STATE OF MINNESOTA

Minnesota Pollution Control Agency

Industrial Division

National Pollutant Discharge Elimination System (NPDES)/
State Disposal System (SDS) Permit MN0057207

PERMITTEE:	US Steel Corp - Minntac
FACILITY NAME:	US Steel - Minntac Tailings Basin Area
RECEIVING WATER:	Dark River

CITY OR TOWNSHIP:	Mountain Iron	**COUNTY:**	St. Louis
ISSUANCE DATE:	September 30, 1987	**EXPIRATION DATE:**	July 31, 1992
MODIFICATION DATE:	**April 13, 2010**		

The state of Minnesota, on behalf of its citizens through the Minnesota Pollution Control Agency (MPCA), authorizes the Permittee to construct, install and operate a disposal system at the facility named above and to discharge from this facility to the receiving water named above, in accordance with the requirements of this permit.

The goal of this permit is to protect water quality in accordance with Minnesota and U.S. statutes and rules, including Minn. Stat. chs. 115 and 116, Minn. R. chs. 7001, 7049, 7050, 7053, 7060 , 7090.3000 through 7090.3080, and the U.S. Clean Water Act.

This permit is effective on the issuance date identified above, as modified on September 13, 2007. This permit expires at midnight on the expiration date identified above.

Signature: _____

Jeff Udd, P.E., Acting Supervisor
Water Quality Permits Unit
Land and Water Quality Permits Section
Industrial Division

for The Minnesota Pollution Control Agency

Submit DMRs to:
Attention: Discharge Monitoring Reports
Minnesota Pollution Control Agency
520 Lafayette Rd N
St Paul, MN 55155-4194

Submit Other WQ Reports to:
Attention: WQ Submittals Center
Minnesota Pollution Control Agency
520 Lafayette Rd N
St Paul, MN 55155-4194

Questions on this permit?

- For DMR and other permit reporting issues, contact: Belinda Nicholas, 651-757-2613.
- For specific permit requirements or permit compliance status, contact: John Thomas, 218-302-6616.
- General permit or NPDES program questions, contact: MPCA, 651-282-6143 or 1-800-657-3938.

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Facility Description

The US Steel - Minntac Tailings Basin Area facility (Facility) is located at Section 21, Township 59 North, Range 18 West, Mountain Iron, St. Louis County, Minnesota.

The principal activity at this facility is taconite processing. At the maximum operating rate, the facility will generate 16.5 million long tons of taconite pellets per year.

The facility consists of the Minntac tailings basin, the drainage area contributing surface runoff to the basin, and all wastewater disposal systems within the area designated on the map on page 5. The contributing drainage area includes part of an overburden/rock stockpile area to the southwest of the basin, as well as part of the Minntac plant area. That portion of the plant area which drains to the basin includes the concentrator, the agglomerator, the sewage treatment plant, the lube storage area, a substation, the plant area reservoir, and part of the crushing facilities.

The Minntac plant consists of a series of crushers and screens, a crusher thickener, a concentrator, an agglomerator, and various auxiliary facilities. The concentrator utilizes a series of mills, magnetic separators, classifiers, hydroclones, hydroseparators, screens and thickeners, as well as a flotation process. Chemical additives include flocculants and various flotation reagents. The flocculants comprise Calgon M-5729, added to the crushing plant dust collector slurry at a rate of one pound per hour (lb/hr), and Calgon M-5372 or equivalent cationic homopolymers added to the concentrator tailings slurry prior to the thickening stage, at a rate of 170 lb/hr. The flotation reagents comprise: (a) an alkyl ether primary amine acetate or alkyl ether diamine acetate collector, Arosurf MG-83, Arosurf MG-83A, Tomah DA-17-5% Acetate, or equivalent (alkyl chain R no greater than C_{14}), added at a maximum rate of 295 lb/hr; (b) an alcohol frother, methyl isobutyl carbinol, Arosurf 2057, Nalflote 8848, or equivalent (mixed C_4 to C_9 aliphatic alcohols only), added at a maximum rate of 101 lb/hr; and (c) anti-foaming agents Oreprep D-202 or Nalco 7810 Antifoam, added at a maximum rate of 162 lb/hr.

The agglomerator receives the concentrate, which is then dewatered by disc filters. The filter cake is then mixed with bentonite and formed into pellets in balling drums. The pellets are dried, heated, and fired in a grate kiln, and then loaded for rail transport.

The wastewater discharges to the tailings basin comprise the following, with their estimated average rates:

Fine tailings slurry/concentrator process water	15,700 gpm
Agglomerator process water	1,700 gpm
Sewage plant discharge, covered under NPDES/SDS Permit MN0050504	40 gpm
Laboratory wastewater (neutralized)	3,650 gal/yr
Plant non-process water (wet scrubber discharge, floor wash, roof runoff, non-contact cooling water)	unknown
Runoff from plant area, stockpile areas and adjacent upland areas	unknown

The agglomerator process water, sewage plant discharge, laboratory wastewater, plant non-process water and surface runoff from the plant area enter the south side of the basin through a series of pipes and ditches to the north of the concentrator and agglomerator buildings, in Section 28. Surface runoff from the upland area to the southeast of the basin enters through a series of four culverts through the perimeter dam. Runoff from the stockpile area and upland area to the southwest of the basin enters by seepage through the perimeter dam.

An average of 15 million long tons of dry fine tailings and 7 million long tons of dry coarse tailings are disposed of each year in the tailings basin. The coarse tailings are generated from the classifier, following the first stage of milling and magnetic separation. The fine tailings are generated from the crusher thickener overflow and the tailings thickener underflow. The fine tailings slurry and concentrator process water is discharged by gravity flow through pipes from the Step I, II, and III thickeners to a series of open ditches to the Minntac tailings basin. The discharge from the flotation process is restricted to Step I thickeners. The fine tailings slurry and flotation discharge is routed to the tailings basin via one of two discharge routes (east or west). Internal waste stream WS006 is representative of the fine tailings slurry discharge to the east while WS007 is representative of the discharge to the west. The basin is segmented into several cells, and the fine tailings discharge line is periodically moved from one cell to another. A permanent pumping station located on the basin returns water to the plant site reservoir. The station is located on the east side of Cell 1 (SE ¼, Section 15). Calcium chloride is occasionally used as a chemical dust suppressant on the basin and haul roads in the facility. Some coarse tailings are used for sanding on roads in the facility during the winter, and others are sold as aggregate product.

The various basin cells are separated by dikes, each constructed of a single berm of coarse tailings placed by truck and various pieces of auxiliary equipment. Most of the perimeter dam for the tailings basin is constructed by spigotting a fine tailings slurry into the core between parallel inner and outer coarse tailings dikes; that part of the perimeter dam on the southwest side of the basin is constructed in the same manner as the interior basin dikes. The coarse tailings dikes are constructed by truck in ten foot lifts. The perimeter dam spigot lines are located on the dry side of the core; this creates a surface slope from the dry side down to the wet side, thus causing the water from the slurry to pond on the wet side of the core and seep through the wet side dike to the retained water within the disposal facility. Peat was removed from the original ground area to be occupied by the perimeter dam, and a ten foot deep key-way was dug in the core portion of this area.

A demolition debris landfill (Solid Waste Permit SW-240) is located on the southeast corner of Cell A-2. The abandoned Minntac dump site (Agency Landfill Inventory Number SL-183) is located in the southwest corner of Cell 1 (SW ¼, SE ¼, Section 21 and NW ¼, NE ¼, Section 28). Paper, lunch wastes, wood scrapes, scrap metal, mill grease, and waste oil were disposed of at this dump during its period of operation.

The basin is sited on an area of shallow (10 to 55 feet deep to bedrock) glacial and glaciofluvial deposits which are principally sand and gravel. Discreet seepage points have been identified along the toe of the perimeter dam on the west side (NW ¼, Section 18) and east side (Sections 10 and 15) of the tailings basin. Flows at the individual seepage points have been estimated at 0.02 to 0.32 million gallons per day (mgd). Two of the largest seepage points are outfall SD001 (formerly 020) on the west toe in the SE ¼, NE ¼, NW ¼, Section 18 and outfall SD002 (formerly 030) on the east toe in the NE ¼, SW ¼, NE ¼, Section 15. Drainage from the facility flows to the groundwater, the Dark River, and the Sandy River to the Little Sandy Lake and Sandy Lake. The Sandy River, Little Sandy Lake, and Sandy Lake are Class 2B, 3B, 4A, 4B, 5, and 6 waters. The Dark River is Class 2B, 3B, 4A, 4B, 5 and 6 waters in its upper reaches, and becomes Class 1B, 2A, 3B, 3C, 4A, 4B, 5 and 6 waters approximately 7 miles downstream, below Dark Lake.

Ten monitoring wells, installed to depths of 14.5 to 28.0 feet below the ground surface, are located around the tailings basin. Monitoring occurs at seven of these monitoring wells, GW003, GW004, GW006, GW007, GW008, GW009, and GW010 (formerly 603, 604, 606, 607, 608, 609, and 610).

Monitoring station SW001 (formerly 701) is located on the Sandy River at Highway 53 (USGS Station 05128400). Monitoring station SW002 (formerly 702) is located on McNiven Creek at Highway 25.

The facility also includes a wastewater treatment system for the blowdown from the Agglomerator Line wet scrubber. The wastewater treatment system includes: a scrubber water recirculation tank, a equalization/precipitation tank, lime slurry make-up and feed system, 1st stage thickener, polymer make-up and feed system, scrubber solids settling/storage pond, and all related piping and equipment.

Scrubber blowdown water from the recirculation tank is sent to the equalization/precipitation tank at an average rate of 50 gallons per minute (gpm). Lime is added at the equalization/precipitation tank to increase calcium concentrations and promote calcium sulfate (gypsum) precipitation. Settling of the precipitated solids occurs in the 1st Stage Thickener. Polymer may be added to the 1st Stage Thickener to enhance solids settling. The solids are sent to a 25 acre-foot, composite lined settling/storage pond located on-site for the dewatering, and possible ultimate disposal, of the solids generated from the treatment system. The overflow from the 1st Stage Thickener is sent to either the Concentrate Thickener or Slurry Mix Tank. Available alkalinity in the concentrate slurry converts from bicarbonate to carbonate and allows calcium carbonate precipitation. The calcium carbonate precipitate is then removed in the disc filters along with the concentrate and made into pellets. The filtrate from the disc filters is then used as process water and eventually sent to the tailings basin. The treatment system is specifically designed to achieve a “no net increase” in mass loading of sulfate and calcium to the tailings basin. Fluoride removal also occurs due to the reactive nature of fluoride with excess calcium.

Waste stream monitoring stations WS002, WS003, and WS004 are included for the scrubber wastewater treatment system. WS002 is located at the plant water make-up to the scrubber system, WS003 is located at the overflow from the 1st Stage Thickener, and WS004 is located on the concentrate slurry to the Concentrate Thickener or Slurry Mix Tank.

A minor modification was done in 2007 to include the addition of waste stream monitoring station WS005, and the revision of the requirement for “no net increase” in calcium mass loading to the tailings basin to more appropriately require a “no net increase” in hardness (calcium + magnesium) mass loading to the tailings basin. WS005 is located at the influent to the Step I Reclaim Thickener. Monitoring at WS005 is required since the Step I Reclaim Thickener can receive overflow from the 1st Stage Thickener in order to comply with the “no net increase” in hardness requirement as described in Chapter 4 of this permit.

This minor permit modification is to permit the construction of a Seep Collection and Return System (SC&R) as required by a Schedule of Compliance originally entered into by the Company and the MPCA on November 14, 2007, and as amended by Amendment No. 1 on February 25, 2010.

U. S. Steel will implement a system of year-round collection and return of tailings basin surface seepage currently reporting to the Sandy River Watershed from the toe of the Minntac tailings basin perimeter dike. An evaluation of surface seepage to the Sandy River Watershed was conducted by U. S. Steel and Barr Engineering, in March 2008 to determine the locations and estimate the rate of surface seepage. The survey revealed that surface seepage to the Sandy River is being discharged in 13 discrete locations along the east side of the tailings basin perimeter dike.

The SC&R system will consist of catch basins located in each of the 13 identified seepage locations, hydraulically connected by subsurface HDPE piping to pump stations. Each of the seepage areas will be shaped and graded to promote seepage flow to the catch basins. Sheet pile cut-off walls will be installed

downgradient of each catch basin, connecting areas of higher elevation on either side of each discrete seepage location, to a depth of approximately 15 feet below existing ground level to ensure that surrounding wetlands are minimally impacted. The system will consist of two subsystems, one collecting seepage from the northern section and the other from the southern section. Each subsystem will terminate in a pump station consisting of a concrete vault containing a duplex pump system capable of returning the collected seepage back to the tailings basin clear pool reservoir.

Upon completion of construction of the SC&R system and commencement of its operation, all water formerly reporting to SD002 (previously designated as Seep 030) will be captured and pumped back into the tailings basin clear pool, effectively eliminating the discharge through the currently permitted outfall.

Due to safety issues at the current internal monitoring station, WS001, the minor permit modification also includes the relocation of monitoring station WS001 to two separate monitoring stations to be identified as WS006 and WS007. The new internal monitoring stations are representative of the entire fine tailings discharge from the Concentrator which also includes discharge from the flotation process. The fine tailings slurry is discharged through one of two routes at any given time, either to the east portion of the tailings basin past WS006 or to the west portion of the tailings basin past WS007, for uniform tailings distribution and disposal.

The location of designated monitoring stations is specified on the attached "Summary of Stations and Station Locations" report.

The location of the facility is shown on the attached aerial photograph.

Location of Permitted Facility

US Steel - Minntac Tailings Basin Area
Summary of Stations

Ground Water Stations

Station	Type of Station	Local Name	PLS Location
GW003	Well, Downgradient	Monitoring Well 3	SW Quarter of the NE Quarter of the NE Quarter of Section 15, Township 59 North, Range 18 West
GW004	Well, Downgradient	Monitoring Well 4	NW Quarter of the SW Quarter of Section 4, Township 59 North, Range 18 West
GW006	Well, Downgradient	Monitoring Well 6	SE Quarter of the NW Quarter of Section 7, Township 59 North, Range 18 West
GW007	Well, Downgradient	Monitoring Well 7	NE Quarter of the NW Quarter of Section 18, Township 59 North, Range 18 West
GW008	Well, Downgradient	Monitoring Well 8	NW Quarter of the NW Quarter of Section 19, Township 59 North, Range 18 West
GW009	Well, Downgradient	Monitoring Well 9	NE Quarter of the SE Quarter of Section 10, Township 59 North, Range 19 West
GW010	Well, Upgradient	Monitoring Well 10	NE Quarter of the NW Quarter of Section 23, Township 59 North, Range 18 West

Surface Discharge Stations

Station	Type of Station	Local Name	PLS Location
SD001	Effluent To Surface Water	Seepage outfall 020	SE Quarter of the NW Quarter of Section 18, Township 59 North, Range 18 West
SD002	Effluent To Surface Water	Seepage outfall 030	SW Quarter of the NE Quarter of Section 15, Township 59 North, Range 18 West

Surface Water Stations

Station	Type of Station	Local Name	PLS Location
SW001	Stream/River/Ditch, Other	Sandy River Station 701	NW Quarter of Section 6, Township 59 North, Range 17 West
SW002	Stream/River/Ditch, Other	McNiven Creek Station 702	NE Quarter of Section 27, Township 59 North, Range 19 West

Waste Stream Stations

Station	Type of Station	Local Name	PLS Location
WS002	Internal Waste Stream	Plant water to Line 3 scrubber	NE Quarter of Section 21, Township 59 North, Range 18 West
WS003	Internal Waste Stream	1st Stage Thickener Overflow	NE Quarter of Section 21, Township 59 North, Range 18 West
WS004	Internal Waste Stream	Concentrate Slurry	NE Quarter of Section 21, Township 59 North, Range 18 West
WS005	Internal Waste Stream	Step I Reclaim Thickener influent	NE Quarter of Section 21, Township 59 North, Range 18 West
WS006	Internal Waste Stream	Concentrator Fine Tailings Slurry Discharge - Eastern Tailings Basin Disposal	NW Quarter of Section 28, Township 59 North, Range 18 West
WS007	Internal Waste Stream	Concentrator Fine Tailings Slurry Discharge - Western Tailings Basin Disposal	NW Quarter of Section 28, Township 59 North, Range 18 West

US Steel - Minntac Tailings Basin Area
Limits and Monitoring Requirements

The Permittee shall comply with the limits and monitoring requirements as specified below.

GW 003, GW 004, GW 006, GW 007, GW 008, GW 009, GW 010

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
Amines, Organic Total	Monitor Only	mg/L	Single Value	Apr, Jul, Oct	Grab	1 x Month	3
Elevation of GW Relative to Mean Sea Level	Monitor Only	feet	Single Value	Apr, Jul, Oct	Measurement, Instantaneous	1 x Month	3
pH, Field	Monitor Only	SU	Single Value	Apr, Jul, Oct	Grab	1 x Month	3
Specific Conductance, Field	Monitor Only	umh/cm	Single Value	Apr, Jul, Oct	Grab	1 x Month	3
Sulfate, Total (as SO4)	Monitor Only	mg/L	Single Value	Apr, Jul, Oct	Grab	1 x Month	3
Temperature, Water	Monitor Only	Deg C	Single Value	Apr, Jul, Oct	Grab	1 x Month	3

SD 001, SD 002

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
Flow	Monitor Only	mgd	Calendar Month Average	Jan-Dec	Measurement	2 x Month	
Flow	Monitor Only	MG	Calendar Month Total	Jan-Dec	Measurement	2 x Month	
Flow	Monitor Only	mgd	Daily Maximum	Jan-Dec	Measurement	2 x Month	
Oil & Grease, Total Recoverable (Hexane Extraction)	10	mg/L	Calendar Month Average	Jan-Dec	Grab	2 x Month	
Oil & Grease, Total Recoverable (Hexane Extraction)	15	mg/L	Daily Maximum	Jan-Dec	Grab	2 x Month	
pH	9.0	SU	Instantaneous Maximum	Jan-Dec	Grab	1 x Month	
pH	6.0	SU	Instantaneous Minimum	Jan-Dec	Grab	1 x Month	
Solids, Total Suspended (TSS)	30	mg/L	Calendar Month Average	Jan-Dec	Grab	2 x Month	
Solids, Total Suspended (TSS)	60	mg/L	Daily Maximum	Jan-Dec	Grab	2 x Month	
Specific Conductance	Monitor Only	umh/cm	Calendar Month Maximum	Jan-Dec	Grab	1 x Month	
Sulfate, Total (as SO4)	Monitor Only	mg/L	Calendar Month Maximum	Jan-Dec	Grab	1 x Month	

SW 001

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
Flow	Monitor Only	mgd	Single Value	Jan-Dec	Measurement, Instantaneous	1 x Month	
Sulfate, Total (as SO4)	Monitor Only	mg/L	Single Value	Jan-Dec	Grab	1 x Month	

SW 002

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
Amines, Organic Total	Monitor Only	mg/L	Single Value	Jan-Dec	Grab	2 x Year	2

The Permittee shall comply with the limits and monitoring requirements as specified below.

SW 002

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
Toxicity, Whole Effluent (Acute)	Monitor Only	TUa	Single Value	Jan-Dec	Grab	2 x Year	2

WS 002

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
Flow	Monitor Only	mgd	Calendar Month Average	Jan-Dec	Measurement, Continuous	1 x Week	2
Hardness, Calcium & Magnesium, Calculated (as CaCO3)	Monitor Only	mg/L	Calendar Month Average	Jan-Dec	Grab	1 x Week	2
Sulfate, Dissolved (as SO4)	Monitor Only	ug/L	Calendar Month Average	Jan-Dec	Grab	1 x Week	2

WS 003

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
Chloride, Total	Monitor Only	mg/L	Calendar Month Average	Jan-Dec	Grab	1 x Month	
Flow	Monitor Only	mgd	Calendar Month Average	Jan-Dec	Measurement, Continuous	1 x Week	2
Fluoride, Total (as F)	Monitor Only	mg/L	Calendar Month Average	Jan-Dec	Grab	1 x Month	
Hardness, Calcium & Magnesium, Calculated (as CaCO3)	Monitor Only	mg/L	Calendar Month Average	Jan-Dec	Grab	1 x Week	2
pH	Monitor Only	SU	Calendar Month Minimum	Jan-Dec	Grab	1 x Week	2
Sulfate, Dissolved (as SO4)	Monitor Only	ug/L	Calendar Month Average	Jan-Dec	Grab	1 x Week	2

WS 004, WS 005

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
pH	Monitor Only	SU	Calendar Month Maximum	Jan-Dec	Grab	1 x Week	2

WS 006, WS 007

Parameter	Limit	Units	Limit Type	Effective Period	Sample Type	Frequency	Notes
Amines, Organic Total	Monitor Only	mg/L	Single Value	Jan-Dec	Grab	1 x Year	2
Evaporation, Accumulated	Monitor Only	in	Calendar Month Total	Jan-Dec	Measurement	1 x Month	1
Precipitation	Monitor Only	in	Calendar Month Total	Jan-Dec	Measurement, Continuous	1 x Month	
Toxicity, Whole Effluent (Acute)	Monitor Only	TUa	Single Value	Jan-Dec	Grab	1 x Year	2

US Steel - Minntac Tailings Basin Area
Limits and Monitoring Requirements

The Permittee shall comply with the limits and monitoring requirements as specified below.

Notes:
1 -- May be estimated from data at measurement stations near the facility.
2 -- See Chapter 4 Special Requirements.
3 -- Three times annually: between March 28 and May 14; between July 1 and July 31; and between October 1 and October 31.

Chapter 1. Ground Water Station Requirements - General

1. Monitoring Wells

1.1 The Permittee shall install, maintain and abandon ground water monitoring wells according to the Minnesota Water Well Construction Code, Minnesota Rules, ch. 4725. Damaged or improperly constructed monitoring wells shall be repaired or properly abandoned and replaced. Information on licensed water well contractors is available from the Minnesota Department of Health.

1.2 Each monitoring well shall be clearly numbered on the outside of the well with either indelible paint or an inscribed number.

1.3 The monitoring wells shall be sampled in accordance with "Minnesota Pollution Control Agency, Water Quality Division: Sampling Protocol for Ground Water Monitoring Wells, July 1997," Triplett, et. al. Copies of this publication are available on the internet at http://www.pca.state.mn.us/water/groundwater/wqsampling.html or may be obtained from the MPCA by calling 651-282-6143 or 800-657-3938.

Chapter 2. Surface Discharge Station Requirements - General

1. Surface Discharges

1.1 Floating solids or visible foam shall not be discharged in other than trace amounts.

1.2 Oil or other substances shall not be discharged in amounts that create a visible color film.

1.3 The Permittee shall install and maintain outlet protection measures at the discharge stations to prevent erosion.

2. Discharge Monitoring Reports

2.1 The Permittee shall submit monitoring results for discharges in accordance with the limits and monitoring requirements for this station. If no discharge occurred during the reporting period, the Permittee shall check the "No Discharge" box on the Discharge Monitoring Report (DMR).

3. Winter Sampling Conditions

3.1 The Permittee shall sample flows at the designated monitoring stations including when this requires removing ice to sample the water. If the station is completely frozen throughout a designated sampling month, the Permittee shall check the "No Discharge" box on the Discharge Monitoring Report (DMR) and note the ice conditions in Comments on the DMR.

4. Special Requirements

Seep Collection and Return System

Chapter 2. Surface Discharge Station Requirements - General

4. Special Requirements

4.1 As required by the Schedule of Compliance issued on November 14, 2007 and as amended by Amendment No. 1 on February 25, 2010, U. S. Steel will implement a system of year-round collection and return of tailings basin surface seepage currently reporting to the Sandy River Watershed from the toe of Minntac's tailings basin perimeter dike.

4.2 Upon completion of construction of the Seepage Collection and Return System (SC&R) and commencement of its operation, all water formerly reporting to SD002 will be captured and pumped back into the tailings basin clear pool, effectively eliminating the discharge through the currently permitted outfall.

The Permittee shall submit notice of initiation of operation of the SC&R system within 10 days of initiation of operation as required by the Schedule of Compliance dated November 14, 2007 and as amended on February 25, 2010.

Chapter 3. Surface Water Station Requirements - General

1. Sampling Location

1.1 Samples shall be taken at mid-stream, mid-depth. Record location, date, time and results for each sample on the supplemental Discharge Monitoring Report form.

2. Discharge Monitoring Reports

2.1 The Permittee shall submit monitoring results in accordance with the limits and monitoring requirements for this station. If flow conditions are such that no sample could be acquired, the Permittee shall check the "No Flow" box and note the conditions on the Discharge Monitoring Report (DMR).

Chapter 4. Waste Stream Station Requirements - General

1. Sampling Location

1.1 Samples for Stations WS002, WS003, WS004, WS005, WS006 and WS007 shall be representative of the monitored activity.

2. Sampling Frequency

2.1 For WS002, WS003, WS004, and WS005, the Permittee may request a reduction in monitoring frequency from the Agency. Reduced monitoring may be allowed if it is determined that the variation of the monitored parameters within the waste stream is small. The Permittee shall be notified in writing if a reduction in monitoring has been authorized; a reduction in monitoring frequency shall not occur until written authorization has been given.

Chapter 4. Waste Stream Station Requirements - General

3. Special Requirements

Determination of no net increase in sulfate mass loading to the tailings basin

3.1 Sampling and analysis shall be done in accordance with the Limits and Monitoring requirements section of this permit. The following steps shall be completed during each sample event:

Step 1: Measure the dissolved sulfate concentration and flow rate of water in the scrubber makeup stream (WS002). Calculate the mass of sulfate in the makeup stream. This is the mass loading of sulfate entering the scrubber system.

Step 2: Measure the dissolved sulfate concentration and flow rate of the overflow from the calcium sulfate thickener (WS003). Calculate the mass of sulfate in the thickener overflow. This is the mass loading of sulfate leaving the scrubber system.

The calculations described above shall be compiled for each calendar year. On an annual basis, the mass of sulfate leaving the scrubber system shall be less than or equal to the mass of sulfate entering the scrubber system.

Determination of no net increase in hardness mass loading to the tailings basin

Chapter 4. Waste Stream Station Requirements - General

3. Special Requirements

3.2 Sampling and analysis shall be done in accordance with the Limits and Monitoring requirements section of this permit. The following steps shall be completed during each sample event:

Step 1: Measure the hardness (calcium + magnesium) concentration and flow rate of water in the scrubber makeup stream (WS002). Calculate the mass of hardness in the makeup stream. This is the mass loading of hardness entering the scrubber system.

Step 2: Measure the hardness concentration and flow rate of the overflow from the calcium sulfate thickener (WS003). Calculate the mass of hardness in the thickener overflow.

Step 3: Subtract the mass of hardness in the makeup stream (Step 1) from the mass of hardness in the thickener overflow (Step 2). This is the mass of hardness that must be removed to satisfy the no net increase requirement. Convert the calculated mass of hardness to the appropriate moles of calcium and magnesium.

Step 4: Measure the pH of the thickener overflow (WS003) and the pH of the concentrate slurry stream (WS004) and/or the influent to the Step I Reclaim Thickener (WS005). Using the difference between the pH of the thickener overflow and the appropriate slurry stream(s) and the flow rate of the thickener overflow, calculate the mass of excess hydroxide ions that are present in the thickener overflow (which will convert bicarbonate in the concentrate stream to carbonate). Convert the mass to moles of hydroxide ions.

The calculations described above shall be compiled for each calendar year. On an annual basis, the number of moles of excess hydroxide ion (Step 4) must be equal to or greater than the number of moles of excess calcium and magnesium (Step 3) in the thickener overflow stream.

3.3 If the oveflow from the calcium sulfate thickener is sent to both the Concentrate Thickener (or Slurry Mix Tank) and the Step I Reclaim Thickener in the same reporting period, the mass of excess hydroxide ions present in the thickener overflow (Step 4 above) shall be total of the individual calculations based on the pH of the each slurry stream and the average flow rate of the thickener overflow to each location during the reporting period.

3.4 As part of the Annual Pollution Control Report, as required in Chapter 6, Requirement 1.3, to be submitted by February 14 of each year, submit a summary of the Line 3 scrubber wastewater treatment system monitoring activities and calculations for the preceding calendar year. The submittal shall include the determination of compliance with the no net increase in mass loading from the Line 3 scrubber wastewater treatment system. If compliance with the no net increase in the mass loading of sulfate and hardness to the tailings basin has not been achieved, the submittal shall include a discussion of why compliance was not achieved, as well as a work plan and schedule, for MPCA review and approval, to achieve compliance.

Toxicity Testing Requirements

Chapter 4. Waste Stream Station Requirements - General

3. Special Requirements

3.5 The Permittee shall conduct acute toxicity testing of the waste stream from WS006 or WS007 (formerly WS001), depending upon which route of fine tailings slurry discharge is being used. Acute toxicity testing shall be conducted at least two times per year from WS006 or WS007 to represent the fine tailings slurry discharge stream. The test organisms shall be the fathead minnow (Pimephales promelas). The acute tests shall consist of a screen of 100 percent of the waste stream once every six months, beginning on the effective date of this permit.

3.6 Based upon review by the Commissioner of the toxicity test results, the permit may be reopened and subject to modification under requirements specified in Minnesota Rules Parts 7001.0170 to 7001.0190. The modified permit may include new requirements for toxicity testing, toxicity limitations, and a toxicity reduction evaluation (TRE) program.

Procedural Requirements for Toxicity Testing

3.7 1) Tests shall be conducted in accordance with procedures outlined in EPA-600/4-85-013 entitled "Methods for Measuring the Acute Toxicity of Effluents to Aquatic Organisms." Any circumstances not covered by this procedural manual, or that require deviation from that which is specified in the manual shall first be approved by the Commissioner.

2) The waste stream sample shall be allowed to settle for 24 hours. The sample supernatant shall then be filtered through a 0.45 um filter. The filtrate shall serve as the sample for toxicity testing.

3) The control water shall be taken from SW002 (formerly 702), and shall undergo settling and filtering as in item 2 above.

4) Analysis for amine shall be conducted on each waste stream sample and control for which a toxicity test is conducted.

5) Submittal of the toxicity testing results shall include the date of sample collection, date of the toxicity tests, enumeration of mortality in samples, and the raw data used in making the calculations. Submittal of the amine results shall include the date of sample collection, date of amine analysis, and the concentrations detected.

3.8 If acute toxicity testing at WS006 and/or WS007 or in the Minntac tailings basin indicates that the waste stream is acutely toxic, the Commissioner may require acute toxicity testing at outfalls SD001, SD002, stations GW001-GW008, or other locations designated by the Commissioner. No discharge from the facility to waters of the state shall be acutely toxic to humans or other animals or plant life, directly damaging to real property, or such as to actually or potentially preclude or limit the use of underground waters as a potable water supply.

Chapter 5. Station Requirements - Specific

1. Ground Water Stations

1.1 GW 003: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

1.2 GW 004: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

1.3 GW 006: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

1.4 GW 007: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

1.5 GW 008: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

1.6 GW 009: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

1.7 GW 010: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

2. Surface Discharge Stations

2.1 SD 001: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

2.2 SD 002: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

3. Surface Water Stations

3.1 SW 001: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

3.2 SW 002: Submit a monthly DMR monthly: due 21 days after end of each calendar month following permit issuance.

4. Waste Stream Stations

4.1 WS 002: Submit a monthly DMR monthly by 21 days after the end of each calendar month following issuance of major permit modification.

4.2 WS 003: Submit a monthly DMR monthly by 21 days after the end of each calendar month following issuance of major permit modification.

Chapter 5. Station Requirements - Specific

4. Waste Stream Stations

4.3 WS 004: Submit a monthly DMR monthly by 21 days after the end of each calendar month following issuance of major permit modification.

4.4 WS 005: Submit a monthly DMR monthly by 21 days after the end of each calendar month following issuance of minor permit modification.

4.5 WS 006: Submit an annual DMR annually by February 14 of each year following permit issuance.

4.6 WS 007: Submit an annual DMR annually by February 14 of each year following permit issuance.

Chapter 6. Industrial Process Wastewater, NPDES/SDS

1. Mine Tailings Basin

1.1 The Permitee shall notify the Commissioner in writing at least 180 days in advance of any expansion of the area covered by mining waste beyond that area contained within the perimeter dam for the tailings basin on the date of issuance of this permit.

1.2 The Permittee shall control surface runoff from mining waste disposal areas when such runoff has caused or is likely to cause the limits specified in the water quality standards, including but not limited to those for turbidity, to be exceeded in the following receiving waters: the Sandy River.

1.3 The Permittee shall submit an Annual Pollution Control Report to the Commissioner. The annual report shall be due on February 14 of each year, and shall detail for the previous year:

a. changes in plant processing from that shown on the flow sheets submitted with the application for this permit, including rates of reagent addition;

b. changes in water balance flow from those flow data submitted with the application for this permit;

c. a current map of the tailings basin, showing all dikes, dams, and cells, and current topographic and water level elevations in the basin;

d. changes in the tailings basin operation from that described in the facility description; and

e. Line 3 scrubber wastewater treatment system submittal required in Chapter 4.

Chapter 6. Industrial Process Wastewater, NPDES/SDS

1. Mine Tailings Basin

1.4 The Permittee shall summarize the following water input and output data on a monthly basis, and shall include these data with the Discharge Monitoring Reports required by this permit:

a. Precipitation depth (this may be estimated from data at measurement stations near the facility);

b. Sources and volumes of non-precipitation water inputs to the facility;

c. Lake evaporation (this may be estimated from data at measurement stations near the facility);

d. Volume discharged from outfall SD001; and

e. Volume discharged from outfall SD002.

2. Toxic Substance Reporting

2.1 The Permittee shall notify the MPCA immediately of any knowledge or reason to believe that an activity has occurred that would result in the discharge of a toxic pollutant listed in Minnesota Rules, pt. 7001.1060, subp. 4 to 10 or listed below that is not limited in the permit, if the discharge of this toxic pollutant has exceeded or is expected to exceed the following levels:

a. for acrolein and acrylonitrile, 200 ug/L;

b. for 2,4-dinitrophenol and 2-methyl-4,6-dinitrophenol, 500 ug/L;

c. for antimony, 1mg/L;

d. for any other toxic pollutant listed in Minnesota Rules, pt. 7001.1060, subp. 4 to 10, 100 ug/L; or

e. five times the maximum concentration value identified and reported for that pollutant in the permit application. (Minnesota Rules, pt. 7001.1090, subp. 2.A)

2.2 The Permittee shall notify the MPCA immediately if the Permittee has begun or expects to begin to use or manufacture as an intermediate or final by-product a toxic pollutant that was not reported in the permit application under Minnesota Rules, pt. 7001.1050, subp. 2.J. (Minnesota Rules, pt. 7001.1090, subp. 2.B)

Chapter 6. Industrial Process Wastewater, NPDES/SDS

3. Mobile and Rail Equipment Service Areas

3.1 Mobile equipment and rail equipment service areas in the facility shall be operated in compliance with the following:

a. The Permittee shall collect and dispose of locomotive traction sand, degreasing wastes, motor oil, oil filters, oil sorbent pads and booms, transmission fluids, power steering fluids, brake fluids, coolant/antifreeze, radiator flush wastewater and spent solvents in accordance with applicable solid and hazardous waste management rules. These materials shall not be discharged to surface or ground waters of the state.

b. The steam-cleaning of mobile equipment and rail equipment, except for limited outdoor cleaning of large drills and shovels, shall be conducted in wash bays that drain to wastewater treatment systems that include the removal of suspended solids and flammable liquids. The only washing of mobile equipment done in outside areas shall be to remove mud and dirt that has accumulated during outside work.

c. The Permittee shall not use solvent-based cleaners, such as those available for brake cleaning and degreasing, to wash mobile and rail equipment unless the cleaning fluids are completely contained and not allowed to flow to surface or ground waters of the state. Soaps and detergents used in washing shall be biodegradable.

d. Mobile and rail equipment maintenance and repairs shall not be conducted in wash bays.

e. Hazardous materials shall not be stored or handled in wash bays.

f. The Permittee shall inspect wastewater containment systems regularly, and repair any leaks that are detected immediately.

g. If the Permittee discovers that recoverable amounts of petroleum products have entered wastewater containment systems, they shall be recovered immediately and reported to the MPCA.

h. Spill cleanup procedures shall be posted in mobile and rail equipment maintenance and repair areas.

4. Polychlorinated Biphenyls (PCBs)

4.1 PCBs, including but not limited to those used in electrical transformers and capacitors, shall not be discharged or released to the environment.

5. New Proposed Dewatering

5.1 The Permittee shall obtain a permit modification before discharging from a new dewatering outfall.

Chapter 6. Industrial Process Wastewater, NPDES/SDS

6. Application for Permit Reissuance

6.1 The Permittee shall include, as part of the application for reissuance of this permit, an updated operating plan for the basin for the next five years.

7. Special Requirements

7.1 The Permittee will be constructing a new scrubber solids settling/storage pond located in the SW 1/4 of the NW 1/4 of the NW 1/4, Section 27, T59N, R18W. The scrubber solids pond may eventually serve as a disposal pond for scrubber solids. The scrubber pond is designed in accordance with MPCA pond design and solid waste design criteria and will include a composite liner and a dewatering system to accommodate dewatering of the pond contents. At closure the pond will be capped with a liner system in accordance with MPCA solid waste capping design criteria.

The scrubber solids pond shall be constructed in accordance with the pond design plans and specifications submitted for the project and in accordance with MPCA approval conditions of the engineering plans and specifications for the pond. The final cover/cap for the pond shall be installed in accordance with the submitted plans, as described in Requirement 7.2 below, and any additional MPCA design specifications required by the MPCA at the time of pond closure.

The scrubber pond is expected to have a useful life of approximately 20 years. Dewatering of pond wastewater will occur periodically using the approved dewatering system. Water removed from the pond shall be returned to the head of the Line 3 scrubber wastewater treatment system. If not returned to the treatment system, collected pond water shall be treated in accordance with MPCA requirements at that time and discharged to the tailings basin or otherwise treated off site. Discharge of pond dewatering to the tailings basin may require a permit modification.

7.2 The Permittee shall submit for MPCA approval, at least 120 days prior to the closure of any scrubber solids pond at the plant, a plan to provide a clay or geosynthetic cap, or other method to minimize erosion and infiltration from the former pond. The plan shall conform to MPCA design criteria in effect at that time, and shall include provisions for perpetual maintenance. The Permittee shall implement the plan upon closure of the disposal pond.

Upon completion of the disposal pond closure project, a detailed description, including a plat, shall be recorded with the county register of deeds. The description shall include general types and location of wastes, depth of fill, and other information of interest to future land owners.

7.3 The Permittee shall submit for MPCA review and approval, plans and specifications, as well as any additional information required by the MPCA, for any additional scrubber solids settling/storage ponds. The scrubber pond(s) shall be designed in accordance with MPCA pond design criteria and include a dewatering system to accommodate dewatering of the pond contents. No construction shall begin until the Permittee has received written approval of plans and specifications for the construction from the MPCA.

Chapter 7. Total Facility Requirements

1. Sampling and Analyses

1.1 Sample preservation and test procedures for the analysis of pollutants shall conform to 40 CFR Part 136 and Minnesota Rules, part 7041.3200.

1.2 Volatile organics shall be analyzed using Minnesota Department of Health Method 465E or equivalent method.

1.3 All monitoring and analytical instruments used to monitor as required by this permit shall be calibrated and maintained at a frequency necessary to ensure accuracy. The Permittee shall measure flows to ensure accuracy within plus or minus ten percent of the true flow values. The Permittee shall maintain written records of all calibrations and maintenance.

1.4 Samples and measurements required by this permit shall be representative of the monitored activity and shall be analyzed by a laboratory certified by the Minnesota Department of Health for the applicable permitted parameters. Analyses of dissolved oxygen, pH, temperature and total residual chlorine do not need to be completed by a certified laboratory.

1.5 The "sample type", "sampling frequency" and "effective period" identified in the Limits and Monitoring section of this permit together designate the minimum required monitoring frequency.

1.6 If a Permittee monitors more frequently than required by this permit, the results and the frequency of monitoring shall be reported on the Discharge Monitoring Report (DMR) or other form for that reporting period.

1.7 For bypasses, upsets, spills or any other discharge that may cause pollution of the waters of the state, the Permittee shall take at least one (1) grab sample for permitted effluent parameters two (2) times per week. If the Permittee believes that measuring these parameters is inappropriate due to known information about the discharge, the monitoring may be modified in consultation with the MPCA. Where there is reason to believe a pollutant other than those limited in the permit is present, the Permittee shall sample for that pollutant. Appropriate sampling shall be determined in consultation with the MPCA.

2. Facility Closure

2.1 The Permittee is responsible for closure and postclosure care of the facility. The Permittee shall notify the MPCA of a significant reduction or cessation of operations described in this permit.

2.2 Facility closure that could result in a potential long-term water quality concern, such as the ongoing discharge of wastewater to surface or ground water, may require a permit modification. An application for permit modification shall be submitted to the MPCA for approval before the proposed change is implemented.

Chapter 7. Total Facility Requirements

2. Facility Closure

2.3 The MPCA may require the Permittee to establish financial assurance for closure, postclosure care and remedial action at the facility.

2.4 The Commissioner may require the Permittee to submit a Pollution Control Deactivation Plan for approval. The Permittee shall notify the Commissioner of any significant reduction or cessation of the operations described in the Facility Description. If a plan is required, the Commissioner will inform the Permittee in writing of this request, and will state the site-specific concerns that the plan shall address and the date by which the plan shall be submitted. The plan shall provide for the implementation, including continued maintenance if necessary, of best management practices and best available technology and shall assure compliance with all applicable laws and Agency regulations which apply to air quality, water quality, and the disposal of hazardous substances.

3. Reporting

3.1 The Permittee shall report monitoring results for the completed reporting period in the units specified by this permit on a Discharge Monitoring Report (DMR) form or other report form provided by the MPCA.

3.2 The Permittee shall report ground water monitoring results on the Discharge Monitoring Report.

3.3 The Permittee shall report monitoring results below the reporting limit (RL) of a particular instrument as "<" the value of the RL. For example, if an instrument has a RL of 0.1 mg/L and a parameter is not detected at a value of 0.1 mg/L or greater, the concentration shall be reported as "<0.1 mg/L." "Non-detected", "undetected", "below detection limit" and "zero" are unacceptable reporting results, and are permit reporting violations.

3.4 A Discharge Monitoring Report (DMR) shall be submitted for each station even if no discharge occurred during the reporting period. The Permittee shall report 'No Discharge', 'No Flow' or 'No Materials Generated' on a DMR or other monitoring report form only if no discharge, flow or materials are generated during the entire reporting period. The schedule for reporting can be found on the Submittals Summary section of this permit.

3.5 Individual values for each sample and measurement must be reported on the Supplemental Report Form provided by the MPCA and submitted with the Discharge Monitoring Report (DMR).

Chapter 7. Total Facility Requirements

3. Reporting

3.6 The Permittee shall report the following information on the Discharge Monitoring Report (DMR):

a. any substantial changes in operational procedures;

b. activities which alter the nature or frequency of the discharge; and

c. material factors affecting compliance with the conditions of this permit.

3.7 The Permittee shall report monitoring results of bypass events on its Discharge Monitoring Report (DMR). If no bypass events occurred, check the "No Discharge" box on the DMR.

3.8 The Permittee or the duly authorized representative of the Permittee shall sign the reports and documents submitted to the MPCA by the Permittee. (Minnesota Rules, pt. 7001.0150, subp. 2.D)

3.9 A person who falsifies, tampers with, or knowingly renders inaccurate a monitoring device or method required to be maintained under this permit is subject to penalties provided by federal and state law. (Minnesota Rules, pt. 7001.1090, subp. 1.G)

3.10 The Permittee shall report noncompliance with the permit not reported under Minnesota Rules, part 7001.0150, subpart 3, item K as a part of the next report which the Permittee is required to submit under this permit. If no reports are required within 30 days of the discovery of the noncompliance, the Permittee shall submit the information listed in Minnesota Rules, part 7001.0150, subpart 3, item K within 30 days of the discovery of the noncompliance. (Minnesota Rules, pt. 7001.1090, subp. 1.H)

3.11 A person who knowingly makes a false statement, representation, or certification in a record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance is subject to penalties provided by federal and state law set forth. (Minnesota Rules, pt. 7001.0150, subp. 3.L)

Chapter 7. Total Facility Requirements

4. Records

4.1 The Permittee shall maintain records for each sample and measurement. The records shall include the following information:

a. the exact place, date and time of the sample or measurement;

b. the date of analysis;

c. the name of the person who performed the sample collection, measurement, analysis, or calculation;

d. the analytical techniques, procedures and methods used; and,

e. the results of the analysis.

4.2 The Permittee shall keep the records required by this permit for at least three (3) years, including any calculations, original recordings from automatic monitoring instruments, and laboratory sheets. The Permittee shall extend these record retention periods upon request of the MPCA and/or during the course of an unresolved enforcement action. (Minnesota Rules, pt. 7001.0150, subp. 2.C.)

4.3 Except for data determined to be confidential according to Minnesota Statutes, ch. 116.075, subd. 2, all reports required by this permit shall be available for public inspection at the MPCA St. Paul office. Effluent data shall not be considered confidential. Confidential material shall be submitted according to Minnesota Rules, pt. 7000.1300.

4.4 The Permittee shall, when requested by the commissioner, submit within a reasonable time the information and reports that are relevant to the control of pollution regarding the construction, modification, or operation of the facility covered by the permit or regarding the conduct of the activity covered by the permit. (Minnesota Rules, pt. 7001.0150, subp. 3.H.)

5. Compliance Responsibility

5.1 The Permittee shall perform the actions or conduct the activity authorized by the permit in accordance with the plans and specifications approved by the agency and in compliance with the conditions of the permit. (Minnesota Rules, pt. 7001.0150, subp. 3.E.)

6. Noncompliance

6.1 Noncompliance with the requirements of this permit subjects the Permittee to penalties provided by federal and state law including monetary penalties, imprisonment, or both. (Minnesota Rules, pt. 7001.1090, subp. 1.B.; U.S.C. title 33, sect. 1319; Minn. Stat. sect. 115.071)

Chapter 7. Total Facility Requirements

6. Noncompliance

6.2 If the Permittee discovers that noncompliance with a condition of the permit has occurred, the Permittee shall:

a. take all reasonable steps to minimize the adverse impacts to human health, public drinking water supplies, or the environment resulting from a permit violation.

b. notify the Minnesota Department of Public Safety Duty Officer at 1(800)422-0798 or (651)649-5451 within 24 hours of becoming aware of a permit violation that may endanger human health, public drinking water supplies or the environment. The Permittee shall submit a written description of the exceedance to the MPCA within five (5) days of discovery of the exceedance.

Nothing in this requirement relieves the Permittee from immediately notifying the MPCA of any release to surface waters of the state. (Minnesota Rules, pt. 7001.0150, subp. 3. J, K)

6.3 The Permittee shall submit a written description of any bypass, spill, upset or permit violation during the reporting period to the MPCA with its Discharge Monitoring Report (DMR). If no DMR is required within 30 days, the Permittee shall submit a written report within 30 days of the discovery of the noncompliance. This description shall include the following information:

a. a description of the event including volume, duration, monitoring results and receiving waters;

b. the cause of the event;

c. the steps taken to reduce, eliminate and prevent reoccurrence of the event;

d. the exact dates and times of the event; and

e. steps taken to reduce any adverse impact resulting from the event. (Minnesota Rules, pt. 7001.0150, subp. 3.K)

Chapter 7. Total Facility Requirements

7. Upset Defense

7.1 In the event of temporary noncompliance by the Permittee with an applicable effluent limitation resulting from an upset at the Permittee's facility due to factors beyond the control of the Permittee, the Permittee has an affirmative defense to an enforcement action brought by the agency as a result of the noncompliance if the Permittee demonstrates by a preponderance of competent evidence:

a. the specific cause of the upset;

b. that the upset was unintentional;

c. that the upset resulted from factors beyond the control of the Permittee and did not result from operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or increases in production which are beyond the design capability of the treatment facilities;

d. that at the time of the upset the facility was being properly operated;

e. that the Permittee properly notified the commissioner of the upset in accordance with Minnesota Rules, part 7001.0150, subpart 3, items K and L; and

f. that the Permittee implemented the remedial measures required by Minnesota Rules, part 7001.0150, subpart 3, item J. (Minnesota Rules, pt. 7001.1090, subp. 1.L)

8. Duty to Notify and Avoid Water Pollution

8.1 The Permittee shall notify the Minnesota Department of Public Safety Duty Officer at (800)422-0798 or (651)649-5451 immediately of the discharge, accidental or otherwise, of any substance or material under its control which, if not recovered, may cause pollution of waters of the state. Notification is not required for a discharge of five (5) gallons or less of petroleum. (Minnesota Statutes, section 115.061)

8.2 The Permittee shall report to the Duty Officer all pertinent information regarding the discharge. Refer to the MPCA "Emergency Notification Guidance for Wastewater Treatment Systems" for further information.

8.3 The Permittee shall take all reasonable steps to minimize the adverse impacts to human health, public drinking water supplies or to the environment resulting from the discharge. This may include restricting or preventing untreated or partially treated wastewater, plant chemicals or feedlot materials from entering waterways, containing spilled materials, recycling by-passed wastewater through the plant, or using auxiliary treatment methods. (Minnesota Statutes, section 115.061)

Chapter 7. Total Facility Requirements

9. Anticipated Bypasses

9.1 The Permittee may allow a bypass to occur if the bypass will not cause the exceedance of an effluent limitation but only if the bypass is necessary for essential maintenance to assure efficient operation of the facility. The permittee shall submit notice of the need for the bypass at least ten days before the date of the bypass. (Minnesota Rules, pt. 7001.1090, subp. 1.J)

9.2 The notice of the need for a bypass shall include the following information:

a. The proposed date and estimated duration of the bypass.

b. The alternatives to bypassing.

c. The proposed measures to mitigate environmental harm caused by the bypass.

d. A proposal for bypass monitoring.

9.3 The Permittee shall not allow an anticipated bypass to occur that will cause an exceedance of an applicable effluent limitation unless the following conditions are met:

a. The bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. For the purposes of this paragraph, "severe property damage" means substantial damage to property of the Permittee or of others; damage to the wastewater treatment facilities that may cause them to become inoperable; or substantial and permanent loss of natural resources that can be reasonably expected to occur in the absence of a bypass. "Severe property damage" does not mean economic loss as a result of a delay in production.

b. There is no feasible alternative to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or performance of maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance.

c. The Permittee has notified the commissioner of the anticipated bypass and the commissioner has approved the bypass. The commissioner shall approve the bypass if the commissioner finds that the conditions set forth in Minnesota Statutes, part 7001.1090, subpart 1, items A and B are met. (Minnesota Rules, pt. 7001.1090, subp. 1.K)

10. Facilities Operation

10.1 The Permittee shall properly operate and maintain the systems used to achieve permit compliance. Proper operation and maintenance includes effective performance, adequate funding, adequate staffing and training, and adequate process and laboratory controls, including appropriate quality assurance procedures. (Minnesota Rules, pt. 7001.0150, subp. 3.F)

Chapter 7. Total Facility Requirements

10. Facilities Operation

10.2 The Permittee is responsible for insuring system reliability and shall install adequate backup or support systems to achieve permit compliance and prevent the discharge of untreated or inadequately treated waste. These systems may include alternative power sources, auxiliary treatment works and sufficient storage volume for untreated wastes. (Minnesota Rules, pt. 7001.0150, subp. 3.F)

10.3 The Permittee shall store, transport and dispose of biosolids, sediments, residual solids, filter backwash, screenings, oil, grease and other substances so that pollutants do not enter surface waters or ground waters of the state.

10.4 The Permittee's discharge shall not cause any nuisance conditions, acutely toxic conditions to aquatic life or other adverse impact on the receiving water.

10.5 The Permittee shall comply with all applicable water quality, air quality, solid waste and hazardous waste statutes and rules in the operation and maintenance of the facility.

10.6 The Permittee shall schedule maintenance of the treatment works during non-critical water quality periods to prevent degradation of water quality.

10.7 In-plant control tests shall be conducted at a frequency adequate to ensure continuous efficient operation of the treatment facility.

11. Chemical Additives

11.1 The Permittee shall receive prior written approval from the MPCA before increasing the use of a chemical additive authorized by this permit, or using a chemical additive not authorized by this permit. "Chemical additive" includes processing reagents, water treatment products, cooling water additives, freeze conditioning agents, chemical dust suppressants, detergents and solvent cleaners used for equipment and maintenance cleaning, among other materials.

11.2 The Permittee shall request approval for an increased or new use of a chemical additive 60 days before the proposed increased or new use.

Chapter 7. Total Facility Requirements

11. Chemical Additives

11.3 This written request shall include the following information for the proposed additive:

a. Material Safety Data Sheet.

b. A complete product use and instruction label.

c. The commercial and chemical names of all ingredients.

d. Aquatic toxicity and human health or mammalian toxicity data including a carcinogenic, mutagenic or teratogenic concern or rating.

e. Environmental fate information including, but not limited to, persistence, half-life, intermediate breakdown products, and bioaccumulation data.

f. The proposed method, concentration, and average and maximum rates of use.

g. If applicable, the number of cycles before wastewater bleedoff.

h. If applicable, the ratio of makeup flow to discharge flow.

11.4 This permit may be modified to restrict the use or discharge of a chemical additive.

12. Inspection And Entry

12.1 The Permittee shall allow a representative of the MPCA, in accordance with Section 308 of the Act and Minnesota Statutes, section 115.04, and upon presentation of proper credentials, to:

a. enter the premises where the facility is located or activity conducted;

b. review and copy the records required by this permit;

c. inspect the facilities, systems, equipment, practices or operations regulated or required by this permit;

d. sample or monitor to determine compliance; and

e. bring equipment upon the Permittee's premises necessary to conduct surveys and investigations. (Minnesota Rules, pt. 7001.0150, subp. 3.I)

Chapter 7. Total Facility Requirements

13. Permit Modifications

13.1 Changes to the facility or operation of the facility may require a permit modification. The Permittee shall submit an application describing the changes to the facility or operation to the MPCA and receive a permit modification prior to implementing the changes. The Permittee must submit the permit modification application fee in accordance with Minnesota Rules, part 7002.0250 with the application.

13.2 The following changes may require a permit modification:

a. Increased use or new use of a chemical additive.

b. Changes in the characteristics, concentrations or frequency of the wastewater flow, which may include new significant industrial discharges to a sanitary sewage treatment system, significant changes in existing industrial discharges to a sanitary system, significant rerouting of wastewater for reuse or for land disposal or significant changes in the levels of indicator characteristics.

c. Changes in biosolids or residual solids use and disposal practices.

13.3 The procedures as set forth in Minnesota Rules, pt. 7001.0100 through 7001.0130, including public notice, apply to applications for permit modifications, with the following exceptions:

a. Modifications solely as to ownership or control as described in Minnesota Rules, pt. 7001.0190, subp. 2.

b. Minor modifications as described in Minnesota Rules, pt. 7001.0190, subp. 3.

13.4 No permit may be assigned or transferred by the holder without the approval of the MPCA. A person to whom the permit has been transferred shall comply with the conditions of the permit. (Minnesota Rules, pt. 7001.0150, subp. 3.N)

14. Construction

14.1 Construction related to facility modifications, additions or expansions that is not expressly authorized by this permit requires a permit modification. If the construction project requires an Environmental Assessment Worksheet under Minnesota Rules, ch. 4410, no construction shall begin until a negative declaration has been issued and all approvals have been received or implemented. (Minnesota Rules, pt. 7001.0030)

14.2 No construction shall begin until the Permittee has received written approval of plans and specifications for the construction from the MPCA.

Chapter 7. Total Facility Requirements

15. Permit Modification, Suspension or Revocation

15.1 This permit may be modified, suspended, or revoked for the following reasons:

a. A violation of permit requirements.

b. Misrepresentation or failure to disclose fully all relevant information to obtain the permit.

c. A change in a condition that alters the discharge.

d. The establishment of a new or amended pollution standard, limitation or effluent guideline that is applicable to the permitted facility or activity.

e. Failure to pay permit fees.

f. Other reasons listed in Minnesota Rules, pt. 7001.0170.

16. Permit Reissuance

16.1 The Permittee shall submit an application for permit reissuance at least 180 days before permit expiration. (Minnesota Rules, pt. 7001.0040, subp. 3)

16.2 If the Permittee has submitted a timely application for permit reissuance, the Permittee may continue to conduct the activities authorized by this permit, in compliance with the requirements of this permit, until the MPCA takes final action on the application, unless the MPCA determines one of the following:

a. The Permittee is not in substantial compliance with the requirements of this permit, or with a stipulation agreement or compliance schedule designed to bring the Permittee into compliance with this permit.

b. The MPCA, as a result of an action or failure to act by the Permittee, has been unable to take final action on the application on or before the expiration date of the permit.

c. The Permittee has submitted an application with major deficiencies or has failed to properly supplement the application in a timely manner after being informed of deficiencies. (Minnesota Rules, pt. 7001.0160)

16.3 If the Permittee does not intend to continue the activities authorized by this permit after the expiration date of this permit, the Permittee shall notify the MPCA. The MPCA may require the Permittee to apply for reissuance or a major modification of this permit to authorize facility closure.

Chapter 7. Total Facility Requirements

17. Property Rights

17.1 The permit does not convey a property right or an exclusive privilege. (Minnesota Rules, pt. 7001.0150, subp. 3.C)

18. Liability Exemption

18.1 In issuing this permit, the state and the MPCA assume no responsibility for damage to persons, property, or the environment caused by the activities of the Permittee in the conduct of actions, including those activities authorized, directed, or undertaken to achieve compliance with this permit. To the extent the state and MPCA may be liable for the activities of its employees, that liability is explicitly limited to that provided in the Tort Claims Act, Minnesota Statutes, section 3.736. (Minnesota Rules, pt. 7001.0150, subp. 3.O)

18.2 The MPCA's issuance of this permit does not obligate the MPCA to enforce local laws, rules or plans beyond what is authorized by Minnesota Statutes. (Minnesota Rules, pt. 7001.0150, subp. 3.D)

19. Liabilities

19.1 The MPCA's issuance of this permit does not release the Permittee from any liability, penalty or duty imposed by Minnesota or federal statutes or rules or local ordinances, except the obligation to obtain the permit. (Minnesota Rules, pt. 7001.0150, subp. 3.A)

19.2 The issuance of a permit does not prevent the future adoption by the MPCA of pollution control rules, standards or orders more stringent than those now in existence and does not prevent the enforcement of these rules, standards or orders against the Permittee. (Minnesota Rules, pt. 7001.0150, subp. 3.B)

20. Severability

20.1 The provisions of this permit are severable, and if any provisions of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

21. Incorporation By Reference

21.1 The Permittee shall comply with the provisions of 40 CFR Parts 122.41 and 122.42, Minnesota Rules, pt. 7001.0150, subp. 3, and pt. 7001.1090, which are incorporated into this permit by reference, and are enforceable parts of this permit.

STATE OF MINNESOTA
MINNESOTA POLLUTION CONTROL AGENCY

IN THE MATTER OF: United States Steel Corporation

SCHEDULE OF COMPLIANCE
Multi-Media Pollutant Reduction

Part 1. ***PARTIES.*** This Schedule of Compliance for Multi-media Pollutant Reductions a ("Agreement" or "Schedule") applies to and is binding upon the following parties:

a. United States Steel Corporation ("Regulated Party")

b. Minnesota Pollution Control Agency ("MPCA")

Unless specified otherwise in this Agreement, where this Agreement identifies actions to be taken by the MPCA, the Commissioner or the Commissioner's designees shall act on the MPCA's behalf.

Part 2.*PURPOSE AND SCOPE OF SCHEDULE OF COMPLIANCE.* The purpose of this Agreement is to enact a multi-pollutant multi-media strategy at the Regulated Party's Minnesota Ore Operations Minntac and Keetac facilities to reduce air quality emissions, water quality pollutant discharges and resolve outstanding water quality non-compliance at the Minntac tailings basin.

This Agreement amends the following agreements between the Regulated Party and the MPCA so that that each of the following agreements are terminated and superseded by this Agreement:

a. The termination language, Part 27, in the September 8, 2008, Stipulation Agreement is hereby amended to allow that that agreement may be terminated when its requirements are incorporated into another compliance document. As a result, the September 8, 2008, Stipulation Agreement is hereby terminated upon the effective date of this Agreement.

b. The termination language, Part 24, in the November 14, 2007, Schedule of Compliance is hereby amended to allow that that agreement may be terminated when its requirements are incorporated into another compliance document. As a result, the November 14, 2007, Schedule of Compliance and the February 25, 2010 Amendment No.

to the November 14, 2007 Schedule of Compliance are hereby terminated upon the effective date of this Agreement.

c. The termination language, Part 18, in the August 11, 2010, Mercury Air Emission Reductions Schedule of Compliance is hereby amended to allow that that agreement may be terminated when its requirements are incorporated into another compliance document. As a result, the November 14, 2007, Schedule of Compliance is hereby terminated upon the effective date of this Agreement.

Part 7 of this Agreement specifies what actions the Regulated Party agrees to undertake to resolve alleged violations set out in Part 6 as well as water quality issues associated with the Minntac tailings basin seep discharges and air quality issues. By entering into this Schedule, the Regulated Party is settling a disputed matter between itself and the MPCA and does not admit that the alleged violations set out in Part 6 of this Agreement occurred. However, solely for the purposes of implementing Part 10 of this Agreement, the Regulated Party agrees that the MPCA may rely upon the alleged violations set out in Part 6 as provided in Part 10 of this Agreement. Except for the purposes of implementing and enforcing this Agreement, nothing in this Agreement constitutes an admission by either Party, or creates rights, substantive or procedural, that can be asserted or enforced with respect to any claim of or legal action brought by a person who is not a party to this Agreement.

Part 3. ***AUTHORITY.*** This Agreement is entered under the authority vested in the MPCA by Minnesota Statutes Chapters 115 and 116.

Part 4. ***DEFINITIONS.*** Unless otherwise explicitly stated, the definitions in Minnesota Statutes Chapters 115, 115A, 115B, 115C, 116, 116B and in Minnesota Rules Chapters 7000 to 7151 apply, as appropriate, to the terms used in this Agreement.

Part 5. ***BACKGROUND.*** The following is the background of this Agreement:

a. The Regulated Party operates two taconite mining and processing facilities in Minnesota; Minnesota Ore Operations Minntac and Keetac. The Regulated Party and the MPCA have agreements in place to resolve alleged water quality non-compliance at the Minntac tailings basin and an agreement detailing how it will adhere to the "Implementation Plan for Minnesota's Statewide Mercury Total Maximum Daily Load" (Mercury TMDL Implementation Plan) dated October 2009, including Appendix 6

"Guidelines for New and Modified Mercury Air Emission Sources" for the proposed new taconite indurating furnace (Phase III) at the Keetac facility and existing Keetac and Minntac operations. The Regulated Party holds an air emissions permit for the Minntac facility which contains a schedule for pilot testing and installing technically feasible Nitrogen oxide control technologies. As provided herein, this Agreement incorporates the requirements of these agreements, references the air emissions permit and contains additional requirements to reduce the air quality and water quality impacts from the Minntac and Keetac facilities. This Agreement details (1) installation of a surface water seepage collection system on the Dark River side of the Minntac tailings basin, (2) decreasing sulfate and hardness levels in the Minntac tailings basin and reducing particulate air emissions by replacing Minntac's wet scrubbers with higher performing control equipment, (3) reducing mercury emissions from the Minntac and Keetac facilities by installing activated carbon injection or equivalent mercury control equipment and evaluating mercury control technologies, (4) reducing sulfur dioxide emissions from Minntac by installing a gas suspension absorber or equivalent dry control equipment, and (5) continuing work to reduce nitrogen oxide emissions by complying with its air emissions permit conditions.

Air Quality Background

b. The MPCA does not allege and this Schedule is not intended to imply that there currently exists air emissions noncompliance at either the Minntac or Keetac facilities

c. The Clean Air Act requires U.S. EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The Clean Air Act requires periodic review of the NAAQS and the science upon which the NAAQS are based and the standards themselves. U.S. EPA has recently promulgated more stringent standards for sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). This agreement will assist in the demonstration of compliance with the recently adopted standards for those pollutants.

d. In 1999, U.S. EPA announced an effort to improve air quality in national parks and wilderness areas such as Voyageurs National Park, the Boundary Waters

Canoe Area Wilderness and Isle Royale National Park. This agreement will reduce impacts on visibility that are important to the Regional Haze program.

e. In 2008, the MPCA issued an air emissions permit for the Minntac facility to resolve alleged PSD violations concerning alleged modifications to the facility. The permit requires NO_x control equipment pilot testing and increasingly more stringent NO_x emission limits.

Mercury Background

f. The MPCA does not allege and this Schedule is not intended to imply that there exists mercury reduction noncompliance at either the Minntac or Keetac facilities

g. One purpose of this Schedule is to detail the MPCA and Regulated Party's activities related to conducting mercury control research, reporting results to the MPCA, and installing feasible mercury control technologies on existing USS' facilities operating taconite indurating furnace Lines 3, 4, 5, 6 and 7 at the Regulated Party's Minntac facility and Phase II at the Keetac facility. These activities will be conducted to adhere to the "Implementation Plan for Minnesota's Statewide Mercury Total Maximum Daily Load" (Mercury TMDL Implementation Plan) dated October 2009, including Appendix 6 "Guidelines for New and Modified Mercury Air Emission Sources" for the proposed new taconite indurating furnace (Phase III) at the Keetac facility. The Mercury TMDL Implementation Plan calls for statewide mercury reductions from existing mercury emitting facilities by 2025.

h. The Regulated Party will reduce mercury emissions from its Minntac and Keetac facilities consistent with the Mercury TMDL Implementation Plan, however, USS' proposed taconite indurating furnace, Phase III, at Keetac, will add new mercury emissions to the statewide emission inventory of mercury emitting sources. The actions described in this agreement are intended to ensure that the Regulated Party will reduce emissions from its Minntac and Keetac facilities consistent with the Mercury TMDL Implementation Plan and will do so before the 2025 goal date. The early reductions will achieve the same or lower cumulative mercury emissions for the years 2008-2025 as would occur without the new contribution from the proposed new taconite indurating furnace, Phase III, at Keetac. To achieve this, the Regulated Party has a goal of installing mercury controls at Minntac and Keetac to ensure that the increase in mercury emissions

from Phase III at Keetac is completely offset by these reductions and to achieve the 2025 target total mercury emission goal from Minntac and Keetac together of 72.8 lbs/yr. See Appendix A for a graphical representation of emission reductions.

i. The MPCA adopted a Statewide TMDL for mercury in 2007. By its terms, Minnesota established that mercury air emissions should be reduced to a statewide total of 789 pounds of mercury per year by 2025. To reach the total reductions, the MPCA developed a Mercury TMDL Implementation Plan in consultation with representatives of mercury-emitting sources. The Plan establishes industry sector-specific mercury reductions that must be met in order to achieve the final, state-wide reductions.

The Mercury TMDL Implementation Plan establishes mercury emission reduction commitments for the Ferrous Mining and Processing Industry: U. S. Steel Minntac, U. S. Steel Keetac, Hibbing Taconite, United Taconite, ArcelorMittal, Northshore Mines, Essar Steel and Mesabi Nugget, to reach a target of 210 lb/yr of emissions by 2025 and establishes related interim goals and implementation guidelines. Achievement of that target requires a 75 percent reduction from the baseline of 841 lbs/yr for the Ferrous Mining and Processing Industry.

j. The State of Minnesota, through its MPCA, will implement the Mercury TMDL Implementation Plan. This effort includes the MPCA's continued application of the "Guidelines for New and Modified Mercury Air Emission Sources" and rulemaking to require certain mercury-emitting facilities to develop enforceable mercury emission reduction plans to meet the sector and source reduction targets and timeframes listed in the Mercury TMDL Implementation Plan. The MPCA recognizes the mercury control technology testing and installation that the Regulated Party has committed to at Keetac and Minntac. To the extent possible, the MPCA's continuing implementation of the Plan will account for mercury emission reductions that the Regulated Party achieves at Keetac and Minntac.

k. As provided in the Mercury TMDL Implementation Plan, by June 30, 2016, or a date established by the MPCA rule, the MPCA will require submittal of a schedule for reducing mercury emissions from the ferrous mining and processing industry by 2025.

l. As its contribution to achieving the TMDL Implementation Plan target of 210 lb/yr of emissions for the ferrous mining and processing industry by 2025, the Regulated

Party has committed to a goal of reducing total emissions to 72.8 lb/yr by 2025, a 75 percent reduction from the baseline of 291.1 lb/yr from Regulated Party taconite indurating furnace lines at Minntac and Keetac.

m. Once the Major Amendment to Air Emissions Permit (13700063-004) is issued and in effect for the Regulated Party's Keetac facility, the Regulated Party will commit to installing and operating mercury control technology on the new taconite indurating furnace at Keetac (Phase III). The Air Emissions Permit will include associated monitoring, recordkeeping and reporting requirements. Projected emissions from this new furnace are up to 54.0 lb/yr.

n. To date, no mercury control technologies have been tested long term or installed on a taconite indurating furnace. The majority of the published information and research on mercury control technologies is based on coal-fired utility boilers.

o. The results of the research to be conducted by the Regulated Party are likely to be applicable to other mining operations on the Iron Range, which may accelerate achievement of the sector wide ferrous mining and processing industry Mercury TMDL Implementation Plan mercury emission reduction goal.

Water Quality Background

p. On March 20, 2009, the Regulated Party submitted a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit application as required by the November 14, 2007 Agreement between Regulated Party and the MPCA. In that application, the Regulated Party proposed a water management strategy based in part on installation of a Process Water Treatment System (PWTS) to treat up to 7,000 gallons/minute of recirculating process water, as well as installation of a tailings basin seep collection and return system to capture surface seepage that discharges to the Sand River watershed. After submittal of the application the Regulated Party requested the MPCA to not act upon the application while the Regulated Party investigated refinements to the PWTS proposed in the permit application.

q. The Regulated Party proposed instead to implement a Dry Controls Project to eliminate or reduce pollutants in the tailings basin at their source. The Regulated Party has determined that instead of installing a PWTS to treat process water while continuing to transfer air pollutants from the wet scrubbers to the recirculating process water, it will

instead eliminate the substantial source of pollutants entering the recirculating process water through installation of dry emission controls.

r. The Dry Controls Project consists of the following control equipment installations, in lieu of the existing wet scrubber on Line 6. Due to the size of the equipment it cannot be located within existing structures; therefore construction timing will be critical to the project timeline.

1. A dry electrostatic precipitator (ESP) or equivalent dry control equipment to reduce air emissions of particulate matter (PM), particulate matter less than 10 microns in diameter (PM_{10}), and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$).

2. A gas suspension absorber or equivalent dry control equipment to reduce air emissions of Sulfur dioxide (SO2).

3. Activated carbon injection or equivalent control equipment to control mercury (Hg) to reduce air emissions of Mercury (Hg).

s. By replacing wet scrubbers with dry emission controls, a very significant reduction in the mass of pollutants transferred to the recirculating process water and passing through the tailings basin will be accomplished. In addition, the Dry Controls Project is expected to achieve emissions reductions for PM, PM_{10}, $PM_{2.5}$, Sulfur dioxide (SO_2), and Mercury (Hg) greater than the existing control equipment.

t. On September 8, 2008 a Stipulation Agreement between the Regulated Party and the MPCA became effective. The Stipulation Agreement required, among other things, that the Regulated Party hire a consultant, identify corrective actions necessary to ensure compliance with the NPDES/SDS permit requirement that there be no net increase in sulfate and hardness to the tailings basin as a result of operation of the Line 3 scrubber, and propose a schedule for implementing the recommended corrective actions, for MPCA review and approval. As required by the Stipulation Agreement, the Regulated Party submitted an Implementation Plan to the MPCA dated January 21, 2009. The Implementation Plan indicated that the Regulated Party intended to rely upon the PWTS to accomplish the permit requirement of no net sulfate and hardness increase to the tailings basin. As indicated in Part 5.p. above, the Regulated Party is no longer considering installation of a PWTS and so the Regulated Party, per the requirements of

the Stipulation Agreement, must identify and implement other corrective actions that ensure compliance with the no net sulfate and hardness increase requirements of the permit.

Part 6. ***ALLEGED VIOLATIONS***

a. NPDES/SDS Permit No. MN0057207 Chapter 4, Part 3.1 states, in-part:

> On an annual basis, the mass of sulfate leaving the scrubber system shall be less than or equal to the mass of sulfate entering the scrubber system.

The NPDES/SDS permit prohibits any increase in the mass of sulfate leaving the scrubber system as a result of the line 3 scrubber operation. The following table indicates the total pounds of sulfate that were added to the process wastewater as a result of the treatment system operation between 2006 – 2010:

Year of Operation	Excess Pounds of Sulfate
2006	80,847
2007	69,839
2008	54,904
2009	18,207
2010	57,558

b. NPDES/SDS Permit No. MN0057207 Chapter 4, Part 3.2 (April 21, 2006, permit modification) states, in-part:

> On an annual basis, the number of moles of excess hydroxide ion…must be equal to or greater than the number of moles of excess calcium …in the thickener overflow stream.

The NPDES/SDS permit prohibits any increase in calcium in wastewater leaving the scrubber system as a result of the line 3 scrubber operation. In 2006, 141,312 pounds of calcium was added to the process wastewater as a result of the line 3 scrubber operation.

> **NPDES/SDS Permit No. MN0057207 Chapter 4, Part 3.2** (September 13, 2007, permit modification) states, in-part:
>
> On an annual basis, the number of moles of excess hydroxide ion…must be equal to or greater than the number of moles of excess calcium and magnesium…in the thickener overflow stream.

The NPDES/SDS permit prohibits any increase in hardness in wastewater leaving the scrubber system as a result of the line 3 scrubber operation. The following table indicates

the total pounds of hardness ($CaCO_3$) that were added to the process wastewater as a result of the treatment system operation between 2007 – 2010:

Year of Operation	Excess Pounds of Hardness ($CaCO_3$)
2007	241,167
2008	352,125
2009	31,133
2010	741,468

Part 7. ***REQUIREMENTS.*** All reports, studies, recommendations and schedules that are required to be submitted by the Regulated Party to the MPCA and are approved by the MPCA shall become enforceable parts of this Agreement.

Particulate Matter, Sulfur Dioxide, and Mercury Air Emissions Reduction Requirements – Dry Controls Project

a. Within 60 days of the effective date of this Agreement, the Regulated Party will submit to MPCA a permit amendment application to permit the installation of the "Dry Controls Project" on Taconite Production Line 6 at the Regulated Party's Minntac facility.

b. Without prior MPCA approval, the Regulated Party shall not withdraw its application for installation of the Dry Controls Project. Should the Regulated Party's request to withdraw its application for installation of the Dry Controls Project be denied by MPCA, the Regulated Party may invoke Dispute Resolution under Part 11 of this Agreement.

c. The Regulated Party will commence construction on the Dry Controls Project within 90 days after the effective date of required permits by MPCA or other regulatory agencies, provided that no judicial or administrative appeal(s) or citizen suit(s) challenging such permit(s) have been filed (Permit Issuance).

d. The Regulated Party will complete construction of the Dry Controls Project no more than 22 construction months after the effective date of required permits. A "construction month" is defined as any month falling between mid-April and mid-November; the calendar months when construction is possible in the region.

e. No more than 12 calendar months after completed construction, the Regulated Party shall complete the commissioning, shakedown, and performance evaluation of the

Dry Controls Project. During the performance evaluation, the Regulated Party shall collect at least six calendar months of data. Dry Controls Project performance evaluation data collection shall include, at a minimum, the following parameters: (1) control equipment performance for PM, PM_{10}, $PM_{2.5}$, SO_2, and Mercury (Hg) (in pounds per hour); (2) the nitrogen oxides/nitrogen dioxides (NO/NO_2) ratio for the stacks affected by the installation; (3) parametric monitoring records; (4) multi-pollutant co-control benefits; (5) cross media impacts; (6) energy efficiency or consumption impact; (7) technical and economic feasibility; and (8) impact on pellet quality.

f. No more than 14 calendar months after completed construction, the Regulated Party shall submit to the MPCA for its review and approval a report detailing the results of the Dry Control Project. The report shall include detail of each of the items listed above and the supporting justification and background data. The report shall also include a proposed schedule for the installation of additional Dry Control Projects at Regulated Party operations in Minnesota.

g. Within 60 days of MPCA approval of the Regulated Party's proposal for additional Dry Control Projects, the Regulated Party will submit required permit applications including schedules for commencing and completing construction, commissioning, and performance evaluations for each additional Dry Controls Project on other lines at the Minntac facility.

h. Without prior MPCA approval, the Regulated Party shall not withdraw its application(s) for installation of additional Dry Controls Projects. Should the Regulated Party's request to withdraw its application for installation of additional Dry Controls Projects be denied by MPCA, the Regulated Party may invoke Dispute Resolution under Part 11 of this Agreement.

i. Upon permit issuance, within 30 days after the end of each calendar quarter, the Regulated Party shall submit to the MPCA a summary of Dry Controls Project activities completed in that quarter and expected outcomes for the next quarter. The summary should provide information so that the MPCA can track the status of the effort; including the installation dates and the other measures used as milestones in the proposed schedule.

<u>Nitrogen Oxides Air Emissions Reduction Requirements</u>

j. The Regulated Party will install a Low NO_x Burner on Taconite Production Line 6 at the Regulated Party's Minntac facility, pursuant to the requirements of the facility's current air emissions permit, the schedule approved by the MPCA on January 18, 2011, and any subsequent schedules approved by the MPCA.

k. The Regulated Party shall operate, evaluate, and report on the Taconite Production Line 6 Low NO_x Main Burner in compliance with the Regulated Party's Minntac's current air emissions permit, the schedule approved by the MPCA on January 18, 2011, and any subsequent schedules approved by the MPCA.

l. Installation of nitrogen oxide control technologies on additional taconite production lines at the Regulated Party's Minntac facility, shall comply with the requirements of the facility's current air emissions permit and any schedules approved by the MPCA.

Modeling and Excess Emissions Reductions

m. The Agreement may be amended to add requirements for NAAQS SO_2, NO_2 and $PM_{2.5}$ modeling after it has been requested of all Minnesota taconite facilities by MPCA.

n. If excess emission reductions are achieved at the Minntac facility and/or the Keetac facility, beyond those required by the Mercury TMDL and/or the culpability studies for the NAAQS at the Minntac facility and/or the Keetac facility, the excess emission reductions shall be available for use by Minntac or Keetac, as appropriate, in any current or future netting analyses, as allowed by NSR/PSD regulations, or the Mercury TMDL.

Mercury Air Emissions Reduction Requirements

o. The Regulated Party shall calculate and report the annual mercury emissions from each indurating furnace at the Minntac facility and the Keetac facility, both current and new indurating furnaces. The Regulated Party shall use the most current stack test or mass balance result for each furnace to calculate mercury emissions. The Regulated Party shall submit this calculation to the MPCA by May 1 of each year for the preceding calendar year. The first report shall be due on May 1, 2014, for calendar year 2013. For all annual mercury accounting reports, the Regulated Party shall use the method approved

pursuant to this paragraph or a method specified in the applicable rules in effect at the time of the report.

p. Within 30 days after start of construction of Phase III [new taconite indurating furnace line] at Keetac, the Regulated Party shall submit an Engineering Evaluation of Potentially Feasible Mercury Control Technologies (Engineering Evaluation) and a proposal to trial a mercury control technology at its Minntac facility or the existing line at the Keetac facility for the MPCA approval. Mercury control technologies will be evaluated in the Engineering Evaluation with the purpose of selecting a technology for a short-term trial. The Engineering Evaluation will identify mercury control technologies potentially feasible for application at a taconite indurating furnace, although only one technology will be selected for the first short-term trial testing. The technologies considered and evaluated for potential selection as a technology for short term trial testing shall include, but not be limited to, the direct capture of mercury from process gas using carbon compounds, the addition of compounds to process gas to promote oxidation and capture of mercury, and the addition of compounds to wet scrubbers to improve mercury capture.

q. To facilitate review and approval of the Engineering Evaluation, the MPCA may request meetings or conference calls with the vendors, equipment suppliers, engineering firms, or others involved in providing bids or data to the Regulated Party for the Engineering Evaluation. The MPCA shall limit its inquiry to three vendors of the technologies reviewed in the Engineering Evaluation. The Regulated Party shall cooperate in arranging such meetings or conference calls.

r. For each technology identified, the Engineering Evaluation shall evaluate: (1) level of mercury reduction, (2) cross media impacts, (3) multi-pollutant co-control benefits or difficulties, (4) energy efficiency or consumption impact, (5) impacts on pellet quality, (6) economic feasibility, and (7) technical feasibility (evaluation criteria). The Engineering Evaluation shall include the identification of each technology, a ranking of the technologies and justification for the ranking and selection of the technology proposed for the first short-term trial testing. The Engineering Evaluation shall also include a thorough description of the proposed short-term trial technology, a test schedule for the short-term technology trial, proposed monitoring and recordkeeping, and an

evaluation of whether the proposed short-term trial technology requires any MPCA permits prior to implementation.

s. Within 30 days of the MPCA approval of the Engineering Evaluation, the Regulated Party shall submit a test plan in accordance with Minn. R. 7017.2001 to 7017. 2060 to conduct a short-term trial of mercury control technology at Minntac or the existing line at Keetac (Phase II indurating furnace) in accordance with the approved short-term trial proposal.

t. The Regulated Party shall commence implementation of the short-term trial no later than 90 days following the later of the MPCA approval of the Regulated Party's test plan or, if a permit(s) are necessary for the short-term trial the effective date of the permit(s), and shall complete the short term trial in accordance with the schedule approved by the MPCA.

u. The Regulated Party shall submit a short-term trial report to the MPCA within 60 days after completion of the short-term trial. The short-term trial report shall include, at a minimum, fuel Hg content(s) (ppm dry and lb/MMBtu), fuel input rate for all fuels (MMBtu/hr), dry greenball Hg content (ppm dry), fired pellet Hg content (ppm dry), pellet production rate (LT/hr), air pollution control device captured solids Hg content (ppm dry), mass rate (lb/hr) and flue gas concentration (ppm dry) of Hg entering and exiting the mercury control technology, control efficiencies (percent reduction), and control equipment parameter(s) identified in the short-term trial proposal. The Regulated Party will describe if the technology tested is sufficiently promising to warrant long term testing and justification for the conclusion reached in the report. The Regulated Party shall include in its report a proposal of either a long term trial or a short term trial for the next highest ranked technology.

v. The next short term trial shall proceed as described in Parts 7.s, 7.t and 7.u. If the Regulated Party concludes in the report on the second short term trial that the technology is not sufficiently promising to warrant long term testing, the Regulated Party shall submit to the MPCA for approval an updated Engineering Evaluation identifying the mercury reduction strategies/technologies that have been developed since the preparation of the original Engineering Evaluation and update the information in the original Engineering Evaluation in this short term trial report. A third short term trial

shall proceed as described in Parts 7.s, 7.t, and 7.u unless the revised Engineering Evaluation concludes no further trials are justified and the MPCA approves. The MPCA may request meetings or conference calls with the vendors, equipment suppliers, engineering firms, or others involved in providing bids or data to the Regulated Party for the revised Engineering Evaluation. The Regulated Party shall cooperate in arranging such meetings or conference calls.

w. If the revised Engineering Evaluation concludes no further trials are justified, evaluation of mercury control technologies will recommence if the MPCA identifies any potentially feasible mercury control technologies not previously reviewed in the Engineering Evaluation and notifies the Regulated Party that additional evaluation of a technology is required. Within 90 days of the MPCA notifying the Regulated Party, the Regulated Party will submit an evaluation of the technology and a schedule for short-term trial if the technology meets the evaluation criteria identified in Part 7.s. If the Regulated Party concludes that the technology is not suitable for a short-term trial, it will provide copies of all relevant documents and a complete justification for rejecting the technology for short-term trial.

x. If the Regulated Party becomes aware of a new technology, which the Regulated Party prefers to test in lieu of the previously identified technologies, the Regulated Party will notify the MPCA of the technology as soon as practicable. Within 60 days of initial notification to the MPCA of the technology, the Regulated Party will submit to the MPCA information supporting testing of the new technology including a permit applicability determination and a trial schedule for the MPCA approval. The information shall include consideration of the evaluation criteria in Part 7.s, and justification for selection of the new technology for short-term trial testing. the Regulated Party will commence testing based on the MPCA approved schedule and after permit issuance, if a permit is required.

y. If the short term trial concludes that the tested technology is potentially feasible based on the evaluation criteria, the Regulated Party shall submit a proposal for a long-term trial to MPCA for approval within 60 days after completion of the short-term trial. The proposal shall describe the goals for the trial, the criteria to be used to determine the success of the mercury control technology application, a schedule for

construction, startup, operation, conclusion of the trial and final report submittal. The Regulated Party shall evaluate its proposed long-term trial technology to determine whether it must apply for the MPCA permits prior to implementation of the long-term trial.

z. Upon the MPCA approval of the Regulated Party's proposal for long-term trial of a selected technology, the Regulated Party shall conduct a long-term trial of a mercury control technology on one existing line. The Regulated Party shall commence implementation of the long term trial within 90 days of the later of the MPCA approval of the long-term trial report or, if a permit(s) is necessary for the long-term trial, from the effective date of the permit(s), and has a goal of completing the long term trials within 18 calendar months after startup of the long term mercury control technology trial.

aa. Within 60 days after completion of the long-term trial, the Regulated Party shall submit a report on the results of the long-term trial. The report shall include an evaluation of mercury controls for installation on the Regulated Party operating taconite indurating furnace lines, addressing the evaluation criteria established in the trial proposal as well as describing what changes to mercury control(s) design or operation were identified from the trial that will be needed to achieve or improve mercury control performance. The report shall also propose a technology or technologies and a schedule for installation on existing operating taconite indurating furnace lines to meet the emission goal.

bb. If the long-term trial report proposes a technology for installation, within 60 days after the MPCA approval of the long-term trial report and technology proposal, the Regulated Party shall submit permit application(s) and a schedule for installation of the selected technology on necessary the Regulated Party operating taconite indurating furnace lines to reach the 2025 goal.

cc. If the long-term trial report proposes no technology for installation and the MPCA agrees, the Regulated Party shall proceed with another short term trial as described in Parts 7. s, 7.t, 7.u, 7.y, 7.z, and 7.aa.

dd. Upon submitting permit application(s) for installation of the selected technology on remaining necessary the Regulated Party operating taconite indurating

furnace lines to meet the reduction goal, the Regulated Party may submit a request to terminate this Schedule.

ee. If by June 30, 2016, the Regulated Party and the MPCA agree that short term and long term testing have not identified technologies for installation and no additional technologies have been identified for testing, the Regulated Party 's testing obligations will be fulfilled by cooperating with the Mercury- Emissions - Reduction Research and Implementation Council established pursuant to the Mercury TMDL Implementation Plan the Regulated Party's cooperation will continue until mercury technologies have been installed or other mercury reduction actions have been taken that meet the Regulated Party's mercury emission reduction goal.

Mercury Air Emissions Reduction Contingency Conditions

ff. The following conditions describe actions the Regulated Party will implement to minimize mercury emissions in the event that long term trial testing is not initiated. By no later than January 1, 2016, the Regulated Party shall submit a plan and schedule for MPCA approval, that is consistent with the Guidelines for New and Modified Mercury Air Emission Sources to offset cumulative mercury emissions from the operation of Phase III from startup of Phase III through January 1, 2025. The plan will include an evaluation of the modification of the particulate matter scrubber operation at Minntac to route mercury-containing scrubber solids from the front of the taconite process to the tailings basin ("wasting scrubber solids").

gg. By no later than June 30, 2016, or within 60 days of approval by the MPCA, the Regulated Party shall implement the plan and schedule if long term trial testing of mercury controls has not been initiated.

Line 3 Scrubber Blowdown Treatment System Requirements

hh. The Regulated Party shall implement corrective measures necessary to resolve the alleged violations indicated in Part 6 of this Agreement by October 31, 2011. If the Regulated Party believes it cannot comply with this deadline for reasons beyond its control the Regulated Party shall follow the procedures described in Part 13 of this Agreement to request an extension. In addition to the requirements of Part 13, the extension request must include a detailed chronology of the Regulated Party's actions to address the alleged violations since submittal of the MPCA approved Implementation

Plan, dated January 21, 2009. Specifically, the request must provide details of actions taken by the Regulated Party to address the alleged violations as expeditiously as possible after the Regulated Party determined that the process water treatment system proposed in the March, 2009 NPDES/SDS permit application would not be implemented, and indicate why, for reasons beyond the control of the Regulated Party, implementation of corrective measures to resolve the alleged violations by October 31, 2011 are not feasible

ii. Within 30 days of the effective date of this Agreement, the Regulated Party shall submit a Management Alternatives Report to MPCA. The Management Alternatives Report shall include evaluations of reuse of Line 3 scrubber blowdown and alternate makeup sources to offset the increase of sulfate and hardness generated by the Line 3 scrubber system.

jj. If the Regulated Party determines that the alternatives identified in the Management Alternatives Report are not feasible, within 60 days of the effective date of this Agreement the Regulated Party shall submit to the MPCA a Line 3 Scrubber Blowdown Treatment System Evaluation Report (Treatment Evaluation Report) that summarizes the Regulated Party's consultants' proposals for modifications to or replacement of the existing Line 3 scrubber blowdown treatment system. The Treatment Evaluation Report shall identify recommendations to ensure compliance with the Permit requirement for no net increase in total sulfate and hardness as a result of operation of the Line 3 scrubber.

kk. Within 90 days of the effective date of this Agreement the Regulated Party shall provide written notification to the MPCA indicating which recommendations within the Management Alternatives Report or the Treatment Evaluation Report shall be implemented.

1. If the Regulated Party proposes to implement the recommendations of the Management Alternatives Report, a schedule for completing activities necessary to implement the water management alternatives shall be included, for MPCA review and approval. The Regulated Party shall submit an application for modification of the NPDES/SDS permit to the MPCA within 30 days of receiving MPCA approval of the schedule for implementing recommendations of the Management Alternatives Report.

2. If the Regulated Party proposes to implement the recommendations of the Treatment Evaluation Report, a schedule for implementation, including a schedule for process demonstration and treatment optimization of at least two technologies, shall be included for MPCA review and approval.

i. The Regulated Party shall submit a Process Optimization Study (Optimization Study) that provides results of process demonstration and treatment optimization of two technologies within 90 days of MPCA approval of the schedule for implementing the Treatment Evaluation Report recommendations. If the conclusions of the Optimization Study indicate that at least one technology can be successfully implemented, the Optimization Study shall include a schedule for completion of construction necessary to implement full scale treatment, for MPCA approval.

ii. If the conclusions of the Optimization Study indicate that no technology can be successfully implemented, the Optimization Study shall recommend other approaches for meeting the permit-required no net increase in sulfate and hardness to the tailings basin as a result of operation of the Line 3 scrubber system, with a schedule for implementation of alternatives, for MPCA approval.

iii. Within 30 days of MPCA approval of an Optimization Study that concludes at least one technology can be successfully implemented, the Regulated Party shall submit an application for permit modification.

ll. Following commissioning of the Line 6 Dry Controls Project, as specified in Part 7.d, the Regulated Party shall complete an analysis of the monthly mass of sulfate diverted from Minntac's recirculating process water system by the Line 6 Dry Controls Project. When the cumulative mass of sulfate and hardness diverted from the recirculating process water system exceeds the overall net increase in sulfate which had resulted from operation of the Line 3 scrubber, the Regulated Party may submit a notification to MPCA to discontinue any treatment technology or management alternative that may have been included in the Line 3 Project, for MPCA consideration.

mm. Should any submittal or request pursuant to paragraphs ii through mm be rejected or denied by MPCA, the Regulated Party may invoke Dispute Resolution under Part 11 of this Agreement.

<u>Dark River Monitoring Requirements</u>

nn. Within 20 days of the effective date of this Agreement the Regulated Party shall contact the Minnesota Department of Natural Resources (DNR) to discuss DNR recommendations for flow validation monitoring of the Dark River downstream of the Minntac Tailings Basin.

oo. Within 30 days of contacting DNR the Regulated Party shall submit a Dark River Monitoring Plan (Monitoring Plan) for establishing flow validation and water chemistry monitoring stations as identified in the Monitoring Plan, for MPCA review and approval. The Monitoring Plan shall include a description of flow validation methodology as well as specific location information for each site and a schedule for startup of flow monitoring stations. In no case shall startup of the stations occur more than 60 days after receipt of approval to access the sites or MPCA approval of the plan, whichever occurs later.

pp. Upon startup of operation of the monitoring stations established on the Dark River, the Regulated Party shall conduct monitoring of all parameters indicated in the MPCA approved Monitoring Plan, according to the schedule indicated in the Monitoring Plan. Analysis of all parameters except field parameters as identified in the Monitoring Plan must be conducted by a laboratory certified by the Minnesota Department of Health for those analyses.

qq. The Regulated Party, beginning with the first month after startup of flow validation monitoring, shall submit the results of flow validation and water chemistry monitoring as a supplement to the next monthly Discharge Monitoring Reports (DMRs) submitted for NPDES/SDS Permit No. MN0057207. The DMRs shall continue to be submitted electronically to MPCA and are not required to be submitted to the MPCA case contact.

rr. The Regulated Party shall conduct baseline monitoring prior to installation of any seep collection infrastructure on the west side of the Minntac tailings basin. If installation of a seep collection system on the west side of the Minntac tailings basin proceeds, monitoring shall continue in accordance with the terms specified by the NPDES / SDS Permit that was modified or reissued to authorize construction of the collection system. If installation of a seep collection system does not proceed, the Regulated Party may submit to the MPCA, for review and approval, a request to end

monitoring of the Dark River. Should the Regulated Party's request to end monitoring of the Dark River be denied by MPCA, the Regulated Party may invoke Dispute Resolution under Part 11 of this Agreement.

ss. By February 1 of each year the Regulated Party shall submit an Annual Dark River Monitoring Report (Monitoring Report) that summarizes monitoring results for the previous calendar year at each monitoring location identified in the Monitoring Plan. The Annual Monitoring Report shall include tables of results of monthly constituent monitoring, as well as a flow validation monitoring results. The annual report shall continue in accordance with the terms specified by the NPDES / SDS Permit that was modified or reissued to authorize construction of the collection system

Dark River Seepage Collection and Return System Requirements

tt. Within 60 days of the effective date of this Agreement the Regulated Party will retain a professional consultant to evaluate and report on the feasibility of collecting surface seepage from the west side of the Minntac tailings basin for return to the recirculating process water system (Feasibility Report) to eliminate the discharge of surface seepage to the Dark River Watershed (Dark River Seep Collection and Return System - SCRS).

uu. Within 60 days of the effective date of this Agreement the Regulated Party shall contact appropriate federal, state and local wetland permitting authorities to discuss the potential SCRS and introduce wetland permitting authorities to the project in an attempt to facilitate the wetland permitting process, if it is determined that the SCRS is feasible. By December 31, 2011, the Regulated Party shall complete delineation of wetlands that, based upon best available information, would likely be impacted by construction of the SCRS, should the SCRS project proceed.

vv. Within 180 days of the effective date of this Agreement the Regulated Party shall submit to the MPCA for approval their consultant's completed Feasibility Report for the SCRS. The Feasibility Report shall identify specific recommendations for construction and operation of a SCRS and provide estimates of the volume per unit time of seepage water that would be collected through elimination of surface seeps or shall identify specific reasons why the project is infeasible.

ww. If the Feasibility Report concludes that a SCRS is feasible, the Regulated Party shall submit an application to the MPCA for modification or reissuance of the NPDES/SDS permit within 30 days of MPCA approval of the Feasibility Report.

xx. Within 90 days of permit application submittal the Regulated Party shall submit Plans and Specifications for the SCRS to the MPCA for review and approval.

yy. The Regulated Party shall commence construction of the SCRS following the latter of either MPCA approval of the SCRS Plans and Specifications or the expiration of any appeal period for the permit issued by MPCA or other appropriate regulatory agencies pursuant to the application(s) submitted to such agencies and provided that no judicial or administrative appeal(s) or citizen suit(s) challenging such permit(s) have been filed. If these conditions are satisfied during the period of April 15 through September, 30, 2011, initiation of construction of the SCRS within 30 days is required, otherwise initiation of construction shall be delayed until the next construction season. A construction season is defined as April 15 through December 15. If weather and/or site conditions prohibit construction, the Regulated Party shall follow the procedures described in Part 13 of this Agreement to request an extension.

zz. The Regulated Party shall notify the MPCA of SCRS construction commencement within 10 days of construction initiation.

aaa. The Regulated Party shall complete construction of the SCRS within eight consecutive construction season months during one or more construction season(s).

bbb. The Regulated Party must initiate operation of the SCRS within 30-days of completion of the SCRS and notify the MPCA of SCRS initiation within 10 days of initiation.

Dark River Mitigation Contingency Plan Requirements

ccc. Within 60 days of the effective date of this Agreement the Regulated Party shall retain a consultant to investigate Dark River flow augmentation strategies. The Regulated Party shall notify the MPCA within 10 days that it has retained a consultant.

ddd. Within 210 days of the effective date of this Agreement the Regulated Party shall provide a Dark River Flow Augmentation Report (Augmentation Report) which was developed by the Regulated Party's consultant. The Augmentation Report shall: (1) identify the maximum flow rate which the identified augmentation options

could provide, (2) identify whether the concentrations of any pollutants in the source water used for augmentation may exceed Dark River water quality standards, including, at minimum total hardness, specific conductance, total sulfate, and total dissolved solids, and 3) identify potential locations for discharging augmentation water into surface waters within the Dark River watershed. If augmentation water quality does not meet the water quality standards of the proposed receiving water the Augmentation Report shall include a literature review of treatment technologies that may provide adequate treatment of augmentation water to ensure compliance with the applicable water quality standards.

eee. Within 240 days of the effective date of this Agreement the Regulated Party shall meet with DNR and MPCA staff to evaluate whether or not operation of the SCRS would have the potential to have an adverse impact on the Dark River. An adverse impact is defined as operation of the SCRS causing (1) a significant decrease in critical low flow quantity or (2) a significant increase in the duration of the critical low flow period at the monitoring stations identified by monitoring as required by Part 7. pp of the Agreement that would not have occurred had the SCRS not been in operation.

fff. If MPCA staff determine that the SCRS does not have the potential to adversely impact the Dark River, the Regulated Party may request of the MPCA that monitoring of the Dark River be terminated. Should the Regulated Party's request to terminate the monitoring of the Dark River be denied by MPCA, the Regulated Party may invoke Dispute Resolution under Part 11 of this Agreement.

ggg. If MPCA staff determine that the SCRS has the potential to adversely impact the Dark River and that flow augmentation options appear feasible based on the Augmentation Report, the MPCA shall notify the Regulated Party of such determination in writing. Within 30 days of such determination, the Regulated Party shall submit a schedule for either implementing construction activities necessary to initiate augmentation or a schedule for conducting bench and pilot scale testing of treatment technologies to ensure that augmentation water meets applicable receiving water standards, for MPCA review and approval. The Regulated Party shall implement the approved schedules upon receipt of written notification from the MPCA that the SCRS has caused adverse impacts to the Dark River.

hhh. If MPCA staff determine that the SCRS has the potential to adversely impact the Dark River and that no augmentation options appear feasible based on the Augmentation Report, the MPCA shall notify the Regulated Party of such determination, in writing. Within 90 days of such determination the Regulated Party shall submit a summary of mitigation project options with implementation schedules that would offset possible adverse impacts to the Dark River by operation of the SCRS, for MPCA review and approval. The Regulated Party shall implement the approved mitigation project and schedule upon receipt of written notification from the MPCA that the SCRS has caused adverse impacts to the Dark River.

iii. The Regulated Party may, after one or more years of operation of the SCRS, request a meeting with DNR and MPCA staff to discuss the available Dark River monitoring data and SCRS seepage collection data. The purpose of the meeting will be to reassess whether or not the SCRS has adversely impacted the Dark River. If a reassessment by MPCA staff determines there has not been an adverse impact to the Dark River resulting from operation of the SCRS, then implementation of the approved augmentation or mitigation options shall not be required and monitoring of the Dark River shall be terminated upon written notification of such by the MPCA.

Tailings Basin Water Quality

jjj. Within 60 days of the effective date of this Agreement, the Regulated Party shall submit a Monitoring Well Installation Plan (Installation Plan) and schedule for installation for MPCA review and approval. The Installation Plan shall identify monitoring wells that will be installed to: 1) refine a groundwater model for sulfate transport, and 2) monitor compliance with the sulfate groundwater standard at the current property boundary. Current property boundary means the Regulated Party's property boundary around the tailings basin that is present on the effective date of this Agreement. The Installation Plan shall also identify the chemical parameters that will be monitored and the frequency of monitoring ground water elevation and chemical parameters. Within 30 days of MPCA review and approval of the Installation Plan the Regulated Party shall install the additional monitoring wells, if field conditions permit. If field conditions do not allow installation within 30 days of MPCA approval of the Installation Plan, the Regulated Party shall notify MPCA and provide an estimated schedule for installation of

monitoring wells at the earliest practical opportunity that field conditions permit, for MPCA approval.

kkk. Within 60 days of the effective date of this Agreement, the Regulated Party shall submit a conceptual groundwater model (Conceptual Model), for MPCA review and approval. The Conceptual Model shall contain a discussion of the characteristics of the aquifer and the overall objectives and underlying assumptions of the groundwater model that will be used to predict sulfate transport from the tailings basin and further described in Part 7.nnn.

lll. Within 30 days of installation of the monitoring wells, the Regulated Party shall submit a Monitoring Well Installation Report (Installation Report). The Installation Report shall include, but is not limited to, a detailed monitoring well log for each monitoring well installed, unique well number for each well, surveyed top of casing elevations for each well, and a digital image (e.g., aerial photograph) identifying the location of the wells in relation to the tailings basin and property boundary.

mmm. Within 90 days of submission of the Installation Report, the Regulated Party shall begin to provide written updates to MPCA regarding the status of the groundwater modeling efforts every six calendar months, at a minimum. The updates shall include all groundwater monitoring information available since installation of the monitoring wells.

nnn. The Regulated Party will incorporate the data gathered from installed monitoring wells into the ground water model of sulfate transport and revise the modeling assumptions in order to accurately model the monitored data. Within 210 days of submission of the Installation Report, the Regulated Party will determine what sulfate concentrations are necessary in the tailings basin to ensure compliance with the groundwater standard at the current property boundary (target concentration). If the Regulated Party is unable to provide a target concentration MPCA staff shall develop a target concentration based on a model of sulfate transport, using available monitoring information and well logs provided by the Regulated Party. If the Regulated Party disputes that the MPCA model does not adequately predict the quality of groundwater outside of the Regulated Party's tailings basin, the Regulated Party may pursue resolution of this dispute through the steps described in Part 11 of this Agreement.

ooo. If ground water monitoring results show non-compliance with the groundwater sulfate standard at the property boundary, the Regulated Party shall, within five days of this determination notify the MPCA. In response, the, MPCA may take action in accordance with Part 23 of the Agreement.

ppp. Within 180 days after the effective date of this Agreement the Regulated Party shall provide an Alternate Makeup Water Report (Makeup Water Report) to the MPCA, for review and approval. The Makeup Water Report shall: (1) provide an evaluation of possible sources of makeup water that would have a lower sulfate concentration than the present makeup water supply, (2) evaluate whether the alternative source would be used instead of or in combination with the present makeup water supply for facility operation to reduce sulfate loading to the tailings basin, and (3) provide a schedule for the construction necessary to utilize the alternate makeup water source. Implementation of the schedule would be triggered upon detection of a violation of the sulfate standard at the property boundary.

qqq. Within 210 days of this Agreement, the Regulated Party shall submit to MPCA a Dry Controls Effectiveness Report (Effectiveness Report) that indicates projections of sulfate concentration in the tailings basin from the date of the report extending to five years after completion of the final dry control project, for MPCA review and approval. The Effectiveness Report shall also include the target concentration, if available, as determined by any finalized modeling as described in Part 7. nnn of the Agreement. If at the time of submittal of the initial Effectiveness Report a target concentration is unavailable, the Regulated Party shall provide to the MPCA an updated Effectiveness Report within 30 days of establishment of the target concentration. If the sulfate concentration projected for the tailings basin five years after completion of the final dry control project is greater than the target concentration, the Effectiveness Report must describe what additional sulfate reduction measures shall be taken, with a schedule, to ensure the sulfate concentration projection is less than the target concentration within five years of completion of the dry air control project. The Effectiveness Report may include the use of alternative makeup water as identified in Part 7.ppp of the Agreement. The Regulated Party shall provide annual updates of the Effectiveness Report by February 1 of each year, subsequent to submission of the first Effectiveness Report. The

annual Effectiveness Reports shall provide revised projections or target concentrations based on new information, as necessary.

Part 8. ***PENALTIES FOR VIOLATIONS OF THIS AGREEMENT.***

a. If the Regulated Party fails to comply with Parts 7.d and 7.g of this Agreement, the Regulated Party shall pay to the MPCA a penalty in the amount of $1,000 per requirement for each day of failure.

b. If the Regulated Party fails to comply with requirements of Part 7.ii – Part 7.qqq of this Agreement, the Regulated Party shall be subject to penalties for each failure, as follows:

1. $500/day for failure to provide timely submittals and notifications to the MPCA, as applicable.

2. $500/day for failure to retain consultants in a timely manner, as applicable.

3. $500/day for failure to initiate construction according to schedules submitted by the Regulated Party and approved by the MPCA, as applicable.

4. $500/day for failure to initiate and complete bench and pilot scale testing according to schedules submitted by the Regulated Party and approved by the MPCA, as applicable.

5. $1,000/day for failure to complete construction and initiate operation according to schedules submitted by the Regulated Party and approved by the MPCA, as applicable.

6. Penalties for failure to comply with requirements of Part 7 of this Agreement shall accrue from the date the Regulated Party was to have fulfilled the requirement until the Regulated Party fulfills the requirement. Penalties shall not accrue while the MPCA considers a timely extension request under Part 13 or during dispute resolution under Part 11, unless the MPCA determines that the Regulated Party filed the request or initiated dispute resolution solely for purposes of delay. If the Regulated Party does not pursue dispute resolution under Part 11 for denial of a timely extension request, penalties shall accrue from the date the extension request is denied by the MPCA Case Contact. If the Regulated Party pursues dispute resolution for denial of an extension request and does not file a timely challenge in a court of competent jurisdiction as

provided by Part 11, penalties shall accrue from the date of a Commissioner's dispute resolution decision against the Regulated Party until the Regulated Party fulfills the requirement that is the subject of the extension request.

c. The Regulated Party shall pay a penalty under this Part within 30 days after receiving written notice from the MPCA that the penalty is due. The written notice shall specify the provision of the Agreement that the Regulated Party has not fulfilled and indicate the date penalties began to accrue. If the Regulated Party fails to make timely payment, the MPCA may assess and the Regulated Party agrees to pay a late payment charge, in addition to the stipulated penalty, to be assessed as follows. Forty-five days after receipt of written notice, the Regulated Party shall be obligated to pay a late charge in an amount equal to ten percent of the unpaid stipulated penalty. Sixty days after receipt of written notice, the Regulated Party shall be obligated to pay an additional late charge in an amount equal to twenty percent of the unpaid stipulated penalty.

d. In dispute resolution before the Commissioner under Part 11, the Regulated Party can contest the factual basis for the MPCA's determination that the Regulated Party has not fulfilled a requirement of this Agreement covered by this Part. However, the Regulated Party waives its right to challenge, on legal grounds, the requirement that it pay penalties under this Part.

e. The Regulated Party shall not be liable for payment of penalties for failure to comply with requirements of Part 7 of this Agreement covered by this Part if it has submitted to the MPCA a timely request for an extension of Agreement under Part 13 and the MPCA has granted the request. The MPCA's grant of an extension of schedule waives the payment of penalties covered by this Part only on the requirements for which the MPCA granted an extension of schedule and only for the time period specified by the MPCA in the grant of an extension. An extension of schedule for one requirement of Part 7 does not extend the schedule for any other requirement of Part 7.

f. Any requirement of this Agreement may be enforced as provided in Minn. Stat.§ 115.071 (2004). Payment of a stipulated penalty does not relieve the Regulated Party of its obligation to fulfill and complete requirements under the Agreement and to otherwise comply with the terms and conditions of the Agreement.

Part 9. ***COVENANT NOT TO SUE AND RESERVATION OF REMEDIES.*** With respect to the Regulated Party, the MPCA agrees not to exercise any administrative, legal or equitable remedies available to the MPCA to address the violations alleged and described in Part 6 as long as the Regulated Party performs according to and has complied with the terms and conditions contained in this Agreement. The MPCA reserves the right to enforce this Agreement or take any action authorized by law, if the Regulated Party fails to comply with the terms and conditions of this Agreement.

Further, the MPCA reserves the right to seek to enjoin violations of this Agreement and to exercise its emergency powers pursuant to Minn. Stat. § 116.11 (2004) in the event conditions or the Regulated Party's conduct warrant such action. Nothing in this Agreement shall prevent the MPCA from exercising these rights and nothing in this Agreement constitutes a waiver of these rights.

The Regulated Party agrees to waive all claims it may now have, as of the effective date of this Agreement, under Minn. Stat. § 15.472 for fees and expenses arising out of matters leading up to and addressed in this Agreement.

Part 10. ***REPEAT VIOLATIONS.*** Federal and state environmental programs establish harsher penalties for violations of environmental laws or rules that constitute repeat violations. In a proceeding to resolve alleged violations by the Regulated Party, if any, occurring after the date of the alleged violations set out in Part 6 of this Agreement, the Regulated Party may argue about the extent to which the violations alleged in Part 6 of this Agreement should affect the penalty amount for the later violations, but waives the right: (1) to contend that the violations alleged in Part 6 of this Agreement did not occur as alleged and (2) to require the MPCA to prove the violations alleged in Part 6 of this Agreement.

Part 11. ***RESOLUTION OF DISPUTES.*** The parties to this Agreement shall resolve disputes that arise as to any part of the Agreement as follows:

a. Either party, acting through its Case Contact (as defined in Part 14 below), may initiate dispute resolution by providing to the Case Contact of the other party an initial written statement setting forth the matter in dispute, the position of the party, and the information the party is relying upon to support its position.

The other party, acting through its Case Contact, shall provide a written statement of its position and supporting information to the case contact of the initiating party within 14 calendar days after receipt of the initial written statement.

b. If the parties, acting through their Case Contacts, do not reach a resolution of the dispute and reduce such resolution to writing in a form agreed upon by the parties within 21 calendar days after the initiating party receives the statement of position from the responding party, the Commissioner shall issue a written decision resolving the dispute. The written decision may address stipulated penalties assessed pursuant to Part 8. The Commissioner's decision shall be considered a final decision of the MPCA for purposes of judicial review.

c. The Commissioner's decision shall become an integral and enforceable part of this Agreement unless the Regulated Party timely challenges the decision in a court of competent jurisdiction. Failure to timely challenge means the Regulated Party agrees to comply with the MPCA Commissioner's decision on the matter in dispute and to pay any penalties that accrue pursuant to Part 8 for failure to fulfill requirements of this Agreement that are the subject of the dispute resolution. Further, if the Commissioner's decision assesses penalties pursuant to Part 8 of this Agreement, the Regulated Party agrees to and shall pay the amount of penalty determined by the Commissioner within 60 days after receiving the Commissioner's decision.

d. Throughout any dispute resolution, the Regulated Party shall comply with all portions of the Agreement that the MPCA determines are not in dispute.

e. Should any request, report, study, recommendation, modification, schedule or other submittal of the Regulated Party be rejected, disapproved, or otherwise denied by MPCA, the Regulated Party may invoke Dispute Resolution under this Part.

Part 12. ***VENUE.*** Actions brought by the MPCA to enforce requirements and terms of this Agreement shall be venued in Ramsey County District Court.

Part 13. ***EXTENSION OF SCHEDULES.*** If the Regulated Party wants an extension of a deadline included in a schedule set out in Part 7, the Regulated Party must request the extension in writing at least ten days before the scheduled deadline, or as soon as possible before that date if the reason for the extension request arises less than ten days before the deadline.

Each deadline extension request shall separately specify the reason why the extension is needed. No requested extension shall be effective until approved in writing by the MPCA, acting through the MPCA Case Contact or the Commissioner.

The MPCA shall grant an extension only for the period of time the MPCA determines is reasonable under the circumstances. The written approval or grant of an extension request shall be considered an enforceable part of the Agreement.

The Regulated Party has the burden of demonstrating to the satisfaction of the MPCA that the request for the extension is timely, and that good cause exists for granting the extension. Good cause can include, but is not limited to, the following:

a. Circumstances beyond the reasonable control of the Regulated Party.

b. Delays caused by the MPCA in reviewing timely submittals required by this Agreement, the Regulated Party submitted in complete and approvable form, which make it not feasible for the Regulated Party to meet the required schedules.

Good cause does not include unanticipated costs, increases in the cost of control equipment, or delays in MPCA review of submittals when the submittals are not in complete and approvable form.

The Regulated Party may challenge a decision by the MPCA to deny a request for an extension under Part 11.

Part 14. ***CASE CONTACT.*** The MPCA and the Regulated Party shall each designate a Case Contact for the purpose of overseeing the implementation of this Agreement. The MPCA Case Contact for air quality issues is Suzanne Bauman; the MPCA Case Contact for water quality issues is John Thomas. The Regulated Party's Case Contact is Chrissy Bartovich. Either party may change its designated Case Contact by notifying the other party in writing, within five days of the change. To the extent possible, communications between the Regulated Party and the MPCA concerning the terms and conditions of this Agreement shall be directed through the Case Contacts. The address and telephone number for Suzanne Bauman is MPCA, Industrial Division-5, 520 Lafayette Rd N, St Paul MN 55155, and (651)757-2798. The address and telephone number for John Thomas is MPCA, 525 S. Lake Avenue, Suite 400, Duluth, MN 55802 and (218)302-6616.

Part 15. ***REGULATED PARTY INFORMATION.*** The Regulated Party shall not knowingly make any false statement, representation or certification in any record, report, plan or other document filed or required to be submitted to the MPCA under this Agreement. The Regulated Party shall immediately upon discovery report to the MPCA any errors in such record, report, plan or other document.

Part 16. ***REVIEW OF SUBMITTALS.*** The MPCA, acting through its Commissioner, Case Contact, or other designated MPCA staff, shall review all submittals made by the Regulated Party as required by this Agreement and shall notify the Regulated Party in writing of the approval or disapproval of each submittal, if applicable. The MPCA and the Regulated Party shall consult with each other upon the request of either party during the review of submittals or modifications. If any submittal is disapproved in whole or in part, the MPCA Commissioner or designated MPCA staff shall notify the Regulated Party of the specific inadequacies and shall indicate the necessary amendments or reviews. Within 15 calendar days after receipt of any notice of disapproval, the Regulated Party shall submit revisions and take actions to correct the inadequacies.

Part 17. ***ACCESS.*** During the term of this Agreement, the Regulated Party agrees to provide the MPCA and its staff access to the Keetac and Minntac facilities and its records and documents related to the implementation of this Agreement to the extent provided under Minn. Stat. § 116.091 (2004) or other law, conditioned only upon the presentation of credentials. The Regulated Party and MPCA shall comply with Minn. Stat. § 116.075 and Minnesota Rule 7000.1300 regarding any such information that is confidential and not public.

Part 18. ***SAMPLING AND DATA AVAILABILITY.*** The Regulated Party shall make available to the MPCA the results of any sampling, tests, or other data generated by the Regulated Party, or on its behalf, to implement the requirements of this Agreement.

Part 19. ***RETENTION OF RECORDS.*** The Regulated Party shall retain in its possession all records, documents, reports and data related to this Agreement.

The Regulated Party shall preserve these records, documents, reports and data for a minimum of three years after the termination of this Agreement despite any document retention policy of the Regulated Party to the contrary, and shall promptly make all such documentation available for review upon request by the MPCA.

Part 20. ***APPLICABLE LAWS AND PERMITS.*** The Regulated Party shall undertake all actions required to be taken pursuant to this Agreement in accordance with the requirements of all applicable state and federal laws and regulations. Except when the MPCA has specified and authorized a different compliance method in Part 7, the Regulated Party must also comply with all applicable permits, orders, stipulation Schedules and schedules of compliance. Nothing in this Schedule exempts or relieves the Regulated Party of its obligation to comply with local governmental requirements.

Part 21. ***LIABILITIES.*** Each party agrees that it will be responsible for its own acts and the results thereof to the extent authorized by law and shall not be responsible for the acts of the other party and the results thereof. The State's liability shall be governed by the provisions of the Minnesota Tort Claims Act, Minn. Stat, §§ 3.732, et seq., and other applicable law.

Part 22. ***OTHER CLAIMS.*** Nothing herein shall release the Regulated Party from any claims, causes of action or demands in law or equity by any person, firm, partnership or corporation not a signatory to this Agreement for any liability it may have arising out of or relating to the release of any pollutant or contaminant from its operations or from a facility. Neither the Regulated Party nor the MPCA shall be held as a party to any contract entered into by the other party to implement the requirements of this Schedule.

Part 23. ***RESERVATION OF REMEDIES.*** Nothing in this Schedule shall prevent the MPCA from taking action to enforce the requirements of this Schedule including issuance of administrative orders, or from requiring additional action by the Regulated Party if necessary to ensure compliance with this Schedule. In addition, the issuance of this Schedule is not an exclusive action or remedy by the MPCA, and except as provided in Part 9 of this Agreement, it does not limit in any way the MPCA's authority to bring an enforcement action against or to seek and collect penalties from the Regulated Party for violations of state and federal environmental laws, rules and permits. Further, the MPCA reserves the right to exercise its emergency powers pursuant to Minn. Stat. § 116.11 (2008) in the event conditions or the Regulated Party's conduct warrants such action.

Part 24. ***SUCCESSORS, AGENTS AND CONTRACTORS.*** This Agreement shall be binding upon the Regulated Party and its successors and assigns and upon the MPCA, its

successors and assigns. If the Regulated Party sells or otherwise conveys or assigns any of its right, title or interest in the Facility, the conveyance shall not release the Regulated Party from any obligation imposed by this Schedule, unless the party to whom the right, title or interest has been transferred or assigned agrees in writing to fulfill the obligations of this Agreement and the MPCA approves the transfer or assignment. The Regulated Party shall ensure that the Regulated Party's agents, contractors and subsidiaries comply with the terms and conditions of this Agreement.

Part 25. ***AMENDMENTS.*** Except with respect to extensions of schedules granted under Part 13 and approved submittals under Part 16, this Agreement may be amended only by written agreement between the parties.

Part 26. ***EFFECTIVE DATE.*** Except with respect to Parts 7.o through 7.gg, the Mercury Air Emissions Reduction Requirements and the Mercury Air Emissions Reduction Contingency Conditions, this Agreement shall be effective on the date it is signed by the MPCA.

The Mercury Air Emissions Reduction Requirements and the Mercury Air Emissions Reduction Contingency Conditions are effective upon issuance of an effective Keetac Permit No. 13700063-004 or the last party signature, whichever is later. In no event will these parts of the Agreement be effective unless the MPCA has issued the Keetac Permit No. 13700063-004 and such Permit is in effect.

Part 27. ***TERMINATION.***

a. Each requirement of this Agreement shall terminate, in whole or in part, if each of the following are met:

1. The Regulated Party has completed and complied with the provisions contained in the Agreement for the Requirement for which termination is sought;

2. The Regulated Party has paid any stipulated penalties due and owing to MCPA associated with the Requirement for which termination is sought.

3. The Regulated Party submits a written request to MPCA indicating that it has completed and complied with the Requirement for which termination is sought; and

4. MPCA, within 60-days of receiving a request from the Regulated Party, has not contested in writing that such compliance with the Requirement has been

achieved. If MPCA disputes the Regulated Party's compliance and completion with the Requirement for which termination is sought, MPCA shall provide written notice to the Regulated Party within 60-days of the date of receipt of the request and the Dispute Resolution Provisions of Part 11 of this Agreement shall be invoked and the Requirement shall remain in effect for that Requirement for which termination is sought pending the resolution of the dispute by the parties, Commissioner or Court.

b. If by December 31, 2018, the State of Minnesota has not initiated action to establish an enforceable schedule for installing mercury control technology at the six existing taconite facilities, Parts 7.o through 7.gg of the Agreement shall be terminated if such Parts have not already been terminated pursuant to Part 27.a, above.

c. If MPCA determines that termination of any provision of this Agreement is appropriate without receiving a written notification by the Regulated Party pursuant to paragraph (a) above, such provision of this Agreement shall be deemed satisfied and terminated when the Regulated Party receives written notification from the MPCA that the Regulated Party has demonstrated, to the satisfaction of MPCA, that the term(s) of the Agreement have been completed. Should the Regulated Party dispute MPCA's determination that such provision is terminated, the Regulated Party may invoke Dispute Resolution under Part 11 of this Agreement.

Part 28. ***SURVIVAL.*** The provisions of Parts 2, 9, 10, 15, 18, 19, 20, 21, 22, 24, and 28 of this Agreement and the rights, duties and obligations of the MPCA and the Regulated Party created in those provisions shall survive termination of this Agreement.

BY THEIR SIGNATURES BELOW, THE UNDERSIGNED REPRESENT THAT THEY HAVE AUTHORITY TO BIND THE PARTIES THEY REPRESENT

UNITED STATES STEEL CORPORATION

By: MS Williams

Michael S. Williams
Sr. VP – North America Flat Roll Ops.
United States Steel Corporation

Date: 6-7-11

STATE OF MINNESOTA POLLUTION CONTROL AGENCY

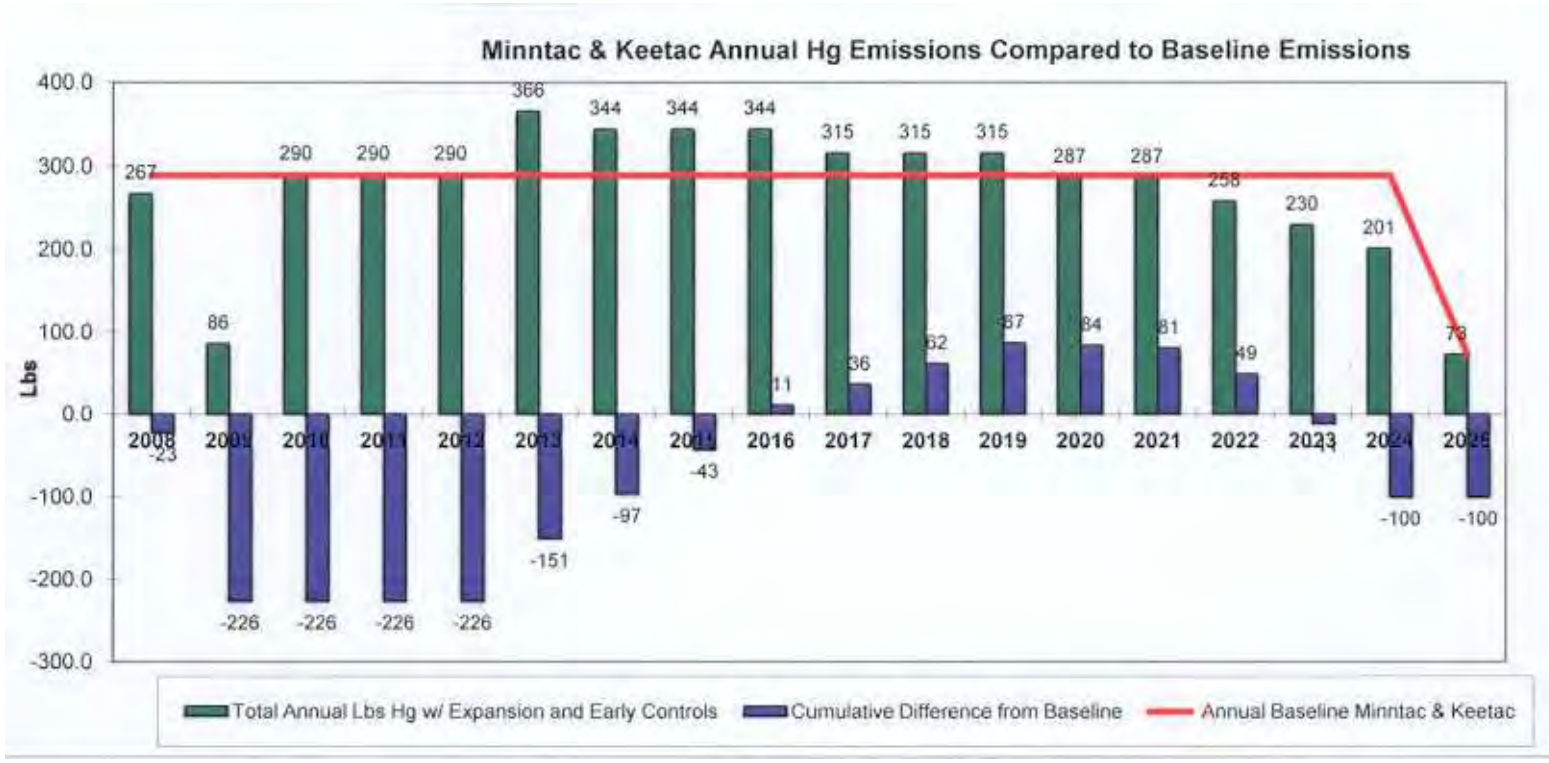
By: Ann Foss

Ann Foss, Director
Strategic Projects Sector
Industrial Division

Date: 6-9-11

APPENDIX A

Graphical Representation of Mercury Emission Reductions


Minntac & Keetac Annual Hg Emissions Compared to Baseline Emissions
Lbs
400.0
300.0
200.0
100.0
0.0
-100.0
-200.0
-300.0
267
86
290
290
290
366
344
344
344
315
315
315
287
287
258
230
201
78
-23
-226
-226
-226
-226
-151
-97
-43
11
36
62
87
84
81
49
-100
-100
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Total Annual Lbs Hg w/ Expansion and Early Controls
Cumulative Difference from Baseline
Annual Baseline Minntac & Keetac

Minnesota Department of Natural Resources

500 Lafayette Road
St. Paul, Minnesota 55155-40_10

Date: May 1, 1996

To: Parties on the EAW Distribution List
Other interested parties

From: Rebecca Wooden
Environmental Review Section
Office of Planning

Phone: (612)297-3355

Re: U.S. Steel - Minntac Extension
Environmental Assessment Worksheet (EAW)

The Department of Natural Resources (DNR) has prepared the attached Environmental Assessment Worksheet (EAW) for the proposed extension of U.S. Steel - Minntac's open pit taconite mine in St. Louis County. U.S. Steel - Minntac proposes a 1.75 mile western extension of its existing open pit taconite mine. The project will near the communities of Kinney and Buhl, Minnesota. The project will not affect existing processing operations.

The EAW is mandatory pursuant to Minnesota Rules part 4410.4300, subpart 11.b, which requires an EAW for expansion of a stockpile, tailings basin, or mine by 320 or more acres.

A 30-day review and comment period will begin on May 6, 1996, when the notice of availability for the EAW is published in the EQB Monitor.

Written comments on the EAW must be received by Wednesday, June 5, 1996, at 4:30 P.M., and should be sent to:

Rebecca A. Wooden
Office of Planning
Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4010

Attachment: EAW for U.S. Steel - Minntac's Mine Extension

RGU2/USX15.doc
#960067-01

Environmental Assessment Worksheet (EAW)

NOTE TO PREPARERS
This worksheet is to be completed by the Responsible Governmental Unit or its agents. The project proposer must supply any reasonably accessible data necessary for the worksheet, but is not to complete the final worksheet itself. If a complete answer does not fit in the space allotted, attach additional sheets as necessary.

For assistance with this worksheet contact the Minnesota Environmental Quality Board (EQB) at (612) 296-8253 or (toll-free) 1-800-652-9747 (ask operator for the EQB environmental review program) or consult "EAW Guidelines," a booklet available from the EQB.

NOTE TO REVIEWERS
Comments must be submitted to the RGU (see item 3) during the 30-day comment period following notice of the EAW in the EQB Monitor. (Contact the RGU or the EQB to learn when the comment period ends.) Comments should address the accuracy and completeness of the information, potential impacts that may warrant further investigation, and the need for an EIS. If the EAW has been prepared for the scoping of an EIS (see item 4), comments should address the accuracy and completeness of the information and suggest issues for investigation in the EIS.

1. **Project Title** MINNTAC MINE EXTENSION

2. **Proposer** U.S. STEEL, MINNTAC
   Contact person B. D. Kniivila
   Address P. O. Box 417
   Mt. Iron, MN 55768
   Phone (218)749-7509

3. **RGU** MN Dept. of Natural Resources
   Contact person Rebecca A. Wooden
   and title Environmental Planner
   Address 500 Lafayette Road, Box 10
   St. Paul, MN 55155-4010
   Phone (612)297-3355

4. **Reason for EAW Preparation**
   ___ EIS scoping _X_ mandatory EAW ___ citizen petition ___ RGU discretion ___ Proposer volunteered

   If EAW or EIS is mandatory give EQB rule category number(s) Minnesota Rules Part 4410.4300, Subp. 11.b.

5. **Project Location**
   _____ 1/4 _____ 1/4 Section _____ Township 58N Range 19W

   County St. Louis City/Twp City of Kinney, Great Scott Township

   All or parts of the following:

SW 1/4	Section 2
NW 1/4 of SE 1/4	Section 2
NE 1/4 of SE 1/4	Section 3
S 1/2 of SE 1/4	Section 3
SW 1/4 of	Section 3
E 1/2 of NE 1/4	Section 9
E 1/2 of SE 1/4	Section 9
NW 1/4	Section 10
SW 1/4	Section 10
NE 1/4	Section 10
NW 1/4	Section 11
S 1/2 of NE 1/4	Section 11

Attach copies of each of the following to the EAW:
a. a county map showing the general location of the project (figure 2)
b. copy(ies) of USGS 7.5 minute, 1:24,000 scale map (photocopy is OK) indicating the project boundaries (figure 3);
c. a site plan showing all significant project and natural features (figures 4 to 13).

[Notes to Reviewers: 1) A Technical Report including surface and groundwater analysis is available from the RGU. This EAW reflects its conclusions. 2) Minntac reports water levels in relation to Lake Superior instead of msl (mean sea level). These levels are apparent in figures 4, 5, and 6. Lake Superior's msl elevation is 602'. Should msl elevations be required, the reviewer should add 602 feet to the elevations reported.]

6. **Description** *Give a complete description of the proposed project and ancillary facilities (attach additional sheets as necessary). Emphasize construction and operation methods and features that will cause physical manipulation of the environment or produce wastes. Indicate the timing and duration of construction activities.*

United States Steel, Minntac, a Division of U.S.X. Corporation, is a taconite mining and processing operation located in northeastern Minnesota. The U.S. Steel - Minntac facility includes an open pit taconite mine, crushing plant, concentrating plant, agglomerating plant, tailings disposal basin, and associated equipment, repair, personnel, and administrative facilities.

The proposed project will continue development of an open pit taconite mine. The project area starts at the present westerly perimeter of the mine and extends west approximately 1.75 miles. The project is approximately 1.0 mile north to south, with the mine area on the southerly half and the stockpile area on the northerly half. The project will include mining from an open pit and construction of surface overburden and waste rock stockpiles. Normal mine activities will also include construction of production truck haul roads, service vehicle roads, railroad tracks and track grades, power lines, etc.

All waste rock and crude ore will require drilling and blasting. The mined material (surface overburden, waste rock, and crude ore) will be loaded by power shovels or front-end loaders into trucks or trains. Surface overburden and waste rock will be hauled by truck to the proposed stockpile. The crude ore will be transported by rail to the nearby U.S. Steel - Minntac facility for crushing, processing, and pelletizing. The proposed project will not affect ore processing facility or tailings basin operations.

Figures 4, 5, and 6 depict the proposed development at pre-production, mid-life, and full development, respectively. Please reference the following key.

Map Color Code:

Light Gray	=	Initial blasting area boundary/development corridor/overburden clearing area/pit boundary
Blue-gray	=	Surface overburden stockpile
Orange	=	Haul roads
Pink	=	Lower Cherty (1&2) (ore body)
Dark Blue	=	Lower Cherty (3&4) (ore body)
Green	=	Lower Slaty (ore body)
Yellow	=	Waste rock
Brown	=	Waste rock on the stockpiles
Red	=	Drainage/pumping patterns

I. Pre-Production Stage (*refer to figure 4*)

Activities and estimated duration:

1. Obtain permits and licenses: 60 weeks from 9/9/95
2. Log and clear salvageable timber: 8-10 weeks
3. Divert Kinney Creek to No. 6 Sump: 4 weeks
4. Build approaches for track grade, lay track, ballast, and tamp line: 8-10 weeks
5. Construct the haul roads/ramps for access to stockpile areas: 2 weeks
6. Remove 3.5 million Long Tons of pre-production surface overburden: 20-24 weeks
7. Drill and blast initial crude ore: 8-12 weeks

This stage will last 6 to 8 months. After securing necessary permits, the company will harvest salvageable timber from the project area. U.S. Steel - Minntac will compensate the state for timber harvested from state-owned land. The next activity includes constructing track grade and rails to the initial extension area, and clearing overburden and waste rock to the edge of the

initial pit boundary (noted in gray in figure 4). Stockpiles to the north will be started with the overburden material. The first portion of the access road to the stockpiles (main corridor) will be constructed.

One or two shovels will load three to six hauling trucks (170-ton to 240-ton capacity) for about six months. Crawler tractors, road graders, front end loaders, and other mobile equipment will be used for stockpile, railroad grade, and haul road construction.

A crude ore mining corridor will be started by blasting in the center of the initial extension area. Stripping and mining activities will occur 24 hours per day, 7 days per week. The first blasting will likely commence within three to four months of initial stripping.

The project will divert the east branch of Kinney Creek to the west pit No. 6 Sump prior to initiation of mine development activities. Later, the extension will breach the west branch of Kinney Creek and a channel will be dug eastward into the present west pit area. The flows will be directed to Sump No. 6 to route the runoff away from the mining activities.

The project will sever the western employee access road (from Kinney) within one year after mining begins.

Normal production will commence about six months from initial stripping and entail two to three shovels or front-end loaders loading rail cars. Stockpile construction will continue westerly. Pursuant to state policy, waste rock from state land will be stockpiled on state land.

II. Mid-Life Stage Activities (*refer to figure 5*)

By late 2005, the project will have moved or mine 90 million tons of crude ore, 10 million tons of waste rock, and 33 million tons of surface overburden.

During the early portions of the mid-life stage, water will be pumped from the present Sump No. 6 location to a discharge pipeline (extending 1,400 feet southwest) to a channel on the east side of the Forsyth pit. This channel drains to the northeast inlet of Kinney Pit lake. For a several-year period, Kinney Creek will not receive dewatering discharge although net inflow to Kinney Pit lake will remain unchanged.

The company will construct an east-west in-pit drainage divide (see figure 5 at 280W). West of this divide, flow will drain to a sump in the former Rana Mine pit. Discharge from the sump will be routed to the west (to the western drainage ditch described in more detail in Item 12).

Eventually, Sump No. 6 will be moved westward with development and discharge to the main branch of Kinney Creek will resume. Stockpiles will continue to expand westerly and vertically. Most of the haul roads to the stockpiles will have been constructed. By this time, a central corridor will extend to the western limit of the mine extension area. The full extent of the bench systems will have been developed by this stage. The railroad will have been extended through the central corridor and will follow the southerly side of the mine.

III. Full Development (*refer to figure 6*)

By 2015, the benches will be cut back to the edge of the pit. Surface overburden stripping activities will decline and cease. The surface overburden piles will near completion since all overburden must be removed prior to crude ore mining. The full development map (figure 6) illustrates (by the color layers) that the perimeter layers will be fully exhausted and the mining activities will be completed.

The total reserve estimate for this project:

Crude taconite ore		200,603,000 Long Tons
Waste rock		27,470,000 Long Tons
Surface overburden		53,033,000 Long Tons
	TOTAL	281,106,000 Long Tons

The planned annual production rates:

Crude taconite ore	10,000,000 Long Tons
Waste rock	1,500,000 Long Tons
Surface overburden	3,500,000 Long Tons

Provide a 50 or fewer word abstract for use in EQB Monitor notice:

U.S. Steel - Minntac proposes a 1360-acre extension of its existing open pit taconite mine. Taconite produced from the 1.75 mile-long westerly extension will be processed at the existing Minntac facility.

7. **Project Magnitude Data**

Total Project Area (acres) 1360 or Length (miles) _____

Number of Residential Units NA

Unattached _____ Attached _____

Commercial / Industrial / Institutional Building Area (gross floor space)

Total NA square feet;

Indicate area of specific uses:

Office _____ Manufacturing _____

Retail _____ Other Industrial _____

Warehouse _____ Institutional _____

Light Industrial _____ Agricultural _____

Other Commercial (specify) _____

Building heights(s) _____

8. **Permits and Approvals Required** *List all known local, state, and federal permits, approvals, and funding required:*

Unit of Government	Type of Application	Status
US Corps of Engineers	Section 404	Preparing Application
MPCA	NPDES/SDS Modification	Preparing Application
	Section 401 Certification	Preparing Application
MN DNR	Permit to Mine Amendment	Preparing Application
	Water Appropriation Permit	Preparing Application
	Protected Waters Permit	Preparing Application

9. **Land Use** *Describe current and recent past land use and development on the site and on adjacent lands. Discuss the compatibility of the project with adjacent and nearby land uses; indicate whether any potential conflicts involve environmental matters. Identify any potential environmental hazard due to past land uses, such as soil contamination or abandoned storage tanks.*

Located on Minnesota's Mesabi Iron Range, the project area has produced and shipped natural iron ore and/or taconite since 1892. The project area is immediately adjacent and contiguous to U.S. Steel - Minntac's current active mine area. The southerly perimeter of the area is marked by several old, inactive, natural ore pits: Atkins, Forsyth, Midway-Seville, and Rana.

The project area includes the abandoned Rana Mine (partially filled with water) and dump areas associated with the Rana operation. Currently located on the project area is an equipment storage, office, and repair facility owned and operated by Rhude & Fryberger, Inc. (a mining company) on property leased from U.S. Steel. Rhude and Fryberger will vacate the property.

Potential environmental hazards relating to this operation include abandoned tanks and soil contamination. The leaseholder will perform a site assessment and implement any recommendations prior to project development.

The project area abuts the Forsyth Mine, which is partially filled with water. This abandoned mine is a designated Trout Lake (Pit), which the DNR stocks with trout.

More than half of the project area is covered by second growth aspen forest. The forested area is managed in part for timber production, and is used recreationally for hunting, berry-picking, snowmobiling, and other outdoor activities.

In the City of Kinney, there are approximately 20 lots leased by the state to individuals, generally for residential purposes. Although the project would not incorporate the lots, most would be within the safety zone for blasting. The "blast safety zone", which is between 2500 and 3000 feet of the blast site must be cleared prior to each blast. The state's lease agreement requires six month's notice of termination. Should the project proceed, the state will notify the affected leaseholders that their leases will be terminated and that they must vacate the lots.

10. Cover Types *Estimate the acreage of the site with each of the following cover types before and after development (before and after totals should be equal):*

	Before	After
Types 2 to 8 Wetlands	281	7
Brush / Grassland	11	0
Wooded / Forest	790	107
Mine Road	20	2
Forest Road/trail	6	0
Existing Mining-Disturbed Area	136	56
MINE AREA:		
Existing pit	54	13
Project pit	0	660
Sloped/seed pit surface wall	0	60
STOCKPILE AREA:		
Existing stockpile	62	29
Surface top (seeded)	0	142
Waste rock top (seeded)	0	50
Surface catch-benches (seeded)	0	20
Rock catch-benches (seeded)	0	29
Sloped surface benches (seeded)	0	120
Waste rock benches	0	15
Stockpile haul roads	0	25
Misc. roads, pipelines, powerlines, etc.	0	25
TOTALS	1360	1360

11. Fish, Wildlife, and Ecologically Sensitive Resources

a. *Describe fish and wildlife resources on or near the site and discuss how they would be affected by the project. Describe any measures to be taken to minimize or avoid adverse impacts.*

Fisheries resources: The DNR has evaluated whether the project might affect fisheries resources in the following protected waters: Forsyth Pit, Kinney Pit lake, and McQuade Lake. Kinney Creek, which the project will affect, does not support a fishery.

A) **Forsyth Pit** -- The Forsyth Pit (DOW#69-1303n), a non-protected water, is a designated stream trout lake and abuts the project area (See figure 7). At some time during the project lifespan, mining operations will breach the north pit wall and dewater the pit. When mining operations cease, the pit will re-fill, although to a level 46 feet lower than present. Close to the community of Kinney, the pit is a popular fishing location. A 1985 study estimated summer fishing pressure at 313 angler hours per acre. Since 1982, the DNR has stocked the pit with brook and rainbow (primarily rainbow) trout on an annual basis. The present stocking rate is 50 fish per acre, or approximately 400 fish. DNR records indicate that few stocked trout survive more than one year, primarily due to angling pressure, and that the pit does not support trout reproduction.

The IRRRB (Iron Range Resources and Rehabilitation Board) has developed an earthen public access ramp on the south side of the pit. The project will make the access unuseable.

While the pit is dewatered it will not support a fishery. During de-watering, the DNR expects angling activity will relocate to other stocked pits and lakes, including Kinney Pit lake (DOW#69-781p).

B) **Kinney Pit lake** -- Also an abandoned mine pit, Kinney Pit lake is a protected water that the DNR and IRRRB have stocked with trout in the past. During active mining and dewatering, the proposed project will not affect fisheries resources in Kinney Pit lake. After mine closure in 20 to 25 years, pit water levels will not drop substantially, and outflow will continue. Inflow to Kinney Pit lake will decrease, especially during winter and dry summer spells -- periods when mine dewatering currently constitutes nearly 100 percent of the inflow. The decreased flows may have some effects on nutrient loading and spawning. Prior to closure, the DNR and U.S. Steel - Minntac will need to evaluate this issue in greater detail and develop mitigation plans if necessary.

C) **McQuade Lake** -- McQuade Lake lies downstream of Kinney Pit lake. It is shallow (21 feet maximum depth) and 96% of the lake's surface area is less than 15 feet deep. The lake has had a history of low dissolved oxygen levels in the winter, although no winterkills have been documented. The proposed project will not affect fisheries resources in McQuade Lake.

D) **Unnamed outflow from Kinney Pit lake** -- There is an unnamed creek flowing south from Kinney Pit lake to McQuade Lake. The creek is not a protected water and DNR staff have not determined what type of fishery, if any, it supports. During active mining, flows in this creek will not change. However, they may diminish somewhat in 20 to 25 years when mine dewatering ceases. While this issue does not warrant intensive analysis before mining begins, the DNR will need to survey the creek to evaluate fisheries and other aquatic resources prior to closure. U.S. Steel - Minntac has agreed to assist in financing this work.

Wildlife resources: Approximately 278 acres of the 1360-acre project area have been disturbed by past mining activity. The greatest proportion of the project area (approximately 775 acres) is second growth aspen forest. The project area also includes nearly 300 acres of wetlands, primarily types 6 and 7 (shrub fresh meadow and wooded swamp). The project will convert approximately 950 acres of forested land and wetland to open pit and stockpile.

Environmental impact analysis conducted on other mine developments in the general project area indicate that approximately 130 species of birds, 43 species of mammals, nine species of amphibians, and two species of reptiles could occur in the proposed project area. Wildlife species present are those commonly occurring in second-growth forests in northeastern Minnesota. The most familiar species include ruffed grouse, white-tailed deer, and snowshoe hare. DNR staff believe gray wolves frequent the project area. The wetland areas provide habitat for songbirds, furbearers, amphibians, and other wetland species.

The project will greatly modify nearly 1000 acres of wildlife habitat. Long-term reclamation will restore habitat values to some of the upland areas for a limited number of species, but during active mining the project area will lose nearly all habitat value. Larger mammals and adult birds will relocate to other areas as mining progresses. Assuming, however, that these areas are already inhabited to capacity, they will not be able to support the increased population. Through die-off and lower reproduction, local wildlife populations will decline until compatibility with the remaining habitat is reached. Smaller mammals, amphibians and reptiles will likely perish as mining advances.

The mining project will extend the existing 9-mile long U.S. Steel - Minntac pit by 1.75 miles. The mine will develop lineally, primarily westward at first, then widening to the north and south. This development pattern may prevent large mammals such as deer, bear, and wolves from moving north-south through the project area.

The state owns, and manages for forestry purposes, much of the land proposed for extension of the open pit mine. These areas are presently open to public use for hunting. If the area is developed as an active mine, hunting or other recreational uses will not be permitted.

b. *Are there any state-listed endangered, threatened, or special-concern species; rare plant communities; colonial waterbird nesting colonies; native prairie or other rare habitat; or other sensitive ecological resources on or near the site?*

X Yes ___ No

If yes, describe the resource and how it would be affected by the project. Indicate if a site survey of the resources was conducted. Describe measures to be taken to minimize or avoid adverse impacts.

The Natural Heritage database is the most complete source of data on Minnesota's rare, endangered, or otherwise significant plant and animal species, plant communities, and other natural features. The DNR has reviewed its Natural Heritage database and found no known occurrences of rare species or natural features in the proposed mine extension area.

The information in the database is drawn from many parts of Minnesota, and is constantly being updated, but it is not based on a comprehensive survey of the state. Therefore, there are significant natural features present in the state that the database does not include. The DNR is in the process of addressing this via the Minnesota County Biological Survey, a county-by-county inventory of rare natural features, which is now underway. However, St. Louis County has not yet been surveyed. Because there has not been an on-site survey of the biological resources of the project area, it is possible that ecologically significant features exist for which the DNR has no record. Impacts to any features that might be present are unavoidable.

Bald Eagle nesting and feeding has been reported in the U.S. Steel - Minntac tailings basin, which is more than three miles from the proposed extension. The proposed project will not result in any change in tailings basin operation, and is not expected to affect eagle activities in the basin. Gray wolves sightings are not recorded in the Heritage database, however, DNR staff believe they frequent the project area. This summer, the state will list gray wolves as "special concern" (down-listed from "threatened"). The wolves in the project area have likely adapted to mining activity and will not be seriously affected by the proposed extension.

12. **Physical Impacts on Water Resources:** Will the project involve the physical or hydrologic alteration (dredging, filling, stream diversion, outfall structure, diking, impoundment) of any surface water (lake, pond, wetland, stream, drainage ditch)?

X Yes ___ No

If yes, identify the water resource to be affected and describe: the alteration, including the construction process; volumes of dredged or fill material; area affected; length of stream diversion; water surface area affected; timing and extent of fluctuations in water surface elevations; spoils disposal sites; and proposed mitigation measures to minimize impacts.

Affected Water Resources:
The proposed U.S. Steel - Minntac Mine Extension will directly affect Kinney Creek, Rana Mine, Forsyth Mine Pit and area wetlands. Kinney Pit lake, McQuade Lake and the western drainage ditch will be indirectly affected by changes in surface water flow. Yates Mine, Wanless Mine, Seville-Midway Mine, Atkins Mine, Dormer Mine and Wade Mine are mine pits that might be affected by changes in groundwater flow (a discussion of groundwater issues can be found in Item 13).

Physical and Hydrologic Alteration (figures 9 and 10):
The mine extension area described in Item 6 and shown in figure 5, will alter area hydrology by reducing the drainage areas of local streams, and by supplementing flow through pit dewatering during active mining. The extension of the west pit will be created by excavating 660 acres of drainage area presently tributary to Kinney Creek. An additional 700 additional acres will be altered by the creation of stockpiles and access roads. Approximately another 540 acres of drainage area presently tributary to Kinney Creek and the western drainage ditch will drain into the extension pit, but it will not be directly altered (see figure 9). Items 6 and 10 describe the project and estimated land use in more detail. The project will incorporate the Rana Mine into the extension pit and will breach the north wall of the Forsyth pit

The effects of these changes on local hydrology were quantified on an average monthly basis by extrapolating streamflow information from the West Two River gaging station. The extrapolation of streamflow data from a gaged site to the ungaged extension area generates reasonable estimates of the streamflow changes so that the magnitude of change can be put in perspective, and used to evaluate potential impacts to aquatic resources. A technical hydrology report, prepared by HDR Engineering for U.S. Steel - Minntac, details the surface and groundwater evaluation process; this report is available from the RGU on request.

Volumes of Dredged or Fill Material:
The project will fill or excavate approximately 275 acres of wetlands. (Refer to figure 10 and Appendix 1 for a map and list of delineated wetlands in the project area.)

U.S. Steel - Minntac has prepared a wetland mitigation plan that proposes mitigation for the U.S. Steel - Minntac West Pit extension project and impacts associated with other mining activities. The proposed mitigation includes purchasing and restoring 480 acres of prior converted wetlands in Aitkin County. The mitigation plan will be reviewed by both the U.S. Corps of Engineers as part of its Section 404 application process, and by the DNR. Pursuant to the Minnesota Wetlands Conservation Act, the DNR will determine the adequacy of the wetlands replacement plan as part of the mining reclamation plan approved under the Permit to Mine.

Length of Stream Diversion:
During the initial production stage, mine construction will divert Kinney Creek approximately 3500 feet east into the present west pit.

Water Surface Area Affected:
Kinney Creek's width averages 10 feet throughout the affected area. The project would physically alter a total surface area of approximately 1.26 acres of the creek. The affected area within Forsyth Pit is approximately 8 acres.

Timing and Extent of Fluctuations in Water Surface Elevations:
Kinney Creek and Kinney Lake
The stream most affected by this proposal will be Kinney Creek, which drains into Kinney Pit lake. Kinney Pit lake is a locally significant body of water; it has a public access and a viable fisheries resource (see Item 11). The present drainage area, to the mouth of Kinney Pit lake, is about 4.3 square miles. Average annual inflow from the drainage area is estimated at 3 cfs (cubic feet per second) or 1350 gpm (gallons per minute). Minntac presently dewaters into Kinney Creek at an average annual rate of about 4.5 cfs (2020 gpm). Dewatering therefore accounts for about 60 percent of the total annual flow entering the lake, but probably constitutes nearly 100% of the flow during winter and dry summer spells. During spring runoff, dewatering is estimated at less than half the inflow. Natural runoff into the lake during winter and dry summer spells is estimated to be only a couple of hundred gallons per minute, while average April inflow may exceed 12 cfs.

As the extension area develops, Kinney Pit lake's natural drainage area will be reduced to about 1.7 square miles (see figure 9). Average annual natural runoff into the lake will be proportionately reduced to about 1.1 cfs (500 gpm), with winter and dry summer flows at or near zero. Dewatering, however, will increase to an average of about 9 cfs (4040 gpm) as the mine extension develops, until the total annual volume of water entering Kinney Pit lake increases about 35% over present conditions. The increased dewatering will raise the lake's winter water levels slightly; high lake levels will, however, be reduced substantially because the reduction in drainage area will reduce peak flows by 40 to 60 percent. Overall, changes in water levels will not affect the utility of the public access.

After mining and dewatering cease (20 to 25 years from now), the only inflow to Kinney Pit lake will be from the remaining 1.7 square mile natural drainage area, about 40 percent of what it is today. Natural, annual inflow to the lake will be reduced to about 35 to 40 percent of what it is today. Streamflow will not be sustained by pumping. Winter, and dry summer, streamflow will likely diminish to zero, although low water levels are not expected to drop below the lake s natural runout elevation since the lake is expected to remain a reflection of the general water table elevation in the area, even without substantial surface water inflow. As described in the mitigation section, U.S. Steel - Minntac will monitor lake levels during active mining, and can relocate their Kinney Creek monitoring station to a downstream location for better impact assessment, if necessary (see Proposed Mitigation Measures, end of this section).

The watersheds of McQuade Lake and the unnamed drainage referred to as the western drainage ditch (see figure 8) also will be affected by the mine extension, but to a lesser degree than Kinney Lake. Outflow from Kinney Lake combines with flow from the western drainage ditch and several local, small streams, and flows south to McQuade Lake.

Kinney Pit Lake Outflow
Outflow from Kinney Pit lake forms the headwaters of an unnamed stream which flows south to McQuade Lake, about 6 miles away. Enroute to the lake, runoff increases from two local drainages, including flow from the western drainage ditch. As noted above, average annual outflow from Kinney Lake will increase about 35 percent during mining of the extension area, however, after mining and dewatering ceases, Kinney Pit lake outflow will likely drop to zero during winter and dry summer periods. Consequently, the reach of the unnamed stream immediately downstream of Kinney Creek will experience a considerable

reduction in natural flow. As previously noted, average annual Kinney Lake outflow will be reduced to about 38% of present, with seasonal outflow at or near zero. The effects of this reduction will diminish as one moves downstream about 1.5 miles where a tributary flow enters from the northeast.

Western Drainage Ditch

The unnamed drainage referred to in this EAW as the "western drainage ditch" is actually a series of natural drainages and ditches through an altered wetland (see figure 8). It flows south, becomes a natural stream south of Highway 169, joins outflow from Kinney Lake and ultimately flows into McQuade Lake.

The extended west pit will consume only about 0.3 square miles of drainage area from the ditch, which will have an insignificant effect on downstream ditch flow. However, during the full and mid-life stages of mine development, water will be pumped from the Rana Mine location westward into the western drainage ditch at an estimated average annual rate of 3.6 cfs (1620 gpm). This dewatering will more than double the average annual ditchflow at Highway 169, and will more than triple winter base flow. High flows will be essentially unaltered. The culverts en route the ditch have been examined for possible blockages to flow that might cause flooding problems due to dewatering; no problem areas were noted. Further examination will be conducted prior to authorizing dewatering into the ditch.

McQuade Lake

The present drainage area of McQuade Lake is 23.1 square miles. Average annual runoff to the lake is estimated at 16 cfs (7180 gpm). Average monthly flow varies from a estimated low of less than 4 cfs (1800 gpm) during the winter to more than 65 cfs (29,200 gpm) during spring runoff. Present dewatering accounts for about 22 percent of the total, annual flow to the lake, but it nearly doubles winter flows. Present dewatering effects on lake level are negligible.

During full mine development, McQuade Lake's drainage area will be reduced about 13 percent, to 20.2 square miles. Average annual runoff to the lake will drop proportionately to about 14 cfs (6240 gpm), but increased dewatering will more than compensate for this loss, raising average annual flow to about 26.5 cfs (11,900 gpm). The dewatering will slightly raise winter and dry summer water levels, but the reduced drainage area will slightly lower peak runoff (about 10 percent) from snowmelt and summer storms, reducing high lake levels.

After mining and dewatering cease, McQuade Lake's drainage area will remain at 20.2 square miles, nearly 90 percent of what it is today. Average annual runoff into the lake will remain about 14 cfs (6240 gpm). After the pit fills with water, outflow may occur at one or two locations, including the western drainage ditch to McQuade Lake. Details on the two potential outlets are discussed in the Technical Hydrology Report. The hydrology of McQuade Lake will be very close to what it was before the beginning of mining operations in the area.

Forsyth Pit

During the Mid-life Development Stage, the mine extension will proceed southward to the Forsyth Pit. The Forsyth Pit will be dewatered and physically broken into, making it part of the larger extension pit. The pit will stay dewatered until mining ceases and the entire west pit fills with water, at which time it is anticipated that the Forsyth will become a small bay of the West Pit, with a maximum water depth of about 10 feet.

Rana Mine Pit

During the Mid-life Development Stage, the mine extension will proceed westward to the Rana Mine. The Rana Mine will be dewatered, physically broken into, and will become part of the extension pit.

Spoils Disposal Sites:

Surface overburden and waste rock from the 660-acre pit extension will be placed on the north side of the project area as shown in figures 4, 5, and 6. The volume of the waste rock stockpiles will be 27,470,000 Long Tons; the volume of surface overburden stockpiles will be 53,033,000 Long Tons.

Proposed Mitigation Measures:

As previously noted, extension of the west pit will result in the permanent elimination of about 2.7 square miles of Kinney Creek s watershed. Kinney Creek is classified as Protected Water by the Minnesota DNR Division of Waters, for a distance of about 3000 feet north of Kinney Lake. Minnesota Rule, part 6115.0280, subpart 5, requires that compensation be provided when protected waters are lost to mining. Compensation must be specified in provisions of a Protected Waters Permit, and will be a subject of discussion between the DNR and U.S. Steel - Minntac during processing of the Protected Waters Permit. Alternative compensation measures might include enhancement to nearby streams or water bodies, and/or enhancement of the ultimate West Pit lake which will be created by the extension.

When areas of the mine are depleted of crude ore, in-pit stockpiles of waste rock may be constructed. The approval of landowners (State of Minnesota) would be necessary. This could reduce the required stockpile area to the north and possibly create "shallows" in the mine pit lake after closure. Surface material could be placed along the shoreline of the anticipated water body that will develop in the abandoned pit. The material would be placed slightly below the anticipated ultimate pit water level. This would promote the development of littoral zones and a more natural lake environment.

U.S. Steel - Minntac also will monitor water elevations in the Wade Mine, Kinney Lake, Yates Mine, and Kinney Municipal Well No. 1. Water elevations will be measured quarterly, except that frozen lake levels will only be measured once each year. The data will be analyzed annually to track significant changes and trends in elevations. The analysis will be useful for understanding the effects of mining on hydrology, and could be useful for future mitigation of impacts.

Wetland mitigation is mandatory under both the Corps of Engineers 404 permit program and the Minnesota Wetlands Conservation Act. U.S. Steel - Minntac has proposed mitigation for this and several additional projects entailing acquisition and restoration of 480 acres of prior converted wetlands. Pursuant to the Wetlands Conservation Act, the Department of Natural Resources will assess proposed mitigation adequacy during the project permitting process.

The current flow monitoring station (US Steel 700) on Kinney Creek could be relocated to a site south of the extension area if warranted. An evaluation of the usefulness of additional flow data will be made as part of the DNR Appropriation permit process. In addition, NPDES flow data will continue to be accumulated for active discharges.

13. **Water Use**

a. Will the project involve the installation or abandonment of any wells? _X_ Yes ___ No

For abandoned wells give the location and unique well number. For new wells, or other previously unpermitted wells, give the location and purpose of the well and the Unique well number (if known).

There is an unregistered domestic well on the western edge of the project site. Before the project commences, the well will be abandoned in accordance with Minnesota Rules parts 4725.3850 to 4725.3875. However, at some time during the project life, the well site will be incorporated into the mine pit.

b. Will the project require an appropriation of ground or surface water (including dewatering)? _X_ Yes ___ No
If yes, indicate the source, quantity, duration, purpose of the appropriation, and DNR water appropriation permit number of any existing appropriation. Discuss the impact of the appropriation on ground water levels.

(*Please refer to figure 11 for a depiction of eventual inundated area and groundwater elevations.*)

Existing appropriations for the dewatering of the U.S. Steel - Minntac West Pit are regulated by DNR Appropriations Permit number 80-2084. Additional appropriation of water will be required for dewatering of the extension area. Permit 80-2084, as modified in January 1995, authorizes three dewatering installations in the West Pit.

Installation Name	Receiving Water	Permitted Average Annual Pumping Rate
Sump No. 6	Kinney Creek or Atkins Pit	5000 gpm/11.1 cfs
Sump No. 11	Kinross Creek	2000 gpm/4.4 cfs
Sump No. 3	E. Branch West Two River	9000 gpm/19.8 cfs

Sump No. 3 is located in the eastern portion of the existing west pit; the proposed project will not affect it. Sump No. 11, located near the center of the West Pit has not yet appropriated any water. The proposed project will not affected future withdrawals at this sump. Sump No. 6 dewaters the western part of the existing west pit.

During the initial phase of project, Sump 6, discharging to Kinney Creek, will dewater the mine extension. As development progresses, dewatering from Sump No. 6 will increase from the present average annuual rate of 2020 gpm to an estimated annual average rate of 4,040 gpm/9.0 cfs. The potential maximum monthly average rate will be 6,380 gpm (14.2 cfs).

Water discharged from Sump No. 6 flows through Kinney Creek to Kinney Pit lake. Water from Kinney Pit lake flows south through an unnamed creek and ultimately into McQuade Lake.

As mining in the extension area progresses westward, the company will construct a sump in the bottom of the Rana Mine pit (see figure 5). Estimated average annual outflow from this sump will be 1,440 gpm/3.2 cfs. The estimated maximum monthly average rate will be 2,270 gpm/5.1 cfs. Water collected in the sump will be pumped from the pit to the western drainage ditch located west of the extension area. This ditch travels south until it ultimately joins the unnamed creek

mentioned above and enters McQuade Lake. The company will apply for an amendment to permit 80-2084 to include the Rana sump.

Pumping duration and quantity will vary with major governing variables such as season and precipitation. The pumping and the suppression of the water table will lower ground water levels surrounding the pit. The irregular shape of the pit and the fractured, sloping, and irregular nature of the Biwabik Formation make future water levels away from the pit difficult to predict. However, the dewatering is expected to depress ground water levels only in areas in close proximity to the active mine.

The impact of dewatering the west pit can be used as an indicator of the potential impact of dewatering the proposed extension area. If ground water pumping from the west pit had a significant impact on local or regional ground water levels, that influence could be observed as decreasing surface water elevations in nearby mine pits. Pumping from the far west end of the west pit began in early 1984. Water level elevations were recorded in the Forsyth and Atkins Pits to monitor the impact of dewatering. These mines are both located within one-half mile south of the west pit.

The Forsyth Pit water level initially dropped approximately 10 feet, then rebounded about 8 feet. The cause of the rebound is unclear, but may have resulted from mineral deposits collecting in fracture zones down-gradient from the Forsyth Pit. The maximum drawdown of 10 feet approximately one quarter mile away from the dewatered west pit may serve as an indicator of the lateral extent of dewatering.

The water level data for the Forsyth and Atkins pits indicate that mine dewatering will not be a dominant influence on ground water levels away from the proposed extension area. The influence of mine dewatering will decrease away from the pit. The Forsyth and Atkins pits are less than one-half mile from the edge of the West Pit. The Kinney wells (and other wells) are located farther from the edge of the proposed extension area.

The City of Kinney uses a well in the Biwabik formation as the primary source of municipal water supply. It is possible that the water level in the Kinney well could decrease a few feet due to dewatering in the extension area. This would represent a decrease in pumping water level of less than 3 percent. The well currently has available drawdown to easily make up this loss. There will be a small increase in pumping costs associated with lifting water farther to the surface. The cumulative influence of all these factors is minor when compared to the problems Kinney has experienced with decreasing well efficiency in the past. Mineral deposits collecting in fractures of the Biwabik Formation decreased the efficiency of the well to near zero in 1993. Hydro-fracturing successfully restored its efficiency.

Other municipal water suppliers along the Iron Range reported no problems with the quantity of ground water available or decreasing ground water levels associated with mining activities.

Water elevations in the Wanless and Yates mines could potentially decrease a few feet due to dewatering in the extension area, but the water level will be more dependent on climatic conditions during the period of mining operations.

c. Will the project require connection to a public water supply? ___ Yes _X_ No
If yes, identify the supply, the DNR water appropriation permit number of the supply, and the quantity to be used.

14. **Water-related Land Use Management Districts** Does any part of the project site involve a shoreland zoning district, a delineated 100-year flood plain, or a state or federally designated wild or scenic river land use district? ___ Yes _X_ No
If yes, identify the district and discuss the compatibility of the project with the land use restrictions of the district.

15. **Water Surface Use** Will the project change the number or type of watercraft on any water body? _X_ Yes ___ No
If yes, indicate the current and projected watercraft usage and discuss any potential overcrowding or conflicts with other users or fish and wildlife resources.

The Iron Range Resources and Rehabilitation (IRRRB) has constructed a public access at the Forsyth Pit. During the mid-life development stage of the project, the pit will be de-watered, and boat access will become infeasible. After mining ceases the entire Minntac pit area will fill with water. At that time, it is possible that the pit could be used for fishing, boating, and other surface water recreation uses.

16. **Soils** Approximate depth (in feet) to:
Groundwater: minimum _10_ average _25-30_ Bedrock: minimum _0_ average _60_
Describe the soils on the site, giving SCS classifications, if known. (SCS interpretations and soil boring logs need <u>not</u> be attached.)

Soils within the project area have not been classified or mapped by the Soil Conservation Service (SCS). Soil types within the area include poorly drained silty clay loams in wetland areas, moderately well-drained clay loams - loamy clays in the highground forest areas, and gravelly soils in the disturbed areas.

17. **Erosion and sedimentation** Give the acreage to be graded or excavated and the cubic yards of soil to be moved:
acres 660 ; cubic yards ---------- ; long tons 281,106,000 ;
Describe any steep slopes or highly erodible soils and identify them on the site map. Describe the erosion and sedimentation measures to be used during and after construction of the project.

Tonnages to be removed:

Crude taconite ore	200,603,000 Long Tons
Waste rock	27,470,000 Long Tons
Surface overburden	53,033,000 Long Tons
TOTAL	281,106,000 Long Tons

The crude taconite ore will be transported to the U.S. Steel - Minntac plant for processing. The waste rock and surface overburden will be placed on the proposed stockpile. The waste rock is needed for production haul roads to and on the stockpile (to support the production trucks.)

Steep Slopes and Erodible Soils:
Steep slopes will exist on the inside of mine pit walls and on stockpile slopes. Locations of these features are shown on the Mine Development Maps. Most erosion that will occur due to the mining operation will be transported by runoff into the mine pit. Sediment not settling in the pit drainage channels will have an opportunity to settle in the mine sumps.

Management Measures:
The pit walls and stockpile lifts will be constructed and reclaimed according to State mineland reclamation rules. Reclamation work will commence as constructed areas become available. Pit wall, surface overburden, and waste rock stockpiles will be seeded as they become available to minimize water and wind erosion.

Discharge from the sumps will be much slower than the surface water runoff rate and will provide the detention time in the sump area necessary for particle deposition. During large runoff events, when suspended sediment may be a problem, the company currently diverts sump discharge to Atkins Mine for additional settling. This management practice prevents discharges with high suspended solids from reaching Kinney Creek.

18. **Water Quality - Surface Water Runoff**
a. *Compare the quantity and quality of site runoff before and after the project. Describe methods to be used to manage and/or treat runoff.*

Quantity:
Most site runoff will be eliminated because it will be directed into the mine pit. During the production stage of mining operations, this runoff will appear as part of the dewatering discharge at Rana Sump and at Sump No. 6.

Quality:
Water quality of existing site runoff is unknown. Seasonal constraints have prevented stream sampling. Receiving water quality data have been collected from grab samples taken in March, 1996.

Water quality of the existing mine sump water has been characterized and quantified. On average, the pit sump water quality was comparable to and, in some cases, better than known regional water quality.

U.S. STEEL - MINNTAC EFFLUENT DISCHARGE[1]

	Sump No. 6 - Outfall 030			Stockpile Seepage			Kinney Creek		
Parameter	avg.	avg. max.[2]	POR[3]	avg.	avg. max.	POR	avg.	avg. max.	POR
Temperature, °F	47.3	48.8	90-95	49.8	49.8	93-95	49.5	50.8	90-95
Total suspended solids (mg/l)	1.62	2.08	90-95	4.3	4.3	93-95	---	---	---
Total Nitrate (mg/l)	2.3	3.1	90-95	0.62	0.62	93-95	---	---	---
Oil and grease (mg/l)	0.5	0.93	90-95	---	---	---	---	---	---
Dissolved iron (mg/l)	0.65	0.86	90-95	0.03	0.03	93-95	---	---	---

[1]From MPCA NPDES monitoring records.
[2]This is the mean of all the reported monthly maxima.
[3]Period of record.

Management Methods
U.S. Steel - Minntac will follow the State mineland reclamation rules to avoid adverse effects from the surface water run-off. This includes sloping, seeding, and tree planting on the mine surface banks and stockpiles. The company will continue to collect NPDES water quality and flow data for active discharges. Water quality samples may be collected quarterly from Kinney Pit.

During large runoff events, when suspended sediment may be a problem, the company will continue to divert sump discharge to Atkins Mine for additional settling through the end of the mid-life stage. This management practice prevents discharges with high suspended solids from reaching Kinney Creek. During later stages of mine development, runoff from the eastern end of the project will continue to be diverted to Atkins Mine for settling. On the western end of the project, sediments will settle in the Rana Pit.

The company will employ maintenance and housekeeping practices designed to reduce the likelihood of leakage and spills from mine equipment. Any spills that do occur will be remediated by recovering free liquid and removing contacted soil for proper disposal. Any drips or spills of blasting agents will be removed from the ground prior to blasting to prevent contact with surface water.

b. Identify the route(s) and receiving water bodies for runoff from the site. Estimate the impact of the runoff on the quality of the receiving waters. *(If the runoff may affect a lake consult "EAW Guidelines" about whether a nutrient budget analysis is needed.)*

Runoff Routes
Within most of the project area, surface water will drain either to the south, to Kinney Creek, or to the western drainage ditch. Kinney Creek, located directly north of the City of Kinney, is presently used as a discharge outlet for U.S. Steel - Minntac's west pit. The man-made ditch, located west of the Rana Mine and railroad grade, will be a discharge point for the proposed mine extension. There are several ponds and settling basins along this ditch, including the Wanless natural ore pit. Figure 8 shows these drainage patterns.

Receiving Water Impacts
Total dissolved solids and dissolved iron were not be present in quantities sufficient to impair receiving water quality. Phosphorus concentrations were not sufficient to spur any significant algal growth in the receiving waters. Except for two occasions in 1993, nitrate concentrations out of the sump outfall did not significantly exceed regional receiving water concentrations. Detectable oil and grease concentrations occurred in the early years of mining activities near the sump area. Concentrations have been reduced with the implementation of management practices designed to protect water quality.

Kinney Pit lake is oligotrophic (nutrient poor) and it is unlikely that eutrophication will occur due to the relatively low nitrogen and phosphorus levels of the dewatering discharge. A large reduction in flow to McQuade Lake could affect in-lake water quality. However, during the mine production stages inflow will actually be increased. After complete closure of the mine and cessation of dewatering, average annual flows will be reduced by 11 percent from present flows. This reduction should not affect lake water quality. After the pit fills, increased flow rates close to the existing condition will occur.

19. **Water Quality - Wastewaters**
    a. *Describe sources, quantities, and composition (except for normal domestic sewage) of all sanitary and industrial wastewaters produced or treated at the site.*

       None.

    b. *Describe any waste treatment methods to be used and give estimates of composition after treatment, or if the project involves on-site systems, discuss the suitability of the site conditions for such systems. Identify receiving waters (including ground water) and estimate the impact of the discharge on the quality of the receiving waters. (If the discharge may affect a lake consult "EAW Guidelines" about whether a nutrient budget analysis is needed.)*

       None.

    c. *If wastes will be discharged into a sewer system or pretreatment system, identify the system and discuss the ability of the system to accept the volume and composition of the wastes. Identify any improvements which will be necessary.*

       Not applicable.

20. **Ground Water -- Potential for Contamination**

a. Approximate depth (in feet) to ground water: 10 minimum; 120 average.

b. *Describe any of the following site hazards to ground water and also identify them on the site map: sinkholes; shallow limestone formations / karst conditions; soils with high infiltration rates; abandoned or unused wells. Describe measures to avoid or minimize environmental problems due to any of these hazards.*

The only known well in the project area is present near the Rana Mine pit, near the caretaker's residence. The well will be abandoned in accordance with Minnesota Rules parts 4725.3850 to 4725.3875. However, at some time during the project life, the well site will be incorporated into the mine pit.

Other potential environmental concerns associated with the caretaker's property, such as a septic system or old equipment, will be remediated prior to beginning the project.

c. *Identify any toxic or hazardous materials to be used or present on the project site and identify measures to be used to prevent them from contaminating ground water.*

The project will involve the transportation and use of blasting agents including ANFO (ammonium nitrate and fuel oil) and emulsion blend explosives. Other materials that will be present are those associated with mobile equipment, e.g., lubricants (greases, hydraulic fluid, oil), fuel oil and gasoline, antifreeze, batteries, and tires. Preventative measures will consist of the transportation of explosives by vendor in leakproof trucks, proper maintenance and fueling techniques, and proper disposal techniques.

Mining operations will not affect ground water quality during the active life of the mine. The dewatering activities will create a local ground water gradient toward the mine from all directions Any potentially contaminated ground water will not be transported against the gradient away from the mine. After mining activities are complete, but before the pit fills with water, groundwater around the entire pit will continue to flow into the pit.

As a check of the potential for mining activities to affect ground water, representatives from almost all the iron range communities were interviewed about their ground water quality. None reported any problems with ground water quality related to mining activities or abandoned mine pits.

The pit lake created by the present west pit and the extension will be approximately 1200 acres. It is anticipated that it will fill with water to approximately elevation 1500 feet msl (mean sea level), with a maximum depth of about 200 feet and a narrow, shallow section between two deeper, east and west sections (see figure 11). Based on an examination of the probable elevations, it appears possible that surface water outflow could occur via the western drainage ditch and/or an unnamed drainage that runs south through Mountain Iron to the West Two Rivers reservoir. Where the water will outflow, if at all, and in what proportions, will be studied as part of U.S. Steel - Minntac's final closure document for their reclamation permit.

The surface material and iron formation material are anticipated to be typical of this area. There are no known underground mine workings in the project area. Diamond drill hole information is available.

21. **Solid Wastes; Hazardous Wastes; Storage Tanks**

a. *Describe the types, amounts, and compositions of solid or hazardous wastes to be generated, including animal manures, sludges and ashes. Identify the method and location of disposal. For projects generating municipal solid waste indicate if there will be a source separation plan; list type(s) and how the project will be modified to allow recycling.*

Petroleum products disposal will be in accordance with the Minnesota Rules parts 7045.0790 to 7045.0855, regulating management of used oil. The antifreeze and batteries are special hazardous wastes and will be recycled/disposed of accordingly. The unusable tires will be picked up by a recycler and reused.

There will not be any major maintenance facility present at the project location. Major repairs will be performed at U.S. Steel - Minntac's existing facility. There will be a need for minor repair work, generating minor amounts of waste products.

b. *Indicate the number, location, size, and use of any above or below ground tanks to be used for storage of petroleum products or other materials (except water).*

There will be no above or below ground petroleum product storage facility within the confines of the proposed project. All fuels, lubricants and other liquid products to be used in this operation will be supplied from existing storage and supply sources. Any on-site equipment fueling that occurs will be performed from a mobile unit.

22. **Traffic** Parking spaces added __0__ Existing spaces (if project involves expansion) _____ Estimated total Average Daily Traffic (ADT) generated __0__ Estimated maximum peak hour traffic generated (if known) and its timing: _____, _____. *For each affected road indicate the ADT and the directional distribution of traffic with and without the project. Provide an estimate of the impact on traffic congestion on the affected roads and describe any traffic improvements which will be necessary.*

The project will not generate additional traffic, however, some employee traffic will be diverted from the Kinney employee access road (which will be severed by the project) to U.S. Highway 169 and the main U.S. Steel - Minntac entrance located on Highway 102.

Approximately one year into the project, U.S. Steel - Minntac's western Kinney employee access road, and approximately 2500 feet of County Road Number 668 (these are actually one road) will be closed. The road dead-ends at the present U.S. Steel - Minntac western pit, and the traffic is primarily by U.S. Steel - Minntac employees. U.S. Steel - Minntac employee traffic is generated during shift changes, at 7:00 AM, 3:00 PM and 11:00 PM. The greatest traffic is generated by the arrival and departure of the 7:00 AM to 3:00 PM shift. Traffic counts were taken on the Kinney access road during the peak shift changes, during which approximately 180 vehicles enter or exit the U.S. Steel - Minntac facility. Less than a quarter of this number enter or exit as the remaining two shifts arrive and depart.

23. **Vehicle-related air emissions** Provide an estimate of the effect of the project's traffic generation on air quality, including carbon monoxide levels. Discuss the effect of traffic improvements or other mitigation measures on air quality impacts. *(If the project involves 500 or more parking spaces, consult "EAW Guidelines" about whether a detailed air quality analysis is needed.)*

There will be no net effect on air quality due to this project. Employees will report to work at existing locations resulting in no increase in personal vehicle emissions. Once mining activities commence, emissions related to the operation of locomotives, production trucks, loaders, graders, automotive vehicles will generally approximate those at the current mining site because mining operations in the existing U.S. Steel - Minntac Pit will be replaced with operations at this project area. Haul distance and equipment usage requirements will be similar to the current operation.

24. **Stationary source air emissions** Will the project involve any stationary sources of air emissions (such as boilers or exhaust stacks)? ____ **Yes** __X__ **No**
If yes, describe the sources, quantities, and composition of the emissions; the proposed air pollution control devices; the quantities and composition of the emissions after treatment; and the effects on air quality.

25. Will the project generate dust, odors, or noise during construction and / or operation? __X__ **Yes** ___ **No**
If yes, describe the sources, characteristics, duration, and quantities or intensity, and any proposed measures to mitigate adverse impacts. Also identify the locations of sensitive receptors in the vicinity and estimate the impacts on these receptors.

The proposed project will generate mining equipment diesel engine exhaust; dust as a result of blasting, materials handling, and equipment movement on unpaved roads; and noise as a result of blasting and heavy mining equipment engine operation. The nearest sensitive receptors are the residences of Kinney (2600 feet to the south), and Buhl (8500 feet to the southwest).

Dust. Fugitive dust generated from haul road traffic, routine mining activity, etc., will be minimized by the use of dust suppressants, watering, grading, and covering with crushed rock. Dust generated from blasting will be controlled by blast technique and taking advantage of optimum weather conditions.

Blasting. Generally, mine blasting is one of the greatest public concerns. Blasting is a necessary part of mining; it cannot be eliminated but it can be controlled to what most people agree is acceptable.

Blasting regulation has focussed on establishing noise and ground vibration limits designed to prevent structural damage to buildings and other manmade structures. These levels are measurable with sensitive instrumentation, and were developed by observing the impacts on structures exposed to actual mine blasts. The noise and vibration limits that were established are well below the levels that start to cause damage such as the initiation or extension of cracks in plaster walls.

Window glass cracking or breakage is the most common type of damage due to blasting. While it can be significantly reduced by meeting blasting limits, it is not always eliminated. Experience has shown that a number of factors beyond blasting influence this type of damage, including extremes in air temperature, stresses on the glass resulting from poor alignment within the

window frame, or simply the age of the glass, which can cause it to be more brittle. In almost every case where window damage occurs as a result of blasting, the windows affected directly face the direction from which the blast occurred, making it simpler to assess the cause of the damage.

The work on developing noise and ground vibration blasting levels was done by the U.S. Bureau of Mines between 1950 and 1975. While the Bureau's main emphasis was on developing blasting limits to prevent structural damage, the Bureau also studied impacts of blasting on people. On the basis of its research, the Bureau concluded that if blasting is controlled so that the structural damage limits are met, most people find the noise and vibrations tolerable, though sometimes disconcerting.

The DNR included the blasting recommendations of the Bureau of Mines in the 1980 Mineland Reclamation Rules. The standard for noise is 130 decibels, and 1 inch per second for ground vibration. The DNR's experience over the last 15 years is that the mining companies blasting on the Iron Range can easily meet the ground vibration standards under almost all circumstances, but have to constantly work on controlling the noise levels when blasting in close proximity to residential areas.

There are a number of factors that influence the level of noise from a blast. These include: the size of the blast, the amount of explosive ignited at any given instant, the direction and speed of the wind that will carry the noise, the integrity of the rock being blasted (degree of fractures and weathering), the barometric pressure, the physical location of the blast (near the surface or deep in the pit), and many other factors. These factors are so variable that mining company personnel must continually adjust blasting patterns to compensate for the variability. Such adjustments are based on the experience the company gains from each blast and the mandatory monitoring of noise and vibration levels. If the levels of noise and vibration start to approach the DNR's standards, actions must be taken on subsequent blasts to lower them. Frequent adjustments include changing spacing of blast holes, reducing the size of the blast pattern, reducing the amount of explosives ignited at any given instant, or delaying the blast until the wind direction changes.

The following describes pre-blasting activities:

U.S. Steel - Minntac uses rotary drills to drill widely-spaced, large-diameter blast holes. These holes are loaded with emulsion blend blasting agents. The upper portion of the holes are back-filled with crushed stone to contain the blast energy.

The holes are tied together using a non-electric system. Millisecond delays interrupt the large blasts, breaking them up into many small, closely-spaced blasts that appear to be one event. Seismographs and sound level meters are placed in nearby neighborhoods to monitor whether ground vibration and noise levels are held to acceptable levels.

U.S. Steel - Minntac blasts only when the meteorological conditions are conducive. Surface winds, winds aloft and temperatures aloft all have a profound effect on the resulting sound level. Blasts are designed to withstand a wait of several weeks if unfavorable weather persists. To insure that no personnel are in the flyrock zone, affected mine areas and neighboring properties are secured before blasts are set off.

In order to determine the potential impact to the population adjoining U.S. Steel - Minntac's mine extension, a noise survey was conducted, in accordance with Minnesota Rules Chapter 7030.0060 subparts 1 to 4. The nearest household to the proposed extension is located 2500 feet from the perimeter of the extension. Therefore, noise sampling was conducted at this distance from various pieces of mining equipment, in order to predict the exposure, at this distance. The study report is included as Appendix 2 of the EAW.

The study concludes that the noise standards set forth by Minnesota rules will not be exceeded at the nearest residence, i.e., 2500 feet from the perimeter of the proposed mine, based on either daytime or nighttime, noise area classification 1 L10 and L50 values, which were gathered from isolated mining heavy equipment. Also, the results of the test equipment indicated that the daytime L10 and L50 values will not be exceeded at the nearest residence from the mine perimeter. However, it is likely that some residences, currently on state-leased land, will at some point be within the blast safety zone that must be cleared before each blast. These surfaces leases may have to be terminated. The lessees would be responsible for removing any structures or personal property from the leased lots.

26. Are any of the following resources on or in proximity to the site:
If any items are answered Yes, describe the resource and identify any impacts on the resource due to the project. Describe any measures to be taken to minimize or avoid adverse impacts.

a. archaeological, historical, or architectural resources? ___ Yes _X_ No

The Minnesota State Historic Preservation Office (SHPO) was contacted to determine whether archaeological, historical, or architectural resources will be affected by the project. SHPO indicated there are no reported historic properties in the project area and that the probability of any unreported properties is low. Based on available information, they conclude the project is unlikely to affect any historic properties.

b. prime or unique farmlands? ___ Yes _X_ No

c. designated parks, recreation areas, or trails? _X_ Yes ___ No

A 14-mile long grant-in-aid snowmobile trail, developed and managed by the Range Trail Committee and the Kinney Trail Club, crosses the project area (see figure 12). The trail, known as the Kinney Spur of the Laurentian trail, branches off from an east-west section of the Laurentian Trail and extends southerly approximately 11 miles, ending at Highway 102 southeast of Kinney, Minnesota. The Kinney Trail Club contracts with the Iron Range Resources and Rehabilitation Board (IRRRB) to groom the trail.

Grant-in-aid trails are developed using easements on private and public land and are subject to relocation or elimination, according to compatibility with the prevailing land use. The Kinney spur crosses state land in sections 2 and 11 of the project area, and Ontario Iron Company land in section 2. The state granted easements, subject to cancellation with 30-day notice to St. Louis county for development of this trail.

U.S. Steel, the Range Trail Committee, the Kinney Trail Club, the IRRRB, and the DNR, have agreed to cooperate in rerouting the trail. The proposed trail alignment is included as figure 13. The proposed trail follows a partially cleared alignment (formerly a forest road) across lands owned by U.S. Steel (section 26 and east half of section 34 of Township 59 North, Range 19 West) and the U.S. Forest Service (west half of section 34, east half of section 33 of Township 49 North, Range 19 West), and the right-of-way for St. Louis County Highway 25.

d. scenic views and vistas? ___ Yes _X_ No

e. other unique resources? _X_ Yes ___ No

Taconite, an important state mineral resource, will be removed from an existing reserve.

27. Will the project create adverse visual impacts? *(Examples include: glare from intense lights; lights visible in wilderness areas; and large visible plumes from cooling towers or exhaust stacks.)* ___ Yes _X_ No
If yes, explain.

28. **Compatibility with plans** Is the project subject to an adopted local comprehensive land use plan or any other applicable land use, water, or resource management plan of an local, regional, state, or federal agency? _X_ Yes ___ No
If yes, identify the applicable plan(s), discuss the compatibility of the project with the provisions of the plan(s), and explain how any conflicts between the project and the plan(s) will be resolved. If no, explain.

St. Louis County has zoned the project area "Industrial 4", in which mining is a permitted use.

29. **Impact on Infrastructure and Public Services** Will new or expanded utilities, roads, other infrastructure, or public services be required to serve the project? ___ Yes _X_ No
If yes, describe the new or additional infrastructure / services needed. *(Any infrastructure that is a "connected action" with respect to the project must be assessed in this EAW; see "EAW Guidelines" for details.)*

30. **Related Developments; Cumulative Impacts**
a. Are future stages of this development planned or likely? ___ Yes _X_ No
If yes, briefly describe future stages, their timing, and plans for environmental review.
b. Is this project a subsequent stage of an earlier project? _X_ Yes ___ No
If yes, briefly describe the past development, its timing, and any past environmental review.

The project will extend U.S. Steel - Minntac's west pit. Existing development includes the west and east pits (approximately 9 miles long), and a tailings basin (approximately 18 square miles), and an ore processing/pelletizing facility located 1.5 miles to the east of the proposed project. The existing plant will process ore from the proposed new mine. The existing mine, taconite processing facility, and tailings basin were permitted and constructed prior to the effective date of the environmental review rules. They did not undergo environmental review and are exempt from environmental review as long as their operation remains unchanged.

In the late 1980's U.S. Steel - Minntac experienced rising water levels in the existing tailings basin, primarily due to high precipitation and lower production (which consumes water). There was some discussion between the company and the DNR regarding the possible need to partially de-water the basin. However, dry weather and increased production resolved the problem. Although the proposed extension will not affect tailings basin operations, the potential exists for the problem to recur. The DNR and U.S. Steel - Minntac plan to analyze the issue in more detail over the next year or so, determine what level of environmental review would be appropriate, and prepare a contingency plan should the issue arise in the future.

c. Is other development anticipated on adjacent lands or outlots? ___ Yes _X_ No

If yes, briefly describe the development and its relationship to the present project.

d. If a, b, or c were marked Yes, discuss any cumulative environmental impacts resulting from this project and the other development.

Taconite and natural ore mining has been on-going on the Mesabi Range since 1892. Mining has greatly changed the landscape of this area, creating stockpiles, dumps and water-filled pits. This project will add somewhat to the cumulative effects of past and present mining.

The primary environmental effect resulting from a century of mining is disruption to surface and groundwater flow patterns. The DNR is presently developing a water budget for the Iron Range. The goal of this effort is to eventually restore and passively retain flows to their original drainage patterns when mining ceases.

31. **Other Potential Environmental Impacts** *If the project may cause any adverse environmental impacts which were not addressed by items 1 to 28, identify and discuss them here, along with any proposed mitigation.*

None.

32. SUMMARY OF ISSUES *(This section need not be completed if the EAW is being done for EIS scoping; instead, address relevant issues in the draft Scoping Decision document which must accompany the EAW.)* List any impacts and issues identified above that may require further investigation before the project is commenced. Discuss any alternatives or mitigative measures that have been or may be considered for these impacts and issues, including those that have been or may be ordered as permit conditions.

The EAW has identified the following potential impacts.

Item 9. Land use. The project area land use will change from forest management and outdoor recreation to mineral development. However, the project site has been zoned for industrial development and the state of Minnesota has leased the mineral rights for development, in order to generate revenues for the state. There are several residences on state leases that may have to be moved due to incompatibility with blasting restrictions. At the end of mining (20 years), it may be possible that some of the area will revert to recreational uses, especially as the mine pit fills with water and is managed for fisheries values.

Item 10. Cover type. The project area cover type will be converted from second growth forest (including some areas previously affected by mining), and wetlands to an industrial purpose. At the end of mining, the project area will be reclaimed to the extent possible; reclamation will include revegetation. The wetlands lost cannot be replaced on-site, but will be replaced pursuant to the Minnesota Wetland Conservation Act, and federal Clean Water Act.

Item 11a. Wildlife. The project will result in habitat losses and eventual reduction in local wildlife populations. Some habitat values may be restored when mining ceases.

Fisheries. In 20 to 25 years, when mining and dewatering cease, flows will decrease in the unnamed creek that forms the outlet for Kinney Pit lake. At present, the DNR does not know what fisheries resources the creek supports. However, should the

project proceed, we will survey the creek, with company assistance, to determine whether fisheries impact mitigation measures will be required at closure.

Item 12. Surface Water Resources. The Forsyth Pit will be incorporated into the larger West Pit extension. During mining operations the recreational fishing opportunities provided by the Forsyth Pit will be lost. A portion of Kinney Creek and much of the creek's drainage area will be incorporated into the mine. Unless pumping into Kinney Creek is maintained, it may flow intermittently when mining ceases. Minnesota Water Law requires compensation for the public values when water resources are impaired. Generally, abandoned mine pits tend to be sterile, providing little habitat for aquatic life.

To compensate for the loss of Kinney Creek headwaters, U.S. Steel has proposed to construct the mine pit walls with slopes that provide littoral zones, which should be conducive to vegetative growth and fisheries management. The DNR will determine the adequacy of this compensation prior to mine closure, when more current information about final mine site configuration, and public values and policy is available. Prior to mine closure, the DNR will also evaluate potential alternative compensation measures; these might include enhancement to nearby streams or water bodies, and/or enhancement of the ultimate west pit lake which will be created by the extension.

Item 22. Traffic. The project will divert traffic from the western employee access to US Highway 169 and the main U.S. Steel - Minntac entrance.

Item 25. Noise/blasting. There will be unavoidable but manageable impacts from blasting.

Item 26c. Recreational trail. The Grant-in-Aid snowmobile trail will be severed, but can be re-routed to provide access to Kinney.

Item 26e. Taconite use. The project will result in the extraction of taconite ore, a valuable resource in the state.

The issues and impacts outlined above do not require further investigation before the project commences.

CERTIFICATIONS BY THE RGU *(all 3 certifications must be signed for EQB acceptance of the EAW for publication of notice in the EQB Monitor)*

A. I hereby certify that the information contained in this document is accurate and complete to the best of my knowledge.
Signature Rebecca Alexander

B. I hereby certify that the project described in this EAW is the complete project and there are no other projects, project stages, or project components, other than those described in this document, which are related to the project as "connected actions" or "phased actions," as defined, respectively, at Minn. Rules, pts. 4410.0200, subp. 9b and subp. 60.
Signature Rebecca Alexander

C. I hereby certify that copies of the completed EAW are being sent to all points on the official EQB EAW distribution list.
Signature Rebecca Alexander

Title of signer Environmental Planner Date 1 May 1996

USX/USX25.doc
#960067-01

Minnesota Environmental Quality Board. Revised June 1990.

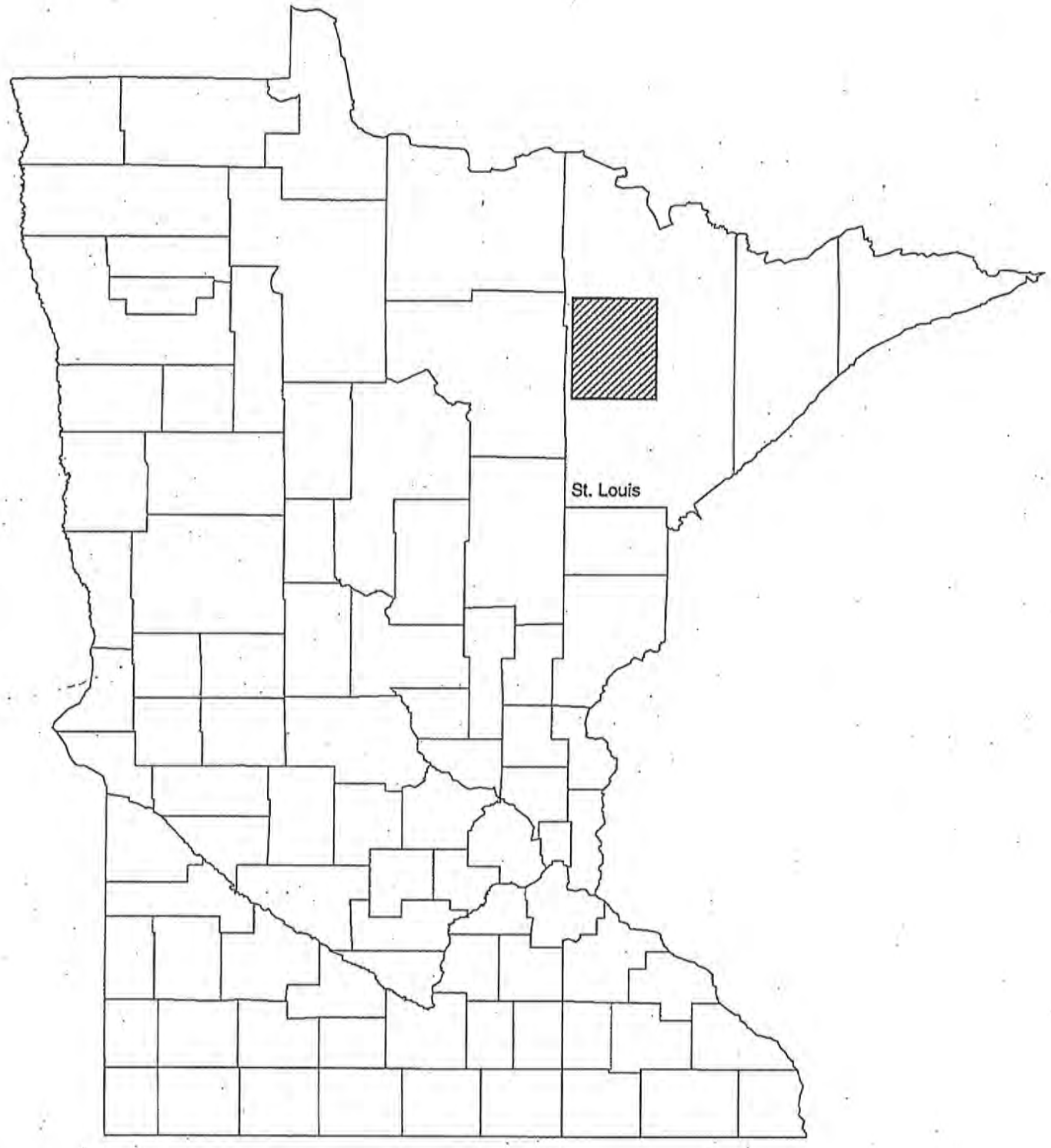
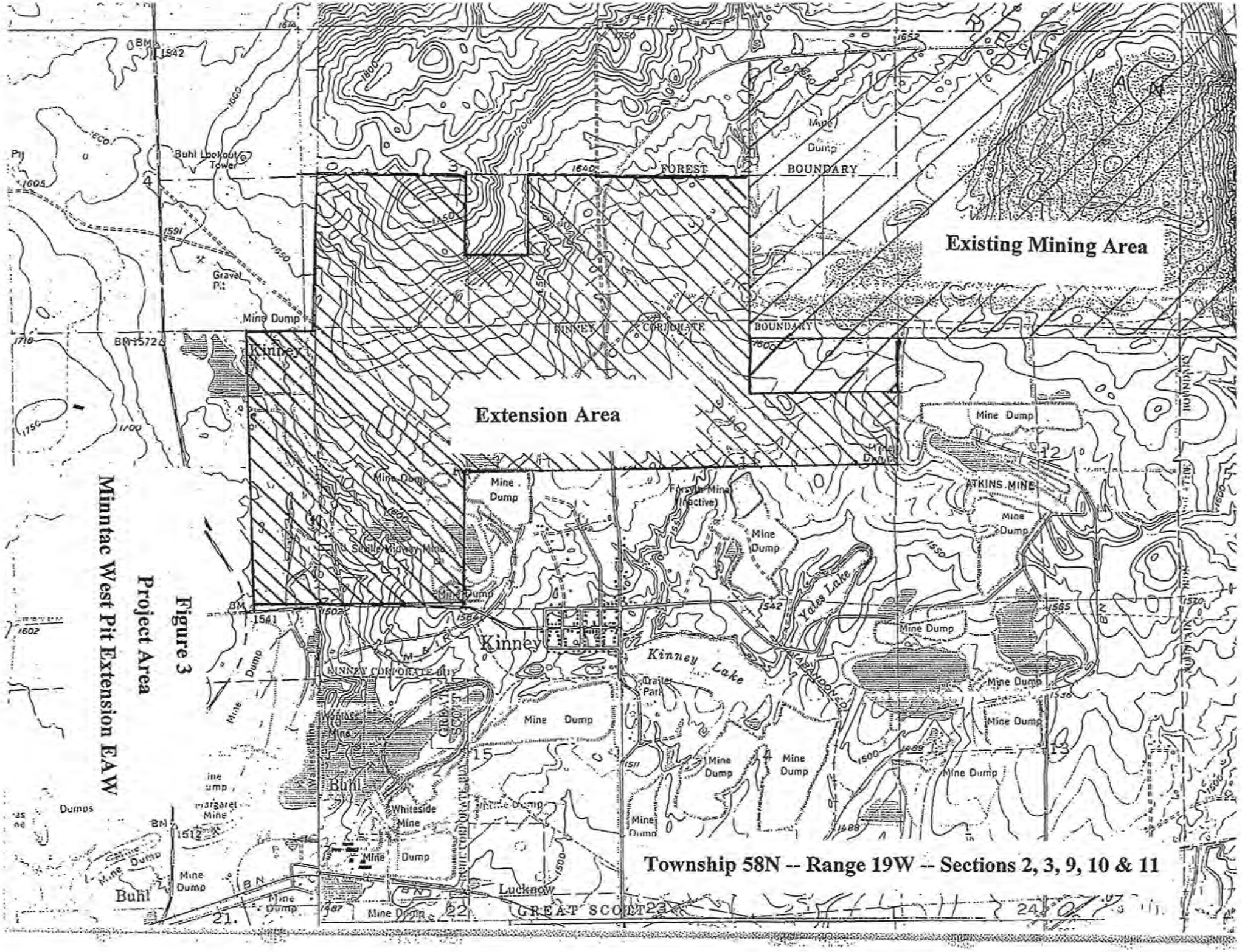
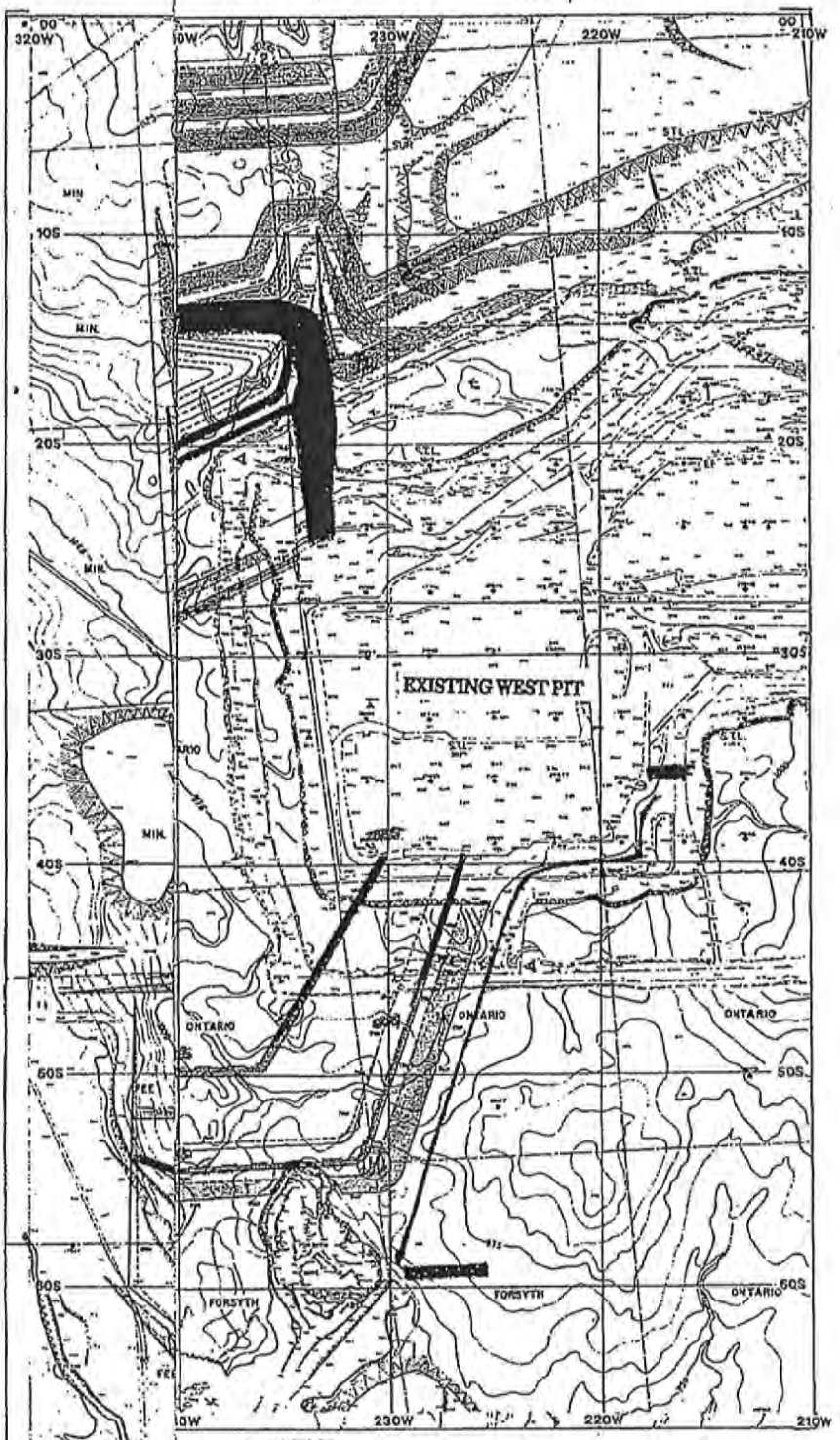


Figure 1

General Project Area

Minntac West Pit Extension EAW


Existing Mining Area
Extension Area
Township 58N -- Range 19W -- Sections 2, 3, 9, 10 & 11
Kinney
Buhl
Lucknow
Yates Lake
Kinney Lake
Buhl Lookout Tower
Gravel Pit
Mine Dump
FOREST BOUNDARY
KINNEY CORPORATE BOUNDARY
ATKINS MINE
Whiteside Mine
Margaret Mine
Trailer Park
GREAT SCOTT
Minntac West Pit Extension EAW
Project Area
Figure 3



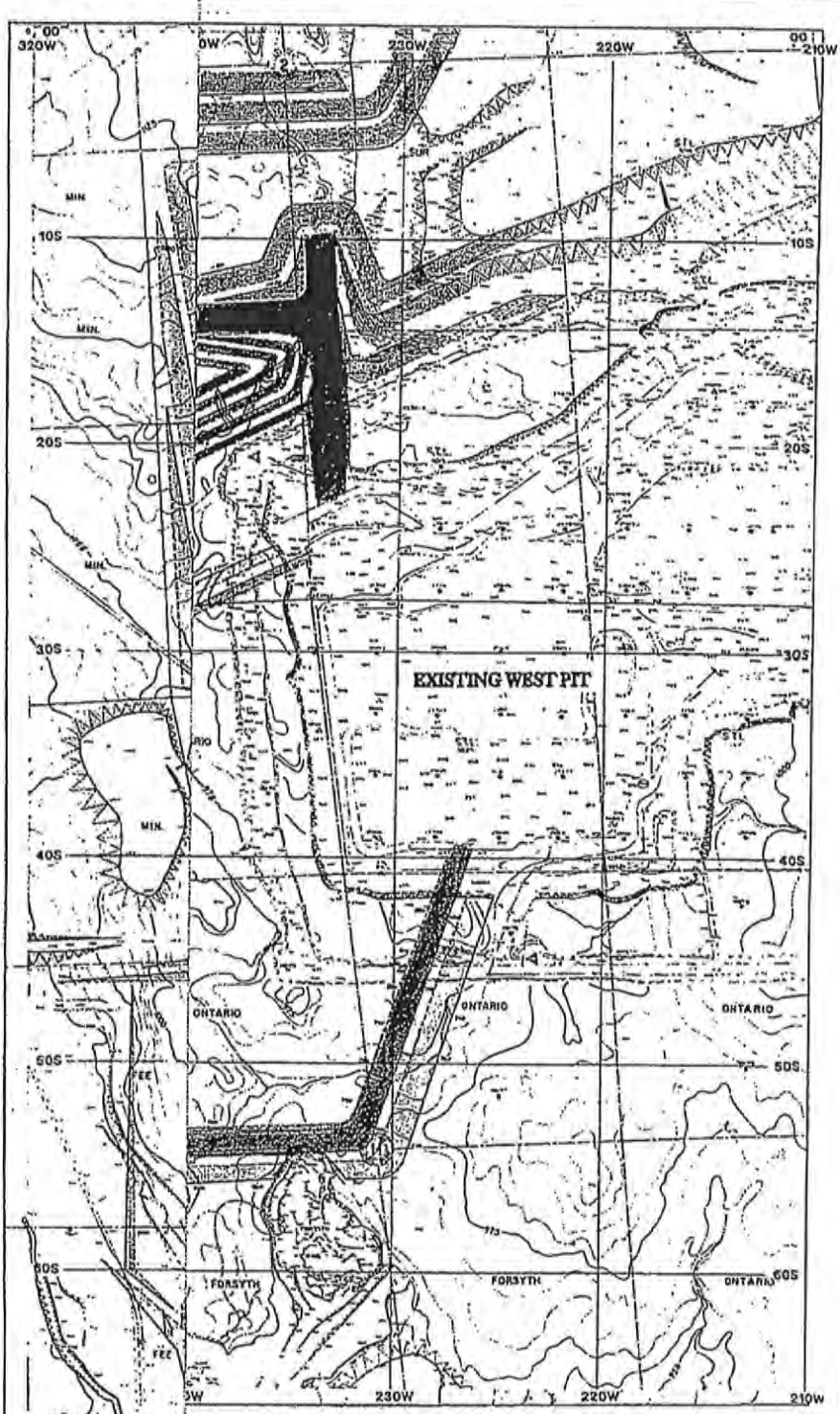
LEGEND

OVER BURDEN
ADS
HERTY (LC-1 & 2)
HERTY (LC-3 & 4)
LOWER SLATY (LS)
WASTE ROCK
SURFACE BANK
WASTE ROCK STOCK PILE

nntac Mine Extension EAW
evelopment-Mid-Life Stage
Preliminary Plan

Date
3-96

Figure
5



LEGEND

- OVER BURDEN
- DS
- ERTY (LC-1 & 2)
- ERTY (LC-3 & 4)
- LOWER SLATY (LS)
- WASTE ROCK
- SURFACE BANK
- WASTE ROCK STOCK PILE

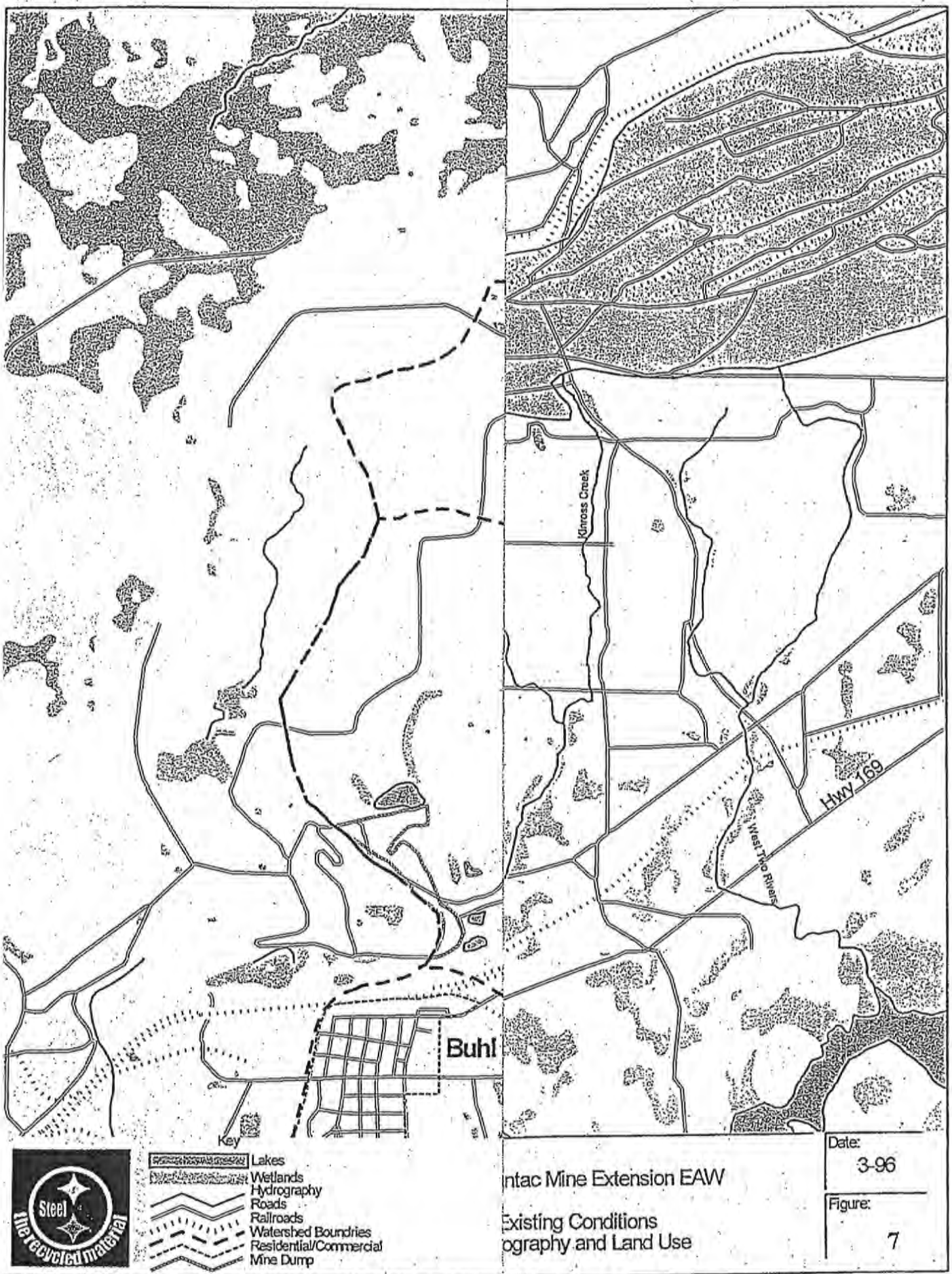
nntac Mine Extension EAW

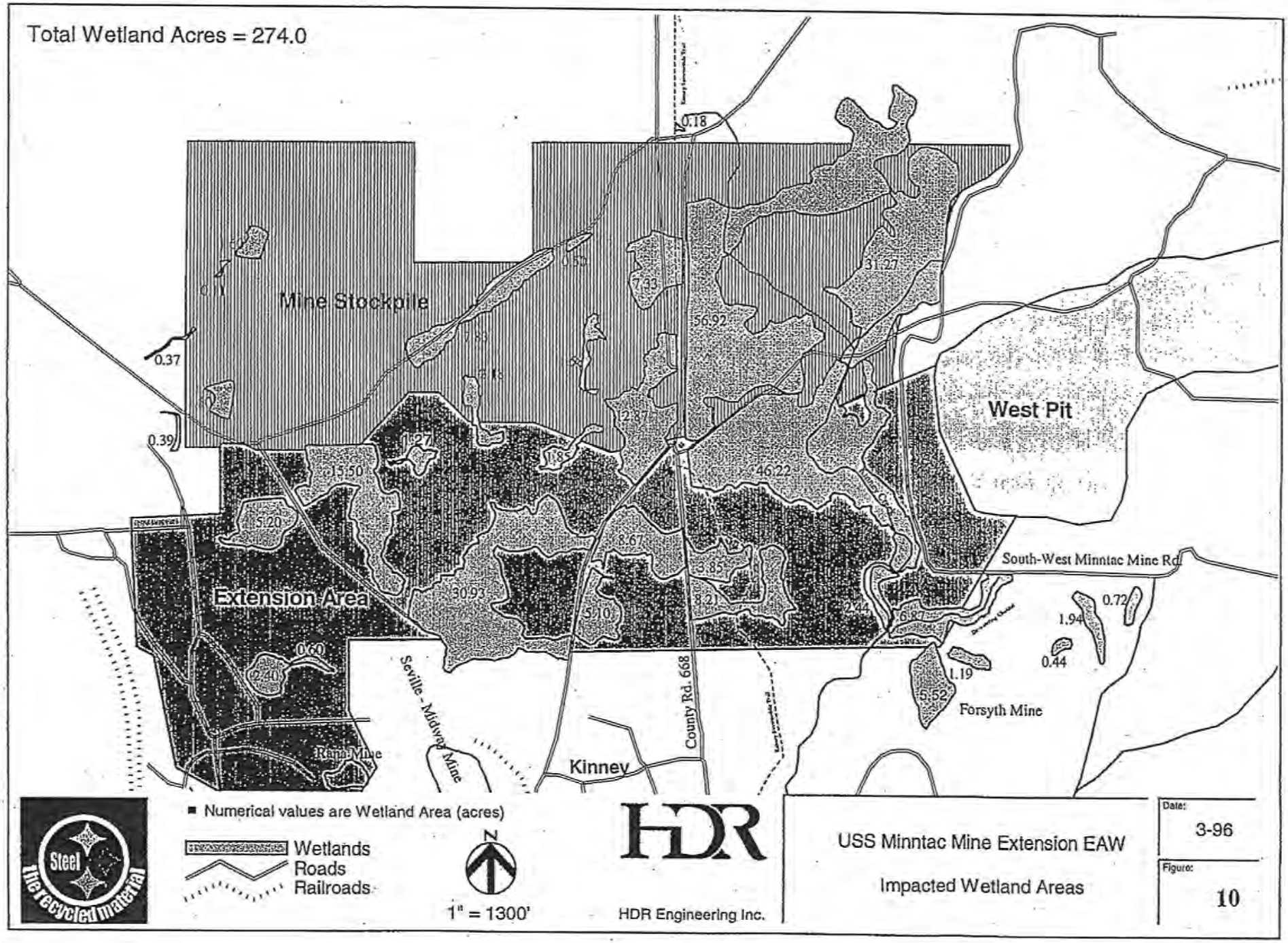
opment-Full Development Stage

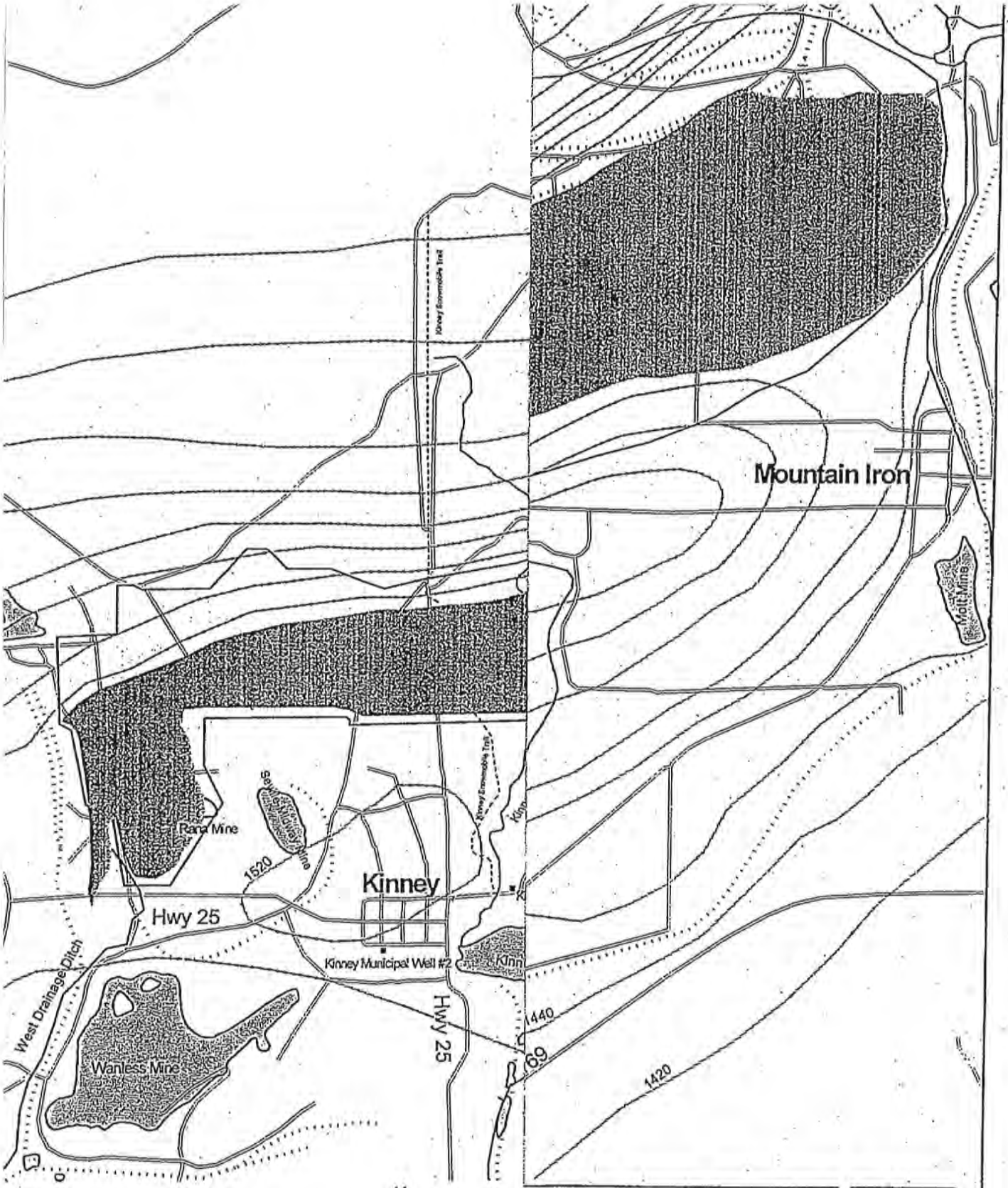
Preliminary Plan

Date 3-96

Figure 6


Kinross Creek
Hwy 169
West Two Rivers
Buhl
Key
Lakes
Wetlands
Hydrography
Roads
Railroads
Watershed Boundries
Residential/Commercial
Mine Dump
Steel
the recycled material
ntac Mine Extension EAW
Existing Conditions
ography and Land Use
Date:
3-96
Figure:
7


Total Wetland Acres = 274.0
Mine Stockpile
West Pit
Extension Area
South-West Minntac Mine Rd
Forsyth Mine
Kinney
Seville - Midway Mine
County Rd. 668
Rana Mine
0.18
0.37
0.39
0.53
7.33
31.27
56.92
7.83
2.87
1.27
15.50
46.22
5.20
8.67
30.93
5.10
8.21
2.44
6.87
0.72
1.94
0.44
1.19
5.52
0.60
2.40
Numerical values are Wetland Area (acres)
Wetlands
Roads
Railroads
N
1" = 1300'
HDR
HDR Engineering Inc.
Steel
the recycled material
USS Minntac Mine Extension EAW
Impacted Wetland Areas
Date:
3-96
Figure:
10



Key

Pool Elevation 150

Lakes

Surface water feat

Roads

Railroads

Ground water cont

ac Mine Extension EAW

ual Inundated Area
undwater Elevations

Date: 3-96

Figure: 11

Steel The recycled material

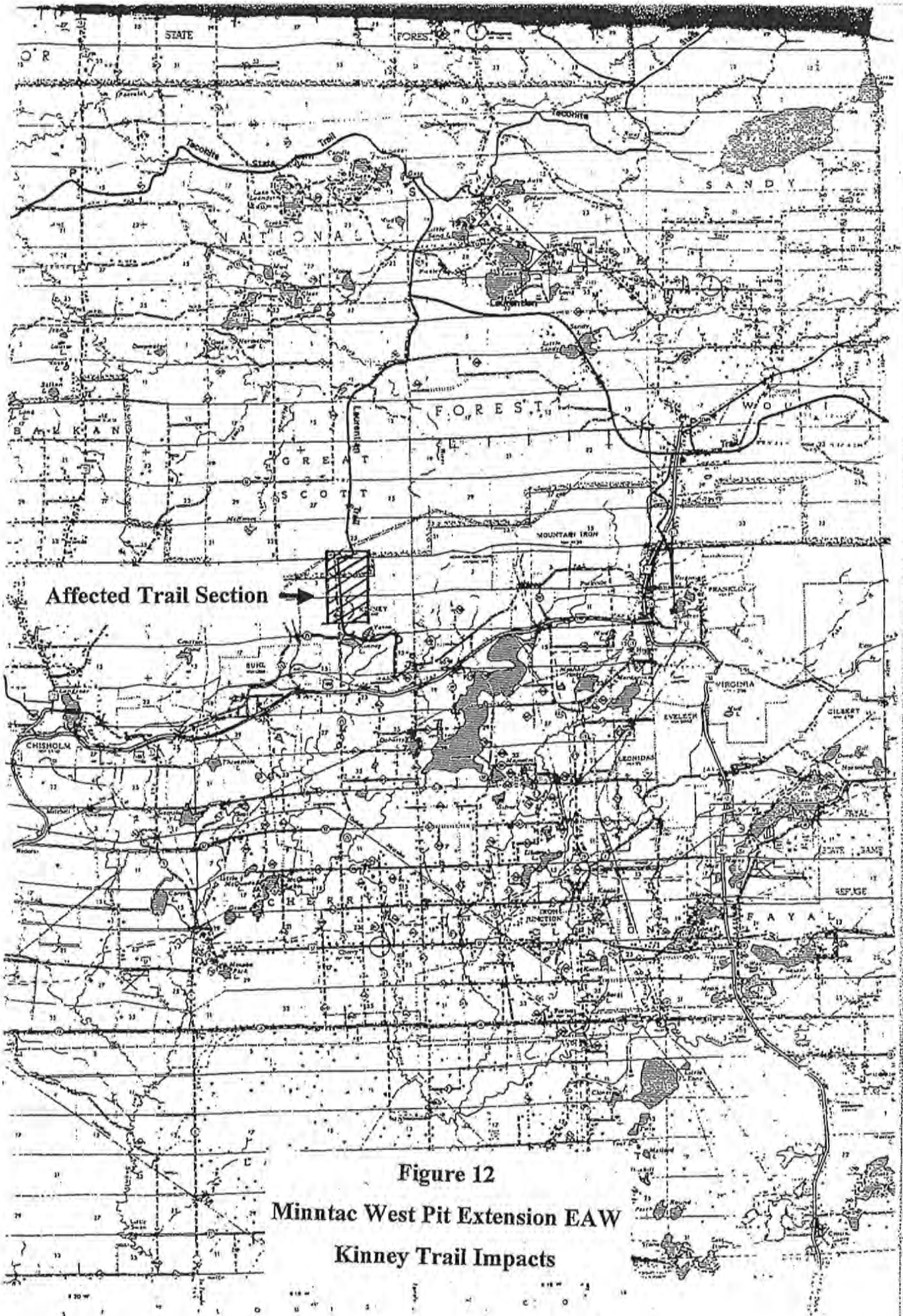


Figure 12

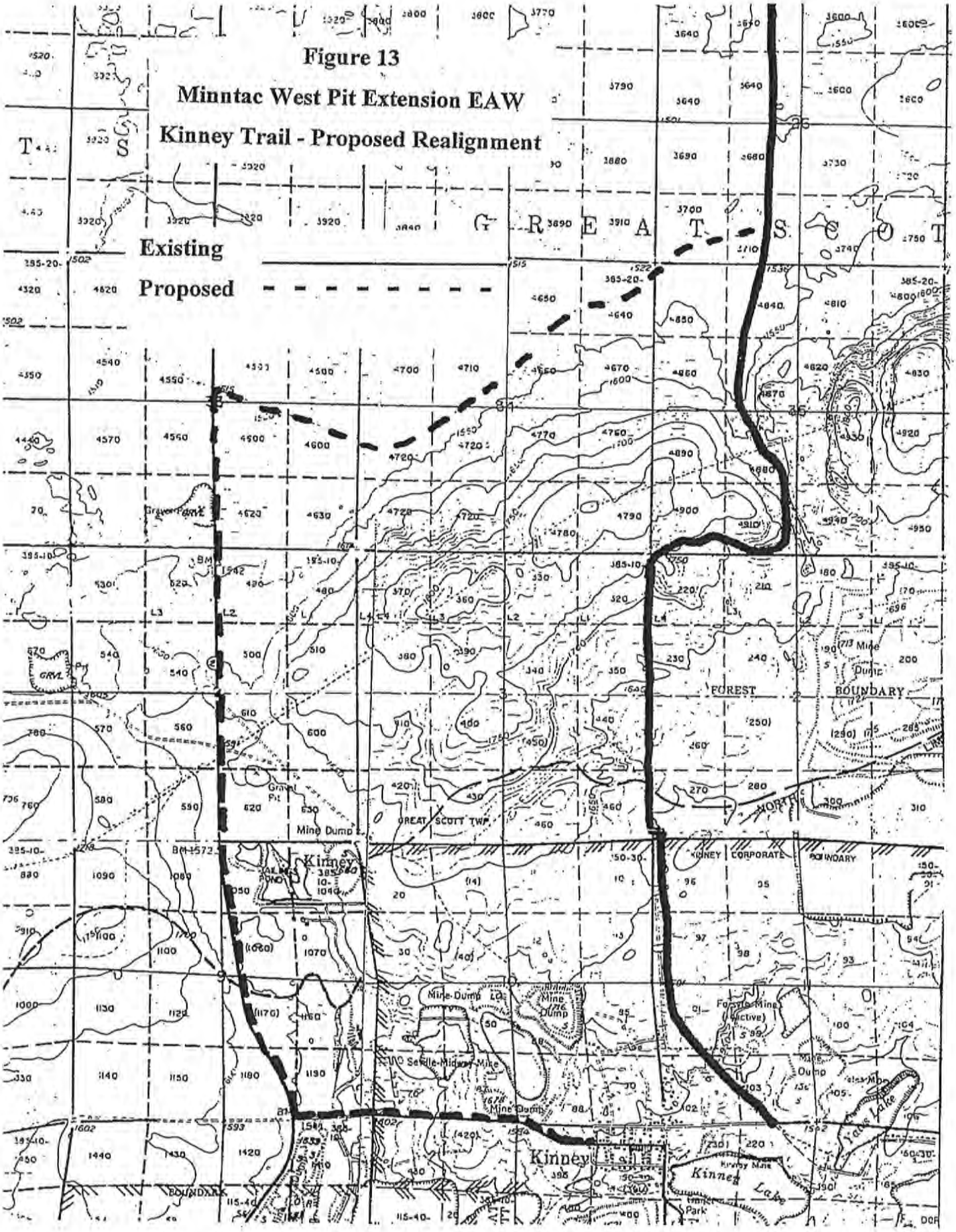
Minntac West Pit Extension EAW

Kinney Trail Impacts

Figure 13

Minntac West Pit Extension EAW

Kinney Trail - Proposed Realignment



Appendix 1

Minntac West Pit Extension EAW

404/WCA Wetland Information

West Pit Expansion

U.S. Steel is a taconite mining and processing operation located in Northeastern Minnesota. The facility includes an open pit taconite mine, crushing plant, concentrating plant, agglomerating plant, tailings disposal basin, and associated equipment, repair, personnel and administrative facilities.

The proposed project is the continuing development of the open pit mine for the extraction of taconite ore. The project is located in the following area:

Township 58N, Range 19W and in all or parts of the following:

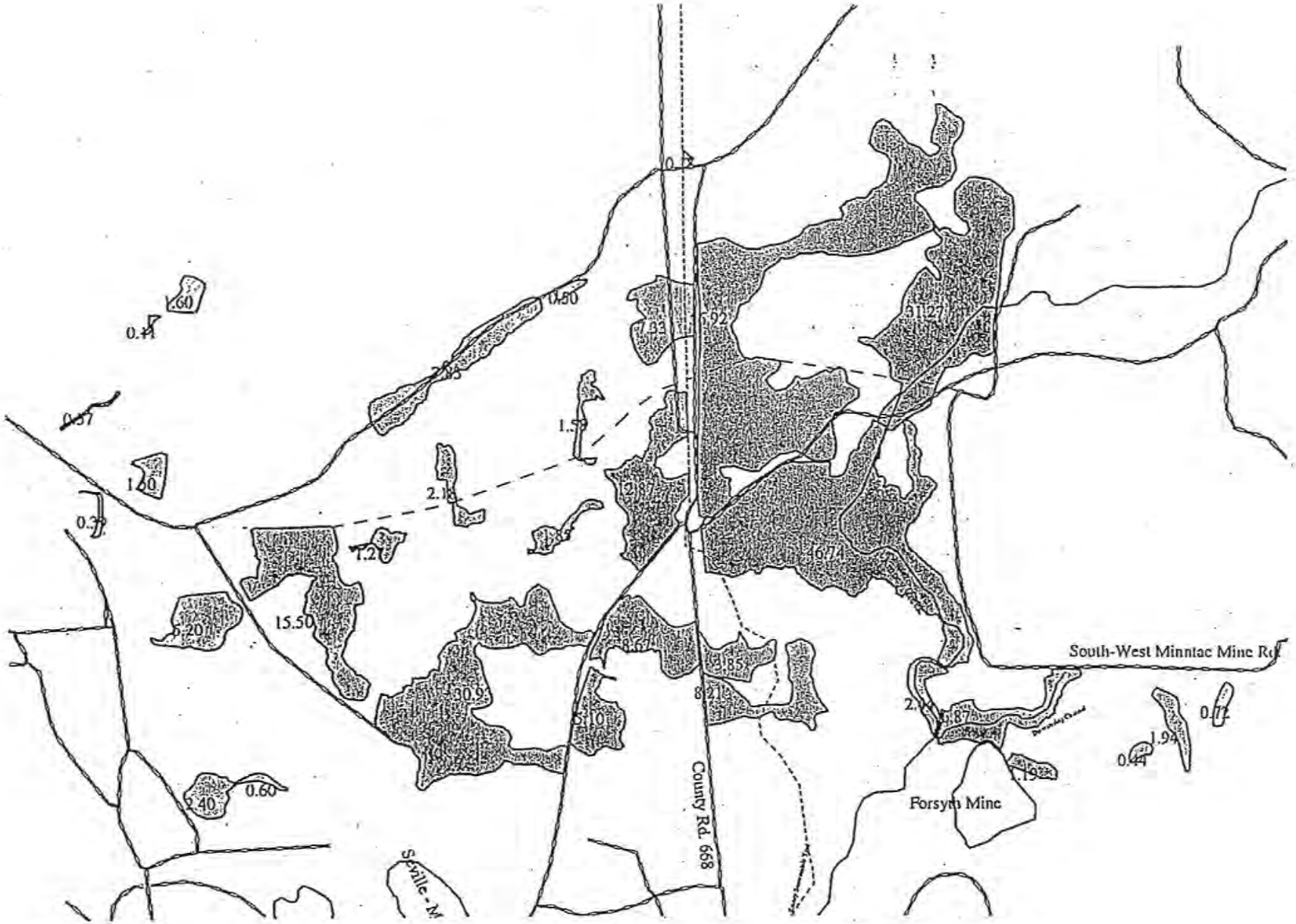
Great Scott Township

SW 1/4 Section 2
NW 1/4 of SE 1/4 Section 2
NE 1/4/ of SE 1/4 Section 3
S 1/2 of SE 1/4 Section 3
SW 1/4 of Section 3
E 1/2 of NE 1/4 Section 9
E 1/2 of SE 1/4 Section 9

Kinney Township

NW 1/4 Section 10
SW 1/4 Section 10
NE 1/4 Section 10
NW 1/4 Section 11
S !/2 of NE 1/4 Section 11

Wetlands within the proposed mine expansion area were delineated and mapped. Figure D-1 indicates the wetland areas as field verified. Included in this appendix are the field data sheets which describe the soil, wetland vegetation and hydrology of the individual wetlands. The following table summarizes dominant wetland types and their acreage.



Total Wetland Acres = 274.0

Figure D-1
U.S. Steel

Summary of Wetland Field Data West Pit Expansion[1]					
Wetland Number	Wetland Type	Dominant Species	Matrix Color		Hydrologic Characteristics
			Soil	Mottles	
D-1	PFOB	F. nigra A. rugosa Carex spp. Salix spp. P. tremuloides Sphagnum spp.	7.5 YR 4/2	-	saturated
D-2	PFOB	F. nigra A. rugosa Carex spp. A. alba Sphagnum spp.	7.5.YR 4/2	-	saturated
D-3	PSSC	F. nigra A. rugosa Salix spp. B. inermis	7.5 YR 4/2	-	saturated
D-4	PFOB	F. nigra A. rugosa P. mariana Carex spp.	7.5 YR 4/2	-	saturated
G-1		Salix spp. B. inermis P. arundinacea A. rugosa	7 YR 2/1	-	inundated saturated
G-2		A. balsamea P. mariana F. nigra A. rugosa Carex spp.	7 YR 2/1	-	saturated
G-3		P. arundinacea A. rugosa Salix spp.	7 YR 3/1	-	inundated saturated
G-4	PSSC	A. rugosa F. nigra P. tremuloides S. gigantea Sphagnum spp.	10 YR 4/1	-	saturated
G-5	PSSC	P. tremuloides Salix spp. F. nigra	7.5 YR 4/1	-	saturated
M-1	POWFh	Salix spp. T. latifolia	7.5 YR 5/1	7.5 YR 5/4	inundated saturated

		Carex spp. A. rugosa P. tremuloides			
M-2	PFO4B	P. mariana A. rubrum Salix spp. Carex spp. L. groenlandicum	7 YR 2/1	7 YR 5/6	saturated
M-3	PSSC	F. nigra Carex spp. A. repens B. inermis A. rugosa P. tremuloides	7.5 YR 3/1	7.5 YR 3/4	saturated
M-4	PSSC	P. tremuloides F. nigra A. alba A. rugosa	7.5 YR 4/1	-	inundated saturated
WL-1	PEMB	Typha spp. Carex spp. A. rugosa A. balsamea P. arundinacea	10 YR 5/2	-	inundated saturated
WL-2	PSSC/EMB	Typha spp. P. arundinacea A. rugosa Salix spp. F. nigra P. tremuloides	10 YR 5/1	10 YR 5/4	saturated
WL-3	PEM/SSC	Carex spp. Typha spp. A. rugosa F. nigra B. inermis	7.5 YR 4/1	-	saturated
WL-4	PSSC	A. balsamea A. rugosa Carex spp. A. repens C. stolinifera P. arundinacea	7.5 YR 2/2	-	saturated
WL-5	PSSC/EM	A. balsamea A. rugosa Carex spp. P. tremuloides	10 YR 2/2	10 YR 4/4	saturated
WL-6	PEM/SSC	A. rugosa A. balsamea P. tremuloides Carex spp. B. inermis	10 YR 2/2	-	inundated saturated

		Typha spp.			
WL-7	PSSC	A. rugosa F. nigra P. tremuloides Salix spp. Sphagnum spp. Carex spp.	7.5 YR 4/1	7.5 YR 4/4	saturated
WL-8	PSSC	F. nigra A. rugosa Salix spp. Carex spp. B. inermis	7.5 YR 4/1	-	saturated
WL-9	PSSC	F. nigra A. rugosa A. balsamea Salix spp. Carex spp. J. effusus	7.5 YR 4/1	-	saturated
WL-10	PSSC	F. nigra Salix spp. Carex spp. J. effusus	7.5 YR 4/1	-	saturated
WL-11	PSSC	A. rugosa A. balsamea Carex spp. P. tremuloides J. effusus	10 YR 5/1	-	saturated
WL-12	PEM/SSC	A. rugosa Typha spp. A. balsamea F. nigra Carex spp.	10 YR 5/1	-	saturated
WL-13	PFO4B	F. nigra A. balsamea A. rugosa Carex spp. P. aquilinum	10 YR 5/1	10 YR 5/4	saturated
WL-14	PFO1B	F. nigra A. rugosa Carex spp. Typha spp.	10 YR 4/1	-	saturated
WL-15	PFO1B	F. nigra A. rugosa C. stolonifera Carex spp. Scirpus spp.	7.5 YR 4/2	7.5 YR 4/4	saturated
WL-18	PFO1B	F. nigra A. rugosa P. tremuloides	2.5 YR 4/1	-	saturated

		Carex spp. P. arundinacea			
WL-19	PFO1B	P. tremuloides F. nigra Salix spp. A. rugosa Carex spp.	7.5 YR 4/1	7.5 YR 4/4	saturated
WL-20	POW/FO1B	P. tremuloides F. nigra A. rugosa Scirpus spp. Carex spp.	7.5 YR 4/1	7.5 YR 4/4	saturated
WL-21	PFO1B	F. nigra A. rugosa Carex spp. Salix spp.	7.5.YR 4/1	-	saturated
WL-22	PFO1B	A. balsamea A. rugosa P. tremuloides Carex spp.	10 YR 4/1	-	saturated

The proposed project requires a mandatory Environmental Assessment Worksheet (EAW). The Minnesota Department of Natural Resources is the State agency responsible for preparing the document. A complete description of the area land use, socio-economic impacts, wildlife, archaeological and historic sites and other information is contained in that document.

The proposed impacts will be withdrawn from the USS/Inland wetland bank as impacts are incurred and the appropriate wetland recording notices will be filed.

List of Dominant Vegetation Observed

Wetland Boundary

Common Name	Scientific Name	Indicator Status	Stratum
Sphagnum moss	Sphagnum magellanicum	OBL	H
Bulrush	Scirpus sp.	OBL	H
Wool grass	Scirpus cyperinus	OBL	H
Cattail	Typha sp.	OBL	H
Soft rush	Juncus effusus	OBL	H
Sedge	Carex sp.	OBL	H
Swamp aster	Aster lucidulus	FACW+	H
Reed canary grass	Phalaris arundinacea	FACW+	H
Cottongrass	Eriophorum spissum	OBL	H
Labrador tea	Ledum groenlandicum	OBL	H
Quack grass	Agropyron repens	FACU	H
Redtop	Agrostis alba	FACW	H
Giant goldenrod	Solidago gigantea	FACW	H
Willow	Salix sp.	FACW-OBL	S →
Speckled alder	Alnus rugosa	OBL	S
Red-osier dogwood	Cornus stolinifera	FACW	S
Box elder	Acer negundo	FACW-	S
Elderberry	Sambucus canadensis	FACW-	S
Black spruce	Picea mariana	FACW	T
Balsam fir	Abies balsamea	FACW	T
Black ash	Fraxinus nigra	FACW+	T
Trembling aspen	Populus tremuloides	FAC	T
Balsam poplar	Populus balsamifera	FACW	T
Tamarack	Larix laricina	FACW	T
Red maple	Acer rubrum	FAC	T
Yellow birch	Betula alleghaniensis	FAC	T

Non-Wetland Boundary

Common Name	Scientific Name	Indicator Status	Stratum
Smooth bromegrass	Bromus inermis		H
Quack grass	Agropyron repens	FACU	H
Grant goldenrod	Solidago gigantea	FACW	H
Bracken fern	Pteridium aquilinum	FACU	H
Stinging nettle	Laportea canadensis	FACW	H
Large-leaved aster	Aster macrophyllus		H

Wooly yarrow	Achillea lanulosa	FACU	H
Redtop	Agrostis alba	FACW+	H
Timothy	Muhlenbergia glomerata	FACW+	H
Kentucky bluegrass	Poa pratensis	FAC-	H
Beaked hazel	Corylus americana	FACU-	S
Box elder	Acer negundo	FACW-	S
Mountain maple	Acer spicatum	FACU	S
Trembling aspen	Populus tremuloides	FAC	T
Paper birch	Betula papyrifera	FACU+	T
Balsam Fir	Abies balsamea	FACW	T
Basswood	Tilia americana	FACU	T
White spruce	Picea glauca	FACU	T
Red maple	Acer rubrum	FAC	T
Northern red oak	Quercus rubra	FACU	T
Red pine	Pinus resinosa	FACU	T
Jack pine	Pinus banksiana	FACU	T

Typical Soil Indicators Observed

Wetland Boundary

Typical soils were clay loams and loamy clays with matrix colors of 5 YR, 7.5 YR, and 10 YR; value/chromas of 5/1, 4/1, 5/2, 4/2; and combinations of histic epipedons exceeding 8 inches thick, gleyed horizons within 18 inches of surface, low chroma mottles, and oxidized rhizospheres.

Non-wetland Boundary

Typical soils were clay loams and loamy clays with matrix colos of 5 YR, 7.5 YR, and 10 YR; value chromas of 5/3, 4/3, 5/4, 4,4; and no indications of mottling, gleying, organic soil, or oxidized rhizospheres.

U. S. Steel
Minnesota Ore Operations
P.O. Box 417
Mt. Iron, MN 55768

Appendix 2

US STEEL-MINNTAC MINE EXTENSION

NOISE EVALUATION

March 15, 1996

Laurie Potter, CIH
Staff Supervisor
Chemistry/Industrial Hygiene

U. S. Steel
Minnesota Ore Operations
P.O. Box 417
Mt. Iron, MN 55768

US Steel-Minntac Mine Extension
Noise Evaluation
03-15-96

Purpose

A noise survey was conducted in the Minntac Mine, on four days in February and March, 1996. The purpose of the survey was to gather data with which to determine potential noise exposures at the nearest Kinney residence to the proposed Minntac mine extension.

Definitions

Activity/EN: Type of work being conducted during sampling period, with computerized results recorded as event numbers (EN)
dBA: Unit of sound pressure level expressed as decibel on the "A" scale
L10: Sound pressure level, expressed in dBA, which is exceeded 10% of the time
L50: Sound pressure level, expressed in dBA, which is exceeded 50% of the time
Lav5: Integregated sound pressure level over time, based on a 5 decibel exchange rate
SPL: Instantaneous sound pressure level

Referenced Standards:

Minnesota Rules Chapter 7030.0060 Subparts 1-4.
ANSI S1.4-1983 S1

Instruments:

Bruel & Kjaer Type 2235 Precision Integrating Sound Level Meter; A-weighting, fast response (Serial No. 1785735) with Weather screen and tripod;
Bruel & Kjaer Type 4230 94 dB, 1000 Hz Calibrator (Serial No. 596261)

Methodology

In accordance with Minnesota Rules, as referenced above, noise sampling was conducted on four days in February and March, 1996. Several pieces of mining heavy equipment were selected for the evaluation, based on the ability to

measure isolated sound from each piece of equipment, at a distance of 2500 feet. The following pieces of mining equipment were evaluated:

:Truck shovel
:Rail shovel
:Loader
:Production truck
:Rotary drill
:Locomotive

Weather conditions were noted, and sampling days were chosen when the temperature exceeded 5ºF, and the wind was relatively calm. (See Table 2.)

Sound levels were measured over time, in order to collect a representative sample, while the mining equipment was operating. Average sound levels (Lav5) were collected, as well as L10 and L50 values, or sound levels which were exceeded 10% and 50% of the time, respectively. These results are listed in Table 1.

A worst case evaluation of noise was also conducted, where two shovels were both working, at a distance of approximately 2500 feet from the test equipment.

Current sound levels in Kinney at shift change and shortly thereafter, were likewise measured.

Results

Table 1: Equipment vs Lav5, L10, and L50 at 2500 feet
Table 2: Weather Conditions
Table 3: Noise Standard (7030.0040)

Discussion

In order to determine the potential impact to the population adjoining US Steel-Minntac's mine extension, a noise survey was conducted, in accordance with Minnesota Rules Chapter 7030.0060 Subparts 1-4. The nearest household to the proposed extension, is located 2500 feet from the perimeter of the extension. Therefore, noise sampling was conducted at this distance from various pieces of mining equipment, in order to predict the exposure, at this distance.

Minnesota Rules for (community) noise exposures are set up based on the type of occupancy (noise area classification) as well as the time of day, and allow for exceedance of specific standards, 10% and 50% of the time, i.e. L10 and L50. Results from this survey were compared with the most conservative noise area classification (1) which includes residential housing (See Table 2). The class 1 daytime L10 and L50 are 65 and 60 dBA, respectively, while the nighttime values are 55 and 50 dBA, respectively.

The mining process begins with the drilling of a pattern using a rotary drill. Therefore, a noise evaluation was conducted, 2500 feet from the #30 GD drill. The Lav5, L10 and L50 values measured on this drill were found to be 43.5, 46.5 and 37.5 dBA, respectively. These values were within the acceptable standards for both daytime and nighttime exposures.

Once a pattern is drilled and blasted, shovels are used to transfer ore into either production trucks or trains. Therefore, truck and train shovels were both evaluated. The Lav5, L10 and L50 on a truck shovel (#27 P&H) were measured at 44.3, 46.5, and 39.5 dBA, respectively, while the same values on a rail shovel (#24 P&H) were found to be 47.6, 50.0 and 46.5 dBA. These values were within the acceptable standards for both daytime and nighttime exposures.

A worst case scenario was also evaluated where two shovels operated approximately 2500 feet from the test equipment, one bench level apart. The #24 Marion rail shovel and #32 BE truck shovel were evaluated, where the Lav5, L10 and L50 were found to be 54.1, 56.5, and 53.0 dBA, respectively. The measured L10 and L50 values were within the acceptable standards for daytime exposures, only.

Periodically, a loader is used to transfer ore, when a shovel is not available. Therefore, this exposure was also evaluated when a 992-CAT loader filled a 240 ton CAT production truck. (The #42 drill was operating in the background at a distance of approximately 3000 feet.) The Lav5, L10 and L50 were measured at 44.0, 48.5, and 38.0 dBA. The measured L10 and L50 values were within the acceptable standards for both daytime and nighttime exposures.

The last phase of mining is the movement of ore, either to a train via a production truck, or by a train to the crusher. The Lav5, L10 and L50 cannot be evaluated at 2500 feet with a moving target. However, a simple instantaneous sound pressure level (SPL) can be measured. This value was found to be 44.0 dBA on a 240 ton CAT truck, and 41.6 dBA on the 951 locomotive, at a distance of 2500 feet. Neither of these values for the truck or locomotive SPL exceeded the daytime or nighttime L10 or L50 standards.

The final piece of sampling data that was collected for this study, was information on the current sound level readings in the town of Kinney, during and after shift change. During the 3 p.m. shift change, the Lav5, L10 and L50 were found to measure 64.7, 69.0, and 63.5 dBA. The same Lav5, L10 and L50 readings shortly after shift change were found to be 58.2, 63.5, and 52.5 dBA, respectively. These values satisfied MPCA's noise area classification 3 requirements for highways and street right-of-ways, for both daytime and nighttime L10 and L50 values (See Table 2).

Conclusions

The purpose of this study was to gather data with which to predict potential noise exposures at the nearest Kinney residence to the proposed Minntac mine extension. The conclusion of this study is that the noise standards set forth by Minnesota rules will not be exceeded at the nearest residence, i.e. 2500 feet from the perimeter of the proposed mine, based on either daytime or nighttime, noise area classification 1 L10 and L50 values, which were gathered from isolated mining heavy equipment. Also, the results of the worst case scenario, where two shovels operated within 2500 feet of the test equipment, indicate that the daytime L10 and L50 values will not be exceeded at the nearest residence from the mine perimeter.

TABLE 1: MINING EQUIPMENT vs Lav 5, L10, L50 at 2500'

PARAMETER	MINING EQUIPMENT						
EQUIPMENT	30 GD DRILL	TS27-P&H TRUCK SHOVEL	RS15-P&H RAIL SHOVEL	RS24/TS32 RAIL/TRK SHOVELS	240T/992 TRUCK & LOADER	240TON CAT TRUCK	951 LOCO
ACTIVITY/EN	DRILL/24	LOAD/21	LOAD/17	LOAD/9	LOAD/26	HAULING	HAULING
DISTANCE	2500'	2500'	2500'	2500'	2500'	2500'	2500'
Lav 5	43.5	44.3	47.6	54.1	44.0	44.0*	41.6*
L10	46.5	46.5	50.0	56.5	48.5	NA	NA
L50	37.5	39.5	46.5	53.0	38.0	NA	NA

where:

Lav 5, L10, L50 are in dBA

*: Listed value = SPL, not Lav 5

Table 2: Weather Conditions

Date	Temp oF	WS	WD	Dewpoint
	Degree F	mph	Degree F	Degree F
2/8/96	10-40	0 -12	320	06-27
2/9/96	21-34	0 -10	130	19-27
3/6/96	06-20	10-12	040-110	03-13
03/14-96	28	06	332	28

(Courtesy of Hibbing Chisholm Municipal Airport)

where: WD: Wind direction
WS: Wind speed

Table 3: Noise Standard (7030.0040)

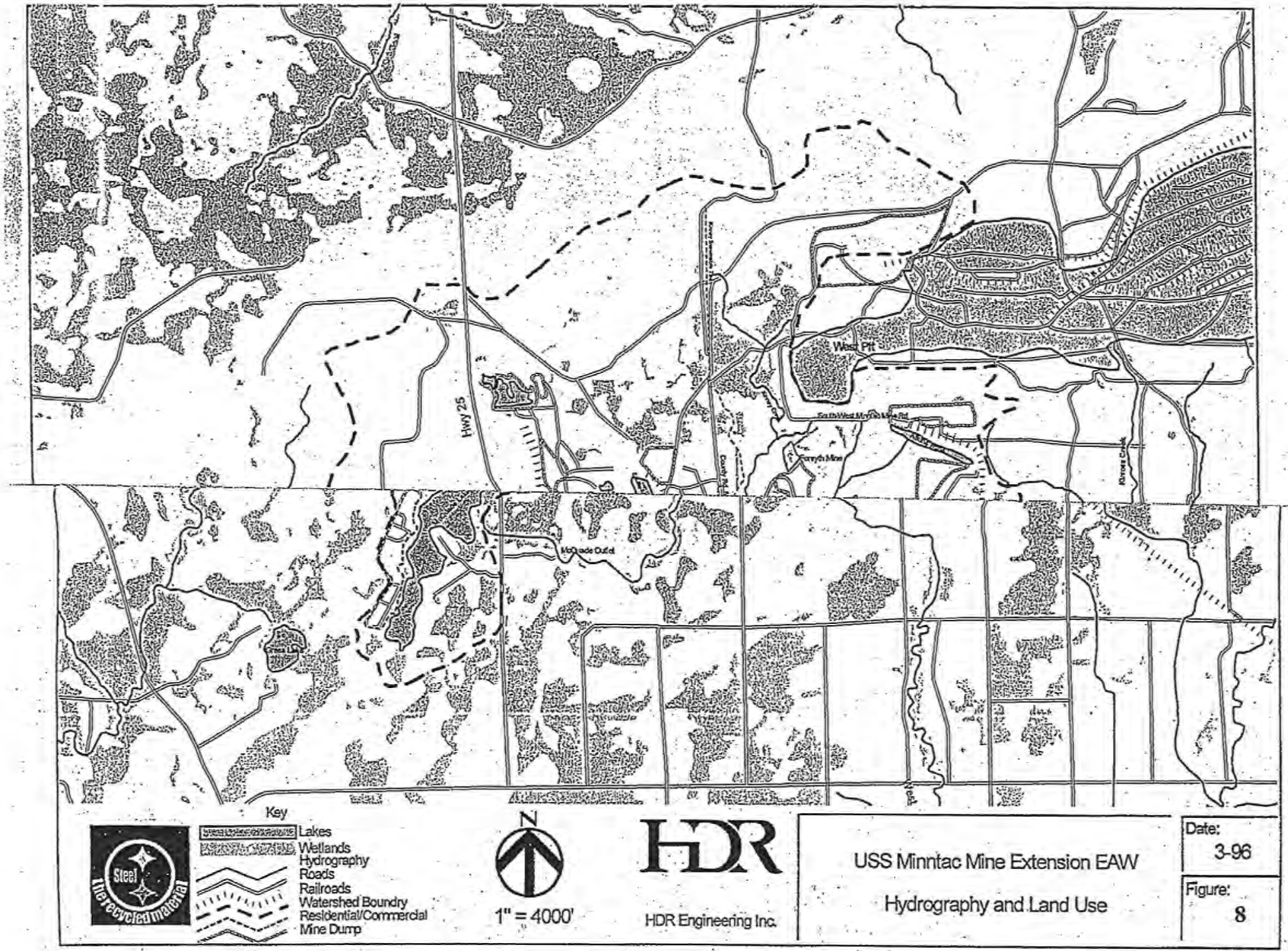
Noise Area Class	Daytime		Nighttime	
	L10	L50	L10	L50
1-(Households)	65	60	55	50
3-(Highways)	80	75	80	75

where: unit of measure= dBA

Table 4: Kinney Shift Change Data

PARAMETER	KINNEY	
ACTIVITY	SHIFT CHANGE	BACK-GRND
EVENT NUMBER	11	12
DISTANCE	5'	5'
Lav 5	64.7	58.2
L10	69.0	63.5
L50	63.5	52.5

where: unit of measure= dBA

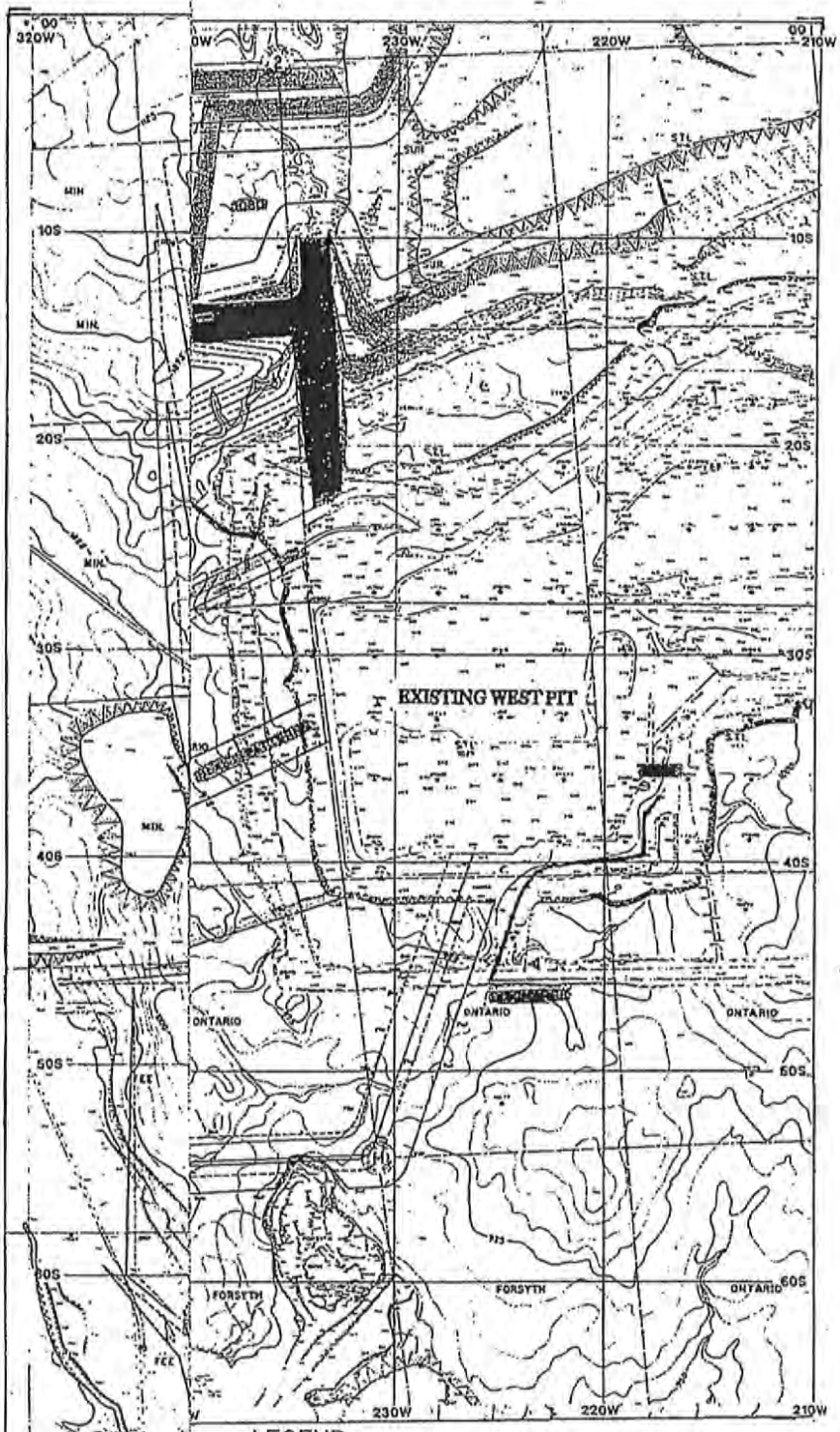

West PH
Hwy 25
Key
Lakes
Wetlands
Hydrography
Roads
Railroads
Watershed Boundry
Residential/Commercial
Mine Dump
N
1" = 4000'
HDR
HDR Engineering Inc.
USS Minntac Mine Extension EAW
Hydrography and Land Use
Date:
3-96
Figure:
8

USS Minntac Mine Extension EAW

Future Conditions
Hydrography and Land Use

Date: 3-96

Figure: 9



LEGEND

- OVER BURDEN
- LOWER SLATY (LS)
- WASTE ROCK
- SURFACE BANK
- WASTE ROCK STOCK PILE

ntac Mine Extension EAW

oment-Initial Preproduction Stage

Preliminary Plan

Date 3-96

Figure 4

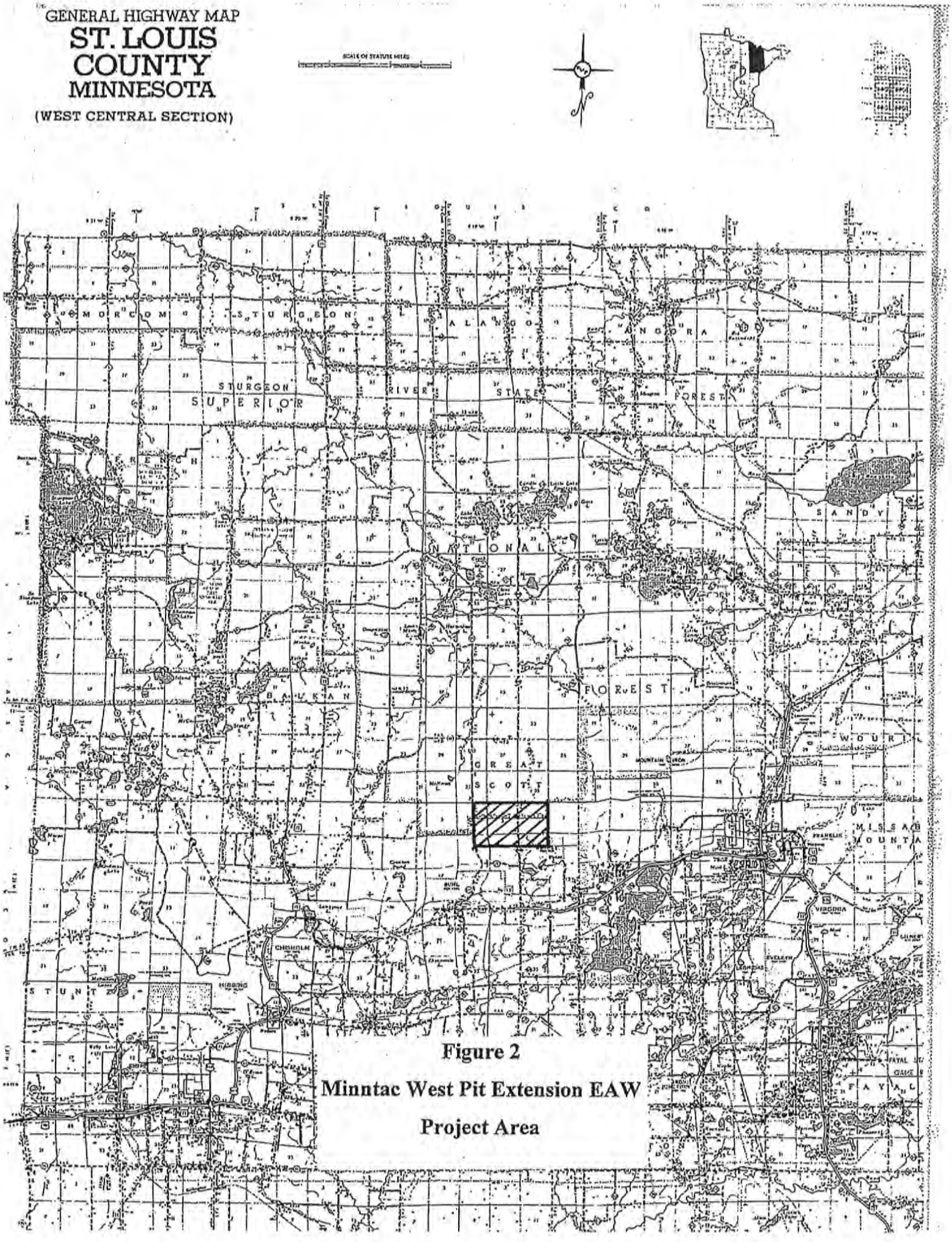


Figure 2

Minntac West Pit Extension EAW

Project Area

file

Minnesota Department of Natural Resources

500 Lafayette Road
St. Paul, Minnesota 55155-4010

DATE: June 10, 1996

TO: Parties on the EAW Distribution List
Other interested parties and persons

FROM: Rebecca Wooden, Environmental Planner **PHONE:** (612)297-3355
Environmental Review Section
Office of Planning

RE: U.S. Steel - Minntac Proposed Mine Extension Project
St. Louis County, Minnesota
Environmental Assessment Worksheet (EAW)
Record of Decision

The Department of Natural Resources (DNR), as Responsible Governmental Unit for environmental review of U.S. Steel - Minntac's proposed Mine Extension Project in St. Louis County, Minnesota, has prepared the attached Record of Decision regarding the need for an Environmental Impact Statement (EIS) for the project. The DNR concludes that an EIS is not required and orders that a Negative Declaration be recorded. The justification for this determination is contained in the Record of Decision.

The Negative Declaration concludes the state environmental review process under the Environmental Quality Board rules, Minnesota Rules parts 4410.1000 to 4410.1700. This project may proceed to permitting.

Attachment: Record of Decision

#960067-01
USX/USXROD.doc

Minnesota Board of Water & Soil Resources

January 18, 2012

Kate Paul
1525 3rd Ave. E.
DNR Minerals Hibbing Office
Hibbing, MN 55746

Re: Palisades III Review – Aitkin County

Dear Kate:

BWSR Central Office staff completed a cursory review of the Palisade III wetland replacement plan. This letter is being provided to the Corps of Engineers as well as the DNR, and serves as BWSR's central office comments to both agencies. While our comments focus on the MN Wetland Conservation Act (WCA), they are also relevant to Clean Water Act Section 404.

From our understanding, the applicant has chosen to pursue wetland replacement credit for this site as a wetland bank for federal Clean Water Act purposes, but as project-specific replacement for WCA purposes. This is unusual. However, deposit in the State Wetland Bank is not required for WCA wetland replacement when it can be clearly designated for a specific project and the wetland impacts associated with it. We trust that the DNR will ensure the project is specifically identified, as any unused "credits" would not available for other yet-to-be-determined projects.

Wetland replacement in Minnesota, including those approved under a permit-to-mine, must comply with the wetland replacement standards of MN Rule 8420. These standards are identical for wetland banking and project-specific replacement. Our limited review was based on consistency with those WCA replacement standards, and has identified significant concerns with the mitigation plan as proposed.

Incomplete Information

In general, the Wetland Mitigation Report and associated documents contained a substantial amount of data and analyses, in many cases well beyond what is necessary. However, it lacks basic information that is needed to evaluate it for compliance with WCA, regardless of whether it is proposed for banking or project-specific replacement. Examples of that information include:

- The plan does not identify a proposed action to generate credit (M.R. 8420.0526), nor does it identify how much credit is proposed, on what basis it is proposed, and for what areas it is proposed. The nearest reference we found was located within the "Crop History Review" (section

Bemidji	Brainerd	Duluth	Fergus Falls	Marshall	Mankato	New Ulm	Rochester
4 West Building	1601 Minnesota Drive	394 South Lake Ave., Room 403	1004 Frontier Drive	1400 East Lyon Street	1160 Victory Drive S., Suite 5	261 Highway 15 South	2300 Silver Creek Rd N.E.
403 Fourth St. NW, Suite 200	Brainerd, MN 56401	Duluth, MN 55802	Fergus Falls, MN 56537-2505	Marshall, MN 56258	Mankato, MN 56001-5358	New Ulm, MN 56073	Rochester, MN 55906
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(218) 755-2600							

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2.4), which mentioned two WCA provisions for restoring farmed wetlands (see additional comments below). In addition, the "Crop History Review" was inadequate and did not contain sufficient detail.

- The plan references a wetland delineation report, but none was found. The only documentation of a wetland delineation found was a rather poor map at an inadequate scale. We found no data sheets or supporting information consistent with the 1987 Wetland Delineation Manual. This information is vital to assess the actions proposed to establish wetland, eligibility and potential credit yield, and other aspects of the proposed plan. In addition, the plan refers to "relict" hydric soils and that "99%" of the site "was once wetland." Yet the wetland map appears to indicate that much of the site is currently wetland. These are contradictory and raise questions about the existing conditions and how replacement credit was determined.
- The plan does not clearly identify which ditches will be abandoned/plugged, and which will be maintained. It uses vague language such as "it is *presumed*," and "*if* all of the drainage ditches are abandoned," and "*many* of the drainage ditches... *may* be abandoned." This does not constitute a restoration plan. Specifically which ditches will be abandoned and plugged, and how? Which will be maintained? How can the site be restored to natural hydrologic conditions if the ditches will remain? In addition, public drainage systems typically have substantial rights-of-way that, if not abandoned, will affect any restoration plan; in addition to effects on hydrology, structures cannot be placed and credits cannot be obtained within the ROW. All of this is the most important information relating to restoration feasibility, and should have been the first thing investigated, prior to investing in site design, etc.
- Issues identified below are described separate, but they also have incomplete information provided in the plan.

Construction Design and Vegetation Establishment

- The construction plan document represents a poor design and does not include the detail needed for our engineering staff to understand the proposal and develop comprehensive comments. Specifically, the replacement plan does not include proposed pool elevations that would allow one to design outlets and estimate credit yield. Outlet pipes with knife gates are not desirable for wetland restoration as they can only be open or closed. This does not appear to be a site that will lend itself well to water level management anyway. If the knife gates are used and closed, there is no way to control wetland water elevations. Our recommendation is to require outlet structures for these wetlands that are sustainable, will provide for a set pool elevation, and will allow discharge from them to safely enter adjoining downstream ditch systems. The current structures that are planned meet none of those criteria. As part of that, the grading plan would also need to be reviewed in detail to ensure consistency with clearly defined planned pool elevations once they are more clearly defined.

- The project is also large enough in scope to require a NPDES permit from the State. The current plan shows some silt fence and seeding but the SWPPP, as part of the NDPES permit, will require

more detail with regard to these planned erosion and sediment control measures.

- The proposed project does not appear to be sustainable as heavy grading will create pools that will require human intervention to maintain the site, including ditch maintenance.

- The vegetation plan does not adequately describe what is being proposed to restore native vegetation onsite. Inconsistency of elevations for communities in the text versus the seed tables needs to be corrected. The planting methods discussion needs to elaborate on the sequencing and timing of construction and planting activities and discuss how, where, and why woody species will be planted. The maximum source distance for seed and plants should also be specified in the plan. A vegetation maintenance schedule should be added to include how, when and where the activities will be implemented. In addition, to aid in native vegetation establishment, an invasive species map should be prepared to aid in control measures. The inconsistency in the allowable percent of invasive species should be clarified as either 15 or 20 percent. Other considerations offered include eliminating Cottonwood from the plan as this specie may become a problem in restored wet meadow areas. It is also recommended to hold back on the timing of some seeding in order to evaluate what comes from the native seed bank and how seed mixes could be tailored to include species that are not dominate in the native seed bank.

- The communities proposed do not emulate pre-development conditions. A less intensive construction design, that does a better job of restoring natural hydrology, would likely restore plant communities that better fit the local area and require less maintenance and management in the long term.

Method of Replacement and Credit Allocation

As discussed above, the only mention of the proposed actions eligible for credit were found in the "Crop History Review," and identified M.R. 8420.0526, Subp. 4 (restoration of partially drained or filled wetland areas) and Subp. 5 (vegetative restoration of farmed wetlands). As such, we assume one or both of these are proposed as the primary action for obtaining credit. In addition, the report states that the site is "appropriate for wetland restoration" and discusses the problems associated with created wetlands. However, the proposed plan does not propose to restore the wetlands. Rather than restoring the hydrology of the site, and thus restoring naturally occurring wetlands and the associated functions, the plan proposes to excavate down to groundwater in order to obtain hydrology, and surround those excavated areas with constructed berms. Such a plan consists of excavation and impoundment, and is better described as a creation than a restoration.

The excavation/impoundment plan is also inconsistent with the WCA actions identified in the report:

- M.R. 8420.0526, Subp. 4 (restoration of partially drained or filled wetland areas) allows the allocation of credit for "restoration of both the natural hydrology regime and native, noninvasive vegetation..."

- M.R. 8420.0526, Subp. 5 (vegetative restoration of farmed wetlands) allows the allocation of credit for the "reestablishment of permanent native, noninvasive vegetative cover on farmed wetland areas that have not been affected by prior drainage or filling..."

The proposed actions do not comply with either of these provisions. It does not propose the restoration of the natural hydrology regime (Subp. 4) and, according to the plan; the entire site has been altered by drainage.

- The only thing we found regarding credit allocation was an indirect reference in the "Proposed Project" section which stated that, of the 1,416 acre site, 1,074 acres would be used for Keetac/Minntac and 480 acres would be "banked." This brings up two significant concerns:

  - The plan evidently proposes to obtain a total of 1,554 acres of credit from a 1,416 acre site. Not only is this inconsistent with State and federal wetland regulations, but it doesn't take into consideration areas within ditch ROW, areas filled for berms, upland buffer credits, and areas that may be ineligible or eligible for reduced amounts of credit. The plan must contain a detailed breakdown of what actions eligible for credit are proposed for each specific area, justification that each area is eligible, and how much credit is proposed.
  - The plan proposes to bank excess credits for future use. This is inconsistent with our understanding, which was based on verbal information provided after our recent conference call. If a *specific* project and associated wetland impacts are not identified, excess credits must be deposited in the State Wetland Bank to be eligible for future use.

- Based on the map of existing wetlands and the proposed construction plan, it appears that substantial areas of existing wetland are proposed to be filled for berms and upland buffer. Not only should credit not be granted for any areas of filled wetland, that fill could actually be a wetland impact that requires replacement.

- The overarching replacement requirement of WCA is the replacement of functions and public value lost to wetland impacts. The current plan appears to consist primarily of excavation down to the groundwater table, construction of berms, and a reliance on precipitation. The functional benefits of these activities are questionable. For example, excavation down to groundwater can reduce the soil's filtration capacity and, in the absence of hydrologic restoration, water quality and floodwater retention functions are unlikely to be improved significantly over current conditions.

Summary

The report was quite voluminous. If any of the above comments are a result of information that we missed, please inform us of its location. Since this site is not currently proposed for banking, our comments are less comprehensive due to staff time limitations. They are adequate, however, to draw some important conclusions.

In general, we found the report woefully inadequate. The report contained a substantial amount of data (more than necessary), but lacked essential information and contained incorrect information. BWSR also has significant concerns that the proposed project does not meet WCA wetland replacement standards. Some of these concerns could possibly be addressed by providing additional information, but others likely cannot be addressed without a substantial re-design of the project that reduces the amount of grading/filling/reliance on berms, addresses drainage, and restores hydrology.

If proposed as project-specific replacement, DNR is the agency responsible for ensuring compliance with WCA for this site. As such, we encourage DNR to involve the appropriate technical and engineering staff to review any plan re-submittals, along with these comments, to ensure compliance with the WCA wetland replacement standards. We also would encourage the applicant to obtain up-front input from regulatory agencies prior to committing substantial site investments in the future.

If you or your co-workers have questions regarding this review please call me at 651-215-1703 and we will be glad to discuss the proposal and the comments provided for your consideration.

Sincerely,

Dan Girolamo

Dan Girolamo
Wetland Bank Administrator

Others that contributed to these comments:
Les Lemm, Wetland Conservation Act Coordinator
Tom Wenzel, Sr. Water Resources Engineer
Dan Shaw, Native Vegetation Specialist
Eric Mohring, Hydrologist

Cc: Aitkin County TEP
Rob Maroney, ACOE
Tom Mings, ACOE
Jill Clancy, ACOE
Doug Norris, DNR
BWSR Staff

Minnesota Board of Water & Soil Resources

April 20, 2012

Jill Bathke
ACOE
180 5th Street
St. Paul, MN 55155

Re: Final Review of Palisades III

Dear Jill:

BWSR Central Office staff completed a review of the revised Palisades III wetland replacement plan dated March, 2012. Our review focused on items that were incomplete or absent during our January 2012 review. The revised plan addresses some past recommendation but overall still remains inconsistent with MR 8420.

Compliance with the Wetland Conservation Act

Our primary concern is the replacement plan, as drafted, does not meet Wetland Conservation Act banking standards but is proposed to replace wetlands regulated by the Act. Specifically, the plan does not propose to restore the site's natural hydrology, does not restore suitable wetland plant communities common to the area and does not propose wetland replacement that will be sustainable. In addition to these shortcomings, the plan proposes a high risk replacement site due to a lack of a contributing watershed and reliance on groundwater for hydrology. Relying on an unnatural source of hydrology may result in high maintenance and significant expense in the future.

Crediting

The replacement plan proposes credit to be generated via MR 8420.0526, Subparts 2, 3, 4 and 5. Subparts 3 and 4 are not appropriate for this site because natural hydrology will not be restored and Subpart 5 is not appropriate because the site has been affected by prior drainage or filling. These pre and post site conditions limit justified crediting to subpart #2 for upland buffer areas and possibly subpart #7 for wetland creation.

Vegetation

To limit the level of risk related to credit yield more attention should be included in the native vegetation establishment section of the plan. Added details should include: how the seedbed will be prepared, how seeding and tree plantings will be accomplished, how the site will be maintained and

Bemidji
701 Minnesota Avenue
Suite 234
Bemidji, MN 56601
phone (218) 755-4235
fax (218) 755-4201

Brainerd
1601 Minnesota Drive
Brainerd, MN 56401
phone (218) 828-2383
fax (218) 828-6036

Duluth
394 S. Lake Avenue
Room 403
Duluth, MN 55802
phone (218) 723-4752
fax (218) 723-4794

Fergus Falls
1004 Frontier Trail
Fergus Falls, MN 56537
phone (218) 736-5445
fax (218) 736-7215

Marshall
1400 E. Lyon Street
Box 267
Marshall, MN 56258
phone (507) 537-6060
fax (507) 537-6368

New Ulm
261 Highway 15 S.
New Ulm, MN 56073
phone (507) 359-6074
fax (507) 359-6018

Rochester
2300 Silver Creek
Road N.E.
Rochester, MN 55906
phone (507) 281-7797
fax (507) 285-7144

Saint Paul
520 Lafayette Road N.
Saint Paul, MN 55155
phone (651) 296-3767
fax (651) 297-5615

when these vegetation establishment activities will occur. This detail will provide a written schedule to monitor vegetation establishment work throughout the monitoring period and will explain how specific tasks will be accomplished. A clear vegetation establishment plan will allow those reviewing the plan and approving credit to fully understand what is being proposed, what is being approved and whether or not the planned work was completed in an acceptable manner.

Long Term Protection

BWSR also is concerned with the long term protection of the bank site. The replacement plan mentions a financial assurance to ensure success. Due to the risk level associated with this site I recommend an assurance that would fund at least one-half of the planned credit, at today's market price, so alternative replacement can be provided if the site fails to achieve performance goals.

Sincerely,

Dan Girolamo
Wetland Bank Administrator

Cc: Kerryann Weaver, EPA
Keith Grow, BWSR
Les Lemm, BWSR

Bemidji
701 Minnesota Avenue
Suite 234
Bemidji, MN 56601
phone (218) 755-4235
fax (218) 755-4201

Brainerd
1601 Minnesota Drive
Brainerd, MN 56401
phone (218) 828-2383
fax (218) 828-6036

Duluth
394 S. Lake Avenue
Room 403
Duluth, MN 55802
phone (218) 723-4752
fax (218) 723-4794

Fergus Falls
1004 Frontier Trail
Fergus Falls, MN 56537
phone (218) 736-5445
fax (218) 736-7215

Marshall
1400 E. Lyon Street
Box 267
Marshall, MN 56258
phone (507) 537-6060
fax (507) 537-6368

New Ulm
261 Highway 15 S.
New Ulm, MN 56073
phone (507) 359-6074
fax (507) 359-6018

Rochester
2300 Silver Creek
Road N.E.
Rochester, MN 55906
phone (507) 281-7797
fax (507) 285-7144

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520 Lafayette Road N.
Saint Paul, MN 55155
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Palisade III Wetland Mitigation Bank Site Report

United States Steel Corporation,
Minnesota Ore Operations

Palisade Wetland Mitigation Project
Aitkin County, Minnesota

March 2012

Executive Summary

The Palisade III Wetland Mitigation Bank Site (Bank Site) is located approximately 2 miles southeast of the City of Palisade in Aitkin County, Minnesota. United States Steel Corporation (U. S. Steel) in 2009 purchased a 4,393-acre property for wetland mitigation purposes. The Bank Site project involves the restoration of approximately 480 acres of agricultural fields. U. S. Steel proposes to compensate for project specific unavoidable wetland impacts for future operations at the two Minnesota Ore Operations facilities (Keetac and Minntac).

The NRCS Custom Soil Resource Report for Aitkin County, Minnesota, indicates that a predominance of hydric soil exists on approximately 98 percent of the Bank Site, indicating existing and/or historical wetland conditions. Approximately 4.9 miles of drainage ditches flow around the property, but it can be anticipated that the Aitkin County Ditch Authority would not authorize the abandonment of any regulated ditches. Therefore, this Bank Site project will involve implementing low profile earthen embankments with minor grading to restore sustaining hydrology. Please refer to Appendix C for the Bank Site Wetland Grading Plan.

Preliminary analysis indicates that sustaining hydrology can be achieved by designing wide, low profile earthen embankments with minor grading. Two minor private ditches representing 1.47 acres of man-made ditches that originate onsite would be abandoned as part of the grading process. These small private ditch abandonments shall have no consequences to upstream properties. The Bank Site design resulted from a systematic investigation of the site hydrology and hydraulics. The investigation necessitated the establishment of water level monitoring points, including deep and shallow piezometers in the aquifer, and staff gauges in the ditches. Hydraulic testing was also performed during data collection. In the end, through a complicated modeling program, it was shown that by just minimizing surface drainage into the peripheral ditches and thereby increasing hydraulic resistance on the Bank Site, the hydrology necessary to sustain wetlands would be achieved.

A watershed approach was employed in the analysis, involving a landscape view of the local watershed and studying the surface and groundwater flows from higher elevations to northeast and southwest, and then draining into the Mississippi and Sandy Rivers. The Bank Site analysis included review of several other local and regional wetlands and their drainage systems. This assessment identified the following conditions within the watershed:

1. Impaired waters draining into the Mississippi River;
2. Sediment loading from past and present farming operations;

3. Reed canary grass and other invasive plant species impacting native vegetation;
4. Hydrology being altered by drainage ditches used for agricultural purposes; and
5. Wetland soil degradation by agricultural activities:
    - Ditching and draining;
    - Soil compaction;
    - Organic soil desiccation and subsidence; and
    - Erosion by wind and water.

The Bank Site project would also include wetland monitoring and maintenance for a minimum of five years. U. S. Steel is also providing financial assurance for future monitoring, maintenance, contingency, proactive and adaptive management to assure that the proposed Bank Site is successful in perpetuity.

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List of Acronyms and Technical Terms

BWSR- Minnesota Board of Water and Soil Resources
CIR - color infra-red
CFR - Code of Federal Regulations
DNR - Minnesota Department of Natural Resources
FQA - Floristic Quality Assessment
GIS - Geographic Information System
IBI - Index of Biological Integrity
IRT - Interagency Review Team
LGU - local governmental unit
MDA - Minnesota Department of Agriculture
MNDNR - Minnesota Department of Natural Resources
MNRAM - Minnesota Routine Assessment Methodology
MOU - Memorandum of Understanding
MPCA - Minnesota Pollution Control Agency
NRCS - Natural Resource Conservation Service
NWI- National Wetland Inventory
Section 404 - Clean Water Act
SWCD - Aitkin County Soil and Water Conservation District
TEP - Technical Evaluation Panel (WCA provisions)
USACE - United States Army Corps
USEPA - United States Environmental Protection Agency
USFWS - United States Fish and Wildlife Service
USGS - U. S. Geological Survey
WCA - Minnesota Wetland Conservation Act of 1991

1.0 Proposed Project

1.1 Introduction

United States Steel Corporation (U. S. Steel) is an integrated steel producer with operations in United States Canada, and Central Europe. With two mining operations in Minnesota, U. S. Steel's Minnesota Ore Operations consist of the Keetac Mine (Keetac) in Keewatin, Itasca County, and the Minntac Mine (Minntac) in Mt. Iron, St. Louis County. Both Keetac and Minntac mining operations are proposing to implement future mining expansions and extensions that would require wetland compensatory mitigation. Unavoidable future wetland impacts at Keetac and Minntac would require replacement credits over the next five or more years.

In 2009, U. S. Steel purchased 4,393 acres of agricultural land southeast of the City of Palisade, in Aitkin County, Minnesota, with the intention of restoring the agricultural land to obtain replacement credits necessary to support future Keetac and Minntac mining operations. To obtain replacement credits for operations over the next five years or more, U. S. Steel is implementing this 480-acre project specific Bank Site wetland restoration project. This Bank Site is also known as Palisade III. Palisade I and II are project specific wetland mitigation sites for Keetac and Minntac, respectively, and are located on adjacent parcels. They would be constructed concurrently with this Bank Site.

Based upon the review of historical aerial photographs and observations of hydric soils, it is evident that 98% of the approximately 480-acre Bank Site was once a wetland habitat that had been drained and then farmed since the 1980s. The historic wetlands were drained through the construction of a system of ditches in the 1970s that was followed in the early 1980s, by farming operations to the present day.

1.2 Project Location

The Bank Site is located in Aitkin County, Minnesota, approximately 2 to 3 miles southeast of the City of Palisade. Specifically, the Bank Site is located in the E ½ of the NW ¼, S ½ of the NE ¼, E ½ of the SW ¼, and the SE ¼ of Section 34 and the S ½ of the SW ¼ of Section 27, of Workman Township (T.49N., R.24W.), Aitkin County, Minnesota. A 1973 USGS and 2009 Aerial Map of the Bank Site are presented in Figure 1.1 and Figure 1.2, respectively.

The Bank Site is located in the Mississippi River Headwaters, specifically Mississippi River-Grand Rapids major watershed. The Bank Site is within Bank Service Area #5 and lies within the Laurentian Mixed Forest province.

Figure 1.1 – USGS Bank Site Location Map

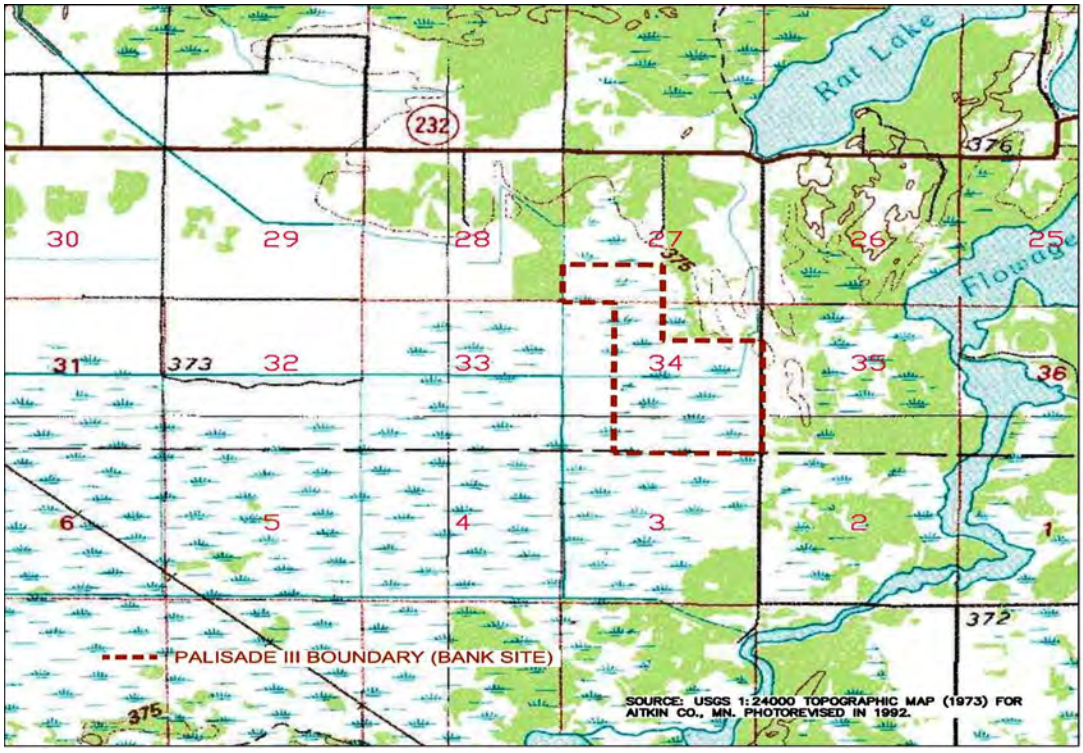
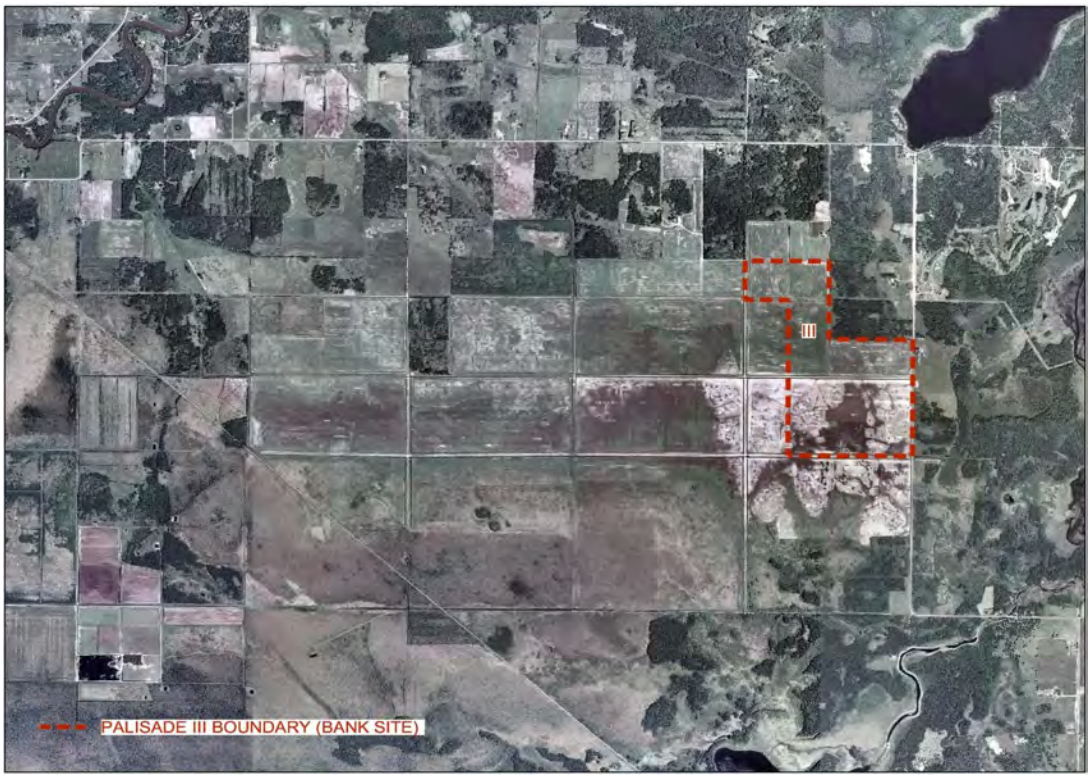


Figure 1.2 – Bank Site Aerial Map (2009)



1.3 Project Purpose and Description

Wetland habitats that will be impacted by U. S. Steel's current and proposed mining operations shall be compensated by wetland restoration on properties owned by U. S. Steel in Palisade, consisting of Palisade I, Palisade II and Palisade III (Bank Site). Palisade I is a project specific mitigation site for the Keetac Expansion Project and encompasses approximately 815 acres. Palisade II is a project specific mitigation site for the Minntac Western Progression Project and encompasses approximately 122 acres. The remaining 480-acre portion of the 1,416-acre larger wetland mitigation area has been designated as a project-specific federal wetland Bank Site for future compensation purposes. The Bank Site project proposes to provide the necessary replacement credits for compensation of future unavoidable wetland impacts over the next five or more years.

The Bank Site project commences with the restoration of wetland hydrology through the design of low profile earthen embankments (8:1 slopes) to prevent precipitation from draining off into the ditches. These earthen embankments not only serve to retain and increase onsite surface hydrology, but would satisfy the upland habitat requirements under MN8320.0522, Replacement Standards (Subpart 6). The entire 2011 growing season was dedicated to hydrologic monitoring and testing. Also, a predictive hydrogeologic and hydrologic model has been refined and calibrated to predict the specific hydrologic systems necessary for sustaining hydrology, while minimizing impacts to adjacent parcels.

1.4 Project Status, Schedules and Permits

This Bank Site's project status and schedule or 2011-2013 are described below:

Season 2011 Completed Activities:

- Site boundary and topographic surveys (June)
- Wetland delineation (June)
- USACE and Technical Evaluation Panel (TEP) wetland jurisdictional determination (July)
- Installation of piezometers, staff gauges, drilled wells and aquifer pump testing (May and June)
- Hydrologic monitoring and computer hydrogeologic and hydrologic predictive modeling/investigation (October)
- Final hydrology report (October)
- Invasive species monitoring and control program (spring and fall herbicide application completed)
- Site plowing/disking (October)
- County ditch abandonment petition (submitted October 2011 and public hearing in 2012)

2012/2013 Construction and Monitoring Schedule:

- Obtain USACE/MNDNR/TEP approval of the Palisade Wetland Mitigation Bank Site Report and Bank Site Plans (early 2012)
- Bank Site to be farmed over the growing season
- Minor hydrologic and site monitoring during the growing season (including a several water level collection events)
- Invasive species monitoring and control throughout the growing season along and within ditches (first spraying would begin in April)
- Down payment of 25% required for seeds by May 2012 (payable to Prairie Moon Nursery) with balance paid within 30 days after delivery (~November 15, 2012)
- Grading contractor to be retained (June/July)
- Seeding contractor to be retained (July/August)
- Construction to begin around October 15 and would continue until soil is frozen
- *Fall seeding would begin as soon as possible concurrently or directly after earthen embankment and grading is completed in each parcel (seeds would be picked up by contractors)
- Woody plant supplier and contractor to be obtained by December for 2013 spring planting season
- Trees and shrubs (final species chosen would be based on availability) delivered for planting in March 2013
- Site monitoring within 3 weeks of the start of the growing season
- Invasive species and hydrology monitoring throughout the growing season
- Implementation of contingencies and/or adaptive management if necessary

*Dormant seeding would occur immediately after construction and continue until the soil is frozen. If seeding cannot be completed in the dormant fall season before the soil is frozen, then snow seeding may occur in February or March 2013 to complete the seeding phase of work. Currently, the proposed construction sequence would begin at Palisade II (Minntac), then Palisade I (Keetac), and then Palisade III (Bank Site). Palisade II consists of 120 acres and is the smallest parcel that can be finished quickly. Palisade I is the largest parcel of about 815 acres.

List of Federal, State and Local Permits

U. S. Steel will obtain all appropriate permits or other authorizations to construct and maintain the Bank Site, prior to debiting any credits. U. S. Steel will also submit to the USACE a draft General Stormwater Permit (Permit No: MN R100001) prior to construction. This would include a completed application to Minnesota Pollution Control Agency located at 520 Lafayette Road North, St. Paul. MN 55155-4194. The permit will require the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP) and the SWPPP is likely to be completed by the chosen contractor.

2.0 Existing Conditions

2.1 Landscape Setting

The topography around the Bank Site is best described as gently rolling with no visible hills or valleys. The property is currently farmed and zoned for agriculture with about 4.9 miles of drainage ditches. The drainage ditches are man-made and run north/south and east/west throughout the property. The vegetation in the ditches includes various herbaceous grasses and invasive plant species (primarily reed canary grass and cattails), with a few scattered small trees and shrubs along the banks. Non-disturbed properties around the Bank Site consist predominantly of native hardwood swamps, shrub-carr and wet meadows.

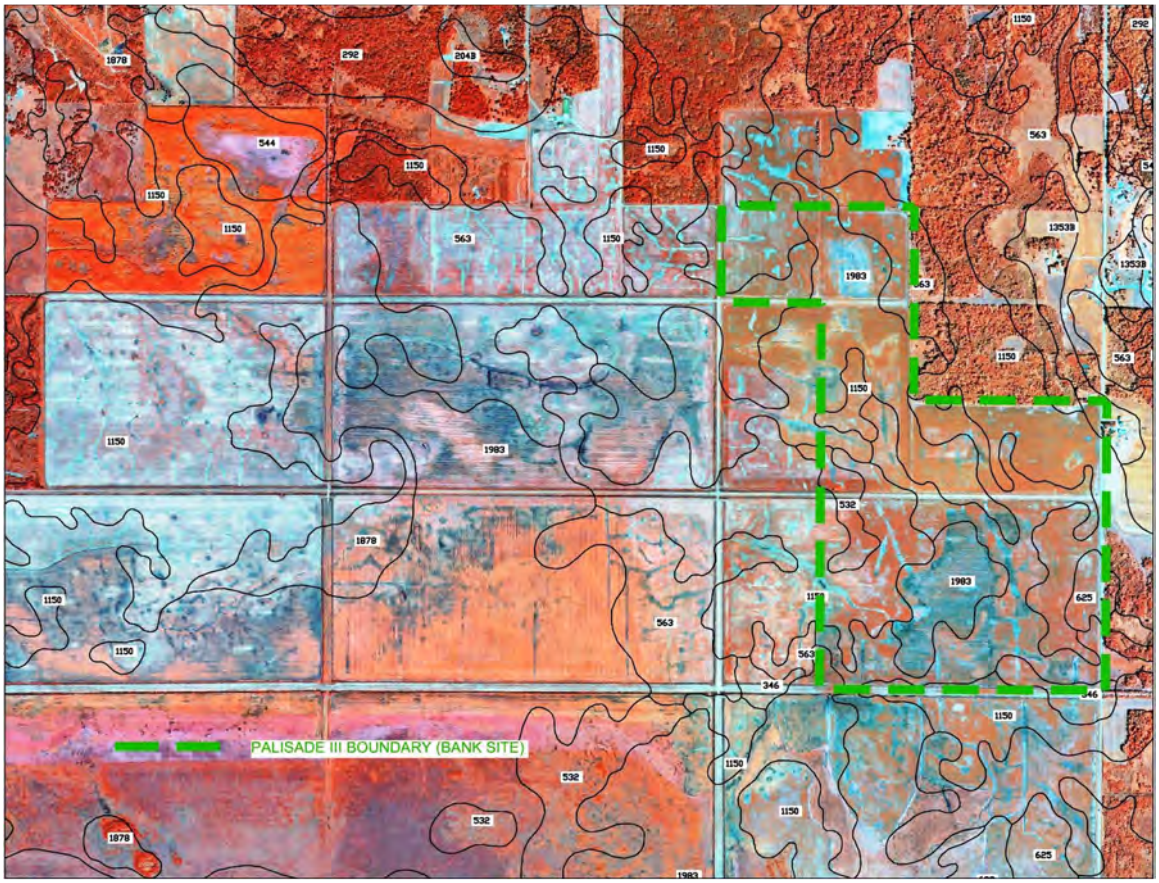
2.2 On-site Soils

Approximately 62% (299 acres) of the Bank Site consists of muck soils likely to have formed from closed depression topography that impeded surface drainage, and over time filled with organic material, forming peat. Approximately 35% (170 acres) of sandy loam are poorly drained. The remaining 11 acres are moderately drained upland soils. The United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Soil Survey of Aitkin County, Minnesota, has mapped the following project soils (grouped by Section below):

Soils on 82-acre parcel in Section 27	**Area on Parcel**	**Hydrogeologic Group**
1983 – Cathro muck, stratified substratum	~ 27 acres	A/D (Very poorly drained)
1150 – Jevne fine sandy loam	~ 26 acres	C (Poorly drained)
563 – Northwood muck	~ 29 acres	B/D (Very poorly drained)
Soils on 398-acre parcel in Section 34	**Area on Parcel**	**Hydrogeologic Group**
1150 – Jevne fine sandy loam	~ 137 acres	C (Poorly drained)
1983 – Cathro muck, stratified substratum	~ 110 acres	A/D (Very poorly drained)
532 – Sago muck	~ 131 acres	D (Very poorly drained)
563 – Northwood muck	~ 2 acres	B/D (Very poorly drained)
625 – Sandwick loamy sand	~ 9 acres	B (Moderately well drained)
346 – Talmoon fine sandy loam	~ 7 acres	C (Poorly drained)
1353B – Cutaway loamy fine sand	~ 2 acres	B (Moderately well drained)

Please refer to the USDA Soils Map in Figure 2.1 below:

Figure 2.1 - USDA Soils Map



Key On-site Soils Information based on NRCS publications:

- Jevne, Northwood, Cathro, and Cutaway soils are reportedly (NRCS) unsuitable for ponds due to seepage.
- High available-water-capacity (AWC) soils cover 98% of the selected parcels.
- High AWC is in peat, typically limited to upper 10 inches when encountered
- Other soils would have saturation on the surface including Jevne, Sago, Northwood, and Cathro soils.
- None of the soils on the Bank Site formed on a perched water table.
- More than 98% are moderately to strongly acidic in shallower horizons.
- More than 96% become neutral to slightly alkaline at deeper depths.
- Borings reveal a confined fine-sand aquifer 6 to 12 feet below ground surface.
- The water table is typically shallower in the confining clayey silt unit.

- The on-site ditches may fully penetrate the confining layers in various places and may drain the underlying water table.

These and other key soil information have been taken into account in the hydrological model and has been considered in the hydrology study and wetland mitigation design.

2.3 Land Use History

Based on the review of aerial photographs received from the USDA Natural Resources Conservation Service (NRCS - Aitkin County field office) and detailed landowners farm subsidies information from the Aitkin County Soil and Water Conservation District (SWCD) office, farming operations have been documented from 1981 to the present day. Therefore, documented land use from the early 1980s to present is farming and no structures or other development are located on the Bank Site.

2.4 Crop History Review

This analysis below is used to determine how many years the Bank Site has been cropped prior to the implementation of this wetland mitigation project. The analysis is based on the USDA/NCRS crop history records documenting specific crop types that were grown on specific parcels of each section of the Township. The record of farming data gathering was from approximately1984 to the present and appears to be continuous with only minor crop data gaps. Fallow years are also accounted for and counted as being farmed. All the USDA/NRCS aerials were used for the crop history review and are summarized below:

Section 27 – The Bank Site contains two 40-acre parcels (80 acres) located in the southwestern-most part of Section 27. Aerial imagery for section 27 was available and reviewed for the following years: 1984 through 1988, 1990 through 1997, 1999, 2000, 2003 through 2006, and 2008 through 2010. From the 22 years of aerial imagery reviewed, it is evident that the Bank Site was cultivated for 15 years (total) with 7 fallow years (total).

Section 34 - The Bank Site contains the eastern half of the northwest quarter, the southern half of the northeast quarter, the eastern half of the southwest quarter, and all of the southeast quarter of Section 34. Aerial imagery for Section 34 was available and reviewed for the following years: 1984 through 1988, 1990 through 1997, 1999, 2003 through 2006, and 2008 through 2010. Additional data was provided by the previous landowner information from the local USDA Aitkin County office for years 1989, 2000, 2002 and 2007. From the 21 years of aerial imagery and 4 years of previous landowner information that were reviewed, evidence of cultivated and fallow areas varies for each parcel. Figure 2.2, Sub-Parcel Mapping below illustrates the portion of Section 34 contained within the Bank Site and the total cultivated and fallow years for each 40-acre parcel.

Figure 2.2 – Sub-Parcel Crop Mapping

Palisade I	**18/6**	Offsite	Offsite
Palisade I	**20/5**	**21/2**	**20/5**
Palisade I	**19/6**	**20/3**	**19/6**
Palisade I	**20/3**	**20/3**	**22/3**

Each rectangle represents a 40-acre parcel of Section 34

Data shown as x/y, where x = previous years cultivated (total) and y = years fallow (total)

Additional data were provided by the USDA Aitkin County office in the form of farm payment history. These documents indicated that various 40-acre parcels were farmed before aerial photographs were available. The earliest documented farming dates based upon crop records for parcels within the Bank Site are summarized below:

Section 27 – portions of Section 27 were farmed during the summer of 1985. At least one of the two 40-acre parcels on the Bank Site was planted with barley in 1985.

Section 34 – all 10 of the 40-acre parcels on Section 34 within the Bank Site were farmed prior to 1985. Wheat was planted in 1983 and barley was planted in 1985.

Correspondence with the Aitkin-Itasca County Program Technicians also indicated that the property owned by U. S. Steel earned farm payments *"every year between1986-2010."* Payment in 1986 may have been based on documented farming activities in 1985 that were then eligible for the payment distribution in 1986. With this payment information, in addition to the above aerial crop history imagery reviews, it is evident that from approximately 1985 to 2011 (yielding a maximum of 26 years of possible farming), all parcels have had seeded crops for the past twenty years (including fallow years).

2.4.1 Determining Credits Generated by a Compensation Site

Under *Minnesota Rule 8420.0526 Action Eligible for Credit, Subpart 2 - Upland buffer areas,* the proposed upland buffers (i.e., earthen embankments) around the high quality wetlands have been designed for this replacement project. The upland buffers meet the minimum requirements in part 8420.0522, subpart 6, in that

the minimum upland width would be no less than 25 feet and the average width is 50 feet or greater. Our low profile upland earthen embankments are also designed with mosaic shaping such that it would blend into the natural setting when constructed and planted. The upland buffers also serve to maximize the hydrology, taking into account that the County most likely will not approve any ditch abandonment request. The Bank Site will consist of approximately 60.5 acres (~12.6% of the property) of upland buffers. Of the 60.5 acres of upland earthen embankments, only 36.68 acres can be used for the 25% upland crediting under Subpart 2, as 26.53 acres of the proposed earthen embankments consist of delineated wetlands where no credit will be considered.

Under *Subpart 3, Restoration of completely drained or filled wetland areas* - the completely drained or filled Bank Site areas consist of approximately 161 acres of drained or filled farmland and approximately 23 acres unpaved roads (which shall remain). The net restoration portion under Subpart 3 consists of approximately 124 acres (161 acres of upland minus 37 acres of that are needed for the earthen embankment construction).

The Bank Site project plan does not involve the restoration of historic native wetland plant communities, but of in-kind native fresh (wet) meadow, sedge meadow, shrub-carr, and hardwood swamp communities appropriate for Aitkin County.

Under *Subpart 4, Restoration of partially drained or filled wetland areas,* U. S. Steel anticipates that approximate 256.67 acres of farmed wetlands would be eligible for up to 100 percent of the wetland area restored, as these wetland areas have been farmed over the past 20 years and consist of degraded wetlands with minimal existing functions. The approximate 256.67 net acres are derived from the total delineated farmed wetlands of 283.2 acres minus 26.53 acres of those wetlands to be filled by earthen embankment construction.

Based on the partially drained wetlands delineated (283.2 acres – 26.53 = 256.67 net acres) plus the drained wetlands (124 upland acres) and 25% for upland buffer (.25 x 36.7 acres = 9.17 acres), the Bank Site would have a maximum of approximately 390 eligible credits at the Bank Site before applying replacement ratios.

For agricultural lands, the ratio is 1.5:1 for being located outside of the major watershed and 1:1 for projects located within the major watershed. Using a 1.5:1 ratio would result in a maximum of approximately 260 replacement credits and using a 1:1 ratio would result in approximately 390 replacement credits.

Both Keetac and Minntac mining sites are located in a part of Minnesota with greater than 80% of pre-settlement wetlands. The USACE under this scenario would start with a 1.5:1 replacement ratio and apply a .25 reduction to projects being in-place and another .25 reduction for project s having in-kind mitigation. Keetac projects would get a .5 reduction and have 1:1 compensatory replacement ratio. Therefore, Keetac mitigation projects could obtain a maximum of 390 replacement credits. Minntac would get a .25 reduction for having only in-kind mitigation and at a 1.25:1 compensatory replacement ratio, Minntac could obtain a maximum of approximately 312 replacement credits. Since the project specific acres have not yet been determined at the

Bank Site, the replacement credit will vary depending on the impact site (Minntac or Keetac) needing replacement credit withdrawals from the Bank Site.

Bank Site Project Calculations (~480 acres)

- Ditch Areas = **12.56** acres
- Roads/Easement Areas = **22.85** acres
- Completely Drained Wetland = **160.99** acres (with 36.68 acres used for earthen embankment and only gets .25 eligible credits)
- Partially Drained Wetland = **283.20** acres (with 26.53 acres under the earthen embankment and has no credit value)
- **12.56 + 22.85 + 160.99 + 283.20 = *479.6*** acres total for Bank Site
- Total Upland/Restoration Areas counted for replacement credits = ***124.31*** acres (160.99 acres minus 36.68 acres converted to earthen embankments and not wetland restoration)
- Total Delineated Wetlands (farmed wetland) = ***256.67*** acres (283.20 acres minus 26.53 acres of framed wetlands converted to earthen embankments)
- Total Upland Earthen Embankment Areas = 63.21 acres (consisting of 36.68 acres of upland areas and 26.53 acres of delineated wetlands where no credit will be given)
- ***124.31*** acres net upland restoration plus ***256.67*** acres net farmed wetland restoration = ***380.98*** acres plus upland earthen embankment credit (36.68 acres x .25 = ***9.17*** acres) yields and maximum of **390.15 eligible credits** prior to using various ratios (1.5:1, 1.25:1, and 1:1) to obtain replacement credits.

Additional Notes:

- Area S-3 private ditch to be abandoned = 0.80ac
- Area S-9 private ditch to be abandoned = 0.67ac
- Total 1.47 acres to be converted from ditches to wetlands with no credit accounted in the above calculations.

Based on the above calculations, the maximum replacement credits available at the Bank Site will depend on whether Keetac or Minntac is withdrawing credits and as noted below based on *"Action Eligible for Credits (MR 8420.0526) and Replacement Standards (MR 8420.0522)"* and USACE accounting methods. Below is a written summary of maximum possible credit yields based on possible ratios used at the site. Also, please refer to Table 2.1 below.

- Using 1:1 replacement ratio (project-specific, w/in major watershed and in-kind), the Bank Site may yield a maximum of 390.15 replacement credits.

- Using 1.25:1 replacement ratio for the ACOE, the Bank Site may yield a maximum of 312.12 replacement credits.
- Using a 1.5:1 replacement ratio, the Bank Site may yield a maximum of 260.1 replacement credits.

Table 2.1 – Credit Ranges Based on Proposed Action and Regulatory Agency

Proposed Action or Technique	**USACE Ratio for Keetac** (In-kind and in-place)	**Credits**	**USACE Ratio for Minntac** (In-kind only)	**Credits**	**MNDNR** (w/in same major watershed and in-kind)	**Credits**	**USACE and MNDNR** (No reduction)	**Credits**
Restoration*	Up to 1:1 (.5 reduction)	Up to 390.15 acres	Up to 1.25:1 (.25 reduction)	Up to 312.12 acres	Up to 1:1	Up to 390.15 acres	Up to 1.5:1	Up to 260.1 acres
Upland Buffers	4:1	Up to 9.17 acres	4:1	Up to 9.17 acres	4:1	Up to 9.17 acres	4:1	Up to 9.17 acres

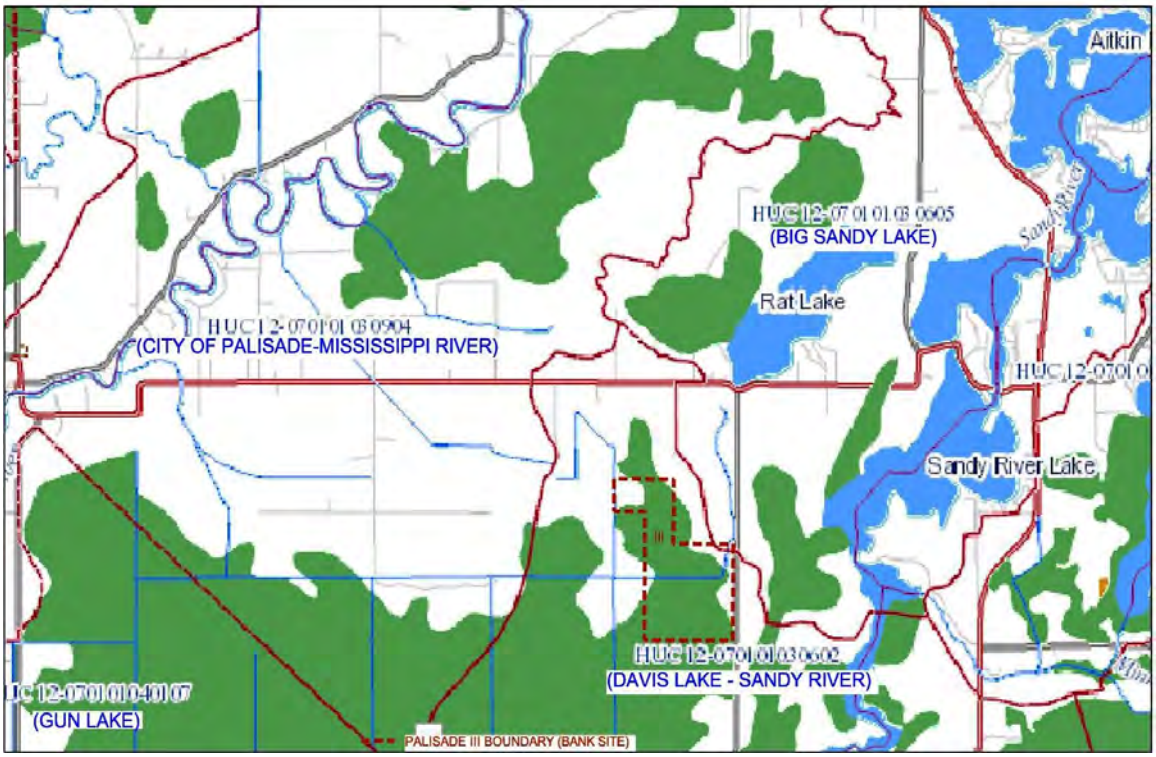
* Restoration of effectively drained wetlands and/or degraded wetlands would consist of: 1) re-establishment where there will be net gain of wetland acres and functions; and 2) rehabilitation of degraded wetlands where wetland functions are increased substantially with no gain in wetland acres (i.e., delineated degraded wetlands). Both re-establishment and rehabilitation at the Bank Site that will have significant net gains in wetland functions and would justify up to1:1 credit for project impacts within the same major watershed for project-specific bank replacement.

2.5 Watershed

The Bank Site lies within the Mississippi River – Grand Rapids major watershed. Keetac mining site lies within this same major watershed but Minntac mining site lies outside of this major watershed.

The on-site hydrology is regionally influenced by the lakes and rivers that surround the property. The Mississippi River is near the Bank Site and is located to the west, northwest and north, with Section 29 having direct drainage via man-made ditches. Rat Lake, Sandy River Lake, Flowage Lake and the Sandy River border to the northeast, east and southeast portion of the property, Davis Lake, Round Lake, Rock Lake, Townline Lake, Long Lake, and Jenkins Lake, border the property to the south and southwest. The predominance of the on-site drainage flows out to the Mississippi River with a small flow to Sandy River. Please refer to Figure 2.3, Watershed Map.

Figure 2.3 - Watershed Map



2.6 Local and Regional Airport Review

A search for local and regional airports within a radius of approximately 50 miles from Palisade identified nine local airports and one international airport. The two closest local airports that may be affected by migratory birds using the mitigation site are found in the cities of Aitkin and McGregor. The McGregor Airport (KHZX) is approximately 5 miles south of the wetland mitigation site and has one paved runway. The runway is 3,400 feet

long by 75 feet wide. It is an "unattended" airport with no control tower and the airport manager is Mike Zebro. This airport reports a local traffic of only 3 transient and 2 local airplane flights per day.

The Aitkin Airport (KAIT) is approximately 18 miles southwest of the wetland mitigation site and has two paved runways. The runways are 3,123 feet long by 140 feet wide and 4,000 feet long by 75 feet wide. The airport is publicly owned by the County and City of Aitkin and the airport manager is Kathy Brophy. The airport has onsite attendance from November through April, 7 days a week between 0900-1600 hours and from May through October, 7 days a week between 0900-1700 hours. This airport reports a local traffic of only 8 transient and 36 local airplane flights per day.

The remaining 7 local airports are about 30 or more miles away from the Bank Site. Most of these local airports report 25 or fewer flights per day average with Brainerd Lake Regional (KBRD) airport having the most flights with 25 transient and 60 local average flights per day. It is not expected that any of the local airports would be impacted by the development of the wetland mitigation site.

The Duluth International Airport is the only international airport within approximately 60 miles due east of the Bank Site. All flights appear to head southeast or southwest with most flights heading due south/southeast towards Detroit, Chicago-O'Hare, New York and Orlando, Florida. Other flights head west to Las Vegas. Based on the general flight path of the three major airlines out of Duluth International Airport (Delta, United, and Allegiant), the proposed wetland mitigation is not located in the airport's flight line and would not have any impacts to large aircrafts.

The above information was obtained from the flight plan website: http://www.fltplan.com/.

2.7 Cultural and Historical Site Review

A table top review for cultural and historical resources was performed by utilizing the Minnesota Historical Society website resources. A search for "*National Register of Historic Places*," listed by county, confirmed that the following ten places of cultural and historical interest exist within Aitkin County:

1. Aitkin Carnegie Library (1911)
2. Aitkin County Courthouse (1929) and Jail (1915)
3. Arthyde Stone House (World War I Era)
4. Bethlehem Lutheran Church (1897)
5. Casey, Patrick, House (1901)
6. Malmo Mounds and Village Sites (ca. 200 B.C. to A.D. 400)
7. National Woodenware Company Superintendent's House (1910)
8. Northern Pacific Depot (1916)
9. Potter-Casey Company Building (1902)

10. Savanna Portage (Transportation route between Upper Mississippi Valley and Great Lakes)

The properties listed above are located in or near the City of Aitkin and none of the structures or properties are on or near the Bank Site. Therefore, none of the listed National Register properties would be impacted by the proposed wetland mitigation project.

3.0 Wetland Impacts

U. S. Steel's mining operations at Keetac and Minntac have the potential of impacting the following wetland types: seasonally flooded basin; fresh (wet) meadow; shallow mash; deep marsh; shallow open water; shrub-carr, alder thicket, and hardwood swamp. These wetlands provide many hydrological, ecological, and water quality functions that may be impacted in future operations. Unavoidable impacts will be compensated for at the Bank Site.

3.1 Wetland Functional Losses

Minntac and Keetac mining sites have many wetland types found throughout their properties. The nature of mining creates unavoidable impacts to wetland habitats. Future wetland impacts and functional losses at Minntac and Keetac may consist of the following:

- Loss of wildlife habitat (direct, indirect and cumulative impacts) for various game and non-game species, such as white-tailed deer, black bear, ruffed grouse, various small mammals and migratory songbirds.
- Loss of linear feet of waterways that would impact many species of fishes and their habitats.
- Loss of benthic macro invertebrates such mayflies, stoneflies, and caddisflies are expected in the streams and that support upper tropic levels.
- Loss of riparian habitats and reduction within the watersheds.
- The mining sites are within the range of Canada lynx (*Lynx canadensis* – federally threatened), gray wolf (*Canis lupis* – federally threatened; state status, Special Concern) and the breeding range of bald eagle (*Haliaeetus leucocephalus* – state status, Special Concern).
- The mining sites are within the range of seven state-listed botanical species that have been found in association with historic mine stockpiles and three species of *Botrychium* (moonwort ferns) and one colonial waterbird nest within one mile of the mine extension limits.
- Losses of wetlands detention, retention, recharge and discharge areas, water quality functions.
- Impacts to water quality.
- Loss of soils and water conservation.
- Increase invasive plant species due to site disturbances.

3.2 Wetland Functional Gains at Bank Site

Wetland functions are the natural process or series of processes that take place within a wetland. These include storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, and for the ecosystem, including wildlife. Functions can be grouped generally as habitat, hydrologic, or water quality. But wetland values are also important locally, such as for recreation activities (e.g., hunting and bird watching). The Bank Site will be a product of all the beneficial processes that work together in a successful wetland.

It is expected that many wetland functions would be improved from such a large scale Bank Site. Such functions include but not limited to:

- Local and regional floodwater retention and detention.
- Removal/reduction of downstream flows, sediments and nutrient removal (i.e., phosphorus and nitrogen).
- Watershed wide improvement to water quality due to the size of the mitigation area.
- Production and export of organic matter.
- Soil and water conservation.
- Increase wetland and upland wildlife habitats (food, water and shelter) for amphibians, mammals and birds.
- Improved native plant ecology through increasing diversity and abundance and hereby maximizing wetland and upland plant communities.
- Reduction of invasive plant species and their seed sources.

4.0 Wetland Delineation

Wetland delineation was performed in late 2010 and early 2011 on the 480 acres of agricultural land. The wetland delineation included the entire project area of Palisade I, II, and III that began in September 2010, and continued into early 2011. Wetland field work performed in 2011 involved re-evaluating the delineated basins from the 2010 season as well as delineating the new basins on the additional 880 acres. Several basins that were delineated in 2010 were expanded and/or combined with nearby delineated basins due to the observed spring hydrology (i.e., ponding) being present in 2011. The extensions of the 2010 delineated wetlands included areas where there was no evidence of crop stress in the field during 2010 or on historical photos covering a period of 2000 to the present.

The land within the U. S. Steel property consists primarily of soybean fields, wheat fields, and seventy-nine (79) wetland and thirteen (13) ditch boundaries. The wetland and ditch boundary delineations followed the methods and criteria from the U. S. Army Corps of Engineers (COE) Wetlands Delineation Manual (1987) and the "*Regional Supplement to the COE Wetland Delineation Manual: Northcentral and Northeast Region*". The boundaries of the wetlands were flagged in the field and were then located with land survey instrumentation. Typical wetlands on-site were classified a seasonally flooded basins, ditched shallow marsh and not ditched fresh (wet) meadows in temporarily and saturated flooded water regime. Ditches that were delineated were classified as being either a fresh (wet) meadow (mostly reed canary grass) or excavated shallow marsh. Areas that bordered the delineated wetland basins and ditches both on and off-site throughout the property consisted of soybean fields, wheat fields, hardwood swamps, and shrub-carr wetlands.

Many of the delineated wetlands and ditches, with the exception of a few basins, were determined to be wetland based only on primary and secondary wetland hydrology indicators. Since each investigated wetland and ditch area was located within a hydric soil unit and the vegetation that was present during the spring consisted mainly of common FAC to FACU agricultural weeds, the determinations were based primarily on the hydrology parameter and as directed by the TEP members. Typical vegetation observed within these basins during the fall of 2010 included soybean and wheat with a few hydrophytic grasses and forbs while observations during the spring of 2011 was mainly soybean and wheat stubble and a few common agricultural weeds.

Field hydrology observations during 2011 indicated a range of standing water levels from a few to several inches within many of the basins to the ditches having 1-5 feet plus of flowing water. Water table levels also ranged widely from being present just below the surface in most basins to no evidence of a high water table. Typically saturation levels in the wetlands and ditches ranged from being at or just below the surface to depths of 10-12". During the time of the spring delineation much of the site's wetland hydrology was determined by primary indicators like the presence of surface water (A1), high water table (A2), saturation of the soil in the upper 12" (A3), sediment deposits (B2), and drift deposits (B3). Secondary indicators of wetland hydrology that were common throughout the delineation include: drainage patterns (B10), saturation visible on aerial imagery (C9), geomorphic position (D2), and shallow aquitard (D3).

The MNDNR Protected Waters Map did not indicate any protected water under MNDNR jurisdiction within the subject property but located within one mile of the site within Sections 27, 28, and 34 of Workman Township are two protected waters; Flowage Lake and Rat Lake. The Mississippi River is located approximately 1.5 miles to the northwest of the subject property in Section 18 of Workman Township.

In a correspondence with MNDNR, Division of Ecological and Water Resources, correspondence #20110551 dated June 21, 2011, MNDNR indicated that *"Based on this query, there are no known occurrences of rare features in the area searched."*

Please refer the Wetland Delineation Report (previously submitted and approved by USACE and TEP) for specific wetland delineation details or Appendix B for the Wetland Delineation Map and Soil Boring information (includes USACE Data Forms).

5.0 Mitigation Strategy and Site Selection

5.1 Compensatory Mitigation

The chosen wetland mitigation property is appropriate for wetland restoration and "*restoration is the preferred compensatory mitigation technique (§332.3(a))*".

Newly created wetland habitats require many years to become functionally established, even under favorable conditions. Even simple wetland marshes are quite complex and their interdependent interactions are presently not clearly understood. Developments of large wetland restoration projects will always involve some uncertainty but to maximize the success rate of any large bank site, a key principle that should be followed is that one should not attempt to create or restore difficult, unique and/or rare wetland types.

In general, sustaining hydrology is the key to a successful wetland mitigation project and the failure to do so would likely result in failure to sustain hydric soils and hydrophytic vegetation. The following items were evaluated to increase the wetland mitigation project success:

1. Minimize landscape manipulation while restoring hydrology:
    - Grading would not require soil movement offsite or brought onto the site (zero net fill design).
    - Development of wide low (8:1 slope) profile earthen embankments to maximize hydrology retention through the minimization of surface water and shallow groundwater losses to the ditch system.
    - Minimize landscape contouring with elevation adjustments as needed to acquire, distribute, and retain wetland hydrology. This would include developing the low areas away from the ditches.
    - If greater than 6 inches of topsoil is to be disturbed in the grading process, the topsoil would be scraped off and stored appropriately nearby; then placed back over the graded areas.
2. Creating micro-topography through disking to maximize seed contact with soil during seeding activities.
3. The Palisade I and II is located in a favorable landscape position:
    - Regionally surrounded by water sources and water bodies and site is topographically in a valley.
    - Located at approximate topographic elevations as adjacent benchmark/reference wetlands.
    - Project location would restore local and regional wetland habitat fragmentation.
    - Existing onsite and adjacent invasive plant species are minimal annual farming and recent herbicide spraying.

4. The subject parcels exhibits hydric soils:

    - 98% of the on-site soils are hydric and favorable for hydric soil function re-establishment.
    - Approximately 62% of the soils were muck soils with historical water tables within 1 foot above and below surface elevations.
    - Remaining mineral soils exhibit hydric conditions with historical water tables within 1.5 feet below surface elevations.

Because of the project's lower landscape topography, presence of onsite and benchmark wetlands and favorable hydrological conditions, and with U. S. Steel financial assurance and commitment, this project would avoid common wetland mitigation pitfalls, such as:

- The inability to accurately estimate or model the following site features:
    - Hydroperiods
    - Water depths
    - Water supply
    - Shallow and deep groundwater tables
    - Substrate (soil variability and types)
- Inability to implement contingency for:
    - Controlling invasive plant species establishment
    - Minimizing grazing of plantings (deer and/or geese)
    - Reacting to catastrophic events (droughts, storms, and droughts)
    - Replanting of herbaceous and woody vegetation should failure occur
- Insufficient follow-through:
    - Inadequate monitoring
    - Inadequate maintenance
    - Inadequate resources for pro-active adaptive management

5.2 Vegetation Establishment

5.2.1 Site Conditions for Vegetation Establishment

Vegetation establishment is based on hydrological information and evaluated data collected from the placement of staff gauges, nested piezometers, paired wells (shallow and deep), cased well (to allow observation of hydraulic testing below the shallow confining unit), and the analysis of aquifer pumping tests.

The analyzed data and flow modeling showed potential depths to shallow groundwater and surface water flows for the growing season during dry, wet and average precipitation years. This modeling integrated topographic data, ditch flow options (including various ditch abandonment scenarios) and associated soil types to calculate potential hydrology levels under various circumstances. Hydrology was found not to be uniform throughout the 480 acres and varied from parcel to parcel depending on the ditch drainage flow and underlying soils. Each soil type was evaluated for parameters including hydraulic conductivity that would provide estimated capillary fringes from the predicted groundwater depths, providing a zone of expected saturation during the growing season as based on the modeled groundwater elevations. Restrictive layers were also evaluated in this process, as clay layers have been identified throughout the property.

After assessing the various existing condition data, alternatives to increase sustaining hydrology were evaluated. Each alternative evaluated had to consider dilemmas such as regulated ditches would not be abandoned and considerations for many offsite private properties that may have elevated groundwater tables from the implementation of this project. Also certain roads could not be modified or removed since they are within utility easements. Correspondence with the Great River Energy Land Rights Department was completed for this project and easement roads would remain open for future maintenance by Great River Energy.

A ditch abandonment petition was submitted to Aitkin County in October 2011 but it is anticipated that abandonment of any County regulated ditches would not be permitted. The 2011 hydrology model and water budget analysis illustrates that if the ditches remained flowing (existing conditions), other site manipulations would be required to obtain adequate sustaining hydrology. Using earthen embankments only was investigated and could capture hydrology for some parcels. However, earthen embankments alone may not maximize or capture adequate precipitation under normal circumstances on some areas of the Bank Site. In addition, using only earthen embankments would create pooling conditions along the earthen embankments after every rainfall. Water pooling during heavy rain events could erode embankment areas and create internal mote scenarios that could short circuit the hydrological restoration by draining directly into the ditches through seepages. To prevent earthen embankment erosion and leakage through the earthen embankments into the ditches, minor grading was designed into the project.

The current Bank Site plan has been modeled to demonstrate sustaining hydrology and increases water onsite to the maximum possible extent without ditch abandonment. Therefore, in anticipation that none of the regulated ditches would be abandoned, minor grading and earthen embankments would be implemented. The heights of the upland earthen embankments are the minimal heights necessary to maximize surface water retention and are about 2 feet higher that the existing grades along most of the parcel perimeters. To construct portions of these perimeter earthen embankments, some delineated wetlands would have to be raised to minimize water loss into the ditches. After grading, some areas would become have shallow pools during heavy precipitation, but these pools are not expected to remain long enough to become shallow marshes.

The proposed contour lines shown on the mitigation plan sheets are a representation of the approximate earthwork required to establish the necessary perimeter earthen embankments and pooling basins. In developing the mitigation plan drawings, the method of construction was a critical component to what is seen on these drawings. The project will required the use of GPS machine controlled (laser guided) construction methods to grade the proposed low profile earthen embankments. This type of specialized equipment have the ability of fine grading (1/2" or better) and are capable of analyzing CAD drawings such that micro-adjustments on blade heights would match the grades shown on the site plan. Therefore, these GPS guided machines must recognize the ground elevations at all times when grading. This means that various contour lines that may typically not be shown are shown to smooth over ground surfaces of the approximate same elevations. This is done for several reasons. The first, reason as just mentioned above, is to assist and guide the construction equipment as it maneuvers over the site. The equipment must know where they are located by reading smoothed out contour elevations as shown on mitigation plan sheets. The second reason for using smoothed out contour lines is based on the limitation of the CAD program to determine accurate cut and fill calculations. The accuracy of net fill calculations is increased by these contour lines and also needed for bid purposes. As such, the proposed project is shown to results in a no net loss of soil and therefore no soil to be removed from any parcel.

Overall, the wetland Bank Site plan is designed to mound up as much overland flow and precipitation as possible. The proposed grades are establish at elevations for obtaining sustaining hydrology throughout the growing season based on average annual precipitation, depth to water table, zones of saturation, soil types, and as compared to adjacent reference wetlands. The wetland mitigation plan also considers the various types of wetlands to be restored and provides elevation grades for the proposed plantings.

Reference wetlands from adjacent forested, shrub-carr and herbaceous wetlands provided some benchmark comparisons during the 2011 growing season. Observations by June 2011 demonstrated that farmed wetlands exhibited a noticeable drawdown and many soil borings no longer exhibited standing water in the soil pits. The adjacent reference wetlands still exhibited water in their pits or still had saturated soil within the top 12-18 inches at the same sampling dates. By late August, much of the farmed wetland areas exhibited dry soils within 18" but

adjacent natural wetlands still remained saturated within 18 inches. During heavy rain events, both areas recover quickly but the farmed wetland areas became dryer quickly after a storm event as storage was evidently less in the farm fields and the ditches were working. These were general observations made by digging paired soil borings at seven locations every month. These paired soil borings were not necessarily at the same boring locations each time, but in the same general area for qualitative observations for soil saturation within 18 inches from the surface.

5.2.2 Proposed Wetland Compensation Plantings

The Bank Site is planned to be seeded in 2012 with high quality native (locally collected) fresh (wet) meadow and sedge meadow seed mixes. These wetland types are the most appropriate for the given site elevations as the lower topographic areas would consist of near shallow marsh conditions and the highest restoration elevations would be optimal for fresh (wet) meadow conditions. The two meadow seed mixes developed by Prairie Moon Nursery will not contain any invasive plant species and all herbaceous species are native and local to Aitkin County. The seed mixes have been collected within 100 miles of the Bank Site.

Woody species will also be planted on 80 acres within the Bank Site and needs to be planted in the spring season (as noted by the Aitkin County Program Forester). Approximately 42 acres of hardwood swamps and 34 acres of shrub-carr wetlands would be planted in the spring of 2013.

5.2.3 Shrub-Carr and Hardwood Swamp Wetland Planting

For shrub-carr and hardwood swamp woody vegetation, the likely species to be planted in the spring of 2013are noted below. Telephone and email consultations were initiated in October 2011 with Craig VanSickle of the Minnesota DNR State Nursery and Daren Wysocki, Timber Program Forester from Minnesota DNR. The discussions entailed appropriate woody vegetation for the wetland Bank Site. As a result of these discussions, the woody species noted below would be planted based on MNDNR availability and their likelihood of survival in this geographic location.

Typical shrub-carr wetland would consist of red-osier dogwood (*Cornus sericea),* nannyberry (*Viburnum lentago*), and highbush cranberry (*Viburnum trilobum).* Other species of shrubs may be available such as willows (e.g., bebb, pussy, and sandbar) and alders and may have to be collected by private nurseries. It was indicated by Craig VanSickle of MNDNR that alder plants are not likely to survive in any nursery environment and would not be adequately available for planting. It was also noted that natural recruitment of willows and alders would be expected take place and would not need to be planted on this site. Shrub-carr seeding may also be an option and that may supplement the woody planting plan. However this method may require more mowing to help small seeding compete as they could be easily shaded out in the first few years of growth.

Hardwood swamp species may consist of balsam fir (*Abies balsamea*), silver maple (*Acer saccharinum*), tamarack (*Larix laricina*), and northern white cedar (*Thuja occidentalis*). Yellow birch (*Betula alleghaniensis)*, red maple (*Acer rubrum)* and black spruce (*Picea mariana*) may also be alternate species.

The proposed planting locations for trees and shrubs are shown on the Wetland Woody Vegetation Plan in Appendix C. The planting areas based on higher topographic wetland areas to optimize tree growth leading into a more saturated shrub-carr area. The areas shown locations may be revised as post construction observation may indicate better locations for the tree and shrub plantings. The proposed woody planting rate is 600 trees and shrubs per acres and this estimate may also be revised based on species availability and size of plant material.

5.2.3 Fresh (wet) Meadow and Sedge Meadow Seed Mixes

Fresh (wet) meadow and sedge meadow seed mixes are dominated by facultative wet and obligate plant species. Both communities have similar hydrology needs but the provided seed mixes have different species dominance. The sedge meadow mix is more diversified and leans toward a wetter area of the mitigation site. Based on the hydrology study, the approximate 1226-foot design pool elevation was selected as the predominant elevation that would separate the fresh (wet) meadow and sedge meadow seeding areas. Even though the proposed seeding elevations are not expected to have uniform hydrological distribution in the fields due to soil types, ditch influence and subsurface drainage, the chosen diversified seed mixes would still germinate throughout the designed wetland areas. In reality, the final micro topography and sustaining hydrology in each parcel will dictate the vegetation establishment, to include species in the native seed bank.

For example, the 1227’ elevation would generally be dryer on most parcels, but in some areas, the 1227’ elevation would be wetter than some 1226’ areas. It is anticipated that fresh (wet) meadow/sedge meadow wetlands would be seeded above the approximate 1226’ elevation and the more diverse sedge meadow wetland would be seeded below the 1226’ elevation. Upland seeding would occur on the earthen embankments at around 1227.5’ and higher elevations.

Based on this scenario, fresh (wet) meadow/sedge meadow wetland would be approximately 27.65% (149.7 acres) of the seeded areas and the more diverse sedge meadow wetland would be approximately 52% (233.79 acres) of the seeded areas. The upland seed mix is expected cover the earthen embankments and would be approximately 16% of the seeded areas (60.54 acres), resulting in approximately 444 acres of total seeding. The remaining acres would consist of roads (22.35 acres) and open ditches (12.56 acres), totaling approximately 479 acres. Please refer to Table 5.1, 5.2 and 5.3 below for the proposed meadow seed mixes.

5.2.4 Upland Seeding

All upland species to be seeded along the earthen embankments are native and local to Aitkin County. False indigo *(Amorpha fruticosa*) and prairie ninebark *(Physocarpus opulifolius*) shrubs will also be seeded with the proposed upland seed mixes. A cover crop of oats and winter wheat will be intermixed on the earthen embankments for quick stabilization and to prevent erosion while native seeds are establishing. These annuals grow rapidly and when seeded lightly, would not compete with herbaceous native plants. These annuals would not reseed in the second year. Maintenance will also be provided in the upland areas such that invasive plant species would be minimal.

TABLE 5.1 – FRESH (WET) MEADOW/SEDGE MEADOW WETLAND SEED MIX (~150 acres)

FRESH (WET) MEADOW/SEDGE MEADOW MIX - FORBS

Description	% by wt.	Wetland Indicator
Asclepias incarnata (Swamp Milkweed)	7.06	OBL
Eupatorium maculatum (Spotted Joe-pye weed)	0.80	OBL
Eupatorium perfoliatum (Boneset)	0.32	FACW
Lobelia siphilitica (Great Blue Lobelia)	0.16	FACW
Mimulus ringens (Monkey Flower)	0.48	OBL
Solidago graminifolia (Grass-leaved Goldenrod)	0.16	FACW
Thalictrum dasycarpum (Purple Meadow Rue)	1.61	FACW
Verbena hastata (Blue Vervain)	1.12	FACW
Veronicastrum virginicum (Culver's Root)	0.16	FAC
Totals for Forbs: Seeding rate: 38 seeds per square foot	**11.88**	~248,292,000 seeds subtotal

FRESH (WET) MEADOW/SEDGE MEADOW MIX - GRASSES, SEDGES & RUSHES

Description	% by wt.	Wetland Indicator
Bromus ciliatus (Fringed Brome PLS)	33.71	FACW
Calamagrostis canadensis (Blue Joint Grass PLS)	0.80	OBL
Carex scoparia (Lance-fruited Oval Sedge)	4.82	FACW
Carex stricta (Common Tussock Sedge)	0.48	OBL
Elymus virginicus (Virginia Wild Rye PLS)	24.08	FACW
Glyceria grandis (Giant Manna Grass)	9.63	OBL
Poa palustris (Fowl Bluegrass PLS)	10.43	FACW
Scirpus atrovirens (Dark-green Bulrush)	3.21	OBL
Scirpus cyperinus (Wool Grass)	0.96	OBL

Totals for grasses, sedges, and rushes: Seeding rate: 143 seeds per square foot	**88.12**	~934,362,000 seeds subtotal
Totals Fresh (Wet)/Sedge Meadow Mix: Seeding rate: 181 seeds per square foot	**100.00**	~1,182,654,000 seeds total

TABLE 5.2 – SEDGE MEADOW WETLAND SEED MIX (~235 acres)

SEDGE MEADOW - FORBS

Description	% by wt.	Wetland Indicator
Anemone canadensis (Canada Anemone)	0.36	FACW
Asclepias incarnata (Swamp Milkweed)	0.96	OBL
Aster puniceus (Swamp Aster)	0.96	OBL
Aster umbellatus (Flat-Topped Aster)	0.60	FACW
Cicuta maculata (Water Hemlock)	3.01	OBL
Desmodium canadense (Showy Tick Trefoil)	6.02	FAC
Eupatorium maculatum (Spotted Joe-pye weed)	0.48	OBL
Eupatorium perfoliatum (Boneset)	0.36	FACW
Helenium autumnale (Sneezeweed)	0.60	FACW
Helianthus grosseserratus (Saw-tooth Sunflower)	0.60	FACW
Liatris pycnostachya (Prairie Blazing Star)	0.24	FAC
Lobelia siphilitica (Great Blue Lobelia)	0.12	FACW
Mimulus ringens (Monkey Flower)	0.12	OBL
Pycnanthemum virginianum (Mountain Mint)	0.96	FACW
Solidago graminifolia (Grass-leaved Goldenrod)	0.24	FACW
Verbena hastata (Blue Vervain)	1.81	FACW
Vernonia fasciculata (Common Ironweed)	0.36	FACW
Veronicastrum virginicum (Culver's Root)	0.24	FACW
Totals for forbs: Seeding rate: 43 seeds per square foot	**18.07**	~440,173,800 seeds subtotal

SEDGE MEADOW - GRASSES, SEDGES & RUSHES

Description	% by wt.	Wetland Indicator
Andropogon gerardii (Big Bluestem PLS)	18.07	FAC
Bromus ciliatus (Fringed Brome PLS)	18.07	FACW
Calamagrostis canadensis (Blue Joint Grass PLS)	0.48	OBL
Carex pellita (Broad-leaved Woolly Sedge)	0.60	OBL

Carex stricta (Common Tussock Sedge)	0.24	OBL
Carex vulpinoidea (Brown Fox Sedge)	1.20	OBL
Elymus virginicus (Virginia Wild Rye PLS)	21.08	FACW
Glyceria grandis (Giant Manna Grass)	1.81	OBL
Glyceria striata (Fowl Manna Grass)	1.33	OBL
Panicum virgatum (Switch Grass PLS)	9.04	FAC
Poa palustris (Fowl Bluegrass PLS)	2.41	FACW
Scirpus atrovirens (Dark-green Bulrush)	1.20	OBL
Scirpus cyperinus (Wool Grass)	0.36	OBL
Spartina pectinata (Cord Grass PLS)	6.02	FACW
Totals for grasses, sedges, and rushes: Seeding rate: 80 seeds per square foot	**81.93**	~818,928,000 seeds subtotal
Totals Sedge Meadow Mix: Seeding rate: 123 seeds per square foot	**100.00**	**~1,259,101,800 seeds total**

TABLE 5.3 - UPLAND SEED MIX (~60 acres of earthen embankments)

UPLAND FORBS

Description	% by wt.
Agastache foeniculum (Anise Hyssop)	0.86
Asclepias syriaca (Common Milkweed)	0.57
Aster laevis (Smooth Blue Aster)	0.57
Aster novae-angliae (New England Aster)	0.29
Astragalus canadensis (Canadian Milk Vetch)	0.57
Desmodium canadense (Showy Tick Trefoil)	0.57
Heliopsis helianthoides (Early Sunflower)	1.25
Hypericum pyramidatum (Great St. John's Wort)	0.57
Liatris pycnostachya (Prairie Blazing Star)	0.57
Monarda fistulosa (Wild Bergamot)	0.57
Oenothera biennis (Common Evening Primrose)	0.57
Petalostemum purpureum (Purple Prairie Clover)	1.82
Rudbeckia hirta (Black-eyed Susan)	2.39
Solidago rigida (Stiff Goldenrod)	0.57
Thalictrum dasycarpum (Purple Meadow Rue)	0.57
Verbena hastata (Blue Vervain)	0.57
Totals for forbs: Seeding rate: 26 seeds per square foot	**12.88**

UPLAND SHRUBS (Seeds)

Description	% by wt.
Amorpha fruticosa (False Indigo)	0.29
Physocarpus opulifolius (Prairie Ninebark)	0.19
Totals for shrubs: Seeding rate: .3 seeds per square foot	**0.48**

UPLAND GRASSES, SEDGES & RUSHES

Description	% by wt.
Agropyron trachycaulum (Slender Wheat Grass PLS)	11.21
Andropogon gerardii (Big Bluestem PLS)	19.16
Andropogon scoparius (Little Bluestem PLS)	15.33
Bouteloua curtipendula (Side-Oats Grama PLS)	15.33
Bromus kalmii (Prairie Brome PLS)	9.58
Elymus canadensis (Canada Wild Rye PLS)	14.37
Panicum virgatum (Switch Grass PLS)	0.57
Sporobolus heterolepis (Northern Dropseed PLS)	0.67
Totals for grasses, sedges and rushes: Seeding rate: 29 seeds per square foot	**86.21**
Totals for Upland Mix: Seeding rate: 56 seeds per square foot	**100**

EROSION COVER CROP FOR EARTHEN EMBANKMENTS

Description	% by wt.
Avena sativa (Oats)	50
Triticum aestivum (Winter Wheat)	50
Totals cover crop for earthen embankments: Seeding rate: 6 seeds per square foot	**100**
Total for Upland Earthen embankments Seeding rate: 62 seeds per square foot	**~2,613,662 seeds**

Depending on the timing for the seeding and planting at the Bank Site, the final quantities and native plant species types may various due to availability. The contractor may substitute with Prairie Moon Nursery consultation and as needed to fulfill the quantities needed and will notify U. S. Steel of its substitutions, if any. The proposed Wetland Seeding Plan is shown at Appendix C.

5.2.5 Vegetation Management Schedule

The herbaceous vegetation noted above will be seeded in the fall of 2012 immediately following construction of the earthen embankments and grading. The sequence required by the contractor would be to seed Palisade II

(Minntac -113 seeded acres) first, followed by Palisade I (Keetac - 747 seeded acres) and then the Bank Site (444 seeded acres). Should weather delay construction during the work schedule, contractors would be asked to complete the current site to the best of their abilities and continue at the next appropriate date. This may mean that Palisade I and II are completed in the fall and the Bank Site may be completed the following spring with snow seeding. A total of approximately 444 acres shall be seeded and later woody species planted at the Bank Site as the remaining land consists of roads and ditches. The contractor will be required to till the land so that the seeds will have maximum contact with the soil when broadcasted.

Post seeding maintenance will involve monitoring and maintenance. The vegetation management plan involves monthly inspection of the overall plant growth and invasive species control as needed. Adaptive management will be initiated if and when needed. All proposed adaptive management will be put into a plan explain the problems with recommended methods to correct the problem. The plan would be submitted to the Interagency Review Team for review. It is anticipated that within the first 2-3 weeks of the first growing season, staff will be onsite evaluating the plant growth and assessing site hydrology.

Herbivore control, mid-summer and/or end of summer mowing, and invasive plant species control may all be necessary during the first few years. Re-seeding may also be implemented if necessary.

6.0 Wetland Hydrology Assessment

This section presents a synopsis of the work performed to characterize the hydrology of the Bank Site. It provides the basis for the use of earthen embankments to retain runoff and thereby increase the elevation of the water table to restore wetland hydrology to the Bank Site. The following sections recapitulate the climate and hydrologic data, the computations completed to estimate the various components of the water budget, the site work performed to characterize the aquifer hydraulics and to establish a ground-water and surface water database, and the efforts expended to frame and calibrate a ground-water model to predict the effects of proposed modifications on the phreatic surface during normal and drought conditions.

The information provided herein is primarily an abstraction from U. S. Steel's draft Wetland Mitigation Report submitted to the USACE in December 2011. That earlier report related the work performed on U. S. Steel's wetland remediation activities on U. S. Steel's contiguous 1,416-acre wetlands mitigation site, of which the Bank Site comprises of approximately 480 acres. The present Bank Site reportreferences information contained in the December 2011 draft Wetland Mitigation Report and readers may go to that report or request for a more detailed report/methods if required.

In that sense, the present Bank Site report is intended to be an update of the December 2011 draft Wetland Mitigation Report. The modeling performed for the 2011 wetland mitigation study indicated that a significant amount of runoff from Bank Site could be retained by earthen embankments and be used to raise the water table,

even without ditch abandonment. Thus, when the difficulties involved in ditch closure arose, the decision was made to propose the installation of earthen embankments to retain as much water on the site as possible and to grade the parcels in order to: (1) provide a more uniform distribution of recharge; and (2) to enhance diversity in the depth to ground water and the depths of ponds that will develop, where closed surface depressions intersect the water table. Other than the effects of the closure of two minor, internal private ditches, the present document will consider the ditches only as they relate to the determination of aquifer properties.

Prior to gathering hydraulic data in the field, a preliminary water budget was performed to facilitate the orderly development of the conceptual site hydrologic model that would guide the data-gathering efforts and, after being adjusted to incorporate those data, form the basis of the predictive finite-difference model. The size of the Bank Site and the complexity necessitated the use of a numerical model in order to predict the efficacy of using earthen embankments and grading to restore wetland hydrology, in lieu of closing ditches. The following sections relate: how the preliminary water budget was developed (Section 6.1); and a recapitulation of the site hydrologic analysis (Section 6.2), through the establishment of a site hydrologic monitoring network and potentiometric database, hydraulic testing, ditch-flow analysis, and computer modeling. Please refer to Appendix F for the Numerical Modeling Results.

6.1 Water Budget

A water budget assessment was initially conducted for the larger 1,416-acre wetland mitigation site in 2011. This involved an examination of the various parcels that make up that larger site and includes information, specific to parcels on the Bank Site. The *Regional Water Budget Manual* published (in 2009) by the New Jersey Department of Environmental Protection was used in lieu of a comparable document supplied by MNDNR. Computation sheets for the whole 1,416-acre project site were included in the December 2011 draft Wetland Mitigation Report.

Because there are several soil series present with different hydrologic properties and the acreage surrounded by peripheral ditches varied, it was best for predictive modeling to break up the water budget into several parcels rectangular parcels (of between 40 and 320 acres) mostly bounded by peripheral drainage ditches, and estimate the various water budget components for each parcel separately rather than to lump them together and try to model the entire site. Figure 6-1 shows the locations of these parcels just for the Bank Site boundary. The portions of these parcels that make up the site include the southern half (40 acres) of Parcel 2, which is the western half of the southwest quadrant of Section 27 of Workman Township; all (40 acres) of Parcel 3, which is the southeast quarter of the southwest quadrant of Section 27; the east half (80 acres) of Parcel 6, which is the northwest quadrant of Section 34; all (80 acres) of Parcel 7, which comprises the south half of the northeast quadrant of Section 34; and the eastern three-quarters (240 acres) of Parcel 8, which is the southern half of Section 34. Consequently, the water-budget assessments in the December 2011 draft Wetland Mitigation Report

for Parcels 2, 3, 6, 7, and 8 are pertinent to the present document and summary tables for the area-specific water-budget components are presented in Table 6-1.

Each water-budget component is briefly discussed in its own section below. Traditionally, the water budget of any hydrologic system would contain several components, including precipitation, evapotranspiration, surface water outflow (run-off), surface water inflow (run-on), ground-water inflow and ground-water outflow. The relative magnitudes of these components vary considerably among the parcels and one or more may be negligible or become negligible seasonally. For example, all or nearly all of the water contributed to the system comes from precipitation. As the site is continuously drained by peripheral and internal ditches, a significant portion of the water leaves the site via the ditch system. Water reaches the ditches predominantly by surface run-off and as baseflow through the shallow aquifer. In the warmer months, evapotranspiration becomes significant. The shallow sand aquifer is the most significant aquifer hydraulically, and local well logs indicate that there is at least one deeper sand aquifer beneath the glacial lake silts and clays that begin 15 to 25 feet below the ground surface.

Although the proportion of the shallow groundwater outflow to deeper units is distinct from baseflow discharge to ditches, both are simply treated as ground-water outflows from the perspective of a conventional water budget. Nevertheless, any leakage through the confining unit to the deep aquifer system may be important since water stored in the ditches may be necessary for diversion and adaptive management in dry years. The magnitude of the leakage could not be estimated without developing an alternate numerical model that can iteratively find a water table elevation that balances the on-site recharge with the relative hydraulic resistances, both horizontally to the ditches and vertically, through the confining unit, to the deep aquifer. The current model, making conservative assumptions where data is lacking, facilitates the estimate of water-table elevation changes in response to proposed site changes for retaining water. The model results have been used to better inform the estimates of ground-water outflow in the water budget. These modeling efforts are discussed further in Section 6.2.4. Under current conditions, it is expected that the water levels in the shallow aquifer and soils are controlled primarily by precipitation recharge and discharge through the ditch system. The following sections describe how each of the water budget components was calculated.

6.1.1 Precipitation and Evapotranspiration

Data used consisted of published temperature and precipitation data compiled by the National Oceanic and Atmospheric Administration (NOAA), ground-water data collected by sets of shallow and deep piezometers installed throughout the site, topographic data published by the United States Geological Survey (USGS), and soil survey data published by the United States Department of Agriculture (USDA).

Historic precipitation, temperature, and weather data was available for the project site from 1892 to present for the Sandy Lake Dam station located 5.2 miles northeast of the project site. To determine daily precipitation and temperature for the wettest and driest years, the Palmer Hydrological Drought Index (PHDI) was used. The PHDI

considers the hydrological impacts of precipitation, ground-water levels, reservoir levels, and temperature of the surrounding area. Data sets for only the last 50 years were considered because older data sets were incomplete. It was determined that the wettest and driest years, beginning with the start of the growing season, were April 1986 through March 1987 and April 1988 through March 1989, respectively. In addition, the year with the median PHDI (April 1990 through March 1991) was selected for use in multi-year simulations in order to prepare the model's starting heads to simulate a wet or dry year that was preceded by a number of "average" years. In addition, a water budget was completed for the first eight months of 2011, which uses daily precipitation and temperature data collected at meteorological stations at Aitkin, Minnesota (approximately 25 miles to the southwest of the mitigation site) and the local airport at McGregor, Minnesota, approximately 6 miles to the south-southeast. These data sets were compared with periodic on-site rain gauge measurements. The entire data were presented in the December 2011 draft Wetland Mitigation Report. The area-specific precipitation for each month of the perspective for wet, dry, normal, and 2011 are presented (along with the other water-balance components) for each parcel included in the Bank Site for the current and proposed site topography in the charts provided in Appendix E.

Because the ground is normally expected to be frozen from December through March, no recharge is assumed during those months and all precipitation falling (as snow) was expected to accumulate until April. For the month of April, the snow is expected to melt at a more or less uniform rate throughout the month and infiltrate continuously. This average rate of snow melt was added to daily precipitation recorded during April for the years of interest. The daily precipitations were used in the surface water inflow and outflow computations, which are discussed below.

The evapotranspiration rates were estimated using the Thornthwaite (1948) method, which utilizes temperature and solar-radiation inputs for the project site. Temperature and insolation data were obtained from the airport weather station at McGregor. The area-specific potential evapotranspiration for each month of the respective for wet, dry, and normal years, as well as 2011, are presented for each parcel included in the Bank Site for the current and proposed site topography in Appendix F. From the charts, it can be seen that evapotranspiration is greater in the warmer months and represents the principal annual outflow, although it is exceeded by groundwater flow and occasionally by runoff during the cooler months.

6.1.2 Surface Water Outflow

Currently, a considerable portion of the precipitation applied to the surface is lost through run-off to the ditch system. The proposed modifications to the site to restore wetlands hydrology include the construction of wide, low earthen embankments to minimize loss to the ditches. As explained above, one of the purposes of dividing the Bank Site into parcels was to break the site into areas that would better represent the differences in local soil hydrologic properties and thus improve the predictive value of the ground-water flow model.

The hydrologic soil classes (HSCs) were identified for each parcel (as related in Section 2.2). For the purpose of calculating the monthly runoff rates for the representative years in each parcel, TR-55 run-off curve numbers (CN) were determined for each of the HSCs present on the parcel, for respective land cover types. For each day in the year and each combination of hydrologic soil class and land cover, the potential maximum retention and the initial abstraction were calculated. On days when the precipitation was less than the initial abstraction, the entire daily recharge was retained on the site, either to be recharged or undergo evapotranspiration. Otherwise, the run-off was calculated using the equation provided in TR-55.

Expected run-off quantities were calculated for the wettest, driest, the year with the median PHDI, and for the first eight months of 2011, based upon the recorded daily precipitation for those respective years. For each parcel, a weighted average run-off was calculated based on the proportion of each soil type therein for each of the selected years. In order to compare the magnitude of the monthly run-off component from each parcel to the corresponding rates of precipitation and evapotranspiration, the combined run-off from all of the soil series in the parcel was divided by the area of the parcel and then converted to inches per month. The parcels identified for the water budget are indicated and numbered in Figure 6.1. The results are shown on the charts provided in Appendix D.

6.1.3 Surface Water Inflow

With the current peripheral ditch configuration, the majority of the run-on would be intercepted before it could enter the U. S. Steel wetlands Bank Site. The eastern half of the north side of Parcel 7 is not bounded by a ditch, but the area is a topographic high and the divide has an approximately north-south orientation, with a drainage ditch to the west and a wetland and stream to the east. Consequently, little surface-water flow is expected to move southward into the parcel.

Parcels 2, 6, and 8 are divided between the Bank Site and U. S. Steel's Palisade I (Keetac) wetland mitigation parcels. There is an east-west oriented divide immediately south of the boundary between the Bank Site portion of Parcel 2 and the northern half, which is part of the Palisade I wetland mitigation site. Therefore, very little overland flow is expected to runoff northward from the Bank Site to Palisade I, and virtually none is expected to flow southward. Similarly, portions of Parcels 6 and 8 are shared between Palisade I on the west and the Bank Site on the east and drainage swales on both parcels that cross the boundary between the wetland mitigation site and Bank Sites divert surface water to the west, away from the Bank Site.

With the proposed site and ditch modifications, no run-on would be diverted onto the Bank Site. The water-budget charts in Appendix D provide a column for surface water inflow, which being nil, is manifested as a gap between the evapotranspiration and the proposed ground-water outflow columns.

6.1.4 Ground-Water Outflow

Flow through the shallow aquifer underlying the Bank Site is controlled primarily by discharge to the ditch system. Precipitation (minus runoff and evapotranspiration) infiltrates as recharge to the shallow aquifer. The recharge causes an increase in hydraulic head. However, not all of the ground water under the parcels discharges to the peripheral ditch system. There is a shallow aquifer, which is mostly unconfined, that facilitates flow of groundwater from the interior of the parcels to the ditches. However, hydraulic testing of shallow aquifers and measurement of flow in the ditches both confirm that a large portion of the site ground water leaves the site, especially in the centers of the parcels, far from the ditches, by flowing downward through a lower-permeability interval, to a regional, deep sand aquifer that sustains local water supply wells. Quantifying the relative proportions of these two outflows was critical to the determination of whether the nullification of selected ditches would have been effective in restoring wetlands hydrology to the site. Given the large areas and variable hydraulic properties and recharge pattern, a finite-difference computer model was needed to perform the computations, the results of which are described in Section 6.2.4.

In order to calculate estimates of monthly ground-water outflow from the parcels to the ditches, initial (i.e. prior to the start of the growing season) average hydraulic gradients adjacent to the peripheral ditch for each parcel were based upon piezometric data (contained in the on-site hydrologic database, which is described in Section 6.2.1) and calculated hydraulic distances derived from the pumping test analyses (which are described further in Section 6.2.2). This was done assuming that the wettest and driest years would be preceded by a normal year. It was reasoned that the hydraulic gradient at this time of the year would be very low as recharge would have been zero for four months by this time. In addition, the starting gradient for a normal year would be such that, by the end of the year, the water in storage would be approximately equal to what it was at the beginning. The initial hydraulic gradient was then found by an iterative procedure using the goal-seeking tool resident in the spreadsheet application for the analysis.

The initial hydraulic gradient in each parcel was multiplied by a representative hydraulic conductivity and aquifer thickness for each parcel, and by the length of the parcel's ditch, to calculate the ground-water outflow for a given month. The change in storage was then divided by the aquifer specific yield to obtain a change in head and aquifer thickness. These head and aquifer-thickness changes were used to calculate the ground-water outflow and storage changes going into each successive month. These parcel-wide estimates of ground-water outflow are underestimates since they do not consider losses via downward flow, through the confining unit, to the aquifer below. They were used to guide the development of the finite-difference model used for the computer simulation and are plotted on for representative wet, dry, normal years, as well as 2011, for each of the respective parcels in the charts in Appendix D. Each chart shows the ground-water outflows for both current and proposed site conditions. It can be seen that ground-water outflow is expected to increase when storage is increased during months with greater precipitation and when, in the proposed condition, where more water is retained on the

parcels through the use of earthen embankments. Groundwater outflow is analyzed in Section 6.2.4, when the distribution of ground-water outflows is discussed, in preparation for predicting the efficacy of constructing earthen embankments for the purpose of restoring wetlands hydrology to the parcels.

6.1.5 Ground-Water Inflow

A strong hydraulic connection between the drainage ditches and the aquifer was observed during pump testing conducted across the site. Currently, the drainage ditches represent powerful hydraulic boundaries that generally would preclude ground-water inflow to the mitigation parcels. Because the currently proposed site modifications are intended to reduce run off on the mitigation parcels and not capture any off-site runoff, the hydrostatic head is expected to increase on the parcels and thereby increase the rate of ground-water outflow, either to the ditches or to the underlying deep aquifer, which has a mostly regional discharge. Consequently, for the evaluation of the water budget for the Bank Site the ground-water inflow into the parcels is considered to be zero and is therefore not represented in the charts in Appendix D.

6.1.6 Water-Budget Evaluation and Summary

The inputs and summary of monthly estimates for each of the monthly water-budget components are tabulated for each parcel in Table 6.1 for the existing site conditions and proposed changes for a repetition of the wettest and driest years in the 50-year period of record, as well as for the year (1990-1991), which was selected to represent an average year and the most recent year (2011-2012). Individual graphs for the separate parcels comprising the Bank Site are included in Appendix D. Each figure shows the values computed for:

1. The monthly precipitation and evapotranspiration, which are assumed to be unaffected by the proposed changes;
2. The surface-water outflow, which is subtracted from the precipitation only for the current site condition, but because of the proposed earthen embankments was retained for the proposed site condition water budget and not subtracted;
3. The monthly ground-water outflow for the existing condition and the expected monthly changes in storage and head; and
4. The monthly ground-water outflow for the proposed condition with the consequent changes in monthly storage and head.

Each graph also shows two curves, representing the cumulative monthly changes in storage, for the existing and proposed site conditions. The curve for the current condition shows the cumulative changes relative to a starting storage that would be maintained in a series of average years. Thus, the cumulative storage at the end of the selected average year is zero and the year ends where it began, with no net change. By zeroing out the average

year, the final cumulative storage for the wettest and driest years are greater and less than zero, respectively (though it may not be obvious because of the chart's scale).

The curve for the proposed condition also shows the cumulative changes relative to a starting storage that would be maintained in the current condition in a series of average years. Consequently, the curve shows both the proposed difference in the monthly accommodation of the various inflows and outflows as well as the predicted difference in the overall storage throughout the year between the proposed and current configurations for the individual parcels for a repetition of the wettest, driest, representative average, and most recent years. The predicted differences in storage between the current and proposed parcel configurations are also presented in Table 6.1.

To summarize, the storage changes for the existing condition were computed by subtracting the evapotranspiration, surface-water outflow, and existing-condition ground-water outflow from the precipitation. Precipitation and snow melt are major components during the spring, summer, and fall, but are practically non-existent during the winter. Evapotranspiration is a major component in the late spring and summer, but is minor in the fall and early spring and zero during the winter. Consequently, the determination of which year is wetter or drier depends not so much on the amount of precipitation, but when the precipitation falls.

In the present condition, surface-water outflow would be a contributing component of the water budget during the spring, summer, and fall, except during major precipitation events and snow melt events, when it would be a principal component. Because of expected normal freezing conditions, it is not considered during the winter.

The results of these analyses show that the retention of run-off (the current surface-water outflow) would result in a substantial increase in the ground-water recharge for each individual parcel, consequently increasing the storage, and by extension, increasing the amount of saturation within the mitigation areas. And as expected, with the increase in storage, there would also be an increase in ground-water outflow due to head differences. One of the benefits of the numerical modeling in Section 6.2.4 will be to quantify the effect of the proposed changes on the distribution of ground-water outflow via the shallow aquifer to the ditches and via downward flow to the deep, regional aquifer on the extent of areas with near-surface saturation. Even with a model that predicts an increase in the amount of ground-water outflow, the amount of saturation would increase significantly after the proposed changes relative to the current condition. Please refer to Appendix F for the Numerical Modeling Results.

6.2 Hydrologic Assessment

The hydrologic regime is the most important controlling factor of wetland species composition and ecosystem processes. Many species, particularly hydrophytic plants, respond primarily to the depth, duration, and timing of inundation. Concentrations of dissolved oxygen, soil development, nutrient cycling, and carbon fluxes are among

the processes influenced by spatial or temporal fluctuations in the depth of the water table. The hydrological assessment involved four components:

1. The establishment of a site-specific hydrological database, which includes meteorological data, water level data from ditch staff gauges and piezometers, and ditch flow measurements;
2. Aquifer hydraulic testing;
3. A systematic analysis of the site's surface water drainage system; and
4. A numerical hydrogeologic model.

Regional Hydrologic Setting

The Bank Site is within the drainage basin of the Mississippi River, which meanders southwestward approximately 2.2 miles northwest of Section 32 of Workman Township. It is the ultimate discharge area for surface water drainage on the mitigation site and for a portion of the aquifer system as well. Also, the Sandy River, which flows southward approximately one mile east of Section 34, is significant in determining the positions of hydraulic divides. Prior to the installation of the ditch drainage system, the easternmost portions of the site, including those parcels in Sections 27 and 34, and the eastern two-thirds of parcels in Sections 28 and 33, probably drained ultimately to the Sandy River. The remainder of Sections 28 and 33 and all of Section 32 drained to the Mississippi River. The present system of ditches and culverts (see Section 6.2.1), installed in the 1970s, channels the flow of Sections 27, 28, 32, 33, and 34 through neighboring sections to the west to a minor tributary of the Mississippi River. The only exception is a ditch on the east side of the northeast quadrant of Section 34 (along the west side of 240th Avenue), which flows north, joins a south-southeast-flowing stream, and turns east entering a culvert (C33 on Figure 6.2), and ultimately discharges into the Sandy River.

The portion of flow in the aquifer system that underlies the parcels that comprise the Bank Site that is diverted to the Mississippi River is dependent on the amount of hydraulic connection between the aquifer and the ditch system. The following sections briefly describe the on-site monitoring network and database (Section 6.2.1), hydraulic testing (Section 6.2.2), the ditch drainage system (Section 6.2.3), and hydraulic modeling in order to determine the optimal means of restoring site hydrology while minimizing impacts to neighboring parcels (Section 6.2.4).

6.2.1 On-Site Hydrologic Data Base

Monitoring wetland hydrology was necessary to establish baseline conditions and to calculate/measure the response of a wetland to hydrologic alterations in the surrounding watershed. It was necessary to install piezometers to monitor the water table during periods when it drops below the soil surface. Piezometers were installed at U. S. Steel's wetlands mitigation site in the fall of 2010 and spring of 2011, measured on several

occasions over the course of the late 2010 and 2011 growing season. Ditch gauges were also installed in ditches, near clusters of piezometers where possible, to monitor synoptic surface water levels.

Water levels have been measured and recorded periodically since September 2010. However, the monitoring network was largely incomplete until May 2011. To date, 18 rounds of water levels have been taken (including seven in September 2010). All water level measurements are tabulated in the December 2011 draft Wetland Mitigation Report.

The water level measurements were used to interpolate the contours of the potentiometric surface for each of the sampling dates, compute the vertical and horizontal components of the hydraulic gradient, serve as observation points for aquifer pumping tests, and provide targets for the calibration of the numerical ground-water flow model.

The water level data taken in mid spring through late summer of 2011 clearly show the effects of temperature and evapotranspiration on water levels. Water table contour maps were constructed for selected dates to illustrate these data. After reviewing the on-site precipitation gauge record, to avoid dates that might have had biased water levels caused by taking readings too soon after thunderstorms, three dates were chosen for contouring: May 20, June 30-July 1, and August 31-September 1, 2011. The Water Table Level Contour Maps are included in Appendix E.

The water level data exhibit an increase in the number of well/ditch gauge clusters that exhibit losing-ditch hydrology as the 2011 growing season progressed. In spring, the ditch gauges indicate that water levels in all but a few of the ditches were lower than in adjacent wells and piezometers. As such, the hydraulic gradient appears to drive flow toward the ditches and much of the flow in the ditches would be more or less continuously accumulated baseflow. By the summer, the trend reverses in many clusters. This hydraulic gradient reversal may be observed in greater detail where continuous data were recorded.

As the water table fell toward the end of spring and continuing through the summer, the number of clusters where the water table drops below the water level in the adjacent ditch sections increases from 11 (On May 20th) to 23 (on September 1st) of the 41 well/piezometer/ditch clusters. The water level in the ditch is maintained by the flow in upstream ditch sections, which continue to received baseflow (as well as runoff). The reason appears to be that the aquifer was losing water through the underlying confining unit to the aquifer below. There were no other possible sinks for ground-water outflow except where parallel ditches on either side of the farm road maintain much different surface water elevations. But this exception cannot be used to explain the behavior observed, because the mere transfer of flow from one ditch to another would retain the mass balance in the ditch system as a whole and the final total would equal the sum of the component ditches, which was not the case. The ditches appear to be losing water to the aquifer at some downstream point. This is confirmed by ditch flow measurements, which will be discussed further in Section 6.2.3.

As the water levels fall, the downward loss would continue as long as the shallow aquifer heads remain greater than those in the deep aquifer. During years with normal precipitation, recharge in less well-drained off-site areas and in the centers of the parcels would pass through the confining unit. This would raise the potentiometric surface in the deeper aquifer to a point where it is greater than the water level maintained in the ditches creating a situation with upward discharge, through the confining unit, to the ditches around the periphery of the parcels. It is clear from precipitation records through September 2011 that 2011 was drier than a normal year. It is expected that the losing-ditch configuration measured in the field represents a condition where the potentiometric surfaces are equilibrating downward (from the long-term average level built up over many years) to a level that would eventually reflect the lower recharge observed in 2011. If this is correct, then the trend would reverse when the recharge rate increases to a more normal level.

6.2.2 Aquifer Hydraulic Testing

Constant-rate aquifer pumping tests were conducted throughout the U. S. Steel wetland mitigation site (including the Bank Site parcels) to determine the properties of the shallow aquifer that exists across the site, the degree of vertical heterogeneity and permeability within the substratum, and the extent of hydraulic connectivity of the aquifer with the ditch system. Pumping rates averaged 1.1 gpm for all of the wells. The dataloggers were monitored via computer throughout the drawdown phase of testing to determine when drawdown had reached a steady-state. At that point, the pump was turned off and the piezometers were allowed to recover. Water levels continued to be recorded during the recovery phase. The duration of pumping ranged between 25.8 minutes (due to a pump failure) and 185 minutes, averaging 96.8 minutes for all wells.

For the hydrographs that were not affected by partial penetration, the image well and law of times methods were used to calculate the distance to the image well. By comparing this calculated radius with the radius under ideal hydraulic connection with ditch, the amount of hydraulic resistance added by the ditch bottom materials was estimated. The protocols followed, methods of analysis, and tabulated results are presented in the December 2011 draft Wetland Mitigation Report. The hydraulic parameter values obtained from these tests varied across the U. S. Steel property and were input to the finite-difference model used to predict the distribution of ground-water outflow between the ditches and the deep confined aquifer that underlies the region.

6.2.3 Ditch Flow Analysis

The Ditch Flow Diagram, Figure 6.2, shows the drainage pattern of the ditches and channels along the fields of the 1,416-acre wetland mitigation project, which includes the Bank Site. In Figure 6.2, the ditch drainage system is superimposed upon a color infrared aerial photograph that can be used to identify the locations of the ditches with respect to other physical features of the site. In order to facilitate the use of this figure, individual streamlines carried by the system are given a letter or number designation (A-Z, 1-9) and grouped (shown by color coding) according to the shared confluences. The official locations of county, state, and Fire Relief

Commission (FRC) ditches are highlighted to facilitate comparison with existing ditches. It should be noted that the observed directions of flow and actual positions of ditches are not always as shown on the official Aitkin County ditch mapping. In addition the locations of county ditches often fall along roads where there are two ditches on either side of the road, flowing in opposite directions. Where this occurs, both ditches are assumed to be included in the county ditch system.

County Ditch Analysis

There are segments of four county ditches designated on the 1,416-acre U. S. Steel property. These are CD-4, CD-38, FRC-A, and FRC-B. In three locations, there are overlaps between CD-4 and FRC-B. Following the convention shown on maps available on-line from Aitkin County, these areas of overlap have been designated "CD-4 & FRC-B". There is no location on the site where FRC-B exists independently of CD-4.

The county ditch system is intended to drain the properties of individuals that may benefit from the drainage. Ditches that are not designated either CD-4, CD-38, FRC-A, or CD-4 & FRC-B are considered private ditches. All ditches on the designated wetlands mitigation site, whether county ditches or private, ultimately drain through CD-38, either by discharging directly to one of its branches or indirectly through sections of FRC-A, CD-4, or "CD-4 & FRC-B". With the exception of CD-38, which throughout the U. S. Steel property, seems to be a simply-branched system of Strahler (1952) first- and second-order tributaries and a single third-order stem, the county ditch designations do not appear to reflect any common discharge point. In contrast to the county maps, portions of CD-4 ultimately drain out through FRC-A or CD-38. County mapping indicates that the diagonal ditch in the northwest quadrant of Section 29 is part of CD-4. The northwest half of the diagonal ditch appears to drain to the ditches along Route 232. The southeast half of the diagonal ditch drains, via a circuitous route (which involves flow through two private reaches), to FRC-A, which eventually joins the most downstream portion of CD-38 before the latter reaches the Route 232 culvert (C11 on Figure 6.2). The one ditch that drains to the Sandy River may be considered to be part of CD-4, although its position does not coincide with that mapped location of CD-4 until it flows off site.

All of the ditch flow through the Bank Site originates on the U. S. Steel property. Since the wetlands mitigation site includes some of the most up-stream portions of the 4,393-acre U. S. Steel property, most of the drainage originates on site. However, as discussed in Section 6.1, a significant portion of the drainage that flows through the mitigation site originates off site. Most of the drainage that originates off site enters through private ditches that are probably not recognized by Aitkin County. Please refer to the Adjacent Property Owners Map in Figure 6.3.

State Ditch Summary

The state ditches, SD-66 and SD-86, have northern branches that extend into the southernmost parts of the U. S. Steel property. Like the county ditches, their designated locations and apparent connections are not completely

confirmed by field study or observations. Portions of the traces shown on the county ditch map do coincide with the locations of several north-flowing ditches which drain through the U. S. Steel property (Ditches 1 through 7) and ultimately discharge to CD-38, downstream of the drainage from the designated wetlands mitigation site, at the point where the CD-38 leaves the property.

Some drainage from off-site properties to the south does enter the site through Ditches 5 and 6, which are considered to be part of SD-86, although they do not drain southward to the east/west-oriented main stem of SD-86. However, neither of these ditches is hydrologically significant with regard to the ditches surrounding the current 1,416-acre wetland mitigation site. Consequently, off-site drainage in state ditches would not be affected by any of the current proposed designs on any part of the 1,416-acre mitigation area, including the Bank Site.

Evaluation of Proposed Ditch Abandonment Effects

The current wetlands mitigation plan proposes to remove two internal ditches in the Bank Site. One of these (Ditch C on Figure 6.2) is located between the southeast and southwest quarters of the southwest quarter of Section 27. The other (Ditch F) lies between the northwest and the southwest quarters of the northeast quarter of Section 34. Ditch abandonment would be accomplished by either partly or completely abandoning a ditch with low-permeability clay or clay loam derived from landscaping in the interior of site. Abandoning these ditches will have an effect on the surface-water outflow from adjacent and upstream sources, which does not appear to include any significant off-site drainage. There may be a small contribution from the southern edge of the northwest quarter of the northeast quarter of Section 34, but the USGS 7.5-minute topographic quadrangle map for the Minnewawa quadrangle indicates that the land slopes toward the west in this area, except perhaps for a narrow band immediately adjacent to the ditch.

Abandonment of these ditch sections will result in a slight rise of the water table in the adjacent parcels, but it is expected to have less local impact than that of adding earthen embankments to retain surface runoff and no measureable regional impact. Nevertheless, it was decided to include the removal of these segments in the numerical model of the site hydrology. Please refer to Appendix F for the Numerical Modeling Results.

Ditch Flow Measurements

In order to better understand the relationship between recharge and the amount of flow in the ditches on the wetlands mitigation site, the response of baseflow to hydraulic heads on the parcels, and to provide baseflow estimates for use in aquifer modeling, the rates of surface-water flow were measured at specific times at sixteen selected points in the ditch system, mostly downstream of the Bank Site. The base map for the potentiometric Water Table Level Contour Maps (presented in Appendix E) shows the locations of these ditch-flow measuring points. A measured ditch cross section was made at each point and the cross-sectional areas were computed for several reference water levels at each location. In addition, the width of the wetted portion of the channel was

also computed from the section to represent successive cross-sectional areas for various elevations. This is because the width of the water surface perpendicular to the direction of flow could be measured with greater certainty than the channel depth and more quickly than the water level elevation. A more detailed account, including tables for use in interpolation of cross-sectional area from channel width for each section, is presented in the December 2011 draft Wetland Mitigation Report.

The rates of surface-water flow and channel widths were measured on four occurrences: June 1-3, June 17, July 13, and September 1-2, 2011. The results of the measurements and calculated surface-water discharges at each point are presented in the December 2011 draft Wetland Mitigation Report. The data exhibit considerable uncertainty, due in part to the effects of strong winds stirring sluggish waters. There may also be a large hyporheic component in the fast, shallow gravelly channel at ditch-flow measuring point DF-15. The following information was obtained:

1. Based upon observations made at ditch gauges in the mitigation site ditches, the upstream ditches are seasonally losing or gaining, with the number of losing locations increasing throughout the growing season.
2. In general, the measuring points that are more downstream do not indicate a systematic accumulation of flow, even in spring.
3. The rate of discharge measured between points in the main channel, in many cases, appears to decrease in the downstream direction (some consistently), even with inflow from tributaries entering between them, which strongly indicates that the ditches themselves are losing flow either continuously or at least in many locations.
4. Based upon field observations, flow increases quickly after recharge events and appears to recede slowly, but there are insufficient data/measurements to quantify this observation across the site.
5. Based upon field observations, certain first order channels appear to be stagnant most of the time, even when channels draining only a few times more area are flowing quickly. This may be an indication that a significant amount of the recharge leaves as ground water, which bypasses the drainage system by draining downward toward the deeper aquifer and not leaving as baseflow to ditches. The flow records for DF-6 and DF-7 consistently indicate stagnant or very slow flowing.

The resolution of some of these uncertainties can be at least partly addressed through numerical ground-water flow modeling. The computer model was used to simulate a conceptual model of the site hydrology and indicates whether the conceptual model is mathematically sound and determine whether the measured surface-water outflow is sufficient, without requiring loss to underlying aquifers (given the measured precipitation, hydraulic

conductivities, and aquifer thicknesses), or whether inclusion of a large ground-water loss to the underlying aquifer is needed in order to explain field observations. The following section attempts to address these issues.

6.2.4 Ground-Water Flow Modeling

The primary purpose of the ground-water flow modeling, using a computer application, was to:

1. Provide a means of confirming the conceptual model of the complex hydrogeologic system present at the mitigation site and surrounding U. S. Steel property;
2. Demonstrate that the water budget is conservative;
3. Provide a means of estimating the changes in hydraulic head that the proposed site modifications may be expected to cause; and
4. Provide insights that might inform recommendations for adaptive management of the mitigation site.

Pre-calibration calculations have shown that the horizontal hydraulic conductivities of the mapped soils are insufficient to convey the estimated average annual recharge to local ditch tributaries without a significant hydraulic head to drive them. Even the shallow, fine sand aquifer, has insufficient permeability. The permeability of the fine sand unit was subjected to constant-rate pumping tests, which resulted in hydraulic conductivities ranging from 2.8 to 61.9 feet/day, which is within the typical range for fine sand. However, it is difficult to accept that a 10-foot layer of this material is sufficient to convey even a few inches of annual recharge to the nearest drainage ditch without a hydraulic gradient that is at least 50 percent greater than has been observed on the Bank Site. In some places, the water table reaches the surface and runs off, developing the wetland areas that were observed and delineated across the wetland mitigation site.

However, run-off cannot entirely explain drainage on this site. Despite the intervening, low-permeability strata, the areas between ditches are very large; it appears that even a small amount of seepage through the silty and sandy clay units to the more productive aquifer at depth has become significant a pathway for site drainage. This hypothesis was tested by constructing and calibrating a ground-water flow model of the region, using USGS MODFLOW (McDonald and Harbaugh 1988).

The model was framed based upon the known stratigraphy and hydrogeologic boundaries of the region, using the hydraulic testing results and water-level and ditch-flow observations related above. In hydrogeologic modeling, both local and regional data are critical. This is because the local system necessarily operates within a continuum and the boundary conditions that define the larger system constrain all of its components. The area of interest of the hydrologic model was the entire U. S. Steel property southeast of Palisade, Minnesota, with specific detail in

the area of the 1,416-acre wetland mitigation site. However, the results presented in this document relate only to the Bank Site. A more comprehensive description of the model results is presented in the December 2011 draft Wetland Mitigation Report.

The model was framed to represent the geometry of the local and regional hydrogeologic units and discharge areas, based upon USGS topographic maps, published glacial geology maps, local water-supply well records, and the logs of borings drilled on site for this project. The available mapping of overburden geology indicates that glacial lake sand, silt and clay, up to about 120 feet thick, overlie Precambrian bedrock. There is a laterally extensive sand layer that supplies water to wells in the area. The site boring program has documented variability in the distribution of sand and fine materials in the uppermost 25 feet across the site. In all of the site borings, there is a fine sand or fine-to-medium sand unit, typically extending from 10 to 20 feet below the ground surface. The sand overlies a silty clay interval, which is part of a composite confining unit that overlies the deep sand aquifer. Above the shallow sand, the soils vary and are as described in Section 2.2. In the areas on the project site mapped by the NRCS as Northwood, Cathro, and Sago muck, there may be a thickness of peat between 0.5 and 6 feet.

It had been observed from the ditch flow measurements collected in 2011 that drainage discharging into ditches sustain losses as it flows westward across the property. The losses are noticeable in that the flow rate is less than the sum of flows measured in the tributaries. The on-site ditch gauge and piezometers couplets manifest seasonality in the gradient direction between the ditch and the aquifer. The only possible mechanism that can explain these losses is discharge to ground-water. However, given the geometry of the regional hydrogeology, it is very difficult to explain this observation other than as a transient phenomenon related to the potentiometric surfaces of the multiple aquifer system slowly falling in response to less than normal recharge. This is supported by the fact that even where the ditches appear to be losing water to the aquifer, the water levels in piezometer clusters nearer the centers of the parcels are always higher than those near the ditches. If the parcel were the recipient of water from ditches for an extended period of time and the only outflow were downward through the confining unit, the water levels in the center would ultimately be the lowest on the parcel. Since this is not the case in any parcel, the condition of losing ditches observed in 2011 must be a recent and temporary phenomenon, which would be consistent with the recent meteorological data.

On a site with fully-established hydrology, the water level elevations observed are generally reflective of the long-term average recharge. Other head-independent boundaries also must represent long-term average values. Since the potentiometric data collected on the site were obtained during a dry year, 2010-2011, we needed to consider the possibility that the water tables would be generally falling throughout the year, with a progressive accumulation of storage losses relative to the series of more normal years that preceded it. This was accomplished by preceding the simulation of the calibration year by a long period with recharge rates estimated for the selected

average year and then calibrating the hydraulic parameters at various points during a simulation of recharges for 2010-2011. The recharge rates for each parcel during the selected average and most recent years were based upon the monthly precipitation and calculated evapotranspiration rates discussed in Section 6.1.1 and surface-water outflow (runoff) rates discussed in Section 6.1.2, all of which are presented by parcel in Appendix D.

Additional calibration to observed site water levels required splitting some of the shallower layers to accommodate: places where the shallow aquifer was closer to the surface (in the vicinity of the southwest corner of the northern half of Section 33); the lower elevation of the drainage ditch in the western portion of the property; and the presence of open water on the ground surface in the proposed site modification alternatives (along with the earthen embankments needed to control its movement). A tabulation of the hydraulic parameters applied to each layer in the calibrated model is provided in the December 2011 draft Wetland Mitigation Report.

Different recharge rates were applied to each parcel of the model, owing to the different surface-water inflow and outflow characteristics calculated in the water budget. These monthly estimates of the parameters for each parcel are shown along with recharge, evapotranspiration, ground-water inflow and outflow, and changes in storage for average driest, wettest, and most recent years in the form of bar charts in Appendix D. Monthly recharge rates for each parcel were calculated by subtracting the monthly site-wide evapotranspiration rates for the selected average year (1990-1991) from the monthly precipitation rates for the same year and further subtracting the calculated run off for the current condition or adding the surface water inflow (if any) for the proposed-condition alternatives. Model input parameters are tabulated in the December 2011 draft Wetland Mitigation Report.

The model required minor changes in the hydraulic conductivities in order to obtain a close match between the model's predicted water table elevations and the potentiometric Water Table Level Contour Maps in Appendix E. The only place where horizontal hydraulic conductivity deviated from the single value applied universally to the shallow aquifer was in the vicinity of well W4, in the southwest corner of Section 27 and southeast corner of Section 28, where the measured water levels were locally very high and the aquifer transmissivity from the pumping test was much lower than average.

There are two places where the recharge rates deviated from the parcel-specific values that were computed for the water balance. One is in the southeast quadrant of Section 28, where run-off from the forested eastern half of the northeast quadrant does not appear to be able to drain into Ditch 8, immediately to the west. Instead, it flows south and pools in the northeast quadrant of the southeast quadrant of Section 28. The other area is the eastern half of the northeast quadrant of Section 34, where a stream flowing southward through the eastern half of Section 27 flows south-southwest into the northeast quadrant of the northeast quadrant of Section 34 and turns east to flow through a culvert under County Road 240, but sustains some back up, which causes sustained wet conditions that extend into the portion of the wetlands mitigation area that occupies the southeast quadrant of the north east quadrant of Section 34. The pooled run off in these two areas is assumed to be the cause of the localized elevated

water levels measured in the associated well clusters. The recharge rates in the immediate areas of observed pooling was increased during calibration until the simulated water levels were comparable to those measured in the respective clusters.

Inspection of the calibrated model indicated that when the simulated potentiometric surface approximated those interpolated between measurements taken on the site in 2011, the vertical component of the hydraulic gradients in each parcel were always downward in the centers of the parcels, but always reversed to upward in the vicinity of a drainage ditch. This matches the conceptual model for long-term average recharge, but does not simulate the observed losing segments in the ditch system, which are attributed to the gradual loss of storage during the dry year during which water-level and ditch-flow data were collected, as explained above. The principal difficulty was that of simulating ditches that could re-wet after going dry, which would have been required activating a MODFLOW feature that had been causing failure to converge errors in earlier versions of the model. However, simulations of dry-year flow under existing conditions that were run for the present report after the submission of the 2011Wetland Mitigation Report definitely show water levels in down-stream ditch sections falling below the ditch bottoms while the water level in the ditches further upstream remain above their respective bottoms.

Being satisfied that the level of calibration was adequate, the model was tested to determine whether the water budget was sufficiently conservative in preparation for using it to simulate the effects of the proposed changes.

Two alternative water-retention scenarios were simulated. Both involved the placement of earthen embankments around the parcels in the Bank Site and the removal of the Ditch C in Section 27 and Ditch F in Section 34. The difference between the two scenarios involves the use of re-grading: (1) earthen embankments (berms) only, with no re-grading; and (2) earthen embankments plus re-grading. The simulations for both scenarios include predictions of the depth of the water table below the ground surface and the depths of inundation above the ground surface for the average annual and late summer (i.e. 60 days without recharge) of average years.

Simulations also were run for a repetition of the driest year for the earthen embankments s plus and re-grading scenario. These indicated that wet conditions would not persist through the spring over most of the Bank Site and none would persist anywhere in the site through the summer of the driest year. Consequently, while simulations for the driest year were also run for the earthen embankments only and current conditions, their maps were not completed for submission.

Interpretation of Modeling Results as They Relate to the Currently Proposed Project

The results of the two simulated scenarios indicate that the earthen embankments and limited ditch abandonment would cause the water table to rise to the point where certain parcels would be partly inundated, with some areas exceeding water levels greater than two feet above the water table throughout the year, during average years.

As described above, the use of 2011 water levels to calibrate the model would result in the model having a tendency to overestimate the amount of ground-water outflow. However, despite this, the average simulated water level rises on individual parcels appear to be comparable to those predicted by the water budget.

In some cases, the water budget may have overestimated the groundwater outflow because the water levels in some parcels rise to the spillway elevation. This means that the water levels would be amenable to adaptive management. This is important because the amount of inundation, both on the site and on upstream properties, can be controlled by adjusting the elevations of earthen embankments spillways. The implementation of selective ditch abandonment in future years would be supportive, considering the potential of increased evapotranspiration after the first few years of wetland development.

In summary, the site's former wet conditions can be restored in the Bank Site by the addition of earthen embankments, grading, and supplemented by the removal of two privet internal ditches C and F.

Additional Information on Possible Adverse Impacts on Adjacent Properties

The decision to eliminate the closure of peripheral ditches from the proposed modifications to the U. S. Steel wetland mitigation site precludes the possibility of causing an increase in the frequency and intensity of flooding on adjacent properties. The unimpeded drainage of the unmodified ditch system would be able to carry stormwater away from upstream properties as well as at present. In fact, with the introduction of earthen embankments around the Bank Site, for the purpose of retaining runoff, would reduce stormflow into the ditches and thereby decrease the frequency and intensity of future flood events.

The induced water-table rise will be significant on the Bank Site under normal conditions and may cause a decrease in the depth to water on adjacent sites of two feet or more. However, more accurate depths to water that could be used to determine whether there would be any adverse affects on the current uses of those properties is dependent upon the ground-surface elevations of those properties, which are not known with sufficient accuracy to make definitive conclusions. However, based upon current aerial photographs, it appears that the areas that would be the most affected are existing wetlands, woodlots and agricultural fields. The nearest domiciles and farm structures are outside of the areas that are likely to undergo significant water table rises. Should it become evident that the rise in water table does impact significant use of adjacent properties, U. S. Steel will implement adaptive manage to ameliorate the impact and/or offer reasonable compensation for valid claims.

How Ditch Maintenance Would Affect the Hydrology (Proposed Earthen Embankments)

As described earlier, the shallow sand aquifer generally extends from 10 to 20 feet below the ground surface across the U. S. Steel wetland mitigation site. In a few places, it is shallow enough be intersected by ditch bottoms of the ditches. The aquifer is an important component of the drainage system in that it facilitates the flow of groundwater from the interior of the parcels to the peripheral ditch. The vertical distance between the bottoms

of the ditches and the top of the aquifer confers some hydraulic resistance that will help keep the water levels high in the wetlands. Consequently, it is important to maintain as much of this hydraulic separation as possible and it could be imperiled by excessive ditch maintenance. It is expected that the Aitkin County Ditch Authority would only dredge to a depth that previously existed. Normal maintenance dredging would not be expected to have significant hydrologic impacts to the mitigation site because: (1) digging deeper than original ditch depths would not be likely since pipe invert elevations are already established at the outflow; (2) in most of the area, the ditches would have to be deepened more than a foot to significantly reduce the hydraulic resistance above the sand layer there; and (3) the stratification of the sand and overlying materials probably results in most of the ditches receiving water through their sides as well as their bottoms, so that the hydraulic resistance is not limited to the bottoms of the ditches, impacted by maintenance dredging.

Based upon our inspection of the ditches, it does not appear that they have ever undergone maintenance dredging. Certain ditch culverts are obviously blocked and drainage is sustained only by interstitial flow through the soil around them. Maintenance may involve dredging the bottoms and sides of the ditches and discharging the spoils onto the adjacent land surface. The proposed earthen embankments will be approximately 50 feet wide (and wider) and average about two feet in height. Therefore, it is very unlikely that the stability of the earthen embankments will be compromised by dredge spoils. Depending upon the throwing power of the dredging machine, the spoils may be deposited on the ditch side of the earthen embankments, the land side of the earthen embankments, or into the wetlands areas. The last named would not alter the function of the earthen embankments in any way. Deposition in a continuous ridge on the berm itself has the potential to raise the effective berm height, which could alter its expected function during times of extreme inundation. Even then, the function of the upland embankment will not be affected, except at the spillways, which could become partly or completely blocked. To address that contingency, the adaptive management plan would include requesting the County Ditch Authority to announce ditch maintenance before it would be performed, discuss dredge spoil management plan prior to any ditch maintenance, and inspection of the berms following a maintenance event. Should any damage (physical or causing invasive plant species) occur to any part of the earthen embankments, U. S. Steel shall make any repairs necessary to restore original conditions.

6.3 Conclusions and Recommendations

1. Most of the standing water that occurs on the Bank Site arrives as precipitation in the form of either rainfall or snowmelt.
2. Evapotranspiration is greatest during the months of July and August. Therefore, rainfall that occurs during the middle of the growing season is a very important factor in distinguishing a “wet” year from a “dry” year.

3. Many of the drainage ditches on the Bank Site are under the jurisdiction of the County Ditch Authority, as they have authority on most of the drainage that flows through the site. But vital ditch sections that control much of the site hydrology are private and under U. S. Steel's ultimate control.
4. On most parcels, a significant amount of water is currently lost from surface run-off into the ditches. Adding berms to retain this run-off will significantly increase water storage and increase hydraulic resistance on the mitigation site. This will restore year-round wet conditions to most of the Bank Site and they will persist throughout the year.
5. Capturing upstream run-off from off-site areas would provide an important amount of water storage to downstream parcels on the mitigation site, but this is not part of the proposed modifications for the Bank Site.
6. Abandoning Ditches C and E on the Bank Site would increase hydraulic resistance to cause the water table to rise in their immediate vicinities.
7. The nature of the aquifer on the U. S. Steel wetlands mitigation site is complex. Based on ditch flow measurements, downstream ditches in the drainage system appear to be losing water through the bottom, which is probably due to 2011 being a year with lower than average recharge. Of equal importance, the mitigation site water-level measurements indicate that water is primarily lost as base-flow to ditches during the springtime and other high water level events when hydraulic head is greatest.
8. The addition of earthen embankments to the Bank Site will decrease the frequency and intensity of flooding on adjacent properties because it will not involve the modification of the ditch system that drains those properties and it will cause the retention of stormwater that would otherwise runoff into the ditches and possibly contribute to hydraulic back-up.
9. The only part of the berms that are vulnerable to ditch maintenance activities is the spillway, which can be addressed by inspection after maintenance event and simple repairs, if needed.

7.0 Wetland Mitigation Goals, Objectives, and Performance Criteria

7.1 Goals

The goal of the wetland mitigation is to provide a no net loss of wetland functions as a result of potential future unavoidable wetland impacts at Keetac and Minntac mining operations. This goal will be attained through the restoration of hydrology, wetland soil functions, and high quality wetland plant abundance and diversity. This wetland restoration and enhancement project would be expected to improve wildlife habitats and connectivity. Secondarily, there would be wildlife habitat and water quality improvements with increased plant diversity.

7.2 Objectives

The project objectives are listed below:

- Provide compensatory wetland mitigation for future unavoidable wetland impacts at United States Steel Corporation, Minnesota Ore Operations (Keetac and Minntac);
- Restore approximately 480 acres of farmland that has been impacted by miles of man-made ditches;
- Improve hydrological functions by increasing wetland area, floodwater storage capacity, and extending wetland hydroperiods, increasing habitat connectivity and repairing wetland fragmentation;
- Improve biological functions, to include increasing wildlife abundance and diversity;
- Improve water filtration function by increasing wetland acreage and planting wetland vegetation to increase diversity of ecological communities;
- Reduce and control invasive species; and
- Improve regional flood capacity and riparian functions.

7.2.1 Performance Standards

This mitigation project contains performance standards based on 33CFR Part 332.5 and Minnesota Rule 8420.0522. These performance standards will ensure that the project is evaluated objectively and establishing as expected. The performance standards should be based on most or all of the following:

- Final wetland acres achieved shall consist of native wetland vegetation where greater than 50% of the native vegetation shall be facultative (FAC), facultative wet (FACW), and/or obligate (OBL) wetland species with dominance of FACW and OBL species;
- Sustaining hydrology necessary to support hydrophytic vegetation;
- Invasive and non-native plant species minimized (e.g., no more than approximately 15% aerial cover) by the end of the third year growing season for herbaceous wetland communities, excluding narrow-leaf

cattail (*Typha angustifolia*). For shrub and woody species, this aerial coverage standard would apply at the end of the fifth year growing season;

- Minimal bare ground exposure (e.g., no more than approximately 5% aerial cover) and overall adequate density;
- Wetland vegetation diversity; and
- Wildlife recruitment.

Performance standards must be reasonably achievable and measurable. They should also be based on the best available science and assessed in a practicable manner. They should be based on wetland characteristics and not on specific wetland acreage targets; instead they should be based on overall success of established functioning wetland acreages.

The following sections describe performance standards specific to fresh (wet) and sedge meadow wetlands, hardwood swamps/shrub-carr wetlands and upland buffers to be grown on the Bank Site. The wetland hydrology (elevations) described below is anticipated under normal circumstances and many wetland communities will thrive when the target hydrology described below is restored.

Fresh (Wet) Meadow and Sedge Meadow

- The fresh (wet) and sedge meadow wetland hydrology would consist of saturation at or within 12 inches of the ground surface for a minimum of 30 consecutive days, or two periods of 15 consecutive days, during the growing season under normal to wetter than normal conditions. Inundation during the growing season is not expected to occur except following the 10-year frequency or greater storm/flood event. The depth of inundation shall be approximately 6 inches or less and the duration of any inundation event shall be less than 15 days.
- The fresh (wet)/sedge meadow herbaceous vegetation would typically not be dominant after the first year of seeding and as many weed species are expected after site disturbances. Mowing once or twice during the first year only would be required to keep weed species from shading out the seeded species and to minimize weed seed production at the end of the summer. The fresh (wet)/sedge meadow herbaceous vegetation shall cumulatively comprise of at least 60 percent areal cover by the end of the second full growing season and 75 percent by the end of the third growing season. At least 85% aerial cover of native species shall be obtained by the end of the fifth year.
- The fresh (wet) meadow herbaceous layer shall be dominated by a minimum of six native, non-invasive species of grasses, sedges, rushes, forbs, or ferns by the end of the fifth growing season.

- Although monitoring is planned for approximately five years, if after three years of maintenance and monitoring it is determined that a fresh (wet) meadow and sedge meadow communities have met the performance standards described above, U. S. Steel may negotiate with the wetland regulatory authorities to determine if monitoring may be then suspended for this community so that the Bank Site can be approved and mitigation credit allocations can be finalized.

Hardwood Swamp and Shrub-Carr Wetlands

- Hardwood swamp and shrub-carr hydrology (woody species) would consist of saturation (water table) near the ground surface, and often as much as 1 foot of water over the site after heavy precipitation.
- Hardwood swamp species after planting are expected to have some mortality after the first year and survival estimate should not be used to document woody species planting efforts for the first three years after planting. Woody species survival may be used as a performance measure in later years if natural colonization does not confound survival estimates. However, plant density should provide for a more reliable estimate of tree and shrub performance for the first three years after planting. The proposed planting rate is 600 stems per acre and performance measures should be measured against that number.
- Native woody species that naturally colonize on the mitigation site will be included in plant density estimates as natural recruitment (just as in native seed bank germination) would be part of the site ecological success.
- Although monitoring is planned for approximately five years, woody species maintenance and monitoring may be required from 5 to 10 years after planting and as growth typically is slow over the first 3 or more years with minimal quantitative measurements. Survival of 50 percent or greater after the 5th years is an acceptable performance standard. This may include 50 percent aerial cover by the end of the fifth year.

Upland Buffer

- Upland buffers are expected to develop within the Bank Site to meet the Wetland Conservation Act and MNDNR requirements under Subpart 6 – Required Upland Buffer. These upland buffers will be in primarily grassland habitats adjacent to the wetlands. Minor shrub seeding will also be implemented during the seeding process. It is expected that portions of the earthen embankments would become wetland habitats, depending on the draw down from the ditches and the location of the earthen embankments relative to restored hydrology. Using a 1-foot linear length along the earthen embankments yields less than 10 acres of wetlands, and this minor amount has not been accounted for in the replacement crediting and as the actual amount may be much after the first year of seeding. These grassland areas will be seeded with native species and will be managed so that no more than 15 percent areal cover of exotic or non-native invasive vegetation is present after 5 years.

- The herbaceous plant coverage may comprise at least 70 percent areal cover by the end of the third full growing season, including at least 4 characteristic grass and forbs species at the end of the third full growing season.
- The herbaceous plant coverage would comprise at least 85 percent areal cover by the end of the fifth (5) full growing seasons.
- Tree or shrub species that volunteer within the adjacent upland buffer areas will be allowed to remain so long as the species are native, non-invasive species, and do not threaten the integrity of the proposed wetland mitigation areas. Some minor upland shrub seeding is planned.

It is recognized that the wetland development process (full function) cannot be established within a few years but will take several seasons to develop. Therefore, short-term, interim performance standards are proposed but would not be representative of potential performance until after the 3rd full growing season, at which time it is expected visually, the wetland habitats as planned have established under normal circumstances. The monitoring report completed after the 3rd or 5th growing seasons will be critically assessed and a determination of whether or not the restored wetland are in conformance with these performance standards, including a final delineation of the wetland areas. Also, after the first two years of a more intensive monitoring program, the following years should only require site visits early in the growing season and late in the growing season unless adaptive management had been implemented. The following sections list examples of performance criteria expected for the Bank Site.

7.2.2 Hydrological Performance Criteria

For years 2 through 5 – The soil in the restored and enhanced wetland will be saturated to within 12-18 inches of the surface or standing water will be present within 6-18 inches of the surface for at least two consecutive weeks of the growing season. The two weeks are based on the wetland definition and approximately 10% of the growing season and approximately the same criteria used to delineation the farmland. Measurements using existing staff gauges and wells throughout the site will also help determine if hydrology has been restored.

7.2.3 Wetland Vegetation Performance Criteria

Woody Species: For years 2 through 5 – native wetland (facultative and wetter) woody species (planted and volunteer) shall achieve an average density of at least 1-4 plants per 100 square feet, or a minimum of 300 seedlings per acre, or greater than 5%, 10%, 20% and 30% aerial cover, respectively, in shrub-carr and forested communities of the restored or enhanced wetlands. At maturity (after 5 years to approximately 10 years after planting), at least 300 trees per acre would be considered success woody species development as 600 trees per acre will be planted.

Sampling for tree species may include 10 meter plots measuring both survival and aerial cover for statistical purposes. Aerial cover (and vigor) measurements after the fifth years would be the best measurement of success.

Sampling for shrubs species would include 5 meter plots measuring survival and aerial cover.

Herbaceous Species: For years 2 through 5– Aerial cover of native, wetland (facultative and wetter) herbaceous plants species will be at least 30%, 40%, 60% and 85%, respectively for fresh (wet) and sedge meadows of the restored wetlands.

7.2.4 Final Performance Standards (5th year of monitoring)

The Bank Site shall be delineated after the fifth year using the current method to assure that the mitigation site contains at least 85% restored wetland by definition.

The above proposed performance standards are developed based on the wetland mitigation Bank Site report and site plan design. Since these standards are developed on a case-by-case basis, they are subject to change as determined by the regulatory agencies after review and approval. All performance standards must be reasonably achievable as based on wetland characteristics and based on best available science that can be measures and assessed in a practicable manner. In general the Final Performance Standards are based on:

- Final wetland acres achieved
- Hydrology similar to adjacent wetland sites and/or within regulatory definitions
- Native herbaceous wetland plants dominant to at least 80% coverage or more
- Invasive plant species minimized to 15% coverage or less
- Vegetation diversity (determined by species stem counts)
- Wildlife recruitment (by observation)
- Final wetland delineation
- High functional wetland – including flora and fauna diversity
- Achieve wetland functionality assessment

7.4 Monitoring

Wetland monitoring shall be based on USACE Regulatory Guidance Letter, No. 08-03, dated 10 October 2008 – "*Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources*." Based on the "*Final St. Paul District Policy For Wetland Compensatory Mitigation in Minnesota*", the standard length of monitoring is 5 years and may be extended to 10 years for establishment of certain wetland types (e.g., forested wetland), or may be shortened if all performance standards are met earlier than five years. Monitoring reports can be submitted less frequently than one year for bank sites requiring more than five years of monitoring.

An annual monitoring report will be prepared during the first five years of monitoring for all actively developing mitigation areas. The report will describe the status of the wetland mitigation, summarize the results of the vegetative and hydrologic monitoring, and discuss management activities, corrective actions conducted during the previous year, and activities planned for the following year. The report will be submitted to the MNDNR and USACE by January 31st of the following year. The monitoring report will include the following information at a minimum:

- Project Overview (page 1) - A brief description of the wetland mitigation area, including dates, location, size, vegetative and hydrologic monitoring data and performance standards, current wetland types and desired wetland types.
- A summary of water level measurements taken to date and a determination of whether the hydrology in the wetland 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 wetland community and the reference wetland 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 when distinctly different communities have developed).
- Color photographs (from fixed locations) and maps of the wetland mitigation areas, reference wetland, and sample plots taken in late August to early September of each year at designated photo-reference points.
- A summary data section and conclusion noting management activities, recommendations and/or corrective actions conducted in the wetland during the previous year and activities planned for the following year.

7.4.1 Monitoring Process

Monitoring will begin the first spring after the 480-acre Bank Site is seeded with native vegetation and would continue for a minimum of 5 years. The Bank Site may be monitored beyond the designated period to track the development of the mitigation project and until such time that U. S. Steel relinquishes site responsibility.

Routine monitoring standards will be used and will require annual estimates of cover, species diversity, and density of woody vegetation for shrub-dominated and forested wetlands. Monitoring activities are driven by site-specific performance criteria as noted in this document or as specified in the permit conditions. Field data would be collected on a variety of environmental parameters including vegetation, soils, hydrology, and wildlife

recruitment. When data analysis is completed, information on site development will be provided in an annual monitoring plan with adaptive management recommendations if necessary. It is proposed that the site will be inspected at least four (4) times during the first two growing season with the last site monitoring inspection completed in September of each year prior to provide the required annual report.

A fixed baseline transect design would be used to sample habitat classes and/or sample units and there would be enough plots to meet the sample size requirements for each habitat class. Each annual report will include a quantitative visual observation for percent aerial cover and survival of woody plants. Use of small plot sizes, frames (e.g., 1-meter square) with smaller grid squares of known area or other appropriate visual devices that will represent known cover values to reduce measurement errors and provide year to year data consistency.

The sampling event will include establishment of baseline locations during the first year with staked transects for all future monitoring visits. Alternatively, a grid transect system can be developed using a GPS unit and an aerial photo-map. These transects may be modified as needed but will need to continue representing all the cover/habitat classes and/or sample sizes for the entire project area. The method of data collection and the number and type of sample units will be specified as a condition of the permit or determined during the end of the first year of monitoring.

Depending on the initial sampling and site characteristics at the end of the 2012 growing season, transects may vary in number, length, and separation distance to be determined. Sampling transect locations are determined by using either a simple, systematic, stratified, or restricted random sampling method. It is expected that 1 to 2 square meter plots for herbaceous plant communities and possibly 65 to 265 square meter plots be used to collect shrub/sapling layer information. In general, the correct sample size and number of samples will need to be developed to accurately describe the existing conditions of habitat class and/or stratum. This number presently cannot be determined until a planting plan and as-built survey are completed. For example, if 70 percent of the mitigation site is shallow marsh, the method and number of transects will be different than if the site has 5-7 habitat classes which represent and greater diversified plan. Finally, a USACE data form will be completed throughout the various transect so that all parameters are evaluated using the most updated 1987 Corps Manual methods, such as the prevalence index (being <3.0).

7.4.2 Mitigation Banking Instrument

The approximate 480-acre mitigation Bank Site will be utilized for future project specific Keetac and Minntac unavoidable wetland impacts. A final draft mitigation instrument is required by the USACE in 2012 and U. S. Steel is current working with the USACE on the items listed below:

- Completing the mitigation bank instrument (MBI);

- Financial assurance for construction, maintenance, monitoring, adaptive management, and overall project success (e.g., performance bonds, irrevocable trusts, escrow accounts, casualty insurance, or letters of credit);
- A provision stating that legal responsibility for providing the compensatory mitigation lies with U. S. Steel;
- Default and closure provisions (if necessary);
- Draft permanent conservation easement (and designated grantee if known);
- Finalizing designated land uses such as passive recreation and/or hunting by the public;
- Signage plan identifying the location, size, material of the signs, wording on the signs (e.g., site description, site boundaries, prohibited use, public access and etc.), and a sign maintenance plan.

A MBI will serve as the contractual agreement between the USACE and U. S. Steel. In particular, it will definitively address objectives, long-term management, contingency plan, financial assurances, and protection of the site in perpetuity. This is essential for the USACE's ability to enforce the provisions of the banking instrument should problems or failures occur.

7.5 Contingency Plan

In any wetland mitigation project, the single most important component is water. To have a successful project, detailed knowledge assessments of local water sources (i.e., precipitation, surface and ground water) is the key to a wetland mitigation success. Acquiring and retaining water in adequate amounts, at the proper time, and with the correct duration are critical components of a mitigation project. However, the weather pattern from year to year is unpredictable and contingency planning is necessary. Even though a mitigation contingency plan usually entails the development of a back-up plan to address risks that jeopardize the original plan to restore the wetland, this contingency plan also considers offsite inundation to private properties during extreme precipitations. A key aspect of contingency planning is the ability to identify potential risks before they arise and plan contingency strategies accordingly, or be aware of them beforehand so that they can be recognized and addressed quickly during the monitoring phase of work. Potential wetland mitigation project risks normally include, but not limited to, insufficient hydrology, predation (e.g., by geese or deer), vandalism (e.g., off road vehicles), and invasive plant species.

As a part of this wetland restoration contingency plan, the need to address potential extreme weather conditions has become apparent. Not only does the mitigation project need to have adequate water distributed to newly planted wetlands, but that same water may have to be monitored and potentially controlled during critical high water events (i.e., large storm and/or successive large storm events). One cannot predict or control the weather,

but the project design would allow for contingency planning to minimize unfavorable impacts due to extreme weather.

The contingency plan addresses potential issues that may occur after the mitigation site is constructed. The plan addresses potential risks that may compromise any one or more of the performance standards/criteria (i.e., hydrology, hydrophytes and soil conditions). In considering a project contingency plan, one would have to anticipate what may occur and be pro-active. The contingency plan would be implemented if and when a project concern is identified during the site monitoring phase.

7.5.1 Drought

The scenario would be a response to a drought early in the mitigation process. Under this scenario, the contingency plan may include irrigation by pumping water from adjacent ditches to the driest areas. In the extreme case, this may require the establishment of eight pumping stations, each capable of discharging up to 1,000 gallons per minute and water taken from existing or newly drilled deep wells (with permits). In the event that the entire site would require irrigation simultaneously (worst case scenario), it is estimated that eight trailer-mounted 3kW generators would also be required. This contingency would be designed to flow approximately 0.5 inches of water to surface of the site in 40 hours of continuous pumping. The cost and implementation of this pump system would be considered only should such a severe drought condition arise. Other alternatives may be available depending on the severity and potential duration of drought conditions. At a certain point and if a severe drought persist, this pumping option would no longer be possible. Another response is to simply maintain the most viable areas and allow some of the other higher elevation wetlands to dry out. It is expected that most wetland areas on the site could survive minor drought conditions and planned re-seeding in areas that don't revive would be considered.

7.5.2 Large Storm Events

Normal to moderate storm events are not expected to impact adjacent properties under normal circumstances. This section addresses large and severe storm events or in some cases where 2 to 3 moderate to large storm events in a row that may create usually severe storm situations. During severely large rain events or repeated rain events in short succession, water table increases to the surfaces in lower topographic areas on adjacent properties may occur. In such severe weather conditions, all of these local areas are expected to be inundated and fully saturated even exclusive of the construction of this mitigation project. In general it is not expected that this project in itself would cause flooding to adjacent properties as functioning ditches would carry off floodwaters and as no regulated ditches would be abandoned as part of this mitigation project. The earthen embankments intended to retain run off may prolong drainage and mound water tables on neighboring properties, possibly unfavorably impacting their potential land use (e.g., farming) for some durations but only temporarily. Depending on the duration of storm events, minor impacts of short duration may be expected during severe weather conditions. A

contingency plan to address possible extreme precipitation events and to minimize impacts to adjacent properties is outlined below.

To minimize the potential of off-site water table impacts and still allow the wetland project to be successful, two water control structures will be constructed. One water control structure is passive using spillways and the second is active, using manually operated valve gates. The proposed 2-foot earthen embankments within the 480-acre Bank Site will consist of three overflow spillways located at the lower sections of the embankments. The second water control structure consist of six 12-inch pipes with six manual valve gates that when opened, would rapidly drain water from the lower areas of the interior parcels should weather conditions be so severe that warrants such action.

These earthen embankments are designed to capture as much rainfall as possible to adequately saturate soils during the spring growing season and to minimize upslope impacts. The elevations of the earthen embankment spillway points are designed to promote the maximum inundation on the mitigation Bank Site while limiting the amount of impacts to neighboring properties. It is not anticipated that the spillway elevations would be reached under normal circumstances, except possibly during spring thaws and other severely wet conditions, when site storage is at its fullest. However, in the event of a very wet season and/or with repeated storms, the duration of inundation may be more than is needed on-site. During these severe conditions, a period of submergence or saturation on off-site properties may be extended.

If the current spillway elevations are observed to be not working, adjustment to spillway release elevations can be accomplished by simple backhoe excavations, thereby lowering the embankment height to allow overflow into the ditches. The spillway can be protected by placement of erosion mats or stones if deemed necessary or if the spillway is compromised by drainage. Should spillway elevation adjustments be completed and later observed to still not provide sufficient site drainage, then manual water releases using the valve gates shall be implemented.

The inlets will have rocks stabilizing the inlet side with debris screens to prevent large objects from blocking flow through the pipes. Inspection of these inlets during wetland monitoring events will assure that the inlets are kept clean of debris. This manual drain system would require monitoring of weather local forecasts and onsite water levels so that the individual charged with operating the system would be able to open the valves if needed in anticipation of a potential high-water event and/or in relief of protracted inundation. The release of water into the ditches is not expected to be a normal operational occurrence and would be implemented only if a severe storm event occurs.

In the event of sudden, extensive flooding, where the water level in the lower parcels prevents accessing the valves on the upper parcels, the more downstream valves would be opened first and the rate of fall of the water surface monitored. When the waters have receded sufficiently to allow embankment access, the flood-relief

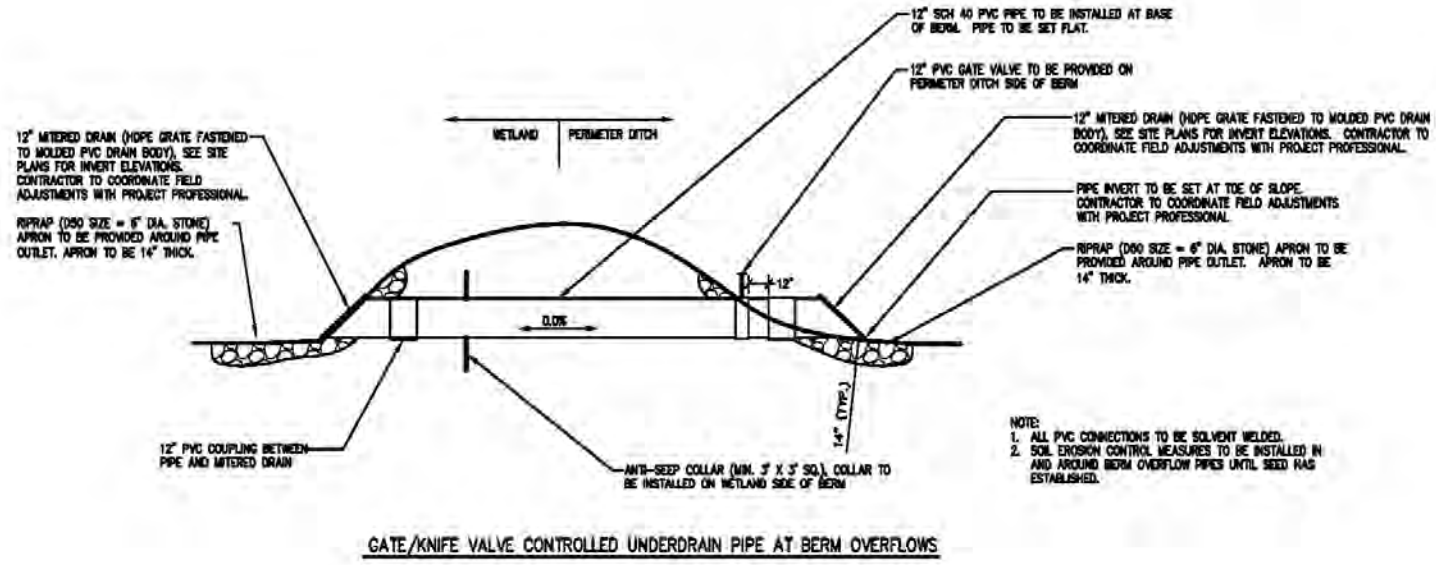
valves on the upper basins would be opened to relieve the pressure difference on the opposite sides of the earthen embankment and thereby limit seepage and piping.

The individual operating the outlet system would have to be able to access the Bank Site and monitor the levels on the parcels and the local weather forecasts. Ideally, the individual would be a local resident who would be able to operate the pumps.

The Bank Site initial objective is to provide sufficient hydrology for developing wetlands so premature pipe drainage is not expected to occur unless extreme weather conditions warrant such action. During the first two years, it will also be important to document the frequency of the opening of valves if ever implemented. If it becomes apparent that the amount of water retained is more than needed to establish wetlands hydrology, the spill points on any appropriate earthen embankment can first be lowered permanently, thus reducing the amount and frequency of potential off-site inundation and the need for more frequent monitoring. It is expected that the fully-established wetlands will need little or no flood-avoidance/relief monitoring and that the monitoring program during the first three years will be sufficient to optimize the final spill point elevations.

The proposed 12” valve gate outlets are constructed of thick PVC and stainless steel paddles and stems. The gate valves would not require long term maintenance and should any pipe become clogged, U. S. Steel shall clean the pipe and replace the screen at the inlet side. Please refer below for details of the knife gate valve design:

Figure 7.1 and Figure 7.2



GATE/KNIFE VALVE CONTROLLED UNDERDRAIN PIPE AT BERM OVERFLOWS

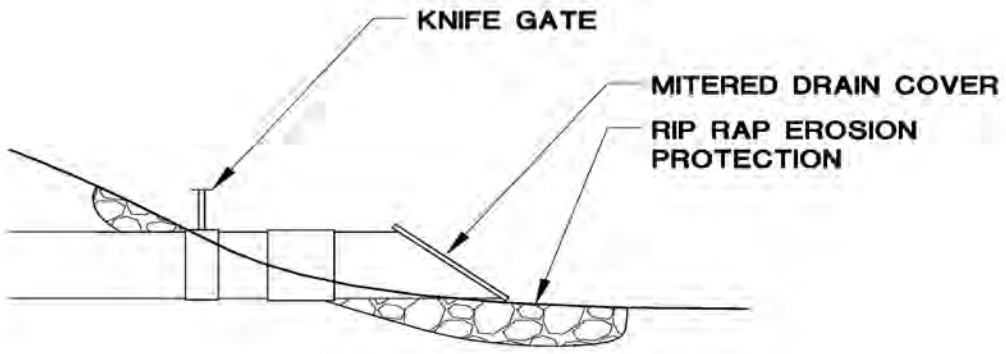


Figure 7.3

If a hydrology problem should occur, either due to insufficient water or excessive water, then a solution must be provided and stated in the annual monitoring plan. Problems may arise from seasonal drought, extreme successive storm events, and/or a long-term problem that needs to be addressed in the contingency plan. Long-term problems may be attributed to surface hydrology and/or groundwater hydrology miscalculations and/or final grade elevations. Hydrological contingency measures will be implemented based on observed conditions or monitoring data. The following steps will be implemented in case of hydrology issues:

- Clearly identify the problem.
- Consult the mitigation design team and regulatory agencies for appropriate and approvable action.
- Possibly adjust elevations or install structures to achieve hydrological conditions (e.g., close off culvert drainage or block ditches in key locations), or release water through the valve gates designed within the earthen embankment system.

7.5.3 Invasive Plant Species

Invasive plant species of concern at the Bank Site consist of the following identified in the field (please refer to the enclosed Invasive Species Map in Appendix A):

- Reed Canary Grass (*Phalaris arundinacea*)

- Hybrid Cattail (*Typha x glauca*)
- Canada Thistle (*Cirsium arvense*)
- Pigweed (*Amarantgus spp.)*

Reed canary grass and cattail are located strictly around the ditch areas as the farm is sprayed annually and farmed. Canada thistle and pigweed species are also found adjacent to the ditches but were also found in colonies away from the ditches in year 2011 when the fields were fallow. Most areas with Canada thistle and pigweed species were sprayed last fall.

Research has demonstrated that an effective way to control reed canary grass (*Phalaris arundinacea*) is a combination of late season herbicide application to maximize rhizome mortality and control burning to reduce the seed bank density. Late season herbicide application is more effective in controlling reed canary grass and burning (in conjunction with subsequent herbicide applications) would reduces the density of the seed bank, limiting reed canary grass's ability to re-colonize from seed. Control burning may not be feasibly/practicable but if deemed necessary, a control burn plan may be implemented as part of the adaptive management plan. A 3-5 year process may be necessary to allow native vegetation to establish and dominate effectively. Repeated applications would be needed and as part of this adaptive management strategy. Currently, 2011 spring and fall herbicide applications of Roundup have been implemented using a 150 gallon skid mounted applicator with a 150' hose. It is planned that applications of Roundup will continue every year and as needed. The annual spring inundation on the site would also control the initial germination of reed canary grass. As the site draws down, reed canary grass begins to germinate and herbicide applications would be utilized to control reed canary grass.

Hybrid cattails are limited to inside of the existing ditches. They were monitored and sprayed in 2011and should they become too abundant in any one location that may jeopardize the seeded areas, they will be sprayed again.

For Canada thistle, consistent saturation along with shading by wetland plants would suppress their growth. Canada thistle is shade intolerant and roots do not develop well in areas with a high water table. Therefore, Canada thistle would need to be managed mostly in dryer disturbed areas along transition areas of the wetland site. Once established, Canada thistle would require a vigilant spray program. One properly timed application of glyphosate (RoundUp) may provide 50 to 90 percent control on shoot re-growth 6 months to a year later. At least one additional application, made to the re-growth, may be needed 3 to 12 months later, to provide adequate stand reductions for long term control. Conditions needed for good performance of foliar herbicides on Canada thistle is specified below:

1. Adequate soil moisture from the soil surface well into the subsoil.
2. Green leaves, not wilted and generally free from extensive damage caused by insects, disease, drought, hard freeze, dormancy etc.

3. Shoot height is at least 10 inches tall in the early June and 8 inches or more in the fall.
4. Flowers not fully opened.
5. The thistle has not been disturbed recently (within 2 months) by tillage.
6. No mowing or cultivation should be done for 10 days after application.

Also biological control using stem weevil, bud weevil or stem gall fly have been known to be successful. These are all commercially available and approved for use in MNDNR.

There are many species of pigweed with about 70 known species. Pigweed is considered a noxious weed in Minnesota but provides food and cover for upland game birds. Some amount of pigweed should not be considered damaging but if deemed necessary, the use of glyphosate (RoundUp) would control pigweed should a large area be invaded by pigweed.

Vegetation problems can also include mortality and/or poor or stunted growth resulting in low ground coverage. These problems can be highly varied and may include animal browsing (i.e., deer and/or geese), and other site issues including vandalism. The following steps may be implemented in case of vegetation issues:

Plant replacement – Evaluate species and quantities necessary to establish aerial density.

Grazing control – Installation of fences, overhead string netting and/or use repellents. Predator decoys and scarecrows, motion sensor noise (bang) devices and other motion device such as balloons may also be evaluated and used. Wildlife grazing and damage should be expected to occur but can be minimized with the installation of early protection devices (e.g., trunk collars) and/or scare devices or strategies.

7.5.4 Wetland Vegetation Failure

For this wetland mitigation project to be successful there must be at least an eighty-five percent aerial coverage of wetland plants over a five year monitoring period. At any time during the monitoring period, should any large areas of any planted vegetation (herbaceous and woody) appear to be compromised or deemed a failure, a re-planting plan will be implemented once the cause of failure has been determined. This may mean increasing hydrology through grading or plugging surficial or sub-surface leaks into the ditches. Also failure could be from grazing and even vandalism by recreational vehicles.

7.5.5 Woody Wetland Vegetation Encroachment

Woody wetland vegetation encroachment shall be allowed and considered part of the natural succession process. However, should woody encroachment from offsite areas appear excessive over the first 3 years of herbaceous plant development, those selected areas may be mowed until the herbaceous layer has established. Once an area has established herbaceous growth, natural woody plant encroachment would be allowed with further interference. Areas planted with woody vegetation would not be disturbed as these areas designated for woody

plant growth has a primary goal as a hardwood swamp, where herbaceous growth may be more limited upon maturity.

7.5.6 Upland Earthen Embankment Management

The earthen embankments will be seeded with native non-invasive species and would not be mowed. Should a large patch of invasive plant growth be observed, spraying would be implemented immediately. Re-seeding would also be implemented if needed.

The ditches adjacent to the earthen embankments may be subject to cleaning by the Aitkin County Ditch Authority at the request of upstream landowners. Should the Ditch Authority decide to dredge any adjacent ditches, U. S. Steel will attempt to work with the Ditch Authority such that the earthen embankments are not impacted by dredge spoils. This may include providing offsite disposal should appropriate open areas not be available near the mitigation site. Effort by U. S. Steel shall be made (via letter to the Ditch Authority) to ask the Ditch Authority for notification prior to any ditch work at the mitigation site so that U. S. Steel can negotiate with the Ditch Authority in regards to the placement of dredge spoils. Should the Ditch Authority perform work without notification to U. S. Steel, and areas of the mitigation site that are impacted by dredge spoils would be clean-up by U. S. Steel and reseeded.

Earthen embankments may also become overgrown with invasive plant species, especially if the embankment was disturbed by the Ditch Authority. U. S. Steel would implement an invasive plant species spray plan and re-seed so that the upland earthen embankment will continue to serve its purpose without compromises.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

APR 05 2012

REPLY TO THE ATTENTION OF:

E-19J

Jill Bathke
U.S. Army Corps of Engineers
Regulatory Branch
190 Fifth Street East, Suite 401
St. Paul, Minnesota 55101-1638

Re: Draft Environmental Assessment for United States Steel Corporation, Minnesota Ore Operations - Minntac Mine Western Progression, Mountain Iron, St. Louis County, Minnesota

Dear Ms. Bathke:

The U.S. Environmental Protection Agency has reviewed the referenced draft Environmental Assessment (EA) prepared by the U.S. Army Corps of Engineers (USACE) pursuant to our authorities under the National Environmental Policy Act (NEPA), Council on Environmental Quality regulations (40 CFR Parts 1500-1508), Section 309 of the Clean Air Act (CAA), and Section 404 of the Clean Water Act (CWA).

The proposed project involves westward progression of the existing Minntac mining operation, within the existing permit to mine boundaries. The project will involve surface mining of a total of 554.33 acres of land, located on the south and southeast edges of the exiting Minntac West Pit. 76.09 acres of wetland impacts are expected to occur, and 95.98 acres of land will become impervious surfaces. The proposed project is expected to retain 1,200 existing jobs, and mine expansion will allow for an additional 7-10 years of active mining. Based on our review, EPA offers the following comments on the Draft EA.

Missing Consultation Records

EPA recommends attaching consultation documents regarding historic and cultural resources (Minnesota Historical Society), and endangered species (U.S. Fish and Wildlife Service and Minnesota Department of Natural Resources) with the EA. Additionally, Section 3.13 "Tribes, Individuals, Organizations, and Agencies Consulted" was left blank. In the Final EA, provide information in this portion of the document.

County Road 102 Reconstruction

The realignment of County Road 102 is considered a connected action under NEPA. County Road 102 should be realigned and reconstructed based on thorough analyses of future mining operations and existing and projected future land-use planning in the vicinity. Additionally, EPA does not support the use of taconite tailings of any size as building material for roadways. Degraded taconite fines found in roadway materials act much like asphalt, thus normal roadway wear-and-tear will ultimately erode taconite tailings, leading to leaching and atmospheric entrainment and deposition of mercury and possibly asbestiform fibers, causing acidification of surface waters and potential human health impacts.

The realigned road should also contain vegetated buffers and/or any other form of bioretention so as to control stormwater.[1] EPA also encourages the Minnesota Department of Transportation (MnDOT) and St. Louis County to adopt an anti-idle policy for the roadway construction effort[2] Additionally, EPA encourages MnDOT and St. Louis County to construct wildlife crossings where wildlife crossings are common.

Wetland Impacts and Mitigation

Indirect impacts to wetland areas were not discussed in the Draft EA. The Final EA should include a discussion of indirect impacts. The Final EA should also discuss mitigation proposals for all direct and indirect impacts, including maps, descriptions, and status as available. For example, if use of one or more bank sites will be pursued, the Final EA should indicate the Federal approval status of those bank sites.

In the Draft EA, USACE states that there are currently unauthorized impacts approximating 4.82 acres that require mitigation; mitigation for those unauthorized impacts is proposed to be combined with required mitigation for proposed wetland impacts. All direct and indirect impacts to jurisdictional wetlands should be mitigated consistent with the Federal mitigation rule.

The Draft EA was silent with regard to proposed stream mitigation. Stream impacts in the affected watershed have been significant, particularly with regard to prior impacts to headwater and higher order streams. Furthermore, the 1996 Environmental Assessment Worksheet (EAW) for previous expansion project at Minntac's facility required mitigation under a Protected Waters Permit and was discussed in the EAW. Stream impacts that are regulated under Section 404 of the Clean Water Act should be mitigated. Stream mitigation should be addressed in the Final EA.

EPA reserves the right to make additional comments as mitigation measures are developed.

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[1] See enclosed document titled *What is Green Infrastructure?*

[2] For ways to reduce greenhouse gas emissions, see the following EPA document titled *Potential for Reducing Greenhouse Gas Emissions in the Construction Sector*: http://www.epa.gov/sectors/pdf/construction-sector-report.pdf

Water Quantity and Watershed Impacts

The extension of the mine has already affected the health of the stream along the southern border of the existing permit to mine limits. The "Western Progression" is expected to increase this effect. At present, the continued dewatering of the Western Pit via sumps Nos. 3 and 6 has affected all of the streams along the southern border. Kinney Creek (recipient of the No.6 sump discharge) and the East Branch of West Two Rivers (recipient of the No. 3 sump discharge) have stream flows running above natural levels because of the increased dewatering discharges in the drainage basin.

The EA indicates that discharge rates of tributary streams between Kinney Creek and the East Branch of West Two Rivers are currently discharging below their natural discharge volume due to the loss of some of their watershed to the existing mine. The western progression is expected to increase these effects, with the West Two Rivers being the most affected by the large amount of watershed that will be taken during the proposed mine expansion.

We recommend sump piping be laid along the edge of the western progression to allow the sump waters to flow into all of the streams along the southern border, in proportion to the amount of watershed lost to the mine, in order to maintain discharge rates as close to natural levels as possible to maintain watershed health.

Biological Integrity and Water Quality

To determine quality, the presence of a waterbody must first be defined. If it is no longer there, the remaining waters must be protected judiciously. All water quality standards must be adhered to, including standards for sulfate (250 mg/L) for groundwater/drinking water and 10 mg/L in any surface waters containing wild rice, if such wild rice waters were to be later identified), conductivity, total dissolved solids, pH, and alkalinity, to mention a few parameters often affected by mining operations. It is difficult to ascertain to what degree compliance with relevant water quality standards will occur as a result of this project.

Thus far, nearly 3 miles of waterway have disappeared due to mining. The Minntac Mine is among the mines that have contributed to over 1,000,000 acres of habitat degradation in northeastern Minnesota affecting fish, birds (including migratory birds), amphibians, reptiles, and large and small mammals that were once dependent on these waters for survival.

Biological communities such as fish provide valuable information about environmental quality, as these organisms are sensitive to changes in a wide array of environmental factors (Karr, 1981)[3]. Most larval fish prefer to live in shallow habitats with dense vegetation (Petering and Johnson, 1991). This vegetation protects larval fish from predation by birds and other fish,

[3] Karr, J.R. 1981. Assessment of Biotic Integrity using fish communities. *Fisheries*, 6(6): 21-27.

shelters them from wave action, and forms microhabitats that are conducive to food production (Petering and Johnson, 1991; Engel, 1988)[4]. Differences in fish species richness, number of tolerant fish species, and number of cyprinid species are considered useful indicators of marsh ecosystem degradation (Karr, 1981; Hocutt, 1981)[5]. For instance, most young fish in the Cyprinidae family are very sensitive to pollution, turbidity, and high temperatures. Many of the shallow, intermittent waterways of this area, used specifically by small fish for reproduction, no longer exist or have been severely degraded. One of the tributaries to Manganika Lake is severely degraded (Index of Biological Integrity = 6.7).

An unnamed tributary "referenced as Kinney Creek" (p. 14) is the remnant of what was once Kinney Creek, once headwatered in the now existing mine footprint. The EA suggests there will be secondary impacts from the elimination of 2,779 linear feet of Kinney Creek, estimated as a 0.04% reduction of the Kinney Lake watershed. No mention is made of the cumulative reduction of the Kinney Creek-Kinney Lake watershed due to the course of previous, sequential expansions. Also, the importance of headwaters to overall stream health is being increasingly recognized. The EA should also mentions more than one "Unnamed Creek." Care should be taken to clearly identify each, such as Unnamed Creek 1.

The Draft EA states that water-related impacts include the transfer of 0.86 mgd water from the St. Louis River watershed to the Dark River (sub-watershed of the Rainy River watershed). The St. Louis River watershed is part of and contributes to the Lake Superior basin. The 1986 Federal Water Resources Development Act (Amended 2000) requires approval by all Great Lakes governors for any exports or diversions of Great Lakes water out of the basin. The 2005 Great Lakes Water Resources Compact prohibits most new diversions and exports of water out of the Great Lakes basin, including those used for non-public water supplies. Any diversion greater than 100,000 gallons-per-day must be approved by all Great Lakes governors[6]. The EA should explain whether or not inter-basin water diversion has been approved by the Governor of Minnesota.

There are a number of wells identified in and south of the western mine expansion. It is possible that some or all of these wells will experience drawdown as a result of mine dewatering, however, the details remain unknown, including potential impacts to private drinking water wells. This issue needs to be further examined and the effects of potential dewatering need to be better defined.

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[4] Engel S. (1988) The role and interaction of submersed macrophytes in a shallow Wisconsin lake. *Journal of Freshwater Ecology*, 4: 329–341.

Petering, R. W. and D. L. Johnson. 1991. Distribution of fish larvae among artificial vegetation in a diked Lake Erie wetland. *Wetlands*, 11:123–138.

[5] Hocutt, C.H. 1981, Fish as indicators of biological integrity. *Fisheries*, 6: 28-31.

[6] See the following internet link: http://www.glslcompactcouncil.org/Docs/Agreements/Great%20Lakes-St%20Lawrence%20River%20Basin%20Water%20Resources%20Compact.pdf

U. S. Steel Minntac's NPDES Compliance Status

The document states that U.S. Steel is in compliance with all applicable NPDES permit conditions and limits with the exception of the conditions for which they are under a schedule of compliance. EPA cautions that only MPCA or EPA are permitted to make any determination as to U. S. Steel's compliance status with regards to NPDES permits. USACE should either delete statements which appear to be making a determination of the facility's compliance status, or give attribution to MPCA or EPA on compliance status on a given date.

Seep Collection and Return Systems

The document states that the operation of the seep collection and return systems (one constructed and one planned) have or will "eliminate all surface seepage discharge" at the Sand and Dark River discharge locations. EPA recommends that USACE limit these statements to factual statements regarding design parameters for seep collection and return systems pertaining to the flow that they are designed to be able to capture in relation to the total discharge flow. Total discharge flow includes any surface and subsurface seepage that discharges to surface waters. EPA further cautions that this document should not make any determination, such as on page 6, indicating that the installation of such a system has addressed a potential compliance issue with the state of Minnesota's 10 mg/L wild rice sulfate standard. Only MPCA or EPA are permitted to make such a determination.

EPA is available to discuss these comments to the EA at your convenience. Please feel free to contact me at 312-886-2910, or by email at westlake.kenneth@epa.gov or Mike Sedlacek of my staff at 312-886-1765, or by email at sedlacek.michael@epa.gov to discuss these comments.

Sincerely,

Kenneth A. Westlake, Chief
NEPA Implementation Section
Office of Enforcement and Compliance Assurance

cc: Duane Hill, Minnesota Department of Transportation (w/enclosure)
Jim Fuldesi, St. Louis County Department of Public Works (w/enclosure)
Bill Johnson, Minnesota Department of Natural Resources (w/o enclosure)
Ann Foss, Minnesota Pollution Control Agency (w/o enclosure)
Nick Rowse, U.S. Fish and Wildlife Service (w/o enclosure)

Enclosure: What is Green Infrastructure?

What is green infrastructure?

EPA

Water: Green Infrastructure

You are here: Water » Water Infrastructure » Green Infrastructure » What is Green Infrastructure?

What is Green Infrastructure?

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water.

Here we review the range of green infrastructure elements that can be woven throughout a watershed, from the smaller scale elements that can be integrated into sites to the larger scale elements that span entire watersheds.

Downspout Disconnection

Downspout disconnection refers to the rerouting of rooftop drainage pipes to drain rainwater to rain barrels, cisterns, or permeable areas instead of the storm sewer. Downspout disconnection stores stormwater and/or allows stormwater to infiltrate into the soil. This simple practice may have particularly great benefits in cities with combined sewer systems.

Factsheets

- Toronto Homeowners' Guide to Rainfall: Downspout Disconnection
- Water Environment Research Foundation

Benefits

- Demonstration of Downspout Disconnection Effectiveness
- Ontario Centre for Municipal Best Practices: Best Practice Summary Report

Examples

- Los Angeles Downspout Disconnection Program
- Milwaukee Downspout Disconnection
- Portland Downspout Disconnection Program

Web Sites

- Mid-America Regional Council
- Blue Water Baltimore

Rainwater Harvesting

Rainwater harvesting systems collect and store rainfall for later use. When designed appropriately, rainwater harvesting systems slow and reduce runoff and provide a source of water. These systems may be particularly attractive in arid regions, where they can reduce demands on increasingly limited water supplies.

Factsheets

- Portland Stormwater Solutions: Rain Barrels
- Portland Stormwater Solutions: Rain Cisterns
- Build it Green (PDF) (3 pp, 43K, About PDF)

Benefits

- Capturing Rainwater to Replace Irrigation Water for Landscapes (PDF) (4 pp, 39K, About PDF)
- Reducing Mains Water Use Through Rainwater Harvesting (PDF) (4 pp, 1.5MB, About PDF)

Examples

- Technicians for Sustainability: Water Harvesting
- New York City Rain Barrel Giveaway Program

Web Sites

- Rainwater Harvesting at North Carolina State University
- American Rainwater Catchment Systems Association

Rain Gardens

Rain gardens (also known as bioretention or bioinfiltration cells) are shallow, vegetated basins that collect and absorb runoff from rooftops, sidewalks, and streets. Rain gardens mimic natural hydrology by infiltrating and evapotranspiring runoff. Rain gardens are versatile features that can be installed in almost any unpaved space.

Factsheets

- EPA Stormwater Menu of Best Management Practices (BMPs)

Benefits

- Bioretention Literature Review

- EPA Stormwater Technology Fact Sheet (PDF) (8 pp, 257K, About PDF)

Examples
- Burnsville, MN Stormwater Retrofit Study

- Urban Design Tools: Bioretention

Web Sites
- Rain Gardens for the Bays
- Rain Garden Network
- Rain Garden Design Templates

Planter Boxes

Planter boxes are urban rain gardens with vertical walls and open or closed bottoms that collect and absorb runoff from sidewalks, parking lots, and streets. Planter boxes are ideal for space-limited sites in dense urban areas and as a streetscaping element.

Factsheets
- Portland Stormwater Solutions: Infiltration Planters
- Portland Stormwater Solutions: Flow-Through Planters

Benefits
- Performance Assessment of Three Types of Rainwater Detention Structures (PDF) (71 pp, 5MB, About PDF)
- See Rain Gardens and Green Streets

Examples
- Michigan Avenue Streetscape
- Philadelphia Water Department

Web Sites
- See Rain Gardens and Green Streets

Bioswales

Bioswales are vegetated, mulched, or xeriscaped channels that provide treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows. As linear features, vegetated swales are particularly suitable along streets and parking lots.

Factsheets
- EPA Stormwater Menu of BMPs
- EPA Stormwater Technology Fact Sheet (PDF) (7 pp, 81K, About PDF)
- Florida Field Guide to Low Impact Development (PDF) (7 pp, 209K, About PDF)

Benefits
- Performance of Engineered Soil and Trees in a Parking Lot Bioswale (PDF) (7 pp, 5.7MB, About PDF)
- Water Quality Benefits of Grass Swales in Managing Highway Runoff (PDF) (16 pp, 216K, About PDF)

Examples
- Wisconsin Department of Natural Resources Technical Standard (PDF) (14 pp, 2MB, About PDF)

Web Sites
- University of New Hampshire Stormwater Center
- See Rain Gardens and Green Streets

Permeable Pavements

Permeable pavements are paved surfaces that infiltrate, treat, and/or store rainwater where it falls. Permeable pavements may be constructed from pervious concrete, porous asphalt, permeable interlocking pavers, and several other materials. These pavements are particularly cost effective where land values are high and where flooding or icing is a problem.

Factsheets
- EPA Stormwater Menu of BMPs: Pervious Concrete
- EPA Stormwater Menu of BMPs: Porous Asphalt
- EPA Stormwater Menu of BMPs: Pavers

Benefits
- Long-Term Stormwater Quantity and Quality Performance of Permeable Pavement Systems (PDF) (15 pp,293K, About PDF)
- Reducing Urban Heat Islands: Cool Pavements (PDF) (39 pp, 6.2MB, About PDF)

Examples
- Use of pervious concrete eliminates over $250,000 in construction costs
- Minnesota city eschews storm drains, uses pervious concrete

Web Sites
- National Ready Mix Concrete Association: Pervious Concrete

- Interlocking Concrete Pavement Institute
- National Asphalt Pavement Association: Porous Asphalt

Green Streets and Alleys

Green streets and alleys integrate green infrastructure elements into the street and/or alley design design to store, infiltrate, and evapotranspire stormwater. Permeable pavement, bioswales, planter boxes, and trees are among the many green infrastructure features that may be woven into street or alley design.

Factsheets

- EPA's Green Streets: A Conceptual Guide (PDF) (7 pp, 5.7MB, About PDF)
- Sustainable Complete Streets (PDF) (3 pp, 357K, About PDF)
- Portland Green Streets Fact Sheet

Benefits

- Portland Vegetated Curb Extension Flow Test Report
- Demonstrating the Benefits of Green Streets for Active Aging (PDF) (61 pp, 2.8MB, About PDF)

Examples

- Seattle Public Utilities Natural Drainage Projects
- Syracuse Green Street: Concord Place (PDF) (2 pp, 220K, About PDF)
- Los Angeles Green Street: Elmer Ave
- The Chicago Green Alley Handbook (PDF) (24 pp, 3.7MB, About PDF)

Web Sites

- Low Impact Development Center: Green Streets
- Green Street Initiatives Around the United States
- Creating a Successful Green Street Program

Green Parking

Many of the green infrastructure elements described above can be seamlessly integrated into parking lot designs. Permeable pavements can be installed in sections of a lot and rain gardens and bioswales can be included in medians and along a parking lot perimeter. Benefits include urban heat island mitigation and a more walkable built environment.

Factsheets

- EPA Stormwater Menu of BMPs
- Minnesota Urban Small Sites BMP Manual (PDF) (6 pp, 2.1MB, About PDF)
- EPA Green Parking Lot Resource Guide

Benefits

- EPA Case Study: Bioretention Applications (PDF) (3 pp, 139K, About PDF)
- Reducing Urban Heath Islands: Cool Pavements (PDF) (39 pp, 6.2MB, About PDF)

Examples

- Ipswich River Watershed Demonstration Project
- Toronto Design Guidelines for Greening Surface Parking Lots (PDF) (40 pp, 9.6MB, About PDF)

Web Sites

- EPA Experimental Stormwater Parking Lot (40 pp, 9.6MB, About PDF)
- Nonpoint Education for Municipal Officials (NEMO) Planning for Stormwater: Parking Lots

Green Roofs

Green roofs are covered with growing media and vegetation that enable rainfall infiltration and evapotranspiration of stored water. Green roofs are particularly cost effective in dense urban areas where land values are high and on large industrial or office buildings where stormwater management costs may be high.

Factsheets

- EPA Stormwater Menu of BMPs
- Charles River Watershed Association (PDF) (2 pp, 622K, About PDF)
- Portland Ecoroofs

Examples

- King County Green Roof Case Study Report (PDF) (31 pp, 1MB, About

Benefits

- EPA's Green Roofs for Stormwater Runoff Control (61 pp, 2.8MB, About PDF)
- Green Roofs as Urban Ecosystems
- The Monetary Value of the Soil Benefits of Green Roofs

Web Sites

- Green Roofs for Healthy Cities

PDF)
- Green Roof and Wall Projects Database
- Portland Ecoroof Program

Urban Tree Canopy

Many cities set tree canopy goals to restore some of the benefits provided by trees. Trees reduce and slow stormwater by intercepting precipitation in their leaves and branches. Homeowners, businesses, and cities can all participate in the planting and maintenance of trees throughout the urban environment.

Factsheets
- EPA Stormwater Menu of BMPs (PDF) (2 pp, 126K, About PDF)
- NEMO Fact Sheet: Control Stormwater Runoff with Trees (PDF) (2 pp, 126K, About PDF)

Benefits
- Sustainable Cities Institute: Benefits of the Urban Forest
- US Forest Service: Urban Forest Data

Examples
- Chicago Trees Initiative
- Philadelphia Water Department: Stormwater Tree Trench

Web Sites
- Watershed Forestry Resource Guide
- i-Tree: Tools for Assessing and Managing Community Forests
- US Forest Service: Urban and Community Forestry

Land Conservation

Protecting open spaces and sensitive natural areas within and adjacent to cities can mitigate the water quality and flooding impacts of urban stormwater while providing recreational opportunities for city residents. Natural areas that are particularly important in addressing water quality and flooding include riparian areas, wetlands, and steep hillsides.

Factsheets
- Using Smart Growth Techniques as Stormwater Best Management Practices
- EPA's Protecting Water Resources with Higher Density Development

Benefits
- The Conservation Fund: Benefits of Green Infrastructure
- Greenways & Blueways

Examples
- Green Seams: Flood Management in Milwaukee
- Alachua County Green Infrastructure Investment Program (PDF) (8 pp, 233K, About PDF)

Web Sites
- EPA Healthy Watersheds Initiative
- The Conservation Fund
- The Trust for Public Land

Last updated on Wednesday, February 15, 2012

http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm

Bioretention
at North Carolina State University BAE
Overview Design Specs. Research Publications Links
NC COOPERATIVE EXTENSION
NC STATE UNIVERSITY
Stormwater Engineering Group

Bioretention Sizing | Underdrain Design | Soil Media | Vegetation | Construction | Maintenance

Bioretention Sizing

As a general guideline, the state of Maryland suggests that a bioretention area occupy between 5 and 7 percent of the drainage area. The following 3-step process can be used to determine the specific footprint required. View the Rain Garden Design Factsheet (2001) for detailed guidance. Other references in the Urban Waterways Series include: Bioretention Performance, Design, and Construction and Maintenance (2006) and Coldwater Stream Design Guidance for Stormwater Wetlands, Wet Ponds, and Bioretention (2007). Another design reference is the NCDENR BMP Manual Chapter on Bioretention.

1. Determine runoff depth using the following equation from the Natural Resources Conservation Service:
   - **Runoff Depth in Inches = (P-0.2*S)^2 / (P+0.8*S)**
   - P = Precipitation (typically use 1 inch)
   - S = 1,000 / CN - 10
   - CN = Curve Number (see table below)

2. Calculate runoff volume to be treated
   - **Runoff Volume (ft³) = Watershed Area (ft²) * Runoff Depth (ft)**
   - Remember to convert runoff depth from inches to feet (1 foot = 12 inches)

3. Calculate required surface area
   - **Bioretention Surface Area (ft²) = Runoff Volume (ft³) / Avg. Depth of Water (ft)**
   - Average depth of water is typically 9 inches, but depends upon the height of the overflow structure

Land Use / Cover	Soil Group A	Soil Group B	Soil Group C	Soil Group D
100% Impervious (parking lots, rooftops, paved sidewalks)	98	98	98	98
Open space (lawns and golf courses) with grass cover <50%	68	79	86	89
Open space with grass cover 50% to 75%	49	69	79	84
Open space with grass cover >75%	39	61	74	80
Woods in fair hydrologic condition	36	60	73	79

Source: USDA. 1986. *Urban Hydrology for Small Watersheds*. Washington, D.C.: U.S. Department of Agriculture. Technical Release No. 55.

Benefits of using green infrastructure

Water: Green Infrastructure/ Low Impact Development

Fact Sheet: Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices

This fact sheet provides additional information about EPA's report Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices, EPA publication number 841-F-07-006, December 2007.

PDF Version (3 pp, 172K, About PDF)

Parking lot runoff is allowed to infiltrate through a vegetated bioretention area

Background

Stormwater has been identified as a major source of pollution for all waterbody types in the United States, and the impacts of stormwater pollution are not static; they usually increase with land development and urbanization. The addition of impervious surfaces, soil compaction, and tree and vegetation removal result in alterations to the movement of water through the environment. As interception, evapotranspiration, and infiltration are reduced and precipitation is converted to overland flow, these modifications affect not only the characteristics of the developed site but also the watershed in which the development is located.

Low Impact Development (LID) is a stormwater management strategy that seeks to mitigate the impacts of increased runoff and stormwater pollution. LID comprises a set of site design approaches and small-scale stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater. These practices can effectively remove nutrients, pathogens, and metals from stormwater, and they reduce the volume and intensity of stormwater flows.

Cost Analysis

This report is an effort to compare the projected or known costs of LID practices with those of conventional development approaches. Traditional approaches to stormwater management typically involve hard infrastructure, such as curbs, gutters, and piping. LID-based designs, in contrast, are designed to use natural drainage features or engineered swales and vegetated contours for runoff conveyance and treatment. In terms of costs, LID techniques can reduce the amount of materials needed for paving roads and driveways and for installing curbs and gutters. Other LID techniques can eliminate or reduce the need for curbs and gutters, thereby reducing infrastructure costs. Also, by infiltrating or evaporating runoff, LID techniques can reduce the size and cost of flood-control structures. Note that in some circumstances LID techniques might result in higher costs because of more expensive plant material, site preparation, soil amendments, underdrains and connections to municipal stormwater systems, as well as increased project management costs. Other considerations include land required to implement a management practice and differences in maintenance requirements. Finally, in some circumstances LID practices can offset the costs associated with regulatory requirements for stormwater control.

Findings

Seventeen case studies were evaluated for this report. In general, the case studies demonstrated that LID practices can reduce project costs and improve environmental performance. Although not all the benefits of the projects highlighted in the case studies were monetized, with a few exceptions, LID practices were shown to be both fiscally and environmentally beneficial to communities. In a few case studies, initial project costs were higher than those for conventional designs; in most cases, however, significant savings were realized due to reduced costs for site grading and preparation, stormwater infrastructure, site paving, and landscaping. Total capital cost savings ranged from 15 to 80 percent when LID methods were used, with a few exceptions in which LID project costs were higher than conventional stormwater management costs. (Table 1)

Table 1. Cost Comparisons Between Conventional and LID Approaches

Project a	Conventional Development Cost	LID Cost	Cost Difference b	Percent Difference b
2nd Avenue SEA Street	$886,803	$651,548	$217,255	25%
Auburn Hills	$2,380,385	$1,598,989	$781,396	32%
Bellingham City Hall	$27,600	$5,600	$22,000	80%
Bellingham Bloedel Donovan Park	$52,800	$12,800	$40,000	76%
Gap Creek	$4,620,600	$3,942,100	$678,500	15%
Garden Valley	$324,400	$260,700	$63,700	20%
Kensington Estates	$765,700	$1,502,900	-$737,200	-96%
Laurel Springs	$1,654,021	$1,149,552	$504,469	30%
Mill Creek c	$12,510	$9,099	$3,411	27%
Prairie Glen	$1,004,846	$599,536	$405,312	40%
Somerset	$2,456,843	$1,671,461	$785,382	32%
Tellabs Corporate Campus	$3,162,160	$2,700,650	$461,510	15%

a Some of the case study results do not lend themselves to display in the format of this table (Central Park Commercial Redesigns, Crown Street, Poplar Street Apartments, Prairie Crossing, Portland Downspout Disconnection, and Toronto Green Roofs). b Negative values denote increased cost for the LID design over conventional development costs. c Mill Creek costs are reported on a per-lot basis.

A rain garden manages runoff from impervious surfaces such as roofs and paved areas.

In all cases, LID provided other benefits that were not monetized and factored into the project bottom line. These benefits include improved aesthetics, expanded recreational opportunities, increased property values due to the desirability of the lots and their proximity to open space, increased total number of units developed, increased marketing potential, and faster sales. The case studies also provided other environmental benefits such as reduced runoff volumes and pollutant loadings to downstream waters, and reduced incidences of combined sewer overflows.

Conclusions

This report summarizes 17 case studies of developments that include LID practices and concludes that applying LID techniques can reduce project costs and improve environmental performance. In most cases, LID practices were shown to be both fiscally and environmentally beneficial communities. In a few cases, LID project costs were higher than those for conventional stormwater management projects. However, in the vast majority of cases, significant savings were realized due to reduced costs for site grading and preparation, stormwater infrastructure, site paving, and landscaping. Total capital cost savings ranged from 15 to 80 percent when LID methods were used, with a few exceptions in which LID project costs were higher than conventional stormwater management costs.

Green roofs capture rainfall, promote evapotranspiration, and offer energy savings. This is a photo of a green roof on the EPA Region 8 building in Denver, CO.

EPA has identified several additional areas that will require further study. First, in all cases, there were benefits that this study did not monetize and did not factor into the project's bottom line. These benefits include improved aesthetics, expanded recreational opportunities, increased property values due to the desirability of the lots and their proximity to open space, increased total number of units developed, increased marketing potential, and faster sales. Second, more research is also needed to quantify the environmental benefits that can be achieved through the use of LID techniques and the costs that can be avoided. Examples of environmental benefits include reduced runoff volumes and pollutant loadings to downstream waters, and reduced incidences of combined sewer overflows. Finally, more research is needed to monetize the cost reductions that can be achieved through improved environmental performance, reductions in long-term operation and maintenance costs, and/or reductions in the life cycle costs of replacing or rehabilitating infrastructure.

Availability

The full report is available for download at www.epa.gov/owow/nps/lid/costs07/documents/reducingstormwatercosts.pdf

EPA

Water: Green Infrastructure/ Low Impact Development

Questions and Answers: Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices

This question-and-answer sheet provides additional information about EPA's report Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices, EPA publication number 841-F-07-006, December 2007.

PDF Version (2 pp, 20K, About PDF)

Q: What is low impact development (LID)?

A: LID comprises a set of site design approaches and small-scale stormwater management practices that are designed to reduce runoff and associated pollutants from the site at which they are generated. By means of infiltration, evapotranspiration, and reuse of rainwater, LID techniques manage water and water pollutants at the source and thereby prevent or reduce the impact of development on rivers, streams, lakes, coastal waters, and ground water.

Q: Why is LID important?

A: LID is needed to reduce the water quality impacts caused by land development and construction. Roofs, pavement, and other impervious surfaces displace vegetation and blanket the soil, causing less stormwater to soak into the ground and more to run off the land surface. Small tributaries and even larger streams cannot accommodate the increased water volume and flow that occur immediately following rainfall and snowmelt events, leading to eroded streambanks, incised channels, streams choked with sediment, destroyed aquatic life and aquatic habitat, and increased flooding and property damage. In addition, stormwater carries a broad mix of toxic chemicals, bacteria, sediments, fertilizers, oil and grease to nearby streams.

Traditional development and stormwater management approaches are usually not designed to address all of these water quality concerns. Instead, many storm drainage systems are designed to remove water from the site as quickly as possible. Use of LID in stormwater management results in flow and pollutant reduction needed to reduce the impacts on our receiving streams.

Q: How does LID work?

A: LID is based on the premise that a natural approach to stormwater management is best. In forests and other natural areas, most rainfall percolates through the soil, is absorbed by vegetation, or evaporates to the atmosphere. LID is a means of enabling developed areas to simulate nature to preserve predevelopment flow conditions.

When the natural landscape is replaced with roads, parking lots, roofs, and other impervious surfaces, rainfall can no longer soak into the ground. This results in a tremendous increase in polluted runoff. Rather than employing the traditional stormwater management approach that uses miles of costly pipes and acres of stormwater ponds to deal with this additional runoff, LID uses natural vegetation and small-scale treatment systems to treat and infiltrate stormwater runoff close to where it originates. Reducing the amount of stormwater runoff generated in the first place reduces impacts on streams carrying stormwater.

Q: How does LID relate to green infrastructure?

A: The term LID is one of many used to describe the practices and techniques employed to provide advanced stormwater management; green infrastructure, conservation

design, and sustainable stormwater management are other common terms. However labeled, each of the identified practices seeks to maintain and use vegetation and open space, optimize natural hydrologic processes to reduce stormwater volumes and discharge rates, and use multiple treatment mechanisms to remove a large range of pollutants.

Q: Can LID apply to redevelopment and infill development?

A: LID approaches can be used to reduce the impacts of development and redevelopment activities on water resources. In the case of new development, LID is typically used to achieve or pursue the goal of maintaining or closely replicating the predevelopment hydrology of the site. In areas where development has already occurred, LID can be used as a retrofit practice to reduce runoff volumes, pollutant loadings, and the overall impacts of existing development on the affected receiving waters.

Q: What was the range of cost savings seen in the case studies?

A: The case studies presented in this report show that LID practices can be both fiscally and environmentally beneficial to communities. Site-specific factors influence project outcomes, but in general, for projects where open space was preserved and cluster development designs were employed, infrastructure costs were lower. In most cases, significant savings were realized due to reduced costs for site grading and preparation, stormwater infrastructure, site paving, and landscaping. Total capital cost savings ranged from 15 to 80 percent when LID methods were used, with a few exceptions in which LID project costs were higher than conventional stormwater management costs.

Q: What types of LID practices are considered in this report?

A: This report examined projects that included bioretention, cluster building, reduced impervious area, swales, permeable pavement, vegetated landscaping, wetlands, and green roofs. Note that typical, real-world LID designs usually incorporate more than one type of the aforementioned practices or techniques to provide integrated treatment of runoff from a site.

Q: Why did EPA produce this report?

A: LID as a stormwater management approach is still relatively new, and quantitative data on the costs and benefits of LID are just beginning to emerge. EPA researched and assembled 17 case studies that examine cost savings and additional costs associated with low impact designs compared to traditional stormwater management designs. These case studies indicate that cost savings can be realized, as described above.

Q: How can I use this report?

A: This report can serve as a primer to those new to the field of low impact site design because it provides background information about the benefits of LID along with case studies showing cost comparisons between traditional stormwater management and LID designs.

For developers and planners interested in implementing or promoting LID projects in the community, this report provides a breakdown of site development costs for both traditional and low impact scenarios, which can be useful when presenting new designs to stakeholder groups who are not familiar with the costs and benefits of LID.

Q: Where can I get more information?

A: You can find more information at EPA's Green Infrastructure Web site at: www.epa.gov/npdes/greeninfrastructure (BROKEN) and at EPA's LID Web site: www.epa.gov/owow/nps/lid/.

United States
Environmental Protection Agency

Office of Water (4203)
Washington, DC 20460

EPA-841-B-00-005B
October 2000

Field Evaluation of Permeable Pavements for Stormwater Management

Olympia, Washington

Key Concepts:

- Structural Controls
- Volume Reduction
- Space Savings

LOW-IMPACT DEVELOPMENT CENTER

Introduction

This study demonstrates the potential of permeable pavement systems to restore soil infiltration functions in the urban landscape. It is based on the results of a project that included installing and monitoring several porous pavement systems in a parking area. The project's objectives were to

- Review existing information on permeable pavements
- Construct full-scale test sites
- Evaluate the long-term performance of these systems

The report outlines the difficulties encountered, costs of installing and maintaining the systems, performance based on existing soil systems, special benefits of filling the open cells with grass as opposed to gravel, and other water quality benefits.

Project Area

The demonstration site was in an office parking lot in Olympia, Washington. Two adjacent parking stalls were constructed using four types of permeable pavement systems that consisted of a combination of grass and gravel, as shown in Figure 1. The designs were

1. A flexible system consisting of a plastic network of cells with grass infill and virtually no impervious area coverage.
2. A flexible system consisting of a plastic network of cells similar to design 1 but filled with gravel.

Project Benefits:

- Elimination of Stormwater Ponds
- Demonstration of Water Quality Benefits
- Lower Maintenance

3. A system consisting of impervious blocks with the space between the blocks filled with grass. (Total surface area is 60 percent impervious).
4. A system consisting of impervious blocks with the space between the blocks filled with gravel. (Total surface area is 90 percent impervious).

A control stall was constructed out of traditional asphalt. A system of pipes, gutters, and automatic sampling gauges was installed to collect and measure the quantity and chemistry of surface runoff and subsurface infiltrate. Figure 2 shows a schematic of the test facility.

Figure 1. Different types of permeable pavement. From top left: reinforced gravel and grass pavement, reinforced grass pavement, 60% impervious concrete blocks with grass, 90% impervious blocks with gravel.

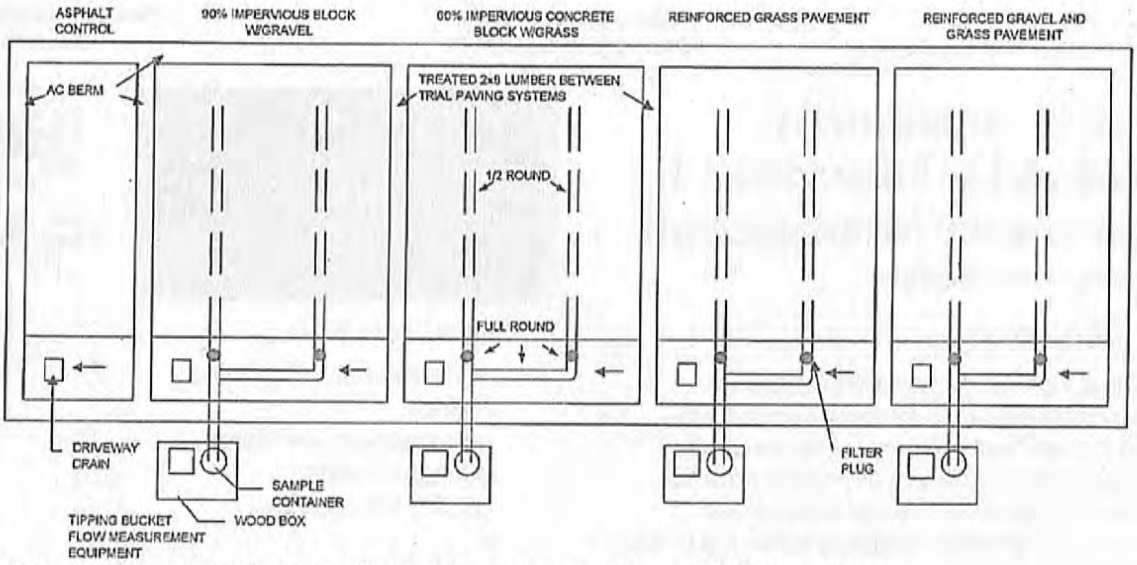

Figure 2. Schematic of the test facility showing treatments and runoff collection devices.

Project Summary and Benefits

The results of this study showed the following relationships:

- The use of permeable pavement systems dramatically reduced surface runoff volume and attenuated the peak discharge, as shown in Figure 3.
- Although there were significant structural differences between the systems, the hydrologic benefits were consistent.
- Storm characteristics and weather conditions influenced the hydrologic responses of the systems.
- Permeable pavement system types vary widely in cost and are more expensive than typical asphalt pavements. Cost comparisons between permeable pavement installations and conventional ponds or underground vaults are limited. However, the elimination of conventional systems and reduced life cycle and maintenance costs can result in significant cost savings over the long term.
- A significant contribution of permeable pavements is the ability to reduce *effective impervious area*, which has a direct connection with downstream drainage systems. This strategy of hydrologic and hydraulic disconnectivity can be used to control runoff timing, reduce runoff volume, and provide water quality benefits.

Contact Information

Derek Booth, Director
Center for Urban Water Resources Management
Box 352700
Roberts Annex 100
(206) 543-7923
dbooth@u.washington.edu

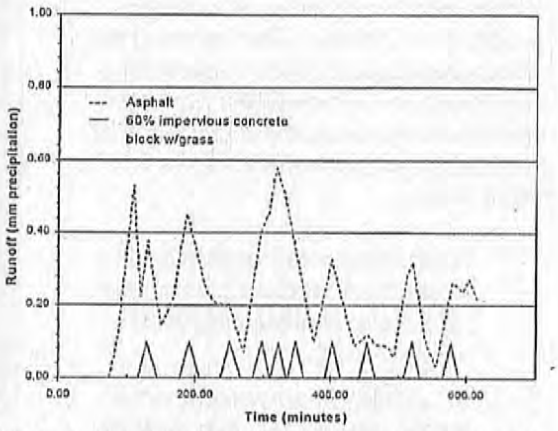

Figure 3. Runoff volumes from asphalt and permeable pavements.

Mike Ali/File

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
180 FIFTH STREET EAST, SUITE 700
ST. PAUL MN 55101-1678

REPLY TO
ATTENTION OF

April 30, 2012

Operations
Regulatory (2011-0832-JCB)
(FORMERLY 2010-04976-JCC)

Mr. Kenneth A. Westlake
NEPA Implementation Section
Region 5, United States Environmental Protection Agency
77 West Jackson Boulevard
Chicago, Illinois 60604-3590
E-19J

Dear Mr. Westlake:

This letter is in response to your April 5, 2012 letter regarding the *Draft Environmental Assessment for United States Steel Corporation, Minnesota Ore Operations- Minntac Mine Western Progression*. The proposed project is located in Mountain Iron, St. Louis County, Minnesota. We appreciate your comments on this document and we would like to take the opportunity to respond to a few of the items addressed in your letter.

The Author of the Draft Environmental Assessment (DEA)

Please note that the DEA was prepared by a third party consultant hired by United States Steel (USS) and had not yet been edited by the Corps. The final EA will be a compilation of the DEA and our Decision Document (the Corps Decision Document includes an Environmental Assessment, 404(b)(1) Guidelines Evaluation, Public Interest Review, and a Statement of Findings). We will modify the final EA to address your comments.

Missing Consultation Records

The Corps has completed numerous in-person and teleconference consultation meetings with the Bois Forte, Fond du Lac, and Grand Portage Bands. The Corps has also completed consultation regarding historic and cultural resources with the Minnesota State Historic Preservation Office (SHPO) and a Programmatic Agreement (PA) has been signed addressing the steps toward fulfilling the requirements of Section 106 of the NHPA. The PA has been reviewed and will be signed by the respective Tribal Council Chairs of the consulting Bands. We are currently working with the consulting Bands to determine the best method to identify historic properties of religious or cultural significance. This consultation will continue until a work plan has been developed and identification of historic properties is complete and, if necessary, an effects determination is made.

County Road 102 Reconstruction

County Road 102 (CR 102) is located south of Minntac's eastern pit. The progression project is located in the west pit. We do not agree that the realignment of County Road 102 (CR 102) is a connected action under NEPA for the western pit progression project. The Council of Environmental Quality has provided guidance on this issue, such that "actions are "connected" if they: (i) automatically trigger other actions which may require environmental impact statements; (ii) cannot or will not proceed unless other actions are taken previously or simultaneously; (iii) are interdependent parts of a large action and depend on the larger action for their justification." (*National Environmental Policy Act Scope of Analysis in Corps Permitting Actions In the Ninth Circuit - A Legal Analysis*. CECC-ZA. 9 July 2007.)

The Minntac Progression Project does not trigger the need for CR 102 to be relocated. Therefore, the Corps has determined that the western pit progression project is not a larger action for which the CR 102 relocation depends upon for justification. However, United States Steel is planning and has participated in pre-application consultation meeting with the Corps about the Minntac Extension Project. This project would expand the Minnesota Department of Natural Resources Permit to Mine limit in both the west and east pit by 483 acres, of which approximately 60 acres are wetlands. United States Steel has been informed by the Corps that the CR 102 relocation would be a connected action for the Minntac Extension Project. We will provide your comments on the building material and construction methods for CR 102 the St. Louis County Highway Department and USS who are both collaborating on the design of the roadway.

Wetland Impacts and Mitigation

Indirect wetland impacts are anticipated as a result of the project, however, the quantity and extent of these impacts are unknown. As such, the Corps will require wetlands immediately adjacent to the proposed project to be monitored for changes in wetland area, vegetation, and hydrology. Any changes observed may require additional wetland mitigation. As a special condition of their permit, United States Steel would be required to develop and implement a monitoring plan for indirect impacts. Monitoring will continue throughout the life of the mining in the west pit mine progression area unless the Corps determines further monitoring is unnecessary.

Although the unauthorized wetland impacts were identified in the DEA as 4.82 acres, in the investigation of the EPA's administrative penalty, USS identified an additional 0.38 acres of wetland fill. In addition to the issued penalty, the 5.2 acres of unauthorized wetland impacts will be mitigated at a mitigation ratio of 1.5:1, for a total wetland bank withdrawal of 7.8 credits.

At the time the DEA was prepared, the Corps was completing site investigations of potential stream channels in the review area. These stream channels that were indentified on the National Hydrography Dataset Plus (NHD) were not field verified until May 2011. During these site investigation, the Corps determined that none of the channels drawn on the NHD had water flow and some of the channels lacked an ordinary high water mark. Years of pumping and dewatering from the nearby mine pit has significantly altered the surface and groundwater watersheds. Although the dry stream channels would not meet the definition of a stream in 33 CFR § 328.4(c)(2), these areas currently function as wetlands and were delineated as such in accordance with the *1987 Corps of Engineers Wetland Delineation Manual* and the *Northcentral/Northeast Regional Supplement*. Mitigation for all

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wetland impacts (including unauthorized wetland impacts) will be mitigated through a combination of in-kind and out-of-kind project specific mitigation and wetland banking. A summary of the proposed wetland mitigation is included with this letter as Attachment A.

Water Quantity and Watershed Impacts

As described above, the tributary streams to the East Branch of the West Two River and Kinney Creek located within our scope of analysis do not have stream flow. In addition, many of these stream channels are located over known iron ore reserves, and within an area that USS has expressed interest in expanding the mine. Thus, the benefit of restoring stream flow could be potentially short lived. In addition, a discharge of flow would require a modification or a new NPDES permit. For these reasons, the Corps has determined it would be best to focus stream restoration efforts on areas where a long-term ecological benefit could be realized.

We have notified USS that their next planned expansion would likely impact jurisdictional streams. If, after going through the required analysis and the stream impacts were permitted, they would be required to find appropriate in-kind stream mitigation within the St. Louis River Watershed. We have required stream mitigation for other mining impacts which impacted jurisdictional streams.

Biological Integrity and Water Quality

We have discussed the inter-basin water transfer issue with MnDNR's state contact for the Great Lakes Compact (Compact), Mr. Dale Homuth. Mr. Homuth has informed us that the Minntac project was constructed prior to the Compact being signed and is therefore grandfathered and exempt from the compact. An inter-basin water transfer would only need to be approved by the MnDNR (the approval authority for inter-basin transfers less than 5 MGD) if Minntac requests a change in their existing water appropriations permit. Mr. Homuth also informed us that all appropriation permits held by USS were still valid and he was not aware of any non-compliance issues.

Future Coordination on Mining Projects

All permit applications for mining actions requiring a letter of permission or individual permit include a public notice. In the state of Minnesota, the vast majority of large-scale mining projects occur in Itasca, St. Louis, and Lake Counties. In order to improve coordination, we recommend that the EPA sign up to electronically receive public notices for these counties. EPA staff can sign up by going to: http://www.mvp.usace.army.mil/list_server/. Unfortunately, due to our workload, is not possible to separately notify the EPA of every mining-related EA that becomes available for comment. However, when the public notice is released we welcome your comments and any request to review an EA once it becomes available. If you have any questions on signing up for our public notices contact Jill Bathke at jill.c.bathke@usace.army.mil or at (651) 290-5357.

If you have any further questions or comments, please contact me at 651-290-5191, or at tamara.e.cameron@usace.army.mil.

Sincerely,

Tamara E. Cameron
Chief, Regulatory Branch

Copies Furnished:

Mr. Duane Hill- Minnesota Department of Transportation
Mr. Jim Foldesi- St. Louis County Department of Public Works
Mr. Bill Johnson- Minnesota Department of Natural Resources
Ms. Ann Foss- Minnesota Pollution Control Agency
Mr. Nick Rowse- U.S. Fish and Wildlife Service
Ms. Chrissy Bartovich- United States Steel Corporation

WETLAND REPLACEMENT PLAN AND BANK WITHDRAWAL FOR THE MINNTAC PROGRESSION PROJECT (2011-00832-JCB)

Palisades II Project Specific Wetland Mitigation Site

PLANT COMMUNITY	IMPACTS AT THE MINNTAC SITE (**ACRES**)	**CREDITS** NEEDED TO MITIGATE FOR IMPACTS, IN-KIND REPLACEMENT (1.25:1)	PROPOSED COMMUNITIES AT PALISADES II (**CREDITS**)	AVAILABLE CREDITS *MINUS* NEEDED IN-KIND MITIGATION CREDITS		**CREDITS** NEEDED TO MITIGATE FOR IMPACTS, OUT-OF-KIND REPLACEMENT (INCREASE RATIO TO 1.5:1)	REMAINING **CREDITS** AT THE PALISADES II SITE*	
Fresh (wet) Meadow /Sedge Meadow	3.79	4.74	17.68 (1:1 restoration ratio)	17.68-4.74=	12.94		(12.94+4.86)-(5.94+10.30)= ((available mitigation credits for wet meadow & native upland) MINUS (needed credits to replace shrub-carr & hardwood swamp impacts))	**1.56** Native upland credits (using a 1.5:1 ratio)
Shrub-carr	31.16	38.95	34.00 (1:1 restoration ratio)	34.00-38.95=	-4.95	5.94 (4.95+1.25=3.96) → (3.96x1.5=5.94)		
Hardwood Swamp	40.46	50.58	42.00 (1:1 restoration ratio)	42.00-50.58=	-8.58	10.30 (8.58+1.25=6.86) → (6.86x1.5=10.30)		
Native Upland			4.86 (4:1 upland ratio, 19.44 acres÷4)	4.86-0=	4.86			
TOTAL	75.41 acres	94.27 credits	94.96 credits			16.24 credits		

Unauthorized Wetland Impact Mitigation:

PLANT COMMUNITY	IMPACTS AT THE MINNTAC SITE (**ACRES**)	**CREDITS** NEEDED TO MITIGATE FOR IMPACTS	AVAILABLE REPLACEMENT **CREDITS** AT THE PALISADES II SITE	REMAINING **CREDITS** NEEDED AFTER PALISADES II SITE USE	AVAILABLE CREDITS AT THOMPSON MITIGATION BANK (**CREDITS**)	AVAILABLE CREDITS AT THOMPSON *MINUS* NEEDED MITIGATION CREDITS	REMAINING **CREDITS** AT THE THOMPSON BANK SITE[2]
Unauthorized Impacts[1]	5.2	7.8 (5.2 acres x 1.5[1])	1.56	6.24 (1.56-7.8= -6.24)	8.9	8.9-6.24=2.66	2.66 wetland credits[2]

[1] Unauthorized fill of to fresh (wet) meadow/sedge meadow, alder thicket/shrub carr, and hardwood swamp wetland communities→ not eligible for mitigation ratio incentives.

[2] These credits may be used for future projects.