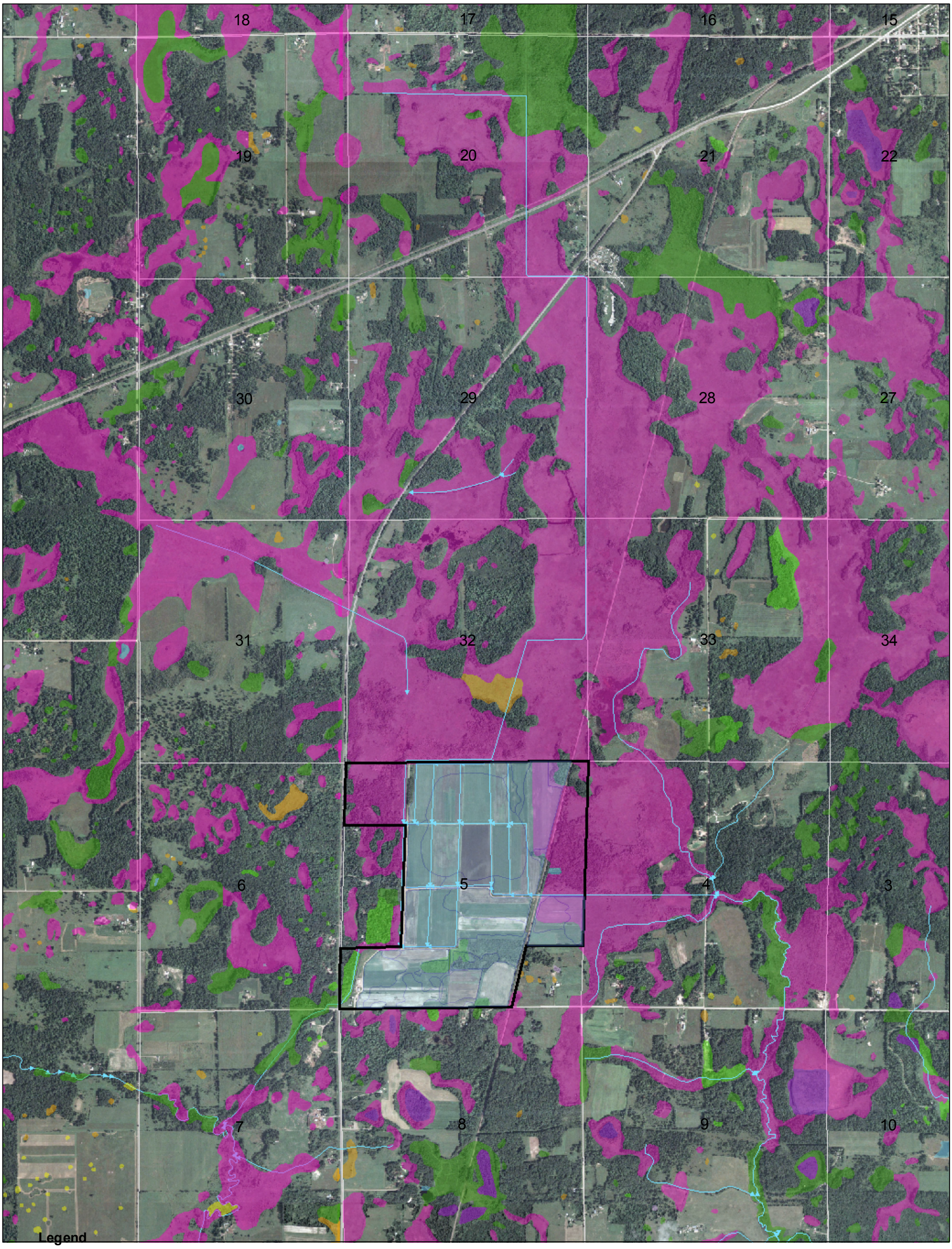
Restoration Areas

- Upland Buffer
- Wetland

0 1,000 2,000 4,000 Feet

Figure 7

DRAINAGE AREAS
Hinckley Wetland
Mitigation Site
PolyMet Mining Company
Pine County, Minnesota



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Legend

National Wetland Inventory

NWI - Circular 39 Classification

- Type 1 - temporary
- Type 2 - wet meadow
- Type 3 - shallow marsh
- Type 4 - deep marsh
- Type 5 - open water
- Type 6 - shrub scrub
- Type 7 - forested
- Type 8 - bog
- Hinckley Restoration Area
- Approximate Property Boundaries
- MnDNR_Ditches
- Public Land Survey

0 1,000 2,000 4,000 Feet

Figure 8

NATIONAL WETLAND INVENTORY MAP
Hinckley Wetland Mitigation Site
PolyMet Mining
Pine County, Minnesota

Legend

Approximate Property Boundaries

Contours

Elevation

1188	1201
1189	1202
1190	1203
1191	1204
1192	1205
1193	1206
1194	1207
1195	1208
1196	1209
1197	1210
1198	1211
1199	1212
1200	1213

Wetland Restoration Areas

Eggers & Reed Classification

- Alder Thicket
- Coniferous Bog
- Coniferous Swamp
- Deep Marsh
- Hardwood Swamp
- Open Bog
- Sedge Meadow
- Shallow Marsh
- Shrub Carr
- Upland
- Wet Meadow

N
W E
S

0 500 1,000 2,000
Feet

Figure 9

WETLAND RESTORATION
PLAN
Aitkin Wetland Restoration Site
PolyMet Mining Company

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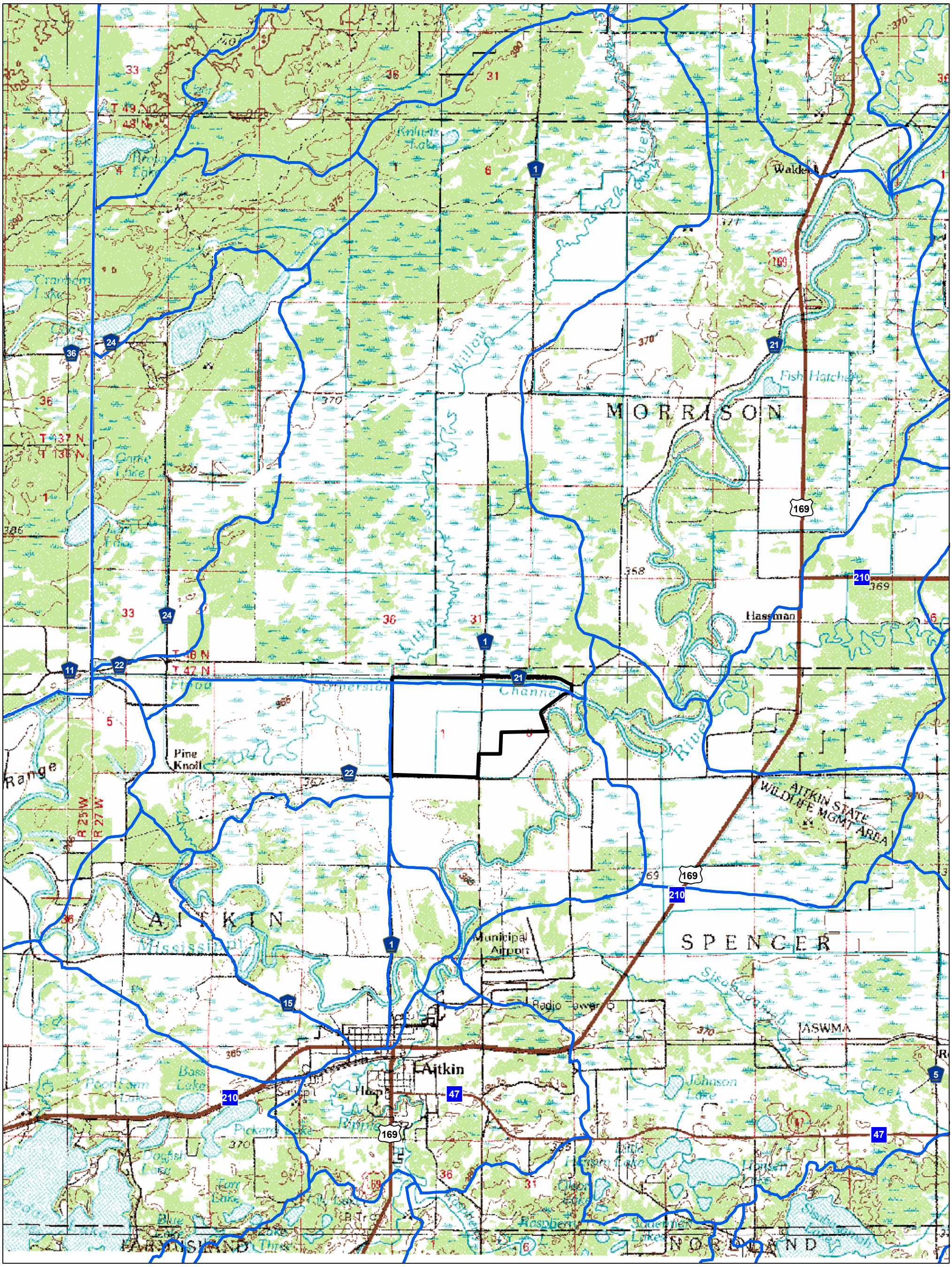


Legend

- Subwatersheds
- Aitkin Wetland Restoration Site

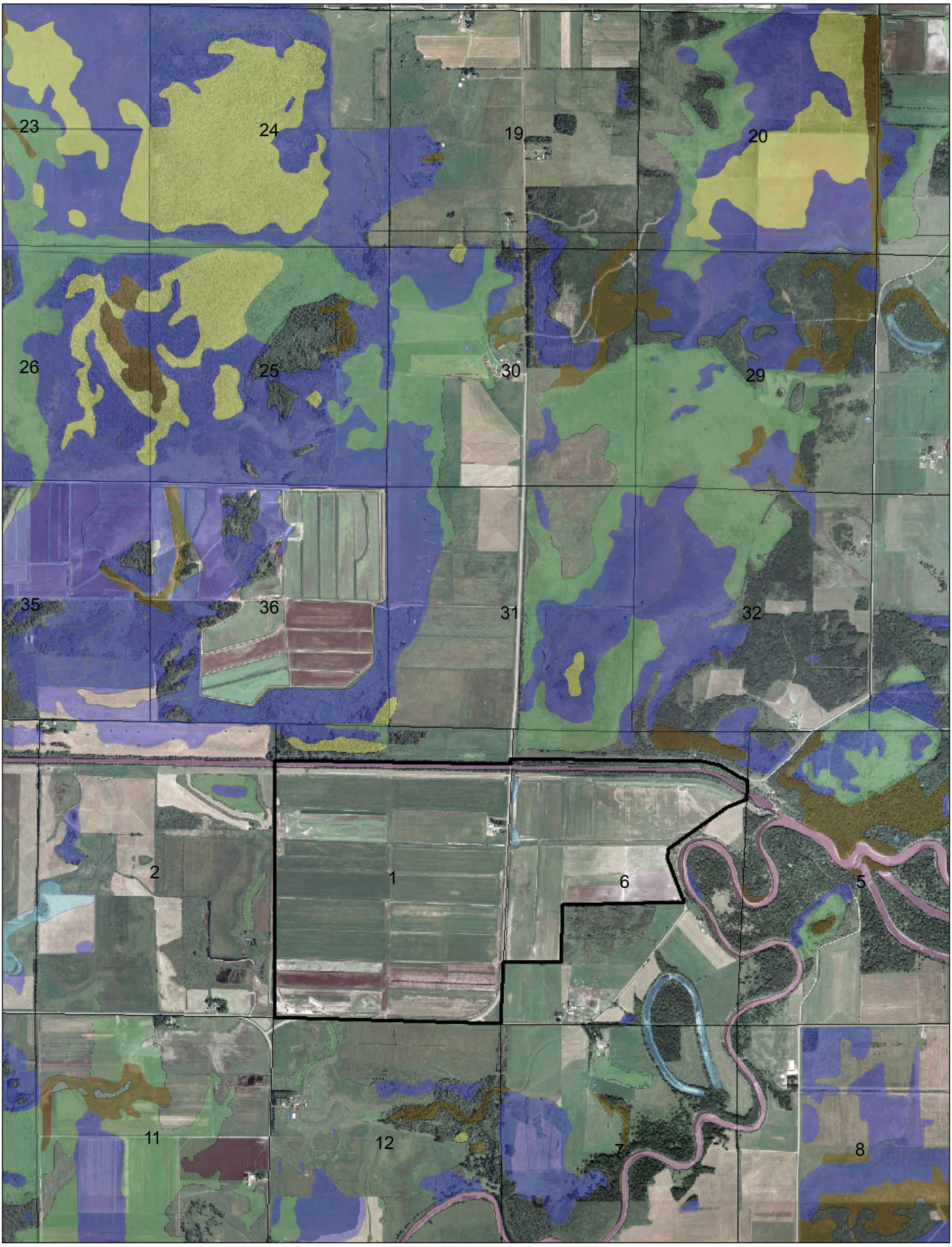
N

Miles

1 0 1

Figure 10

DRAINAGE AREA MAP
Aitkin Wetland Restoration
PolyMet Mining Company
Aitkin County, Minnesota



Legend

Approximate Aitkin Sod Farm Property

National Wetland Inventory - Circular 39

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 90
- Public Land Survey

0 1,000 2,000 4,000 6,000 Feet

Figure 11

NATIONAL WETLAND INVENTORY
Aitkin Wetland Restoration Site
PolyMet Mining Company

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Legend

- Approximate Aitkin Sod Farm Property
- Minor Watersheds
- Major Watersheds

Aitkin County Soils

- Non-Hydric
- Mineral Hydric
- Organic Soils

N
W E
S

0 0.5 1 2 Miles

Figure 12

AITKIN COUNTY
SOIL SURVEY
Aitkin Wetland Restoration Site
PolyMet Mining Company

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Legend

Approximate Property Boundaries

0 500 1,000 2,000 3,000 Feet

Figure 13

1939 AERIAL PHOTO
Hinckley Wetland
Mitigation Site
PolyMet Mining
Pine County, Minnesota

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Legend

Approximate Property Boundaries

N
W E
S

0 500 1,000 2,000 3,000
Feet

Figure 14

1940 AERIAL PHOTO
Aitkin Wetland Restoration Site
PolyMet Mining Company
Aitkin, Minnesota

Legend

- Approximate Property Boundaries
- Public Land Survey

0 500 1,000 2,000 Feet

Figure 15

1991 AERIAL PHOTO
Aitkin Wetland Restoration Site
PolyMet Mining Company
Aitkin, Minnesota

Legend

Wetland Restoration Areas

- Partially Drained Wetland
- Upland Buffer
- Wetland
- Public Land Survey

0 300 600 1,200 Feet

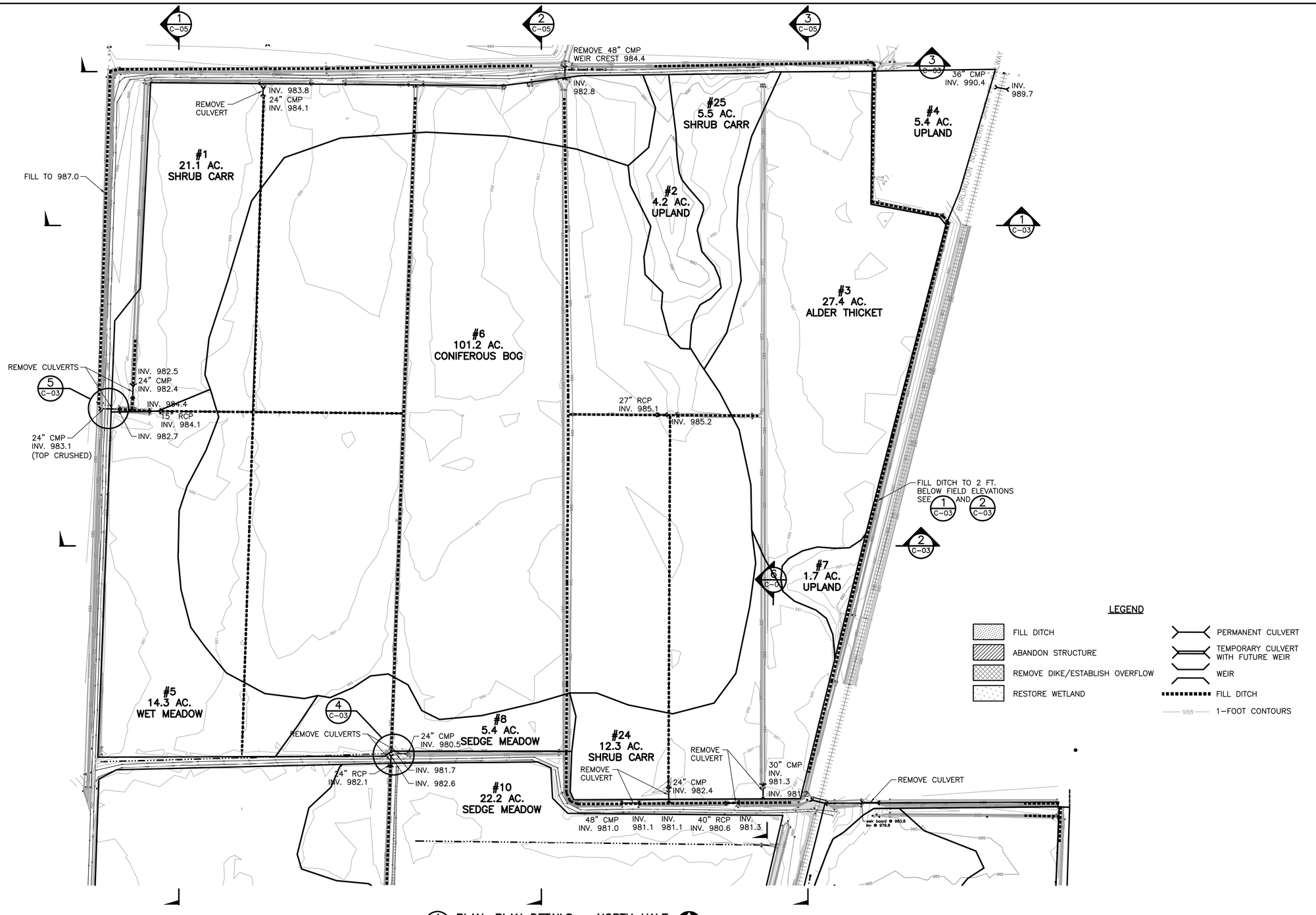
Figure 16

1991 AERIAL PHOTOGRAPH
Hinckley Wetland
Mitigation Site
PolyMet Mining
Pine County, Minnesota

Appendices

Appendix A

Hinckley Wetland Restoration Plans



1 C-05 2 C-05 3 C-05 3 C-03 1 C-03 5 C-03 4 C-03 5 C-03 2 C-03

1 C-03 PLAN: PLAN DETAILS – NORTH HALF
1"=200'-0"

0 200 400
SCALE IN FEET

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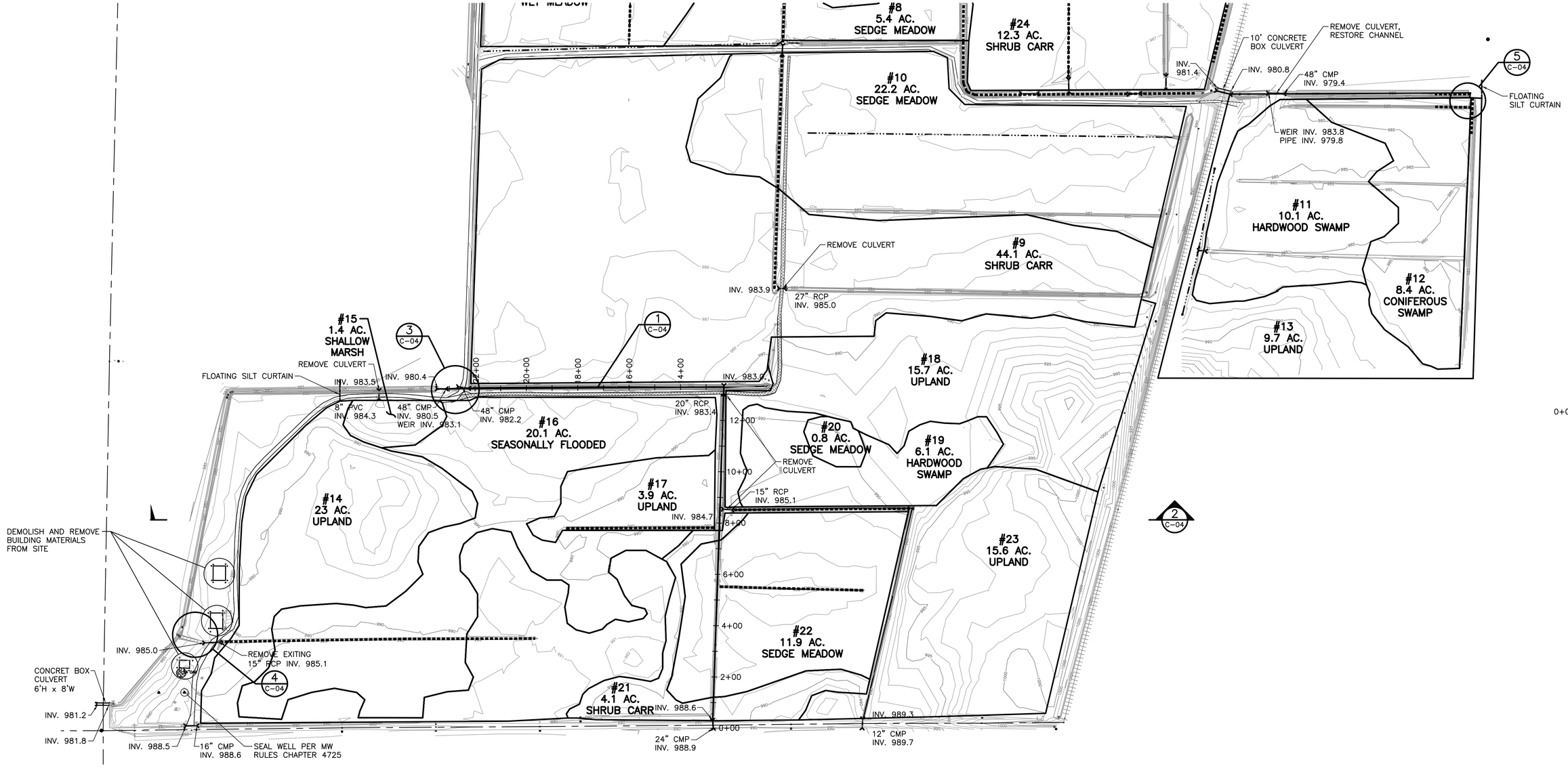
POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

PLAN DETAILS – NORTH HALF

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. C-01
REV. No.



1 C-04 PLAN: PLAN DETAILS – SOUTH HALF
1"=200'-0"

0 200 400
SCALE IN FEET

LEGEND

- FILL DITCH
- ABANDON STRUCTURE
- REMOVE DIKE/ESTABLISH OVERFLOW
- RESTORE WETLAND
- PERMANENT CULVERT
- TEMPORARY CULVERT WITH FUTURE WEIR
- WEIR
- FILL DITCH
- 988 1–FOOT CONTOURS

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HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

PLAN DETAILS – SOUTH HALF

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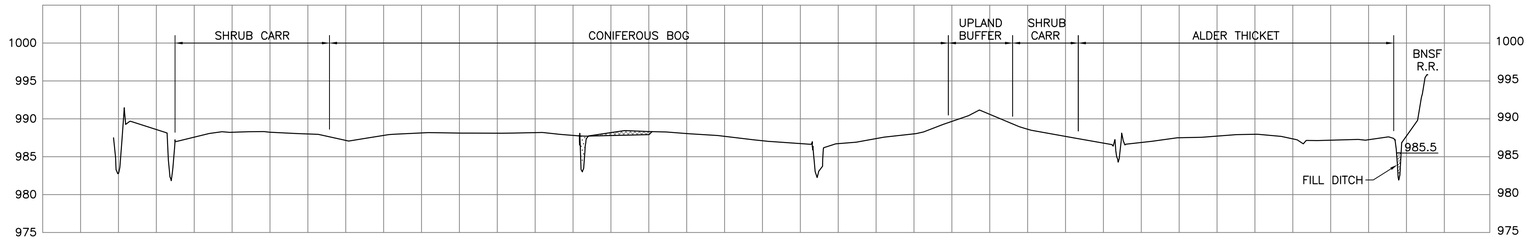

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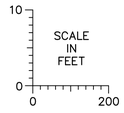

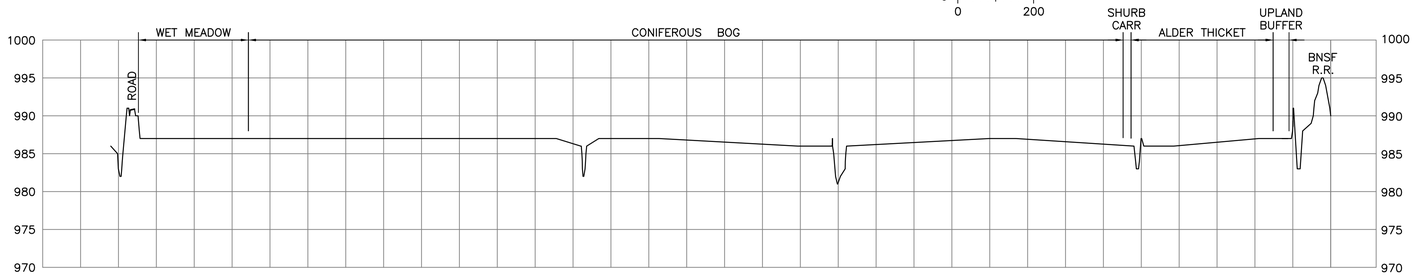

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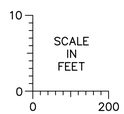

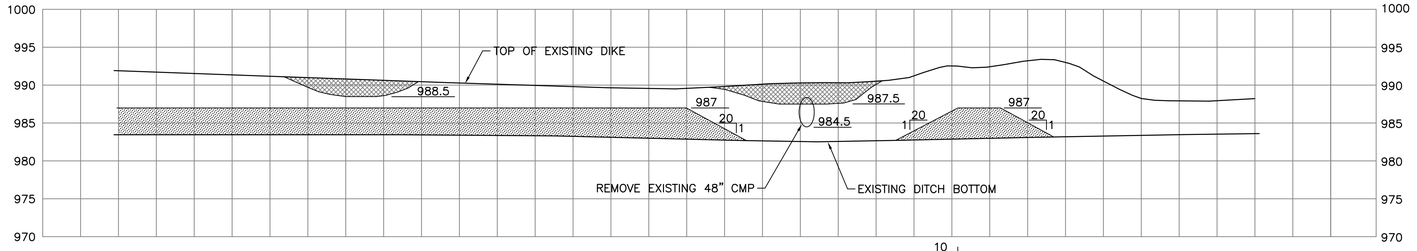

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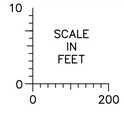

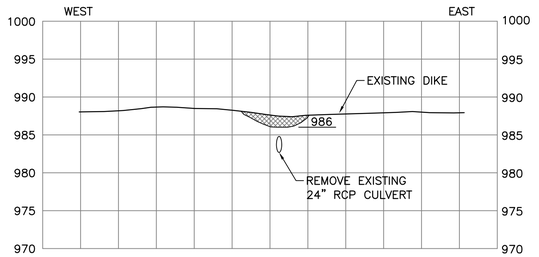

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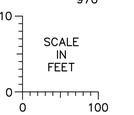

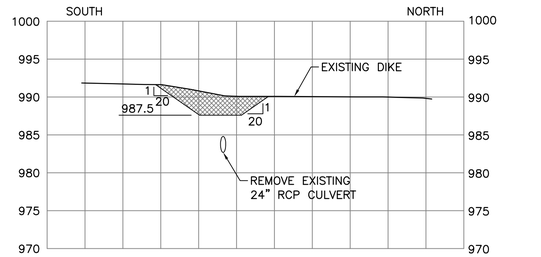

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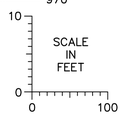

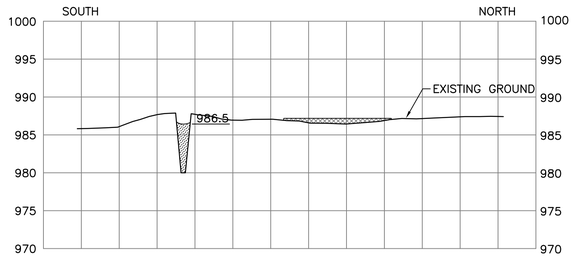

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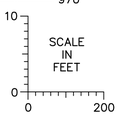

FILL DITCH
ABANDON STRUCTURE
REMOVE DIKE/LOWER OVERFLOW
RESTORE WETLAND

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HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

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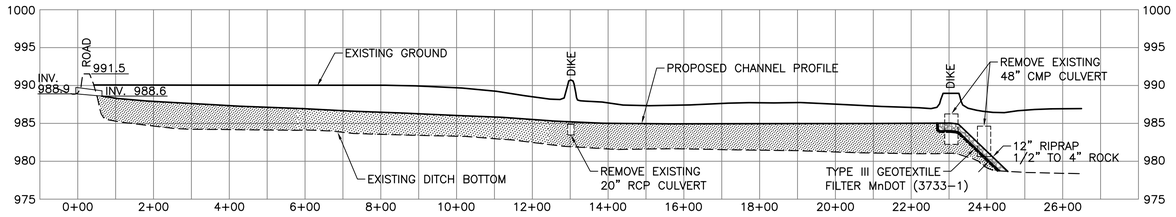

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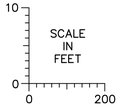
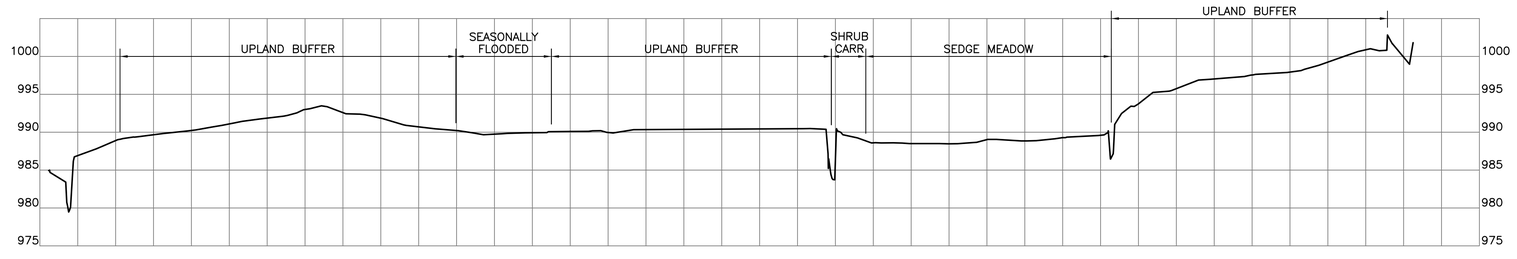


LEGEND

- FILL DITCH
- ABANDON STRUCTURE
- REMOVE DIKE/LOWER OVERFLOW
- RESTORE WETLAND



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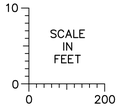

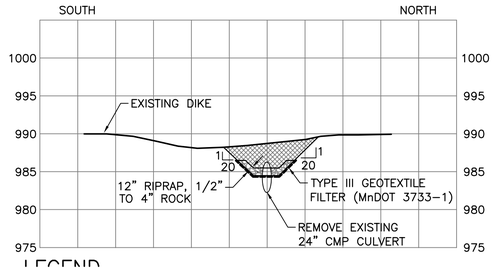

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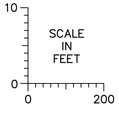

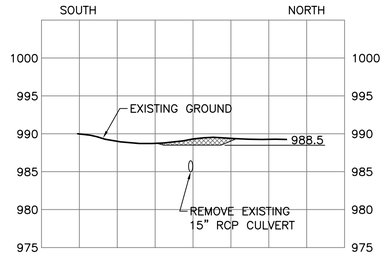

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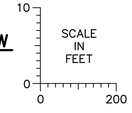

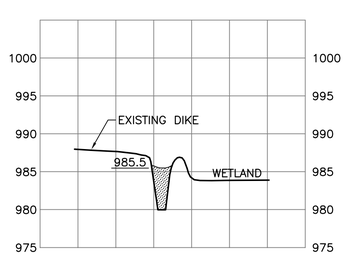

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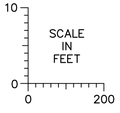

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HINCKLEY, MINNESOTA

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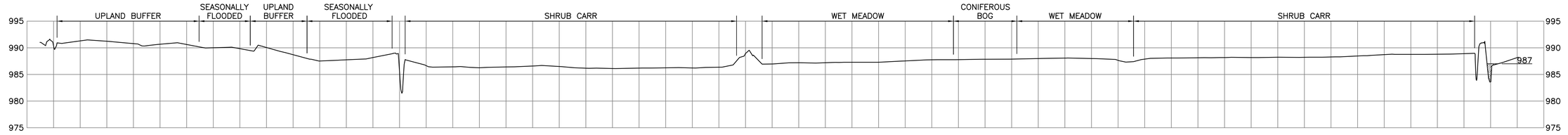

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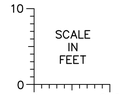

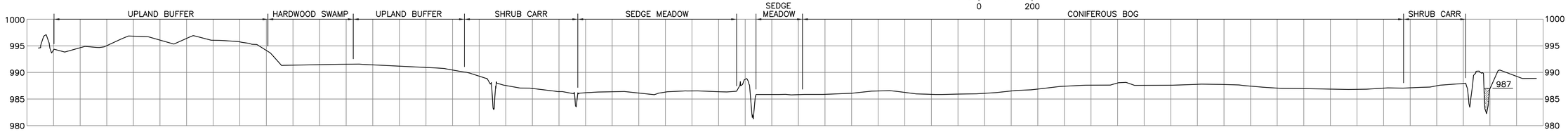

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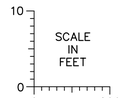

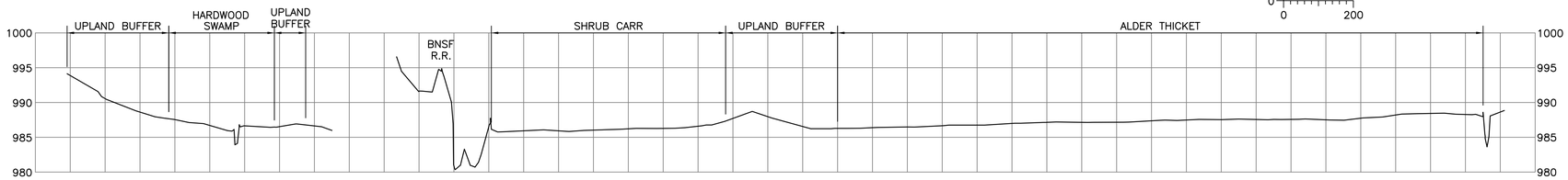

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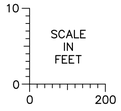

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HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

CROSS SECTIONS – ENTIRE SITE

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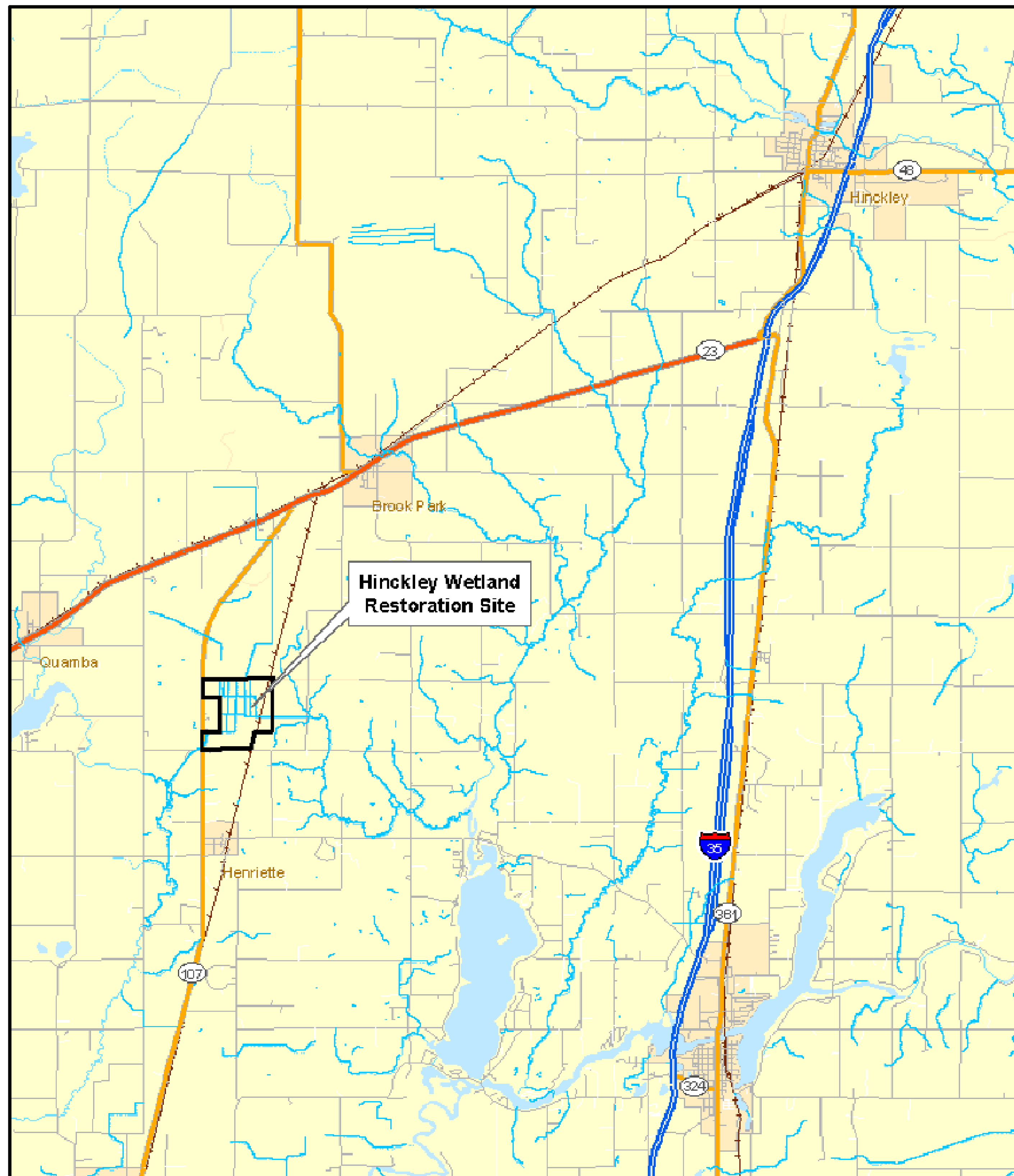
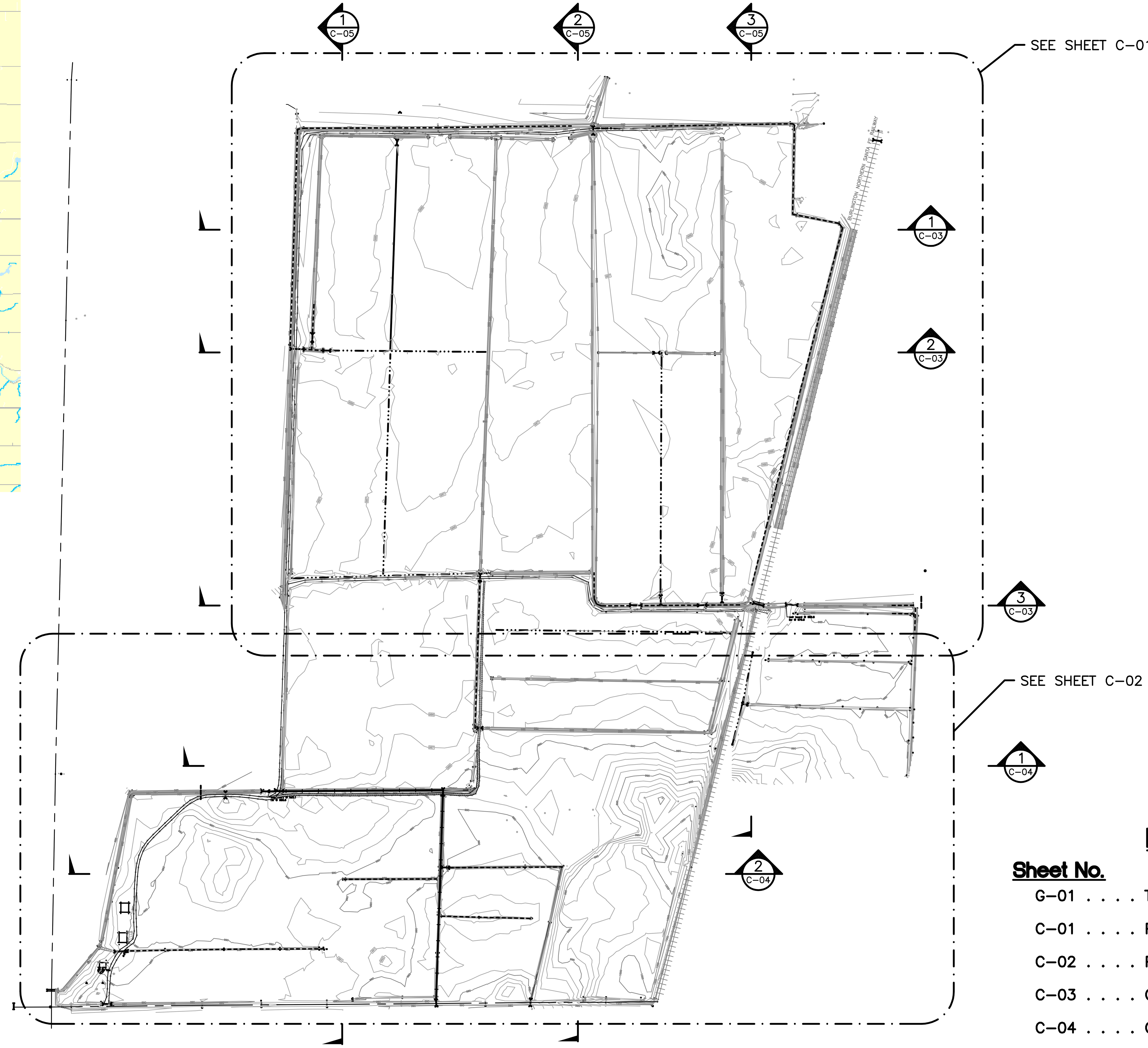
HINCKLEY, MINNESOTA



SITE LOCATION MAP

STATE MAP



PLAN: OVERALL SITE PLAN SHEET INDEX
1"=400'-0"
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SCALE IN FEET

INDEX

Sheet No.	Title
G-01	TITLE SHEET, INDEX, AND SITE LOCATION MAP
C-01	PLAN DETAILS – NORTH HALF
C-02	PLAN DETAILS – SOUTH HALF
C-03	CROSS SECTIONS – NORTH HALF
C-04	CROSS SECTIONS – SOUTH HALF
C-05	CROSS SECTIONS – ENTIRE SITE

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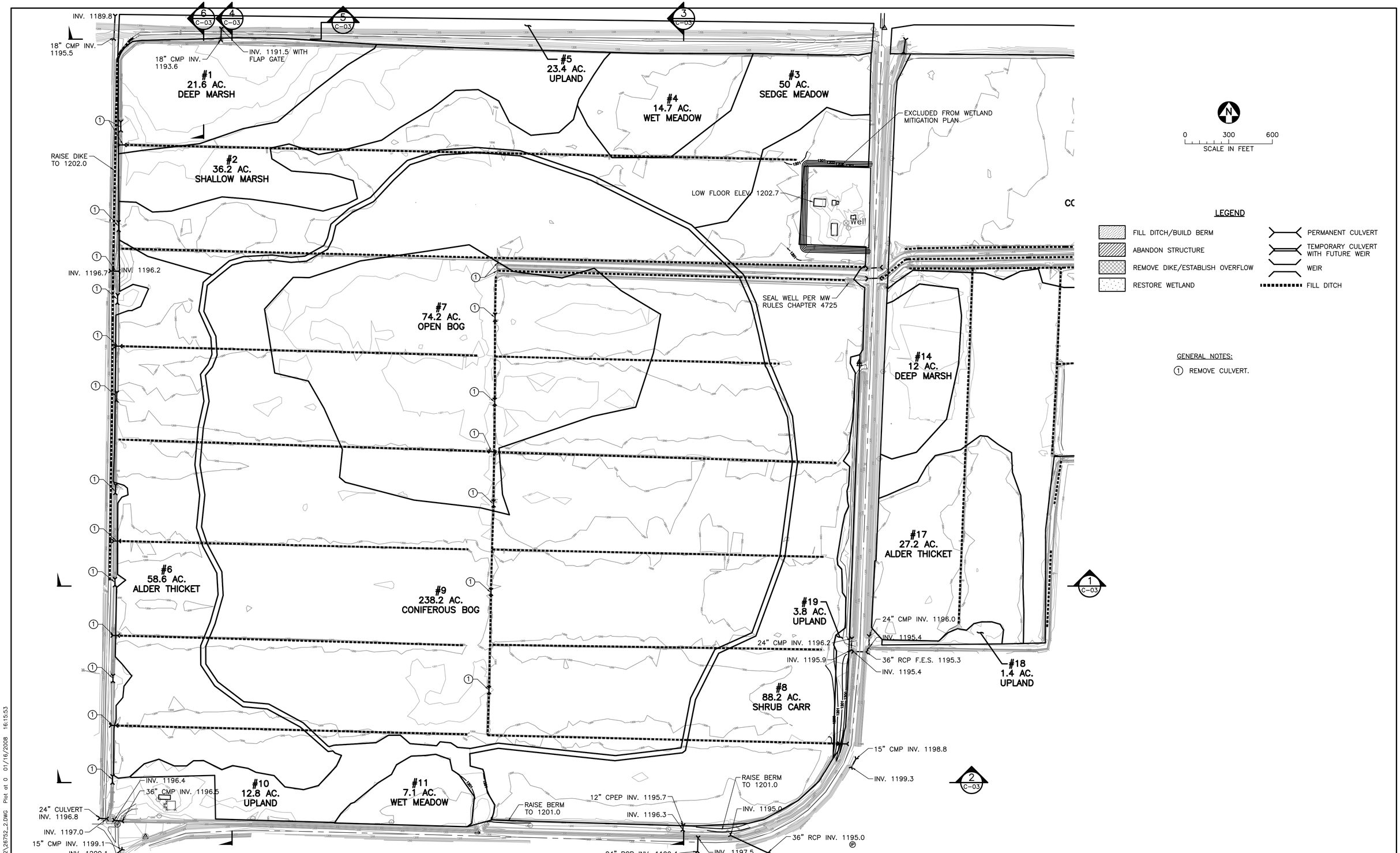
HINCKLEY WETLAND REPLACEMENT PLAN
HINCKLEY, MINNESOTA

TITLE SHEET, INDEX, AND SITE LOCATION MAP

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. G-01
REV. No.

Appendix B

Aitkin Wetland Restoration Plans



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DATE _____ REG. NO. _____

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BID							
CONSTRUCTION							
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Project Office:
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4700 WEST 77TH STREET
MINNEAPOLIS, MN.
55435-4803
Ph: 1-800-632-2277
Fax: (952) 832-2601
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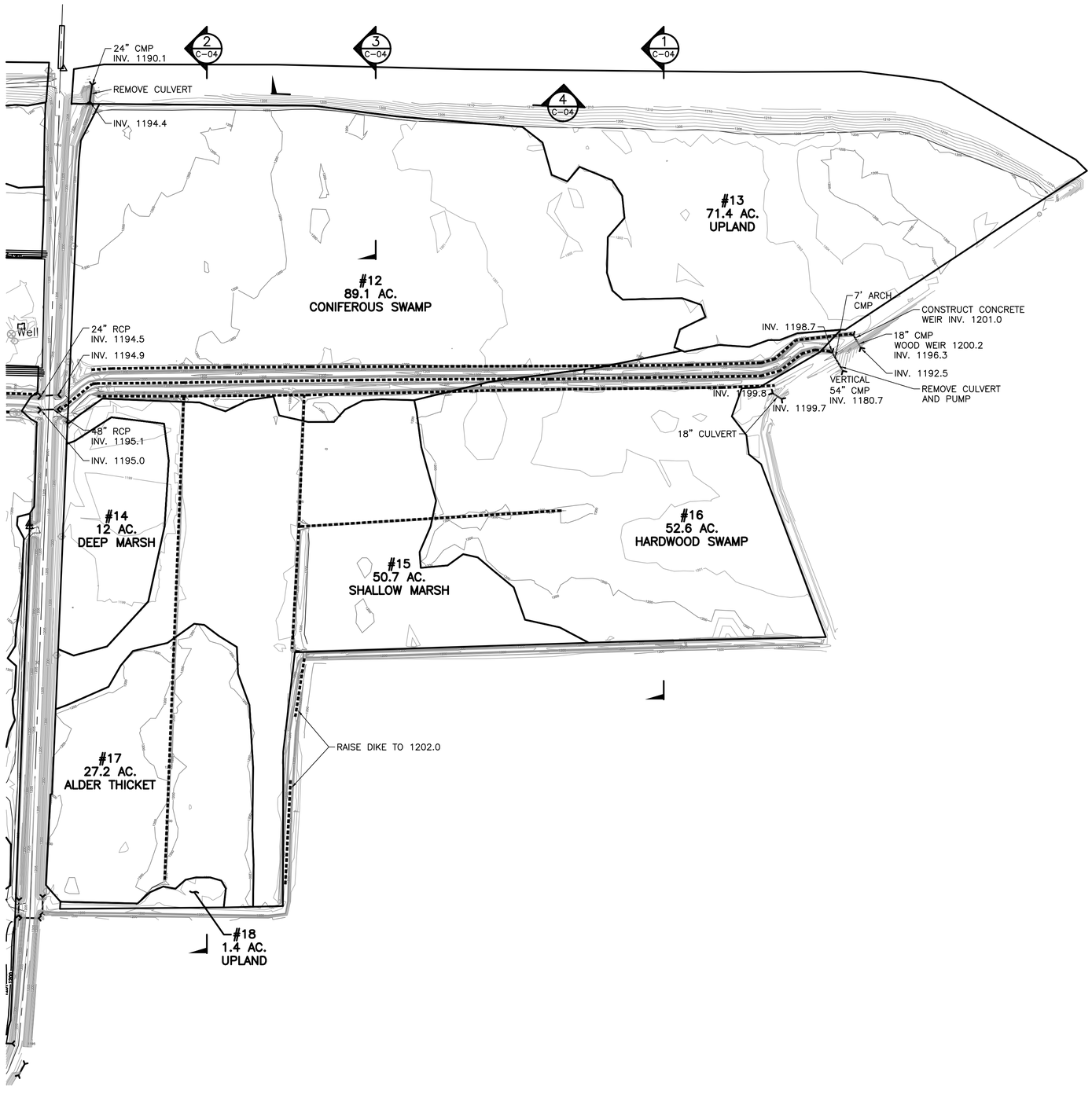
Scale	AS SHOWN
Date	6/20/07
Drawn	JMW
Checked	MAJ
Designed	MAJ
Approved	MAJ

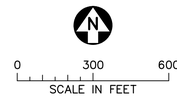
POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

PLAN DETAILS – WEST HALF

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. C-01
REV. No.





LEGEND

- FILL DITCH/BUILD BERM
- ABANDON STRUCTURE
- REMOVE DIKE/ESTABLISH OVERFLOW
- RESTORE WETLAND
- PERMANENT CULVERT
- TEMPORARY CULVERT WITH FUTURE WEIR
- WEIR
- FILL DITCH

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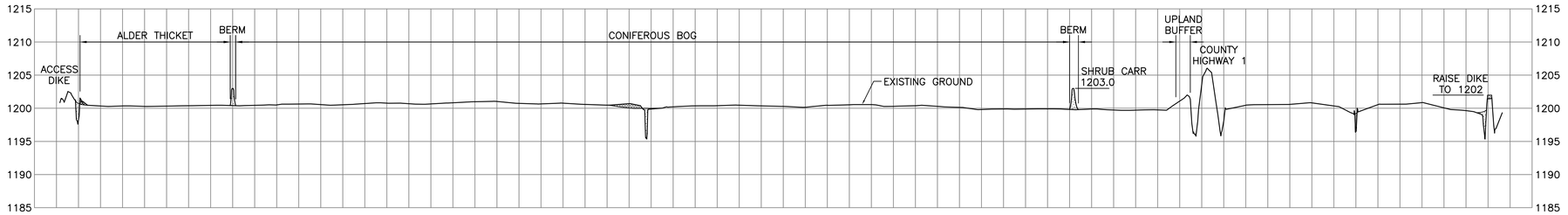
HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

PLAN DETAILS – EAST HALF

BARR PROJECT No.	
23/69-862	
CLIENT PROJECT No.	
DWG. No.	REV. No.
C-02	



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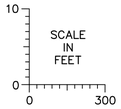

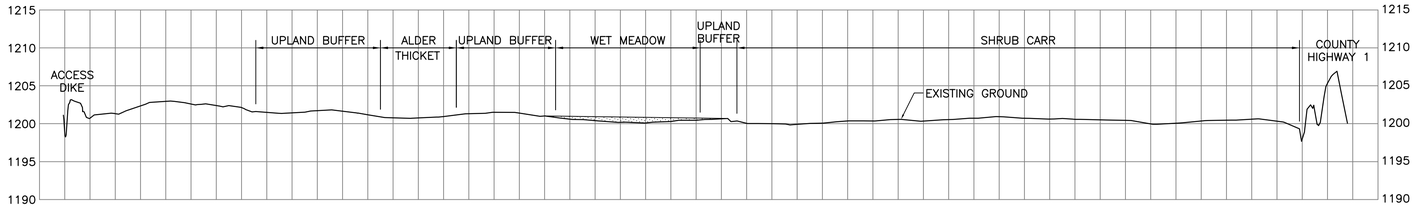

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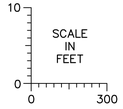

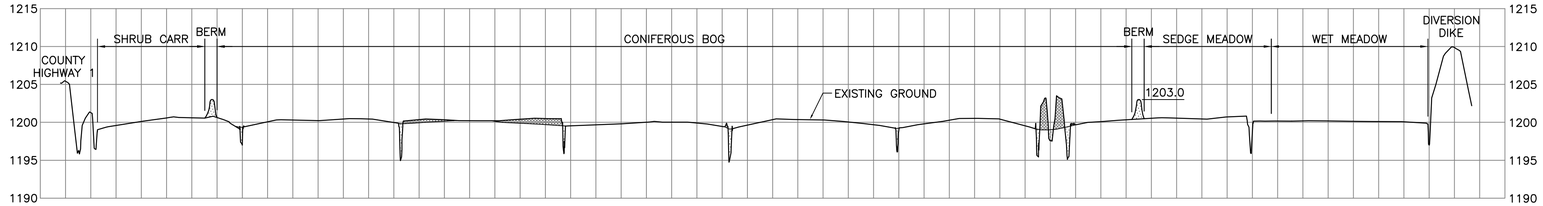

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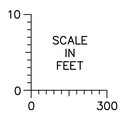

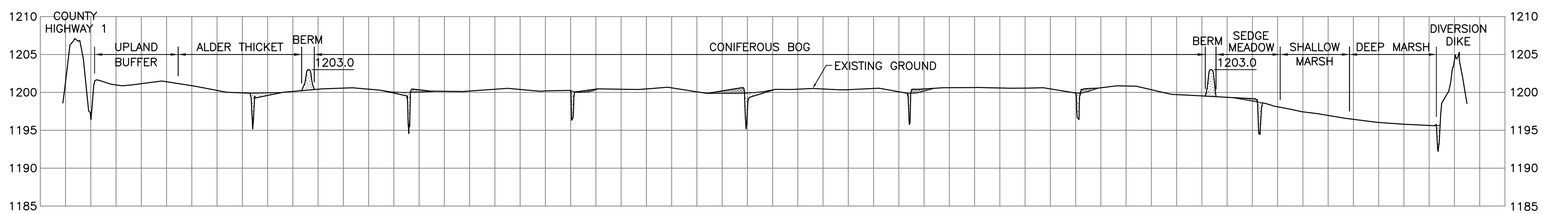

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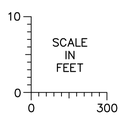
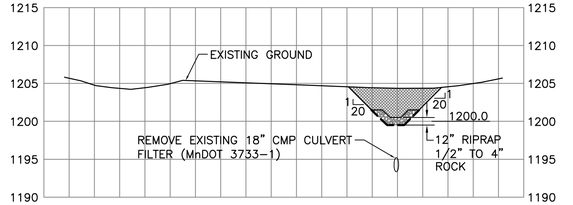
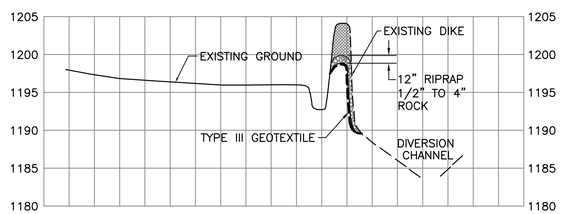




5 C-01 SECTION: PROFILE – DIVERSION DIKE OVERFLOW



6 C-01 SECTION: PROFILE – DIVERSION DIKE OVERFLOW

LEGEND

- FILL DITCH/BUILD BERM
- ABANDON STRUCTURE
- REMOVE DIKE/ESTABLISH OVERFLOW

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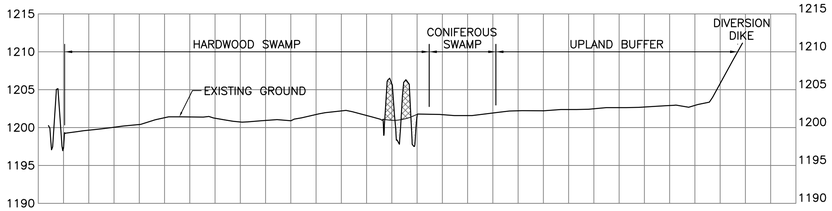
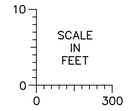
POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

CROSS SECTIONS – WEST HALF

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. C-03
REV. No.

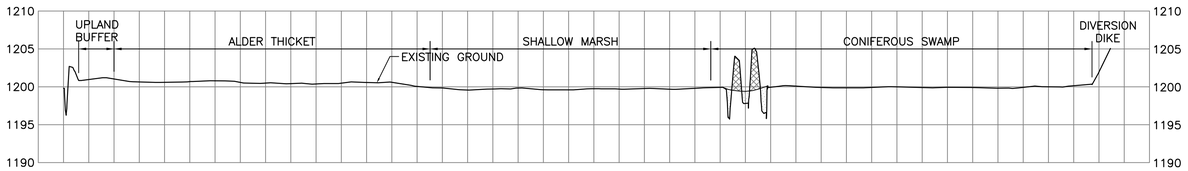


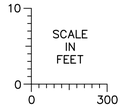


1 C-02 **SECTION: CROSS SECTION –**

LEGEND

- FILL DITCH
- ABANDON STRUCTURE
- REMOVE DIKE/ESTABLISH OVERFLOW
- RESTORE WETLAND





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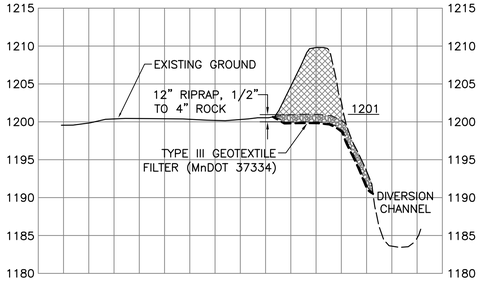
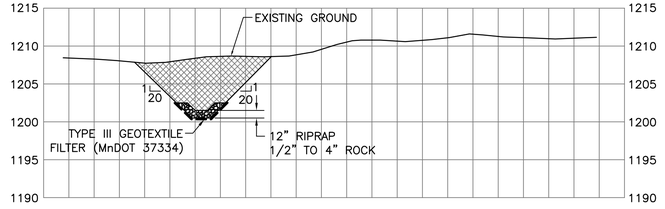
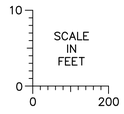
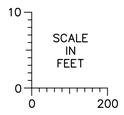




4 C-02 **SECTION: PROFILE – EAST PROPERTY DIVERSION CHANNEL INLET**



3 C-02 **SECTION: PROFILE – EAST PROPERTY DIVERSION CHANNEL INLET**



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CONSTRUCTION							
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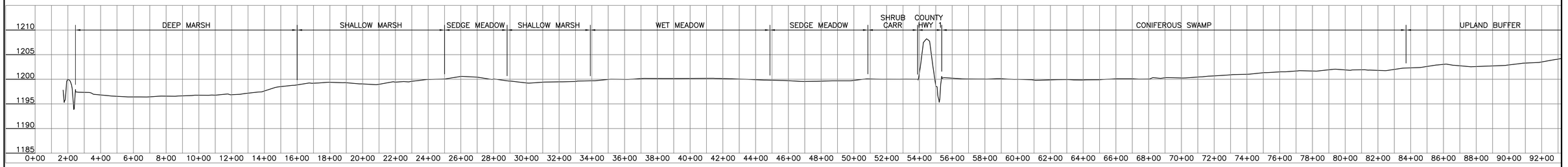
Designed	MAJ
Approved	MAJ

POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

CROSS SECTIONS – EAST SIDE

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. C-04
REV. No.



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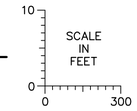
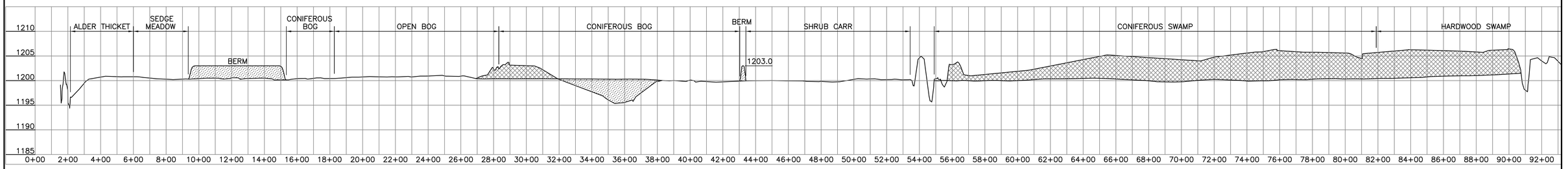
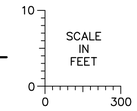
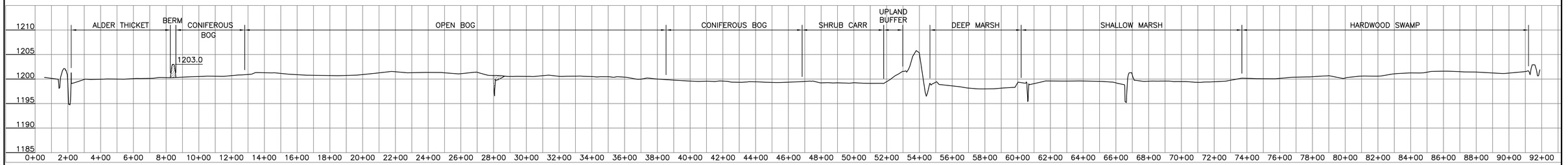


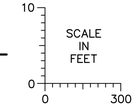


2 G-01 **SECTION: CROSS SECTION –** 1"=200'–0"





3 G-01 **SECTION: CROSS SECTION –** 1"=200'–0"



LEGEND

- FILL DITCH/BUILD BERM
- ABANDON STRUCTURE
- REMOVE DIKE/ESTABLISH OVERFLOW

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Approved	MAJ

POLYMET MINING COMPANY
HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

CROSS SECTIONS – ENTIRE SITE

BARR PROJECT No. 23/69–862
CLIENT PROJECT No.
DWG. No. C–05
REV. No.

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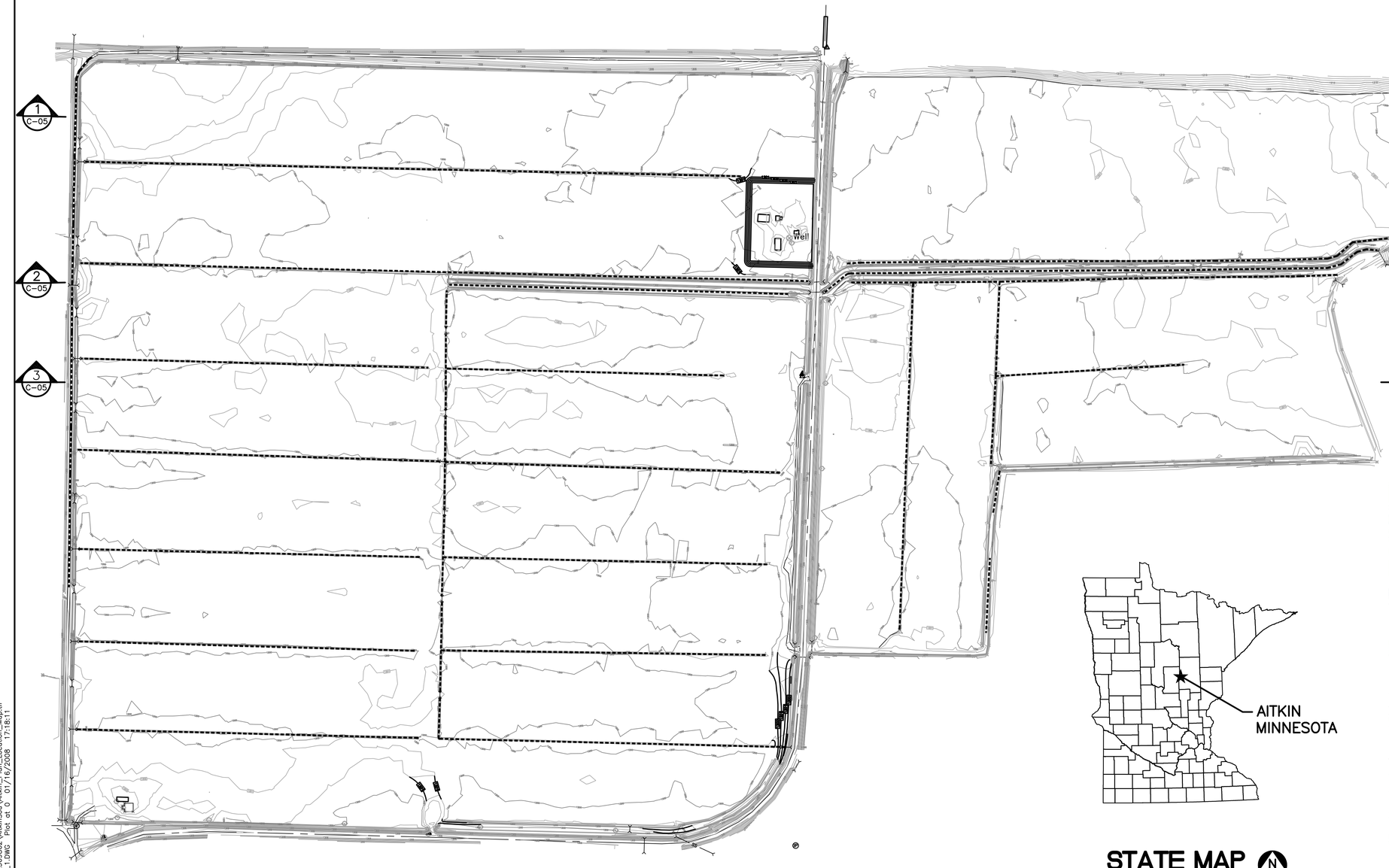
POLYMET MINING COMPANY

HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN

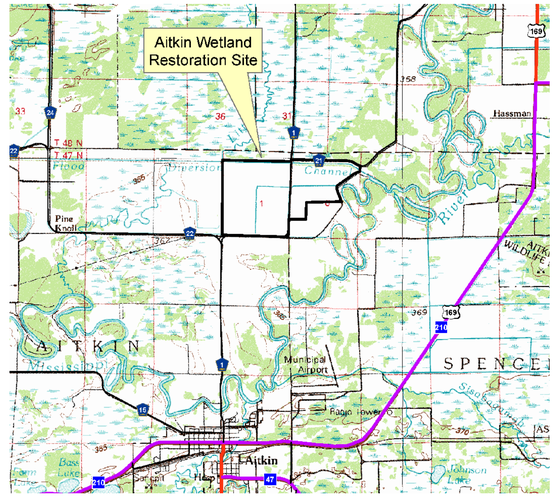
AITKIN, MINNESOTA

0 400 800
SCALE IN FEET



INDEX

STATE MAP



SITE LOCATION MAP

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HOYT LAKES, MINNESOTA

AITKIN WETLAND RESTORATION PLAN
AITKIN, MINNESOTA

TITLE SHEET, INDEX, AND SITE LOCATION MAP

BARR PROJECT No. 23/69-862
CLIENT PROJECT No.
DWG. No. G-01
REV. No.

Appendix C

Example Seed Mixes

Agrecol®
Agricultural Ecological Solutions

EMERGENT MIXED HEIGHT (STANDARD MIX)		
ITEM #	SM-EM	
COVERAGE AREA	43,560	SQ.FT.
SEEDS	60	PER SQ.FT.
PLS WEIGHT	5.276	POUNDS

MIX DIVERSITY BY TYPE	% OF SEED COUNT	SPECIES COUNT	OUNCES	% WEIGHT
GRASSES	30%	5	23.515	27.86%
SEDGES	60%	15	26.383	31.26%
WILDFLOWERS	10%	7	34.514	40.89%
LEGUMES	0%	0	0.000	0.00%
TOTALS	**100%**	**27**	**84.412**	**100.00%**

SPECIES INFORMATION

LATIN NAME	COMMON NAME	TOTAL SEEDS	% TOTAL SEEDS
GRASSES			
CALAMAGROSTIS CANADENSIS	BLUE JOINT GRASS	156,816	6.00%
GLYCERIA CANADENSIS	RATTLESNAKE GRASS	117,612	4.50%
GLYCERIA GRANDIS	REED MANNA GRASS	235,224	9.00%
LEERSIA ORYZOIDES	RICE CUTGRASS	117,612	4.50%
SPARTINA PECTINATA	PRAIRIE CORD GRASS	156,816	6.00%
SEDGES			
CAREX COMOSA	BRISTLY SEDGE	104,544	4.00%
CAREX CRINITA	FRINGED SEDGE	78,408	3.00%
CAREX HYSTERICINA	PORCUPINE SEDGE	104,544	4.00%
CAREX STRICTA	TUSSOCK SEDGE	78,408	3.00%
JUNCUS DUDLEYI	DUDLEY'S RUSH	104,544	4.00%
JUNCUS EFFUSUS	COMMON RUSH	130,680	5.00%
JUNCUS TENUIS	PATH RUSH	104,544	4.00%
JUNCUS TORREYI	TORREY'S RUSH	130,680	5.00%
SCIRPUS ACUTUS	HARD-STEMMED BULRUSH	52,272	2.00%
SCIRPUS ATROVIRENS	DARK-GREEN BULLRUSH	156,816	6.00%
SCIRPUS CYPERINUS	WOOL GRASS	156,816	6.00%
SCIRPUS FLUVIATILIS	RIVER BULLRUSH	26,136	1.00%
SCIRPUS PENDULUS	RED BULLRUSH	104,544	4.00%
SCIRPUS PUNGENS	COMMON THREE SQUARE RUSH	26,136	1.00%
SCIRPUS VALIDUS	SOFT-STEM BULLRUSH	209,088	8.00%
WILDFLOWERS			
ACORUS CALAMUS	SWEET FLAG	46,671	1.79%
ALISMA SUBCORDATUM	COMMON WATER PLANTAIN	65,340	2.50%
BIDENS FRONDOSA	COMMON BEGGARS'S TICK	18,669	0.71%
IRIS VIRGINICA SHREVEI	BLUE FLAG IRIS	9,334	0.36%
MIMULUS RINGENS	MONKEY FLOWER	46,671	1.79%
SAGITTARIA LATIFOLIA	ARROWHEAD	65,340	2.50%
SPARGANIUM EURYCARPUM	GIANT BUR-REED	9,334	0.36%
LEGUMES			

Agrecol®
Agricultural Ecological Solutions

SEDGE MEADOW MIXED HEIGHT (STANDARD MIX)		
ITEM #	SM-SMM	
COVERAGE AREA	43,560	SQ.FT.
SEEDS	60	PER SQ.FT.
PLS WEIGHT	4.605	POUNDS

MIX DIVERSITY BY TYPE	% OF SEED COUNT	SPECIES COUNT	OUNCES	% WEIGHT
GRASSES	15%	6	15.955	21.66%
SEDGES	45%	13	14.558	19.76%
WILDFLOWERS	40%	29	32.302	43.84%
LEGUMES	1%	1	10.863	14.74%
TOTALS	**100%**	**49**	**73.678**	**100.00%**

SPECIES INFORMATION

LATIN NAME	COMMON NAME	TOTAL SEEDS	% TOTAL SEEDS
GRASSES			
BROMUS CILIATUS	FRINGED BROME	32,670	1.25%
CALAMAGROSTIS CANADENSIS	BLUE JOINT GRASS	81,675	3.13%
GLYCERIA CANADENSIS	RATTLESNAKE GRASS	65,340	2.50%
GLYCERIA GRANDIS	REED MANNA GRASS	65,340	2.50%
LEERSIA ORYZOIDES	RICE CUTGRASS	81,675	3.13%
SPARTINA PECTINATA	PRAIRIE CORD GRASS	65,340	2.50%
SEDGES			
CAREX BEBBII	BEBB'S SEDGE	113,088	4.33%
CAREX COMOSA	BRISTLY SEDGE	67,853	2.60%
CAREX CRINITA	FRINGED SEDGE	45,235	1.73%
CAREX HYSTERICINA	PORCUPINE SEDGE	90,471	3.46%
CAREX STIPATA	COMMON FOX SEDGE	90,471	3.46%
CAREX STRICTA	TUSSOCK SEDGE	67,853	2.60%
CAREX VULPINOIDEA	BROWN FOX SEDGE	90,471	3.46%
JUNCUS DUDLEYI	DUDLEY'S RUSH	90,471	3.46%
JUNCUS TENUIS	PATH RUSH	90,471	3.46%
JUNCUS TORREYI	TORREY'S RUSH	113,088	4.33%
SCIRPUS ATROVIRENS	DARK-GREEN BULLRUSH	113,088	4.33%
SCIRPUS CYPERINUS	WOOL GRASS	113,088	4.33%
SCIRPUS VALIDUS	SOFT-STEM BULLRUSH	90,471	3.46%
WILDFLOWERS			
ACORUS CALAMUS	SWEET FLAG	35,599	1.36%
ALISMA SUBCORDATUM	COMMON WATER PLANTAIN	35,599	1.36%
ASCLEPIAS INCARNATA	MARSH MILKWEED	17,800	0.68%
ASTER NOVAE-ANGLIAE	NEW ENGLAND ASTER	53,399	2.04%
ASTER PUNICEUS	RED-STEMMED ASTER	48,059	1.84%
BIDENS FRONDOSA	COMMON BEGGARS'S TICK	7,120	0.27%
CACALIA SUAVEOLENS	SWEET INDIAN PLANTAIN	8,900	0.34%
EUPATORIUM MACULATUM	SPOTTED JOE PYE WEED	53,399	2.04%
EUPATORIUM PERFOLIATUM	BONESET	53,399	2.04%
HELENIUM AUTUMNALE	SNEEZEWEED	53,399	2.04%
HELIANTHUS GROSSESERRATUS	SAW-TOOTH SUNFLOWER	8,900	0.34%
HYPERICUM PYRAMIDATUM	GREAT ST. JOHN'S WORT	17,800	0.68%
IRIS VIRGINICA SHREVEI	BLUE FLAG IRIS	3,560	0.14%
LOBELIA CARDINALIS	CARDINAL FLOWER	49,839	1.91%
LOBELIA SIPHILITICA	GREAT BLUE LOBELIA	53,399	2.04%
LYCOPUS AMERICANUS	WATER HOREHOUND	44,499	1.70%
MIMULUS RINGENS	MONKEY FLOWER	53,399	2.04%
PENTHORUM SEDOIDES	DITCH STONECROP	44,499	1.70%
PHYSOSTEGIA VIRGINIANA	OBEDIENT PLANT	17,800	0.68%
PYCNANTHEMUM VIRGINIANUM	MOUNTAIN MINT	44,499	1.70%
SILPHIUM PERFOLIATUM	CUPPLANT	8,900	0.34%
SILPHIUM TEREBINTHINACEUM	PRAIRIE DOCK	3,560	0.14%
~~SOLIDAGO OHIOENSIS~~	~~OHIO GOLDENROD~~	~~53,399~~	~~2.04%~~
SOLIDAGO RIDDELLII	RIDDELL'S GOLDENROD	53,399	2.04%
THALICTRUM DASYCARPUM	PURPLE MEADOW RUE	17,800	0.68%
VERBENA HASTATA	BLUE VERVAIN	58,738	2.25%
VERNONIA FASCICULATA	IRONWEED	44,499	1.70%
VERONICASTRUM VIRGINICUM	CULVER'S ROOT	51,619	1.98%
ZIZIA AUREA	GOLDEN ALEXANDERS	35,599	1.36%
LEGUMES			
CASSIA HEBECARPA	WILD SENNA	13,068	0.50%

Agrecol
Agricultural Ecological Solutions

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Madison, WI 53718
608-226-2544
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Agrecol warranties that the product conforms to the description on the label. This warranty is limited to the amount of the purchase price. Agrecol has no responsibility to special, consequential or contingent damages.

WET PRAIRIE MIXED HEIGHT		
LOT #	SM-WPM	
COVERAGE AREA	43560	SQ.FT.
SEEDS	60	PER SQ.FT.
PLS WEIGHT	157.138	OUNCES
TESTED	2/22/2005	
NOXIOUS WEED/LB	NONE	

Mix Diversity	% Seed Count	Species Count	PLS Ounces	% Weight
Grasses	40.00%	11.00	78.507	49.96%
Sedges	10.00%	5.00	1.570	1.00%
Wildflowers	47.00%	30.00	53.820	34.25%
Legumes	3.00%	3.00	23.240	14.79%
Totals	**100.00%**	**49.00**	**157.138**	**100.00%**

Species Information

LATIN NAME	COMMON NAME	ORIGIN	TOTAL PLS OZS	PERCENT OF MIX
GRASSES				
ANDROPOGON GERARDII	BIG BLUESTEM	SE WI	5.734	3.65%
BROMUS CILIATUS	FRINGED BROME	IOWA COUNTY	14.508	9.23%
CALAMAGROSTIS CANADENSIS	BLUE JOINT GRASS	WAUSHARA CO WI	0.467	0.30%
ELYMUS CANADENSIS	CANADA WILD RYE	IA	14.038	8.93%
ELYMUS VIRGINICUS	VIRGINIA WILD RYE	ROCK CO WI	22.107	14.07%
GLYCERIA CANADENSIS	RATTLESNAKE GRASS	WI	3.308	2.10%
GLYCERIA GRANDIS	REED MANNA GRASS	GREEN CO WI	1.341	0.85%
LEERSIA ORYZOIDES	RICE CUTGRASS	DANE CO WI	2.788	1.77%
PANICUM VIRGATUM	SWITCH GRASS	KENOSHA CO WI	2.521	1.60%
SORGHASTRUM NUTANS	INDIAN GRASS	GREEN CO WI	5.349	3.40%
SPARTINA PECTINATA	PRAIRIE CORD GRASS	MN	6.346	4.04%
SEDGES				
CAREX STIPATA	COMMON FOX SEDGE	DANE CO WI	1.032	0.66%
CAREX VULPINOIDEA	BROWN FOX SEDGE	DANE CO WI	0.333	0.21%
JUNCUS TENUIS	PATH RUSH	DANE CO WI	0.030	0.02%
SCIRPUS ATROVIRENS	DARK-GREEN BULLRUSH	DANE CO WI	0.128	0.08%
SCIRPUS CYPERINUS	WOOL GRASS	DANE CO WI	0.047	0.03%
WILDFLOWERS				
ASCLEPIAS INCARNATA	MARSH MILKWEED	ROCK CO WI	6.292	4.00%
ASCLEPIAS SYRIACA	COMMON MILKWEED	DANE CO WI	1.910	1.22%
ASTER NOVAE-ANGLIAE	NEW ENGLAND ASTER	IOWA CO WI	0.587	0.37%
ASTER PUNICEUS	RED-STEMMED ASTER	ROCK CO WI	0.503	0.32%
BIDENS FRONDOSA	COMMON BEGGARS'S TICK	DANE CO WI	1.346	0.86%
ERYNGIUM YUCCIFOLIUM	RATTLESNAKE MASTER	JEFFERSON CO WI	2.951	1.88%
EUPATORIUM MACULATUM	SPOTTED JOE PYE WEED	IOWA CO WI	0.514	0.33%
EUPATORIUM PERFOLIATUM	BONESET	DANE CO WI	0.299	0.19%
HELENIUM AUTUMNALE	SNEEZEWEED	IOWA CO WI	0.382	0.24%
HELIANTHUS GROSSESERRATUS	SAW-TOOTH SUNFLOWER	LACROSSE CO WI	1.375	0.87%
HELIOPSIS HELIANTHOIDES	EARLY SUNFLOWER	GREEN CO WI	6.369	4.05%
HYPERICUM PYRAMIDATUM	GREAT ST. JOHN'S WORT	KENOSHA CO WI	0.047	0.03%
LIATRIS SPICATA	MARSH BLAZING STAR	KENOSHA CO. WI	3.399	2.16%
MIMULUS RINGENS	MONKEY FLOWER	PA	0.028	0.02%
~~MONARDA FISTULOSA~~	~~WILD BERGAMOT~~	~~WAUKESHA CO WI~~	~~0.681~~	~~0.43%~~
NAPAEA DIOICA	GLADE MALLOW	ROCK CO WI	5.967	3.80%
PARTHENIUM INTEGRIFOLIUM	WILD QUININE	WI	3.266	2.08%
PYCNANTHEMUM VIRGINIANUM	MOUNTAIN MINT	WALWORTH CO WI	0.257	0.16%
~~RATIBIDA PINNATA~~	~~YELLOW CONEFLOWER~~	~~JEFFERSON CO WI~~	~~1.528~~	~~0.97%~~
RUDBECKIA SUBTOMENTOSA	SWEET BLACK-EYED SUSAN	IOWA CO WI	0.965	0.61%
SILPHIUM PERFOLIATUM	CUPPLANT	LAFAYETTE CO WI	3.770	2.40%
SILPHIUM TEREBINTHINACEUM	PRAIRIE DOCK	ADAMS CO WI	3.040	1.93%
SOLIDAGO GRAMINIFOLIA	GRASS-LEAVED GOLDENROD	IOWA CO WI	0.071	0.04%
~~SOLIDAGO OHIOENSIS~~	~~OHIO GOLDENROD~~	~~WALWORTH, WI~~	~~0.535~~	~~0.34%~~
SOLIDAGO RIDDELLII	RIDDELL'S GOLDENROD	KENOSHA CO WI	0.595	0.38%
THALICTRUM DASYCARPUM	PURPLE MEADOW RUE	WALWORTH CO WI	2.221	1.41%
VERBENA HASTATA	BLUE VERVAIN	ROCK CO WI	0.611	0.39%
VERNONIA FASCICULATA	IRONWEED	COLUMBIA CO, WI	1.619	1.03%
VERONICASTRUM VIRGINICUM	CULVER'S ROOT	DANE CO WI	0.107	0.07%
ZIZIA AUREA	GOLDEN ALEXANDERS	IOWA CO WI	2.586	1.65%
LEGUMES				
BAPTISIA LEUCANTHA	WILD WHITE INDIGO	IOWA CO WI	4.752	3.02%
CASSIA HEBECARPA	WILD SENNA	DANE CO WI	10.863	6.91%
DESMODIUM CANADENSE	CANADA TICK TREFOIL	KENOSHA CO WI	7.625	4.85%

Appendix D

Aitkin County Soil Survey Legend

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter The initial numbers represent the kind of soil A capital letter following these numbers represents the class of slope Symbols without a slope letter are for nearly level soils or miscellaneous areas

SYMBOL	NAME
72	Shooker very fine sandy loam
119C	Pomroy loamy fine sand, 6 to 12 percent slopes
124	Brickton silt loam
133B	Dalbo very fine sandy loam, 1 to 6 percent slopes
142	Nokay fine sandy loam
144B	Flak sandy loam, 3 to 8 percent slopes
144C	Flak sandy loam, 8 to 15 percent slopes
146B	Wabedo sandy loam, 1 to 6 percent slopes
147	Spooner silt loam
152B	Milaca fine sandy loam, 3 to 8 percent slopes
152C	Milaca fine sandy loam, 8 to 15 percent slopes
152E	Milaca fine sandy loam, 15 to 25 percent slopes
164B	Mora fine sandy loam, 1 to 4 percent slopes
166	Ronneby loam
167B	Baudette silt loam, 1 to 5 percent slopes
186	Nemadji loamy fine sand
188B	Omega loamy fine sand, 2 to 6 percent slopes
188C	Omega loamy fine sand, 6 to 12 percent slopes
188E	Omega loamy sand, 12 to 25 percent slopes
202	Meehan loamy sand
204B	Branstad loam, 2 to 6 percent slopes
204C	Cushing loam, 6 to 12 percent slopes
204E	Cushing loam, 12 to 25 percent slopes
218	Watab fine sand
240B	Warba very fine sandy loam, 1 to 6 percent slopes
240C	Warba very fine sandy loam, 6 to 12 percent slopes
243	Stuntz very fine sandy loam
266	Freer silt loam
268B	Cromwell fine sandy loam, 1 to 6 percent slopes
268C	Cromwell sandy loam, 6 to 12 percent slopes
268E	Cromwell fine sandy loam, 12 to 25 percent slopes
268F	Cromwell fine sandy loam, 25 to 40 percent slopes
292	Alstad loam
302B	Rosholt fine sandy loam, 2 to 6 percent slopes
302C	Rosholt fine sandy loam, 6 to 12 percent slopes
346	Talmoon fine sandy loam
428	Hassman muck
454B	Mahtomedi loamy coarse sand, 2 to 6 percent slopes
454C	Mahtomedi loamy coarse sand, 6 to 12 percent slopes
454E	Mahtomedi loamy coarse sand, 12 to 25 percent slopes
454F	Mahtomedi gravelly loamy sand, 25 to 40 percent slopes
458B	Menahga loamy sand, 1 to 6 percent slopes
458C	Menahga loamy sand, 6 to 12 percent slopes
458E	Menahga loamy sand, 12 to 25 percent slopes
464B	Brennyville silt loam, 2 to 5 percent slopes
469B	Hillcity silt loam, 1 to 6 percent slopes
502	Dusler silt loam
504B	Duluth fine sandy loam, 1 to 6 percent slopes
504C	Duluth fine sandy loam, 6 to 12 percent slopes
504E	Duluth fine sandy loam, 12 to 25 percent slopes
531	Beseman muck
532	Sago muck
533	Loxley peat
540	Seelyeville muck
541	Rifle peat
543	Markey muck
544	Cathro muck
546	Lupton muck
549	Greenwood peat
563	Northwood muck
564	Friendship loamy sand
607	Pengilly silt loam
615	Cowhorn loamy very fine sand
617B	Goodland silt loam, 1 to 10 percent slopes
618B	Itasca silt loam, 1 to 6 percent slopes
621	Morph very fine sandy loam
625	Sandwick loamy sand
627	Tawas muck
628	Talmoon muck, depressional
629B	Wawina loamy very fine sand, 1 to 10 percent slopes
672	Willosippi loam
685	Oesterle fine sandy loam
732B	Bushville loamy fine sand, 1 to 6 percent slopes
734	Cormant loamy fine sand, stratified substratum
736	Ronneby-Mora complex
738B	Milaca-Millward complex, 2 to 8 percent slopes
738C	Milaca-Millward complex, 8 to 15 percent slopes
759	Waukenabo fine sandy loam
795	Redby loamy fine sand, stratified substratum
797	Mooselake and Lupton mucky peats
798	Sago and Roscommon soils
799	Seelyeville-Bowstring association
869	Lobo and Waskish peats
870B	Itasca-Goodland complex, 2 to 6 percent slopes
870C	Itasca-Goodland complex, 6 to 12 percent slopes
870E	Itasca-Goodland complex, 12 to 25 percent slopes
872	Pengilly-Winterfield association
928C	Cushing-Mahtomedi complex, 2 to 10 percent slopes
928D	Cushing-Mahtomedi complex, 10 to 25 percent slopes
928F	Cushing-Mahtomedi complex, 25 to 40 percent slopes
980	Blackhoof and Mahtowa soils
990	Twig and Giese soils
1002	Borosaprists and Fluvaquents, frequently flooded
1030	Pits, gravel-Udipsamments complex
1031	Histosols, ponded
1072	Udorthents, shallow (sanitary landfill)
1115	Newson loamy sand
1150	Jevne fine sandy loam
1154	Sax muck
1353B	Cutaway loamy fine sand, 1 to 6 percent slopes
1354A	Aftad fine sandy loam, 0 to 3 percent slopes
1356	Water, miscellaneous
1372	Wealthwood loamy fine sand
1375B	Alban fine sandy loam, 3 to 8 percent slopes
1878	Hamre muck
1982	Baudette-Spooner complex
1983	Cathro muck, stratified substratum
1984	Leafriver muck
W	Water

CUL

BOUNDARIES

County or pa

Field sheet r

LAND DIVISIO
(sections an

ROAD EMBLE

Federal

State

PITS

Gravel pit

Appendix E

Aitkin Soil and Water Transect Data

Table 1
Aitkin Wetland Mitigation Site
Soil Boring Summary
PolyMet Mining Co.

Soil Boring ID	Depth (inches)	Soil Type	Hydrology	Date	Location Description	Vegetation	Approximate Ground Elevation (ft. MSL)
West Side of Highway 1							
SB-1	0-20	mucky peat/peaty muck	No saturation, no water table	4/25/2007	T47N, R27W, S1	Kentucky blue grass	1199.9
	20+	black loam	No saturation, no water table				
SB-2	0-28	mucky peat/fibric peat	No saturation, no water table	4/25/2007	T47N, R27W, S1	Kentucky blue grass	1200
	28-32+	dark brown loam	No saturation, no water table				
SB-3	0-22	mucky peat/fibric peat	No saturation, no water table	4/25/2007	T47N, R27W, S1		1199.9
	22-24+	dark brown to black loam	No saturation, no water table				
SB-4	0-20	mucky peat/fibric peat	Frost at 12-20 inches, no saturation	4/25/2007	T47N, R27W, S1	Kentucky blue grass	1200
SB-5	0-17	mucky peat/fibric peat	Frost at 11-17 inches, no saturation	4/25/2007	T47N, R27W, S1	Kentucky blue grass	1200.4
SB-6	0-12	muck	No saturation, no water table	4/25/2007	T47N, R27W, S1	Sod field	1201.1
	12-28	fibric peat	No saturation, no water table				
	28+	gleyed and tan silt loam	No saturation, no water table				
SB-7	0-11	muck	No saturation, no water table	4/25/2007	T47N, R27W, S1	Sod field	1201
	11-24	fibric peat	Frost 12-24 inches, no saturation				
	24-28+	mucky peat	No frost, no saturation				
SB-8	0-15	fibric peat	No saturation, no water table	4/25/2007	T47N, R27W, S1	No vegetation	1196.4
	15-18	gleyed silt loam	Frost at 16 inches, no saturation				
SB-9	0-11	muck	No saturation, no water table	4/25/2007	T47N, R27W, S1	Canada bluejoint grass?, Juncus sp.?, reed canary grass	1200
	11-16	mucky peat/fibric peat	Frost at 14 inches, no saturation				
East Side of Highway 1							
SB-10	0-4	black loam	No saturation, no water table	4/25/2007	T47N, R26W, S6	Recently cut sod, no vegetation	1201.1
	4-8	light brown fine sand	No saturation, no water table				
	8-24	mixed sand, silty clay loam, mottling at 11 inches, mixed colors-light brown, black, and reddish mottles	No saturation, no water table				
SB-11	0-12	black sandy clay loam	No saturation, no water table	4/25/2007	T47N, R26W, S6	Recently cut sod, no vegetation	1201.5
	12-16	light brown sand	No saturation, no water table				
	16-18+	mixed silt, sandy clay, mixed colors-yellowish-brown, light brown	No saturation, no water table				
SB-12	0-14	black sandy loam	No saturation, no water table	4/25/2007	T47N, R26W, S6	Recently cut sod, no vegetation	1200.6
	14-17	dark gray sandy clay loam	No saturation, no water table				
	17-18+	tan sand	No saturation, no water table				
SB-13	0-12	black sandy loam	No saturation, no water table	4/25/2007	T47N, R26W, S6	Kentucky blue grass	1200.3
	12-17	dark gray sandy clay loam	No saturation, no water table				
	17-18+	tan sand	No saturation, no water table				
Reference Wetlands							
SB-14	0	Soils frozen at the surface	1-2 inches of inundation	4/25/2007	T48N, R26W, S7, 5 miles north of Aitkin sod farm	sedge meadow/ shrub carr/ tamarack swamp	N/A
SB-15	0	Soils frozen at the surface to 1-3 inches in depth under shrubs	0-2 inches of inundation	4/25/2007	T48N, R26W, S8, 5 miles north of Aitkin sod farm	shrub carr/ sedge meadow	N/A

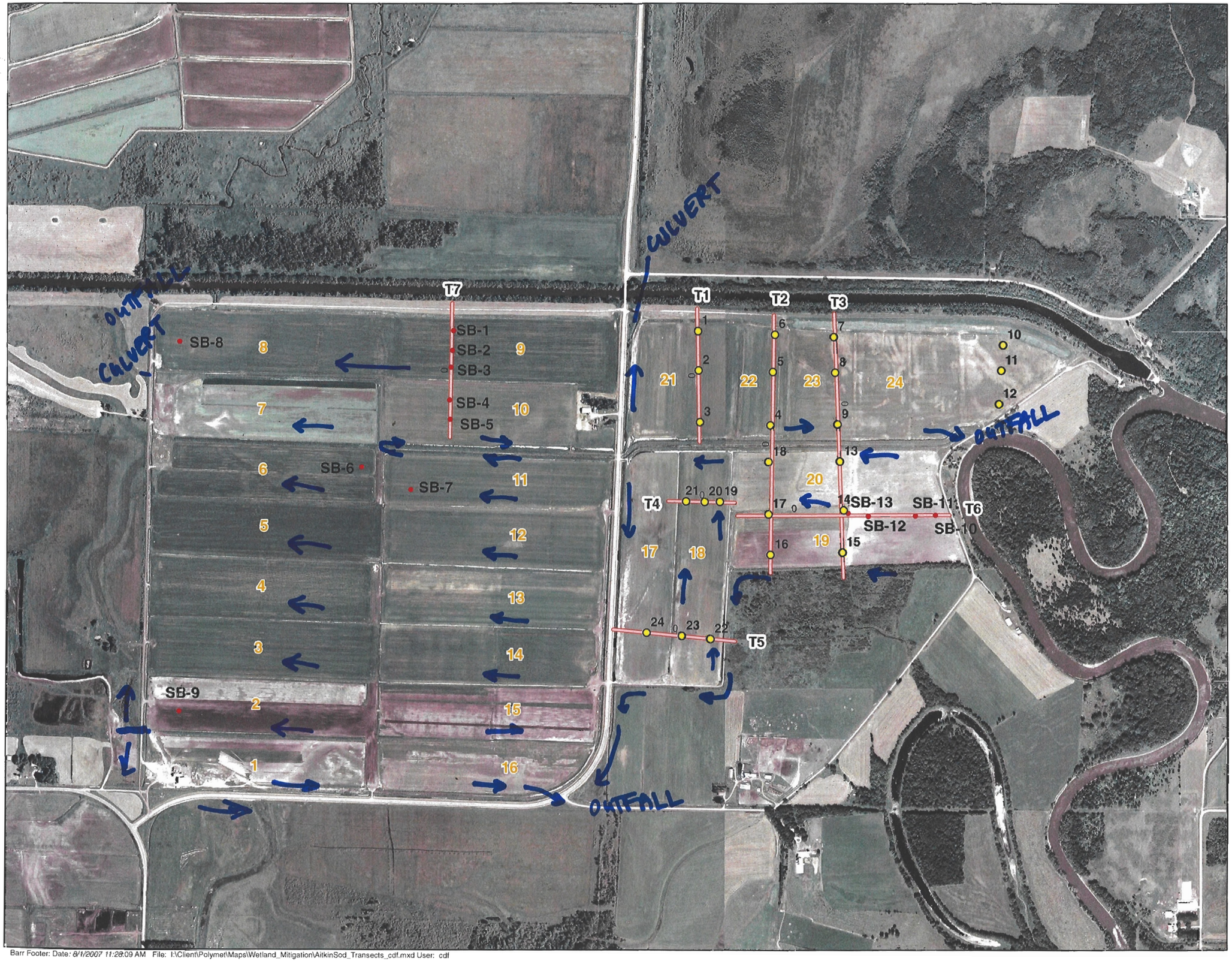


Figure A-1

TRANSECT LOCATIONS
Aitkin Sod Farm
Wetland Restoration
PolyMet Mining Co.

Barr Footer: Date: 8/1/2007 11:28:09 AM File: I:\Client\Polymet\Maps\Wetland_Mitigation\AitkinSod_Transects_cdf.mxd User: cdf

Legend for Soil Stratigraphy and Water Table Diagrams

Organic Soil


Sod/Oe = grass sod layer that is usually about 4 inches thick with peat soil


Oe = peat soil (Organic, Hemic)


Oa = mucky soil (Organic, Sapric)

Mineral Soil (ordered from coarse to fine textured)


s = sand


fs = fine sand


lfs = loamy fine sand


sl = sandy loam


fsl = fine sandy loam


l = loam


scl = sandy clay loam


fscl = fine sandy clay loam


cl = clay loam


si = silt


sicl = silty clay loam

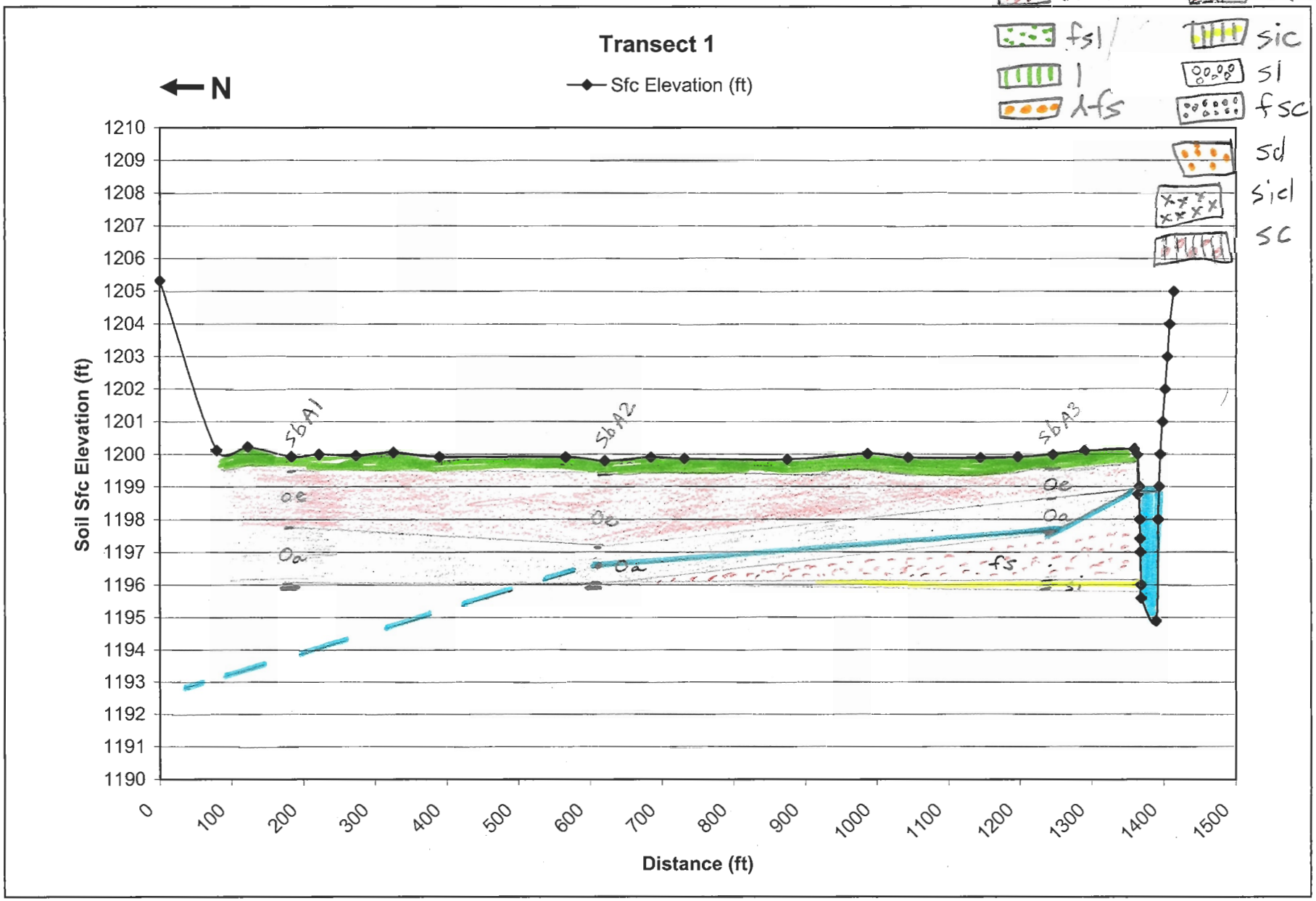

sic = silty clay


sc = sandy clay


c = clay


Measured / observed water Table

Assumed water Table - below the bore hole depth


WT
WT depth unknown
Sod/Oe
Oe
Oa
sand
silt
clay
cl/fscl
si/fs
fsl
l
l-fs
sic
sl
fscl
sd
sicl
sc
Transect 1
N
Sfc Elevation (ft)
Soil Sfc Elevation (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
SbA1
SbA2
SbA3
Oe
Oa
fs
sl
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Distance (ft)

A-3

Transect 2

Sfc Elevation (ft)

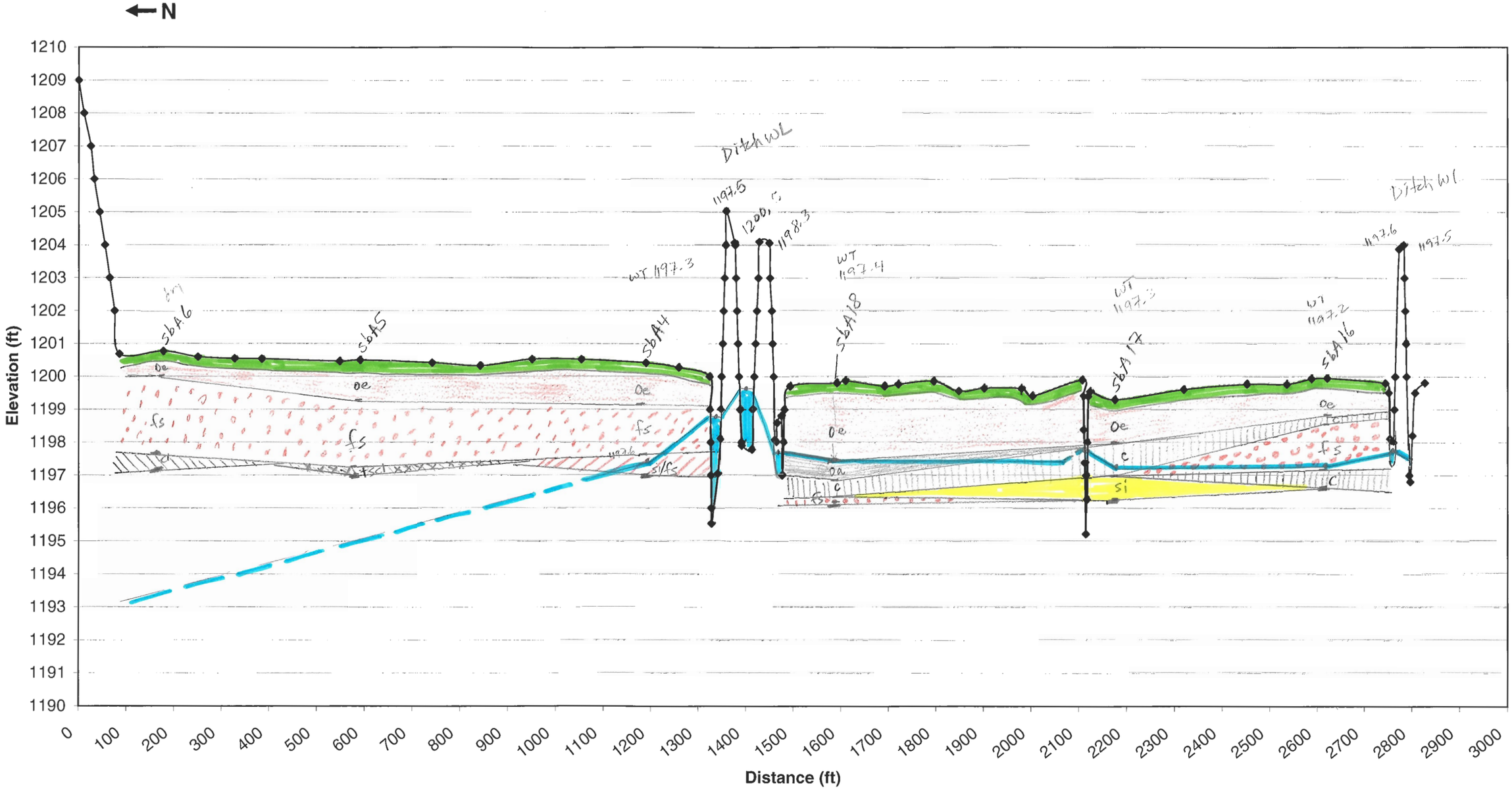
N

Elevation (ft)

1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190

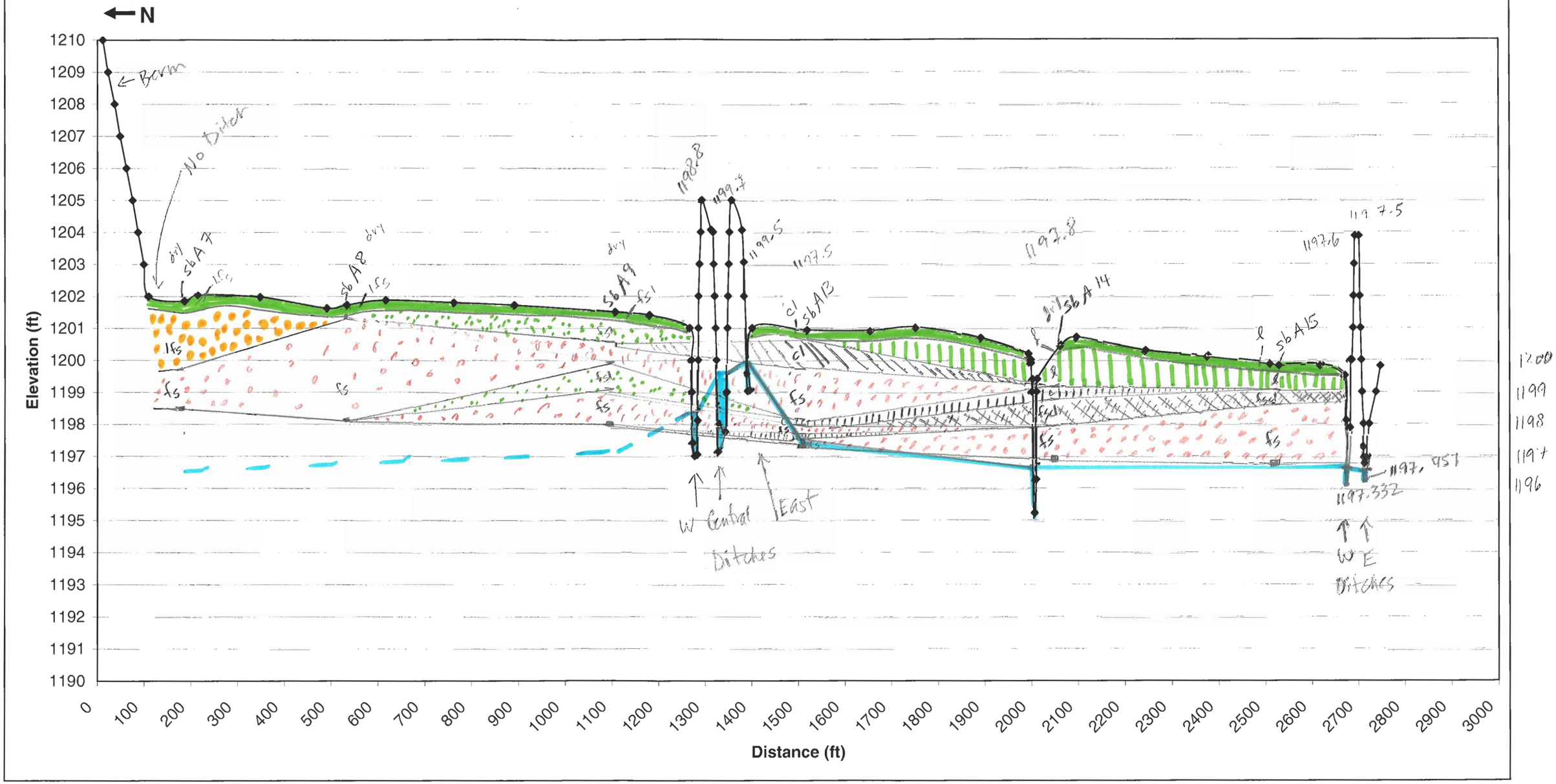
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000

Distance (ft)

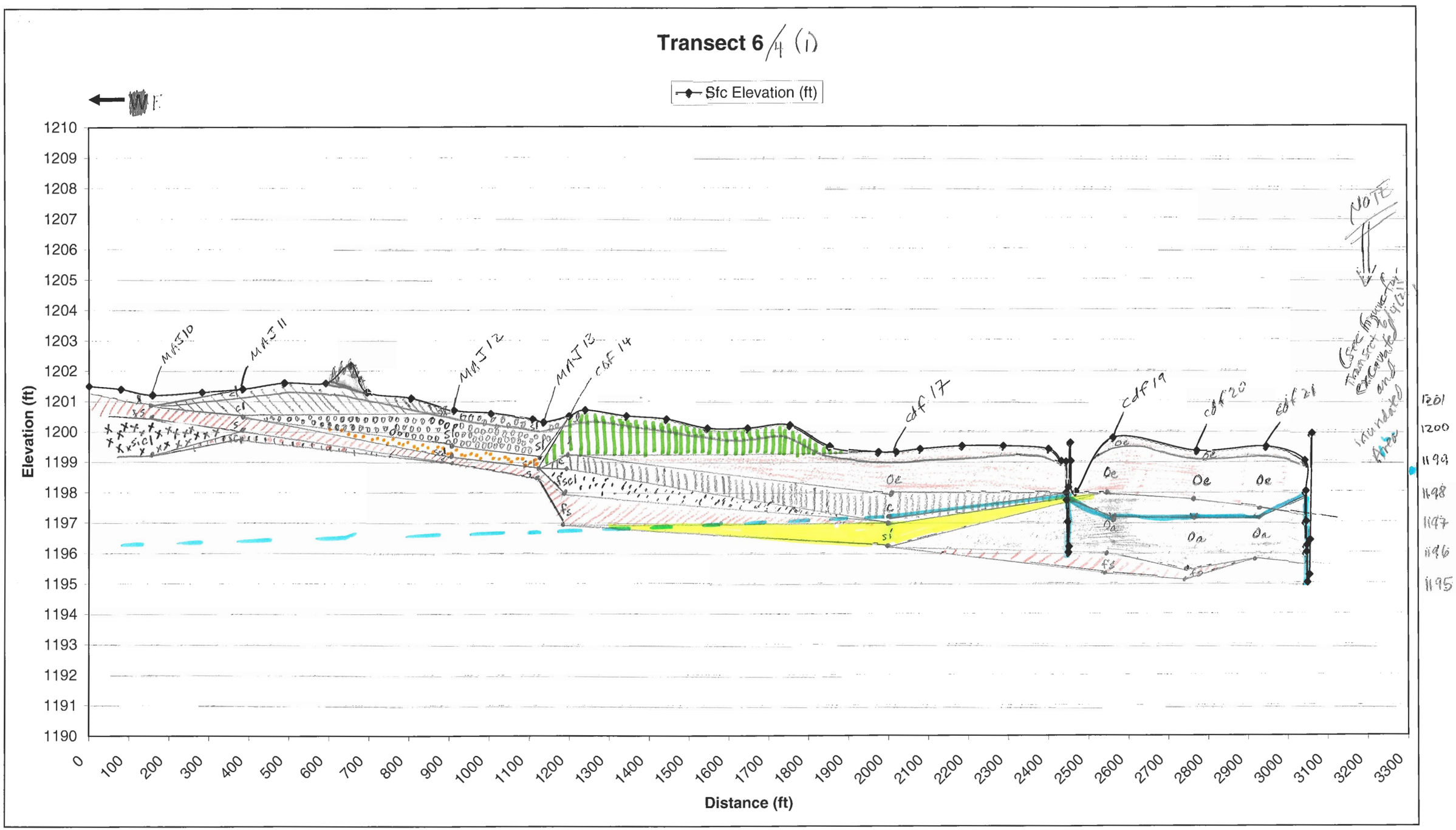


Transect 3

Sfc Elevation (ft)



Transect 6/4 (1)



Transect 6/4 (2)

WATER TABLE
Observed/Measured
Below measured depth

Sfc Elevation (ft)

← N

MAS 11
MAS 12
MAS 13
CDF 17
Ditch
CDF 19
CDF 20
Ditch WL
CDF 1197.8
CDF 21
excavated and inundated Area
ROAD

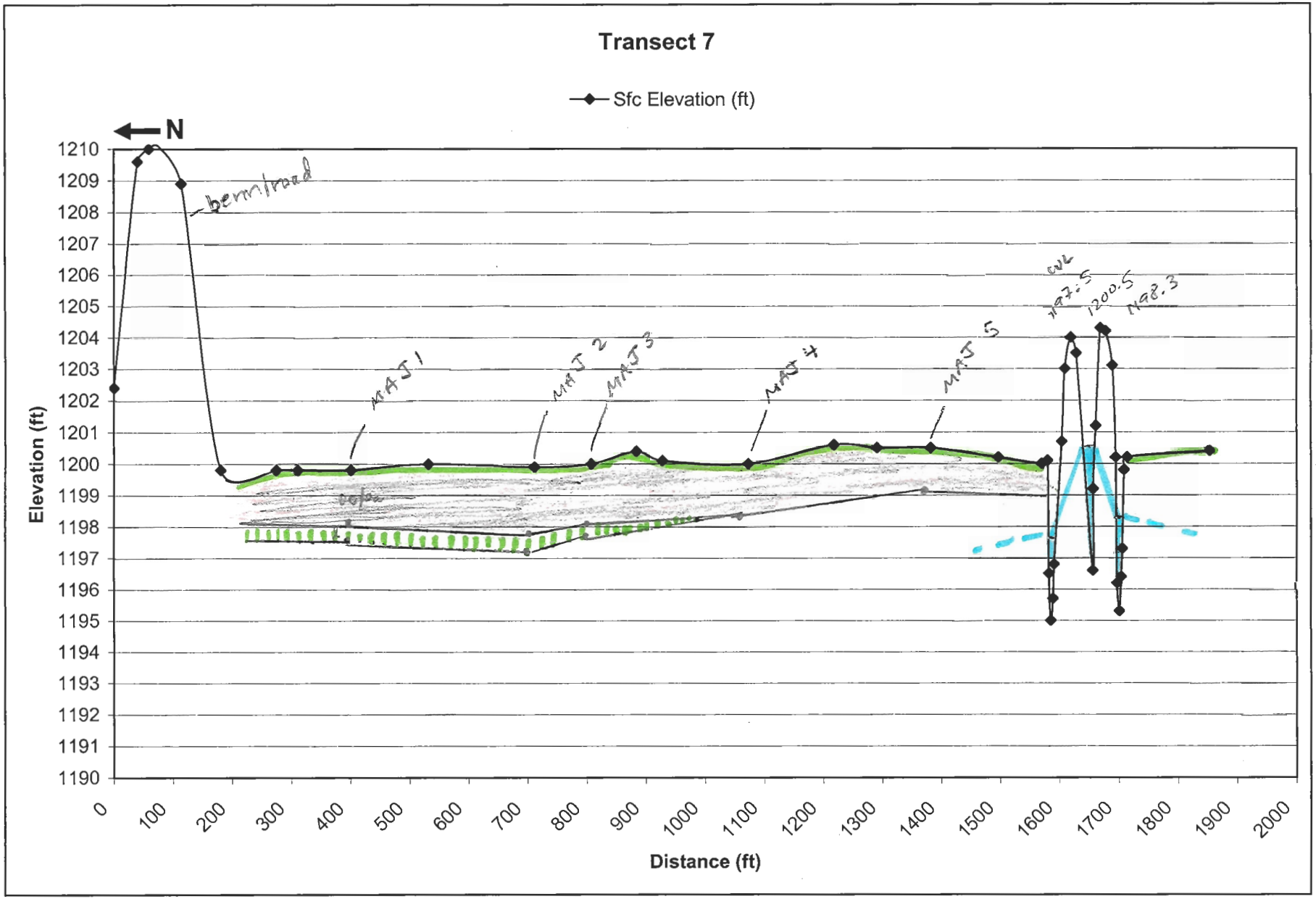
Elevation (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190

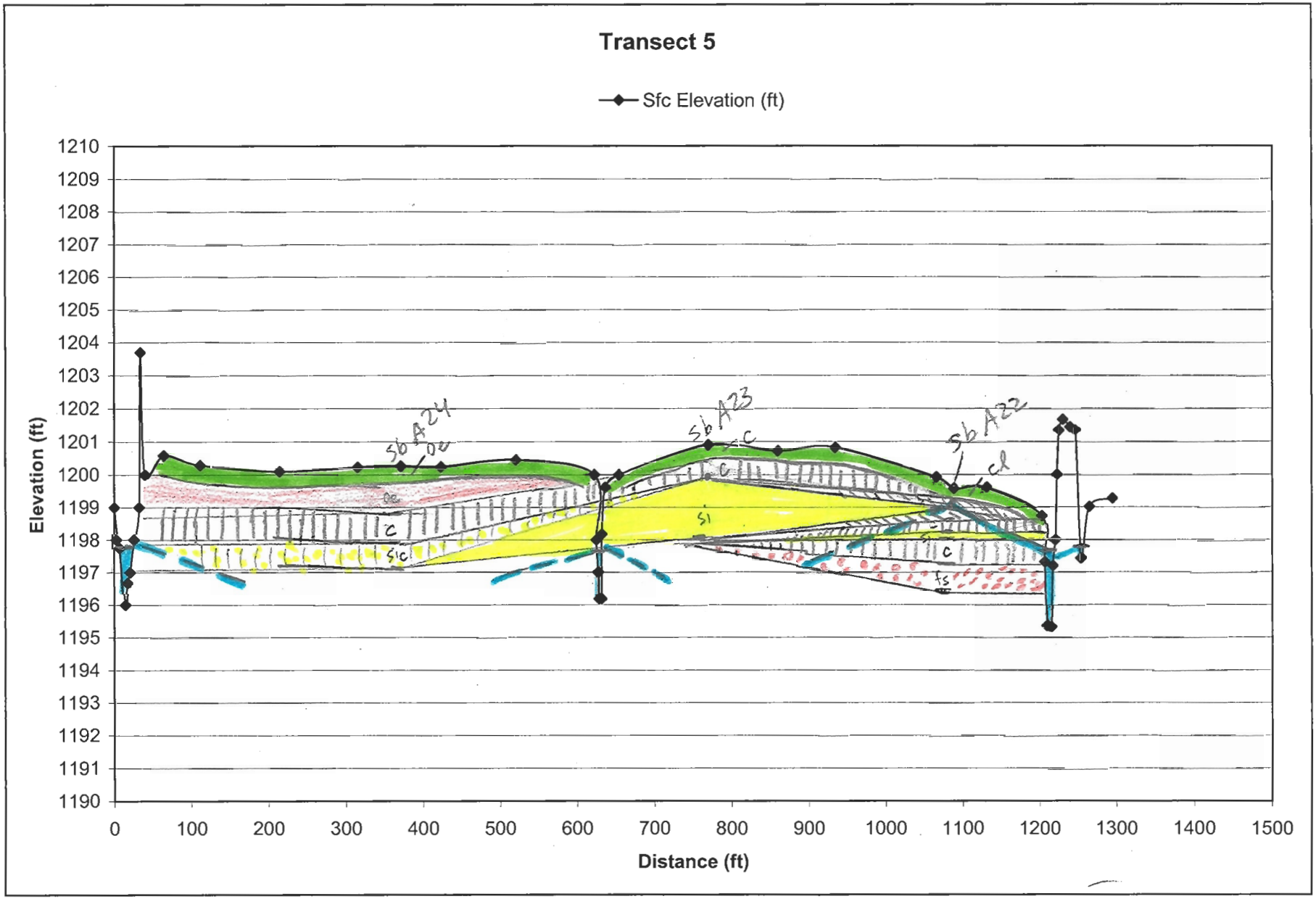
1209
1199
1198
1197
1196

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800

Distance (ft)

West Side


Transect 7
Sfc Elevation (ft)
N
Elevation (ft)
Distance (ft)
berm/road
MAT 1
MAT 2
MAT 3
MAT 4
MAT 5
GWL
1197.5
1200.5
1192.3
slope
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000


Transect 5
Sfc Elevation (ft)
Elevation (ft)
1210
1209
1208
1207
1206
1205
1204
1203
1202
1201
1200
1199
1198
1197
1196
1195
1194
1193
1192
1191
1190
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Distance (ft)
sb A24
sb A23
sb A22
c
cl
si
sic
fs

Appendix F

Permanent Conservation Easement Example

(Above Space is Reserved for Recording Information)

PERPETUAL CONSERVATION EASEMENT
FOR WETLAND BANK

Grantor:

Location: within Section 6, Township 47 North, Range 26 West, County of Aitkin and Section 1, Township 47 North, Range 27 West, County of Aitkin

This Perpetual Conservation Easement for Wetland Replacement ("Easement") is made on (date) by the undersigned, hereinafter referred to collectively as the "Grantor":

RECITALS

A. This Easement is made pursuant to and in furtherance of the Wetland Conservation Act of 1991, as amended, Minn. Stat. §103G.222, *et. seq*. ("WCA") and the rules implementing WCA, Minn. R. ch. 8420 ("WCA Rules").

B. This Easement pertains to all or part of the real property in Aitkin County, Minnesota, which is legally described on *Exhibit A* attached hereto and made a part hereof ("Real Property").

C. The Real Property is the subject of a wetland bank plan pursuant to Minn. R.8420.0740.

D. The Grantors include all of the following (1) all the fee owners of the Real Property and (2) the applicants under the bank plan if different from the fee owners. The term "Grantor" includes all of the Grantors if there is more than one. The Grantors are jointly and severally responsible for complying with the terms of this instrument. This Easement and the duties and restrictions contained in it shall also run with the land.

E. WCA is administered by the State of Minnesota through its Board of Water and Soil Resources ("State").

F. The local government unit ("LGU") charged under WCA with approval of the subject wetland replacement plan ("replacement plan") is the Minnesota Department of Natural Resources – Division of Lands and Minerals. The subject wetland mitigation plan includes all fully executed forms provided by the State, all supporting maps, engineering plans, drawings, monitoring plan, vegetation establishment plan and management plan and facilities maintenance plan. A complete copy of the replacement plan is on file at the LGU. The address of the LGU is 1525 Third Avenue East, Hibbing, MN 55746. The State is responsible for the acceptance of this Easement.

G. The replacement plan requires the restoration or creation of a wetland on the portion of the Real Property designated in Exhibit B attached hereto and made a part hereof ("Replacement Area"). The replacement plan may also require the establishment of upland buffer within the Replacement Area. This Easement pertains to both wetlands and specified uplands within the Replacement Area.

H. The Replacement Area is subject to the WCA, WCA Rules and all other provisions of law that apply to wetlands, except that the exemptions in Minn. Stat. §103G.2241 and Minn. R. 8420.0122 do not apply to the Replacement Area, pursuant to Minn. Stat. §103G.222, subd. 1(h) and Minn. R. 8420.0115.

I. All references in this Easement to Minnesota Statutes and to Minnesota Rules are to the statutes and rules currently in effect and as amended or renumbered in the future.

J. The purposes of this Easement are to maintain and improve the ecological values of the Replacement Area through the means identified in the replacement plan and to preserve the Replacement Area in a natural condition in perpetuity.

IN ADDITION, THE GRANTORS, FOR THEMSELVES, THEIR HEIRS, SUCCESSORSAND ASSIGNS COVENANT THAT THEY:

1. Shall establish and maintain wetlands and upland buffers within the Replacement Area as specified in the replacement plan approved by the LGU and on file at the offices of the LGU. The wetland and any specified upland buffer area shall be the size and type specified in the replacement plan. Grantor shall not make any use of the Replacement Area that would adversely affect any of the functions or values of the area. Those functions and values are identified in Minn. R. 8420.0540, subp. 10, or specified in the approved replacement plan.

2. Shall pay the costs of establishment, maintenance, repairs and reconstruction of the wetlands and specified upland buffers within the Replacement Area, which the LGU or the State may deem necessary to comply with the specifications for the Replacement Area in the approved replacement plan. The Grantor's obligations under this paragraph include the payment of any lawful taxes or assessments on the Real Property.

3. Shall establish and maintain visible monuments such as signs, numbered fence posts or survey posts at prominent locations along the boundary of the Replacement Area in accordance with the approved replacement plan. If numbered fence posts are used, Grantor's Replacement Plan must contain a survey or scaled drawing of the property that corresponds to the fence post numbering. Posts

must be at least 4 feet high and notably visible on the landscape. If signs are used, such signs must be have a surface area of at least one quarter (1/4) square feet, mounted on a fence post at least 4 feet above ground, and minimally contain the words "Boundary of Wetland Replacement Area - Subject to Perpetual Conservation Easement Restrictions – Contact MN Board of Water and Soil Resources or Local Soil and Water Conservation District for Further Information." Said monuments must be made of non-degradable material and shall be at least four feet in height.

4. Grants to the LGU, the State, and the agents and employees of the LGU and the State, reasonable access to the Replacement Area for inspection, monitoring and enforcement purposes. The LGU, the State, and the agents and employees of the State are hereby granted a perpetual ingress and egress easement ("Access Easement") for access to and from the Replacement Area. The Access Easement shall be over and across the area ("Access Area") that is specified on Exhibit A attached hereto and made a part hereof or, if not specified on Exhibit A, the most reasonably direct and convenient route between the Replacement Area and a public road. If all or any part of the Access Area is owned by a person or entity other than Grantor, then the owner has joined in this Easement for purposes of granting the Access Easement by signing below. The signed written consent and subordination of all other holders of interests in the Access Area has been or will be obtained by Grantor and recorded in the same manner as specified in paragraph 5 below. This Easement grants no access to or entry to the Real Property, the Replacement Area, or the Access Area to the general public.

5. Represents that Grantor is (a) the fee owner of the Real Property and (b) the applicant under the replacement plan, if different from the fee owner. Grantor represents that all other parties who may have an interest in the Real Property (e.g., mortgagees, contract for deed vendees, holders of easements, etc.) have consented and subordinated their interests to this Easement by signing below. If it is determined at any time that there is any other party who may have an interest in the Real Property that is prior to this Easement, then Grantor shall immediately obtain and record a consent and subordination agreement signed by such other party. Acceptance of this Easement does not release Grantor from the obligation to obtain and record a consent and subordination agreement signed by any party who may have an interest in the Real Property that is prior to this Easement, even if such interest was of record at the time of acceptance.

6. Will record this easement at Grantor's expense in the real property records of the county where the Real Property is located. Said recording shall take place within 30 days of the State's acceptance of this Easement. The Grantor shall provide the original copy of the recorded easement to the State prior to making any credits from this replacement area available for use.

7. Acknowledge that this Easement shall be unlimited in duration, without being re-recorded. This Easement shall be deemed to be a perpetual conservation easement pursuant to Minn. Stat. ch. 84C.

8. Acknowledge that, unless expressly authorized in writing by the LGU in the approved replacement plan, Grantor:

(a) Shall not produce agricultural crops on the Replacement Area, except that this provision does not restrict the harvest of the seeds of native vegetation if only the seed-head is

removed in the process of harvest and does not involve the use of vehicular, motorized equipment;

(b) Shall not cut hay, mow vegetation or cut timber on the Replacement Area except as allowed or prescribed in the Replacement Plan;

(c) Shall not make any vegetative alterations on the Replacement Area that do not enhance or would degrade the ecological functions and values of the Replacement Area. Vegetative alterations shall be limited to those listed in the approved replacement plan;

(d) Shall not graze livestock on the Replacement Area;

(e) Shall not place any materials, substances or other objects, nor erect or construct any type of structure, temporary or permanent, on the Replacement Area.

(f) Shall not allow vehicular traffic on the Replacement Area except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(g) Shall not alter the topography of the Replacement Area by any means including plowing, dredging, filling, mining or drilling except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(h) Shall not modify the hydrology of the Replacement Area in any way or by any means including pumping, draining, ditching, diking, impounding or diverting surface or ground water into or out of the Replacement Area except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(i) Shall regularly inspect and maintain structures specified in the Replacement Plan in good working condition to sustain the goals in the approved Replacement Plan.

9. Acknowledge that the Grantor is responsible, at Grantor's cost, for weed control by complying with noxious weed control laws and emergency control of pests necessary to protect the public health on the Replacement Area.

10. Acknowledge that this Easement may be modified only by the joint written approval of the LGU and the State. If the Replacement Area has been used to mitigate wetland losses under the Federal Water Pollution Control Act, the U.S. Army Corps of Engineers (or successor agency) must also agree to the modification in writing.

11. Acknowledge that this Easement may be enforced, at law or in equity, by the LGU or the State. The LGU and the State shall be entitled to recover an award of reasonable attorney's fees from Grantor in any action to enforce this Easement. The right to enforce the terms of this Easement is not waived or forfeited by any forbearance or failure to act on the part of the State or LGU. If the subject Replacement Area is to be used partially or wholly to fulfill permit requirements under the Federal Water Pollution Control Act or a federal farm program, then the provisions of this Easement

that run to the State or the LGU may also be enforced by the United States of America in a court of competent jurisdiction.

12. Acknowledge that this Easement is not valid until the Easement has been accepted by the State, the Grantor has recorded this Easement and the State has received evidence of such recording.

SIGNATURE OF GRANTOR

SIGNATURE OF FEE OWNER(S): _____

_____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name(s) with marital status).

_____
Notary Public

Notarial Stamp or Seal

SIGNATURE OF BANK APPLICANT (S), IF DIFFERENT FROM FEE OWNER: _____

_____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name(s) with marital status).

_____
Notary Public

Notarial Stamp or Seal

ACCEPTANCE

The State accepts the foregoing Easement.

MINNESOTA BOARD OF WATER AND SOIL RESOURCES:

By: _____

Its: _____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name of person) as (title) of the Board of Water and Soil Resources.

_____
Notary Public

Notarial Stamp or Seal

This instrument was drafted by the Board of Water and Soil Resources
One West Water Street, St. Paul, MN 55107

If there are additional holders of interest the subject real property CHECK HERE ☐ and attach their Consent and Subordination agreement [BWSR Form Number: wca-bank-03 (consent).doc].

EXHIBIT A

Legal Description of Real Property

EXHIBIT B

Map or Survey of Bank Area

(Above Space is Reserved for Recording Information)

PERPETUAL CONSERVATION EASEMENT
FOR WETLAND BANK

Grantor:

Location: within Section 5, Township 39 North, Range 22 West, County of Pine

This Perpetual Conservation Easement for Wetland Replacement ("Easement") is made on (date) by the undersigned, hereinafter referred to collectively as the "Grantor":

RECITALS

A. This Easement is made pursuant to and in furtherance of the Wetland Conservation Act of 1991, as amended, Minn. Stat. §103G.222, *et. seq*. ("WCA") and the rules implementing WCA, Minn. R. ch. 8420 ("WCA Rules").

B. This Easement pertains to all or part of the real property in Pine County, Minnesota, which is legally described on *Exhibit A* attached hereto and made a part hereof ("Real Property").

C. The Real Property is the subject of a wetland bank plan pursuant to Minn. R.8420.0740.

D. The Grantors include all of the following (1) all the fee owners of the Real Property and (2) the applicants under the bank plan if different from the fee owners. The term "Grantor" includes all of the Grantors if there is more than one. The Grantors are jointly and severally responsible for complying with the terms of this instrument. This Easement and the duties and restrictions contained in it shall also run with the land.

E. WCA is administered by the State of Minnesota through its Board of Water and Soil Resources ("State").

F. The local government unit ("LGU") charged under WCA with approval of the subject wetland replacement plan ("replacement plan") is the Minnesota Department of Natural Resources – Division of Lands and Minerals. The subject wetland mitigation plan includes all fully executed forms provided by the State, all supporting maps, engineering plans, drawings, monitoring plan, vegetation establishment plan and management plan and facilities maintenance plan. A complete copy of the replacement plan is on file at the LGU. The address of the LGU is 1525 Third Avenue East, Hibbing, MN 55746. The State is responsible for the acceptance of this Easement.

G. The replacement plan requires the restoration or creation of a wetland on the portion of the Real Property designated in Exhibit B attached hereto and made a part hereof ("Replacement Area"). The replacement plan may also require the establishment of upland buffer within the Replacement Area. This Easement pertains to both wetlands and specified uplands within the Replacement Area.

H. The Replacement Area is subject to the WCA, WCA Rules and all other provisions of law that apply to wetlands, except that the exemptions in Minn. Stat. §103G.2241 and Minn. R. 8420.0122 do not apply to the Replacement Area, pursuant to Minn. Stat. §103G.222, subd. 1(h) and Minn. R. 8420.0115.

I. All references in this Easement to Minnesota Statutes and to Minnesota Rules are to the statutes and rules currently in effect and as amended or renumbered in the future.

J. The purposes of this Easement are to maintain and improve the ecological values of the Replacement Area through the means identified in the replacement plan and to preserve the Replacement Area in a natural condition in perpetuity.

IN ADDITION, THE GRANTORS, FOR THEMSELVES, THEIR HEIRS, SUCCESSORSAND ASSIGNS COVENANT THAT THEY:

1. Shall establish and maintain wetlands and upland buffers within the Replacement Area as specified in the replacement plan approved by the LGU and on file at the offices of the LGU. The wetland and any specified upland buffer area shall be the size and type specified in the replacement plan. Grantor shall not make any use of the Replacement Area that would adversely affect any of the functions or values of the area. Those functions and values are identified in Minn. R. 8420.0540, subp. 10, or specified in the approved replacement plan.

2. Shall pay the costs of establishment, maintenance, repairs and reconstruction of the wetlands and specified upland buffers within the Replacement Area, which the LGU or the State may deem necessary to comply with the specifications for the Replacement Area in the approved replacement plan. The Grantor's obligations under this paragraph include the payment of any lawful taxes or assessments on the Real Property.

3. Shall establish and maintain visible monuments such as signs, numbered fence posts or survey posts at prominent locations along the boundary of the Replacement Area in accordance with the approved replacement plan. If numbered fence posts are used, Grantor's Replacement Plan must contain a survey or scaled drawing of the property that corresponds to the fence post numbering. Posts

must be at least 4 feet high and notably visible on the landscape. If signs are used, such signs must be have a surface area of at least one quarter (1/4) square feet, mounted on a fence post at least 4 feet above ground, and minimally contain the words "Boundary of Wetland Replacement Area - Subject to Perpetual Conservation Easement Restrictions – Contact MN Board of Water and Soil Resources or Local Soil and Water Conservation District for Further Information." Said monuments must be made of non-degradable material and shall be at least four feet in height.

4. Grants to the LGU, the State, and the agents and employees of the LGU and the State, reasonable access to the Replacement Area for inspection, monitoring and enforcement purposes. The LGU, the State, and the agents and employees of the State are hereby granted a perpetual ingress and egress easement ("Access Easement") for access to and from the Replacement Area. The Access Easement shall be over and across the area ("Access Area") that is specified on Exhibit A attached hereto and made a part hereof or, if not specified on Exhibit A, the most reasonably direct and convenient route between the Replacement Area and a public road. If all or any part of the Access Area is owned by a person or entity other than Grantor, then the owner has joined in this Easement for purposes of granting the Access Easement by signing below. The signed written consent and subordination of all other holders of interests in the Access Area has been or will be obtained by Grantor and recorded in the same manner as specified in paragraph 5 below. This Easement grants no access to or entry to the Real Property, the Replacement Area, or the Access Area to the general public.

5. Represents that Grantor is (a) the fee owner of the Real Property and (b) the applicant under the replacement plan, if different from the fee owner. Grantor represents that all other parties who may have an interest in the Real Property (e.g., mortgagees, contract for deed vendees, holders of easements, etc.) have consented and subordinated their interests to this Easement by signing below. If it is determined at any time that there is any other party who may have an interest in the Real Property that is prior to this Easement, then Grantor shall immediately obtain and record a consent and subordination agreement signed by such other party. Acceptance of this Easement does not release Grantor from the obligation to obtain and record a consent and subordination agreement signed by any party who may have an interest in the Real Property that is prior to this Easement, even if such interest was of record at the time of acceptance.

6. Will record this easement at Grantor's expense in the real property records of the county where the Real Property is located. Said recording shall take place within 30 days of the State's acceptance of this Easement. The Grantor shall provide the original copy of the recorded easement to the State prior to making any credits from this replacement area available for use.

7. Acknowledge that this Easement shall be unlimited in duration, without being re-recorded. This Easement shall be deemed to be a perpetual conservation easement pursuant to Minn. Stat. ch. 84C.

8. Acknowledge that, unless expressly authorized in writing by the LGU in the approved replacement plan, Grantor:

(a) Shall not produce agricultural crops on the Replacement Area, except that this provision does not restrict the harvest of the seeds of native vegetation if only the seed-head is

removed in the process of harvest and does not involve the use of vehicular, motorized equipment;

(b) Shall not cut hay, mow vegetation or cut timber on the Replacement Area except as allowed or prescribed in the Replacement Plan;

(c) Shall not make any vegetative alterations on the Replacement Area that do not enhance or would degrade the ecological functions and values of the Replacement Area. Vegetative alterations shall be limited to those listed in the approved replacement plan;

(d) Shall not graze livestock on the Replacement Area;

(e) Shall not place any materials, substances or other objects, nor erect or construct any type of structure, temporary or permanent, on the Replacement Area.

(f) Shall not allow vehicular traffic on the Replacement Area except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(g) Shall not alter the topography of the Replacement Area by any means including plowing, dredging, filling, mining or drilling except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(h) Shall not modify the hydrology of the Replacement Area in any way or by any means including pumping, draining, ditching, diking, impounding or diverting surface or ground water into or out of the Replacement Area except for the purpose of implementing construction or maintenance activities specifically authorized in the replacement plan.

(i) Shall regularly inspect and maintain structures specified in the Replacement Plan in good working condition to sustain the goals in the approved Replacement Plan.

9. Acknowledge that the Grantor is responsible, at Grantor's cost, for weed control by complying with noxious weed control laws and emergency control of pests necessary to protect the public health on the Replacement Area.

10. Acknowledge that this Easement may be modified only by the joint written approval of the LGU and the State. If the Replacement Area has been used to mitigate wetland losses under the Federal Water Pollution Control Act, the U.S. Army Corps of Engineers (or successor agency) must also agree to the modification in writing.

11. Acknowledge that this Easement may be enforced, at law or in equity, by the LGU or the State. The LGU and the State shall be entitled to recover an award of reasonable attorney's fees from Grantor in any action to enforce this Easement. The right to enforce the terms of this Easement is not waived or forfeited by any forbearance or failure to act on the part of the State or LGU. If the subject Replacement Area is to be used partially or wholly to fulfill permit requirements under the Federal Water Pollution Control Act or a federal farm program, then the provisions of this Easement

that run to the State or the LGU may also be enforced by the United States of America in a court of competent jurisdiction.

12. Acknowledge that this Easement is not valid until the Easement has been accepted by the State, the Grantor has recorded this Easement and the State has received evidence of such recording.

SIGNATURE OF GRANTOR

SIGNATURE OF FEE OWNER(S): _____

_____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name(s) with marital status).

_____
Notary Public

Notarial Stamp or Seal

SIGNATURE OF BANK APPLICANT (S), IF DIFFERENT FROM FEE OWNER: _____

_____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name(s) with marital status).

_____
Notary Public

Notarial Stamp or Seal

ACCEPTANCE

The State accepts the foregoing Easement.

MINNESOTA BOARD OF WATER AND SOIL RESOURCES:

By: _____

Its: _____

STATE OF MINNESOTA)
) ss.
COUNTY OF _____)

This instrument was acknowledged before me this day of , by (name of person) as (title) of the Board of Water and Soil Resources.

_____
Notary Public

Notarial Stamp or Seal

This instrument was drafted by the Board of Water and Soil Resources
One West Water Street, St. Paul, MN 55107

If there are additional holders of interest the subject real property CHECK HERE ☐ and attach their Consent and Subordination agreement [BWSR Form Number: wca-bank-03 (consent).doc].

EXHIBIT A

Legal Description of Real Property

EXHIBIT B

Map or Survey of Bank Area