Zavoral Mining and Reclamation Surface Water Plan

October 2012

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Zavoral Mining and Reclamation Project
Surface Water Plan

Purpose:
The Surface Water Plan (Plan) has been prepared for a sand and gravel mine located in Scandia, Minnesota (Site). The Site is leased by Tiller Corporation (Tiller) and its operating division Barton Sand and Gravel Company is the operator of the mine. The purpose of the Plan is to identify Site drainage patterns, identify and describe surface waters proximate to the Site, existing water quality and Site environment. The identification of these features enabled the development of the appropriate measures that will be implemented at the Site to address erosion and sedimentation control, site drainage and the protection of surface water features. The protective measures developed for the Site are identified through the compilation of permits, permit requirements, and best management practices (BMPs) identified in the Stormwater Pollution Prevention Plan (SWPPP) that will be implemented throughout the duration of the Zavoral Mining and Reclamation Project (Project).

Permits Required:
- Stormwater Management, Carnelian-Marine-St. Croix Watershed District (CMSCWD)
- Erosion and Sediment Control, CMSCWD
- National Pollutant Discharge Elimination System (NPDES) and State Disposal System (SDS) General Permit MNG490000 for Nonmetallic Mining and Associated Activities

Permit Requirements:
- Stormwater Pollution Prevention Plan (SWPPP)
    - Includes erosion and sedimentation control and best management practices (BMPs) that are enforceable and will be applied throughout the duration of the Project.

Monitoring
Because stormwater will be directed internally and will not discharge from within the mining limits, no on-site stormwater monitoring is required. In the event that stormwater is not entirely contained on-site, stormwater monitoring and sampling as outlined in MNG490000 will be required.

Site Information[1]:
Excerpts Modified from Sections 4.6, 4.9 and 4.10 of the Environmental Impact Statement (EIS)

1.0 Physical Impacts on Water Resources
2.0 Erosion and Sedimentation
3.0 Impact Analysis
4.0 Mitigation Measures

[1] AECOM. 2012. *Proposed Zavoral Mine and Reclamation Plan*. Environmental Impact Statement. Scandia, MN.

1.0 PHYSICAL IMPACTS ON WATER RESOURCES

1.1. *Site Drainage*

The Site has a total area of approximately 64 acres, consisting of 52 acres that have no off-site discharge (are internally drained) and approximately 12 acres that discharge off-site to three separate tributaries, all of which drain to the St. Croix River (**Figures 1 and 2**). All off-site drainage originates in perimeter areas of the Site along the northern, eastern, and southern Site boundaries. The north perimeter watershed, which is 3.43 acres in size, drains to Zavoral Creek and is partially composed of land in the scenic easement that is part of the St. Croix River District. A 2.19-acre area discharges to the unnamed creek, named Middle Creek in this EIS. The remaining 5.97 acres that drain off-site discharge to the South Creek, as named for this EIS. The watersheds discharging off-site have slopes ranging from 2% to 25% within the mining limits. In comparison, slopes along adjacent areas of the St. Croix River escarpment range up to 100% or higher. In the remaining 82% of the Site, runoff is trapped within depressions (internally drained) and does not leave the Site.

The affected environment includes areas downstream of the externally draining perimeter watersheds and the internally drained area. Areas downstream of the Site include steep escarpment areas adjacent to the St. Croix River, where small tributaries either traverse the escarpment or originate in the escarpment. These small tributaries have perennial flow starting near the base of the escarpment, supported by springs occurring there. Above the springs, there is flow in the tributaries during and shortly after periods of significant rain or snow melt. The small tributaries have steep gradients; flow velocities in them would be expected to be relatively fast and erosive as a result. Furthermore, the tributaries discharge to the St. Croix River, a very large stream compared to the tributaries. The areas in the St. Croix River that are subject to Project impacts are relatively small areas near the point where the tributaries discharge to the river. These small areas would be associated with locations where the relatively high velocity of the small tributary inflow is dissipated in the St. Croix River[2].

Short duration flow measurements were made for Zavoral Creek during the course of the EIS preparation. Information was developed from existing topographic mapping and other existing data, such as soils maps, that were used for the analysis of water resources.

Potential effects of the Project on water resources were investigated by analyzing Site runoff rates and infiltration in internally drained areas during operation and after reclamation, and then comparing these rates to existing conditions. Natural Resources Conservation Service (NRCS) runoff prediction methodology was used to predict peak flows for existing conditions, during mining and post-operation conditions (Soil Conservation Service 1986). The computer program XPSWMM, which implements NRCS peak flow estimation methods, was used to complete the analysis to estimate the flows discharged from the Site to Zavoral Creek, Middle Creek, and South Creek. Peak runoff rates for the 2-year, 10-year and 100-year 24-hour duration storm events (2.8, 4.2 and 5.9 inches of rain respectively were estimated. The analysis included 2-year, 10-year, and 100-year recurrence interval 24-hour storm events for the discharges to Zavoral, Middle, and South Creeks (**Table 1**).

[2] Subject to Project impacts if off-site discharges of stormwater were allowed. The SWPPP describes the intent to divert all stormwater from disturbed areas to where it will drain internally.

Table 1: Peak Off-Site Discharge Rates for Existing Conditions (24-hour Storms)

	Storm Recurrence Interval		
	2-year	10-year	100-year
Discharge to Zavoral Creek (cfs)	0.0028	0.1443	2.1838
Discharge to Middle Creek (cfs)	0.0007	0.0357	0.8046
Discharge to South Creek (cfs)	0.0036	0.1851	2.7266

For the areas of the Site that are internally drained, all runoff infiltrates within depressions and becomes groundwater. The three creeks that the Site discharges to are buffered by wetlands downstream of the Site but only have perennial flow downstream of springs originating along the base of the St. Croix River escarpment. Typically, flowing water is present in all three creeks downstream of the springs with depths ranging from 2 to 6 inches (CCES January 2011). Upstream of these springs, the creeks only have flowing water during and shortly after storm events or during snow melt periods.

Zavoral Creek, which has a total watershed area of approximately 1,500 acres, was gauged downstream of the Site by the Washington Conservation District (WCD) from June 2010 to November 2010, April 2011 to October 2011 and March 2012 to November 2012 (projected) just upstream of a driveway culvert approximately 400 feet upstream of the St. Croix River. The EIS analyzed data from the 2010 period and during this period, Zavoral Creek averaged a depth of 1.4 inches and a flow rate of 0.3 cubic feet per second (cfs). The data shows the creek flowing steadily with several peaks in flow in response to rain events occurring in the recording period, with no peak lasting more than 2 hours. Rain Gauge Station 212881 of the MnDNR State Climatology Office, located on Forest Lake approximately 8 miles west of the Site, recorded over an inch of rainfall on the days containing the largest peaks in flows. The Middle Creek and South Creek watersheds are approximately 400 and 300 acres in size, respectively. Based on the Zavoral Creek gauge, Middle Creek and South Creek would also have shallow perennial flows downstream of springs occurring at the base of the escarpment, short duration peak flows during large storm events or snow melt, and areas with no perennial flow upstream of the springs.

On the St. Croix River, the nearest stream gauge is the U. S. Geological Survey (USGS) gauge 05340500, St. Croix River at St. Croix Falls. This gauge is located 18.7 miles upstream of the Site and has a watershed of 6,240 square miles, over 340,000 times greater than the existing watershed areas draining off-site. The average flow at this gauge over the 104 years on record is 3,610 cfs. Using a flow duration curve created from daily flows from 1902 to 2011, approximately 99% of the flows recorded at this gauge are above 800 cfs and 35% of flows recorded are above the average of 3,610 cfs with the highest flow of 60,900 cfs recorded on April 25, 2001.

Potential geologic hazards are related to the elevation relief between the Zavoral Site and the St. Croix River and the erodible nature of the soil. The surface soils consist of highly erodible granular materials. These soils are generally stable unless water is introduced. Surface water drainage is the primary source of water that could lead to erosion and soil transport.

Existing on-site storage capacity for capturing and infiltrating stormwater was calculated by delineating the topographic depressions within the Site and using existing topographic mapping. The existing on-site

storage capacity was calculated to be approximately 78.1 acre-feet. A 100-year recurrence interval 24-hour duration storm event at this location is 5.9 inches. This equates to a volume of 25.6 acre-feet of runoff assuming all rain becomes stored in a depression and is not lost to evapotranspiration or interception by vegetation. The existing depression areas are depicted in **Figure 2**. The analysis of the capacity for capturing and infiltrating stormwater was completed on the basis of potential overflow points (**Table 2**), of which the Site has three. The other five depression areas would discharge internally to the three listed in **Table 2**; the flow paths are shown in **Figure 2**.

Table 2: Existing On-Site Stormwater Storage

Depression Area	Overflow Elev. (ft)	Max Stage 100-year event	Max Depth 100-year event
2	866	859.4	3.4
7	854	851.5	1.5
6	862	854.4	0.4

Depression Area 7 would be the most likely to overflow under existing conditions. Further calculations, conservatively completed by ignoring infiltration, evapotranspiration, and interception, indicate that Depression Area 7 would overflow if a 100-year 24-hour storm (5.9 inches) would be followed the next day by another 100-year 24-hour storm. This result indicates the likelihood of an overflow event from existing depression areas to an off-site area is small under existing conditions.

1.2 *Water Quality*

There is limited available water quality data for the creeks and St. Croix River near the Site. The WCD has been collecting water quality samples from Zavoral Creek on a seasonal basis at varying dates since 2010. The most recent data available is from the 2011 season (**Table 3**). USGS records do not have any water quality data more recent than October 16, 2003, at their closest monitoring station, the St. Croix River at St. Croix Falls. The most recent water quality records available from the MPCA relevant to the Site are from September 14, 2006, for Station 06SC017, St. Croix River near Rustrum State WMA located 1,000 feet upstream of the Site. **Table 3** shows the comparison of the results from the WCD Zavoral Creek averages from 2011 and MPCA Station 06SC017 data recorded on September 14, 2006.

Table 3: Water Quality Characteristics of Project Area Water Bodies

	St. Croix River	Zavoral Creek
Data Source	MPCA	WCD (average of samples)
Date Sampled	9/14/2006	5/18-9/26/2011
Temperature (°C)	17.4	12.5
Dissolved Oxygen (mg/L)	9.8	10.7
pH	8.14	8.10
Conductivity (µmhos/cm)	222	546
Total Suspended Solids (mg/L)	2.8	2.3
Total Phosphorus (mg/L)	0.024	0.034

The data for Zavoral Creek represents the groundwater source for the baseflow of the creek, with the creek having relatively low water temperature and relatively high conductivity. Both streams have good levels of dissolved oxygen, relatively high pH, and relatively low total suspended solids. Zavoral Creek does have higher total phosphorus than the St. Croix River, indicating the groundwater source of Zavoral

Creek yields greater phosphorus concentrations than found in the river.

2.0 EROSION AND SEDIMENTATION

Soils within the Site are categorized by the Natural Resource Conservation Service (NRCS) as hydrologic soil Group A, a category composed of sandy soils (NRCS September 2011). Soils that are sandy infiltrate runoff at relatively high rates. Watershed areas that discharge off-site have well-established vegetation, which, combined with the sandy nature of the soil, enhances infiltration and decreases the risk of erosion. Surface runoff occurs when the soil is saturated or when the rate of rainfall or snow melt exceeds the infiltration rate. The majority of runoff from the Site is infiltrated and becomes groundwater because of internal drainage and the sandy nature of the Site soils.

Portions of the Site that discharge to the creeks, referred to as the Middle and South Creeks in this EIS, are forested by White-pines and other trees. The area discharging to Zavoral Creek is vegetated primarily with nonnative and native grasses.

Approximately 35% of the internally drained watershed areas are forested, the remainder is nonnative and prairie grasses. Several areas with steep slopes that drain internally are attributed to mining activities from the mid 1960s to the 1980s. Existing Site topography is shown on **Figure 2** along with the depression areas that drain internally.

The topography in the area between the Site and the St. Croix River includes steep slopes and bluffs that have a high risk for erosion. Designated wetlands outside the proposed mining and reclamation area, but within the Site boundary, include reaches of the three creeks to which the Site is tributary. The creeks are characterized as “ravines with several seep areas along the hillsides.” Vertical cuts in soils and soil sloughing occur in areas along Zavoral Creek and Middle Creek.

Potential impacts on erosion and sedimentation exist after the start of construction when soils are exposed for overburden removal or other activity. The source areas of potential erosion and sedimentation project impacts are 4.6 acres on the perimeter of the Site that would discharge off-site during construction (**Figure 3**). Watershed areas discharging off-site during operation would include 1.3 acres discharging to Zavoral Creek, 1.0 acre discharging to the Middle Creek, and 2.3 acres discharging to the South Creek, a total of 4.6 acres or 7% of the Site.

The watersheds discharging off-site have slopes ranging from 2% to 25% within the mining limits. In comparison, slopes along adjacent areas of the St. Croix River escarpment range up to 100% or higher. For the remaining 93% of the Site, runoff is trapped within depressions (internally drained) and does not leave the Site. Internally drained areas would not have potential for off-site erosion and sedimentation impacts, as these impacts are the result of runoff.

3.0 Impact Analysis

Potential impacts of the Project on water resources were investigated in the EIS by analyzing Site runoff rates during and after the Project, and then comparing these rates to existing conditions. The computer program XPSWMM was used for the analysis of existing conditions, during mining and post-operation conditions to estimate the flows discharged from the Site to Zavoral Creek, Middle Creek, and South Creek. Peak runoff rates for the 2-year, 10-year, and 100-year 24-hour duration storm events (2.8, 4.2 and 5.9 inches of rain, respectively) were estimated (**Table 4**).

Table 4 shows the reductions in the 2-year, 10-year, and 100-year peak flows comparing existing conditions to conditions during operation (**Figure 3**). During operation, a berm would be constructed on the south end of the Site as close to the mining limits as possible. This berm would be the boundary between internally drained and off-site discharge areas. For this analysis, it was assumed the berm is an existing ridge. It may be possible during Site grading to construct this berm closer to the Site perimeter. The closer the south berm can be installed to the mining limits, the smaller the watershed draining offsite.

As this watershed gets smaller, the peak flow rates to the South Creek during mining and post-reclamation would decrease. During operation, the berm to be installed on the south end of the Site should be constructed as close to the mining and reclamation limits as possible. This would result in lower off-site peak flow rates and increased on-site infiltration than the estimates presented in this analysis.

Table 4: Peak Flow Reductions During Mining

	2-year Peak Flow (cfs)			10-year Peak Flow (cfs)			100-year Peak Flow (cfs)		
	Existing	During Mining	% Reduction	Existing	During Mining	% Reduction	Existing	During Mining	% Reduction
North (Zavoral) Creek	0.0028	0.0008	71%	0.1443	0.0406	72%	2.1838	0.6730	69%
Middle Creek Watershed	0.0007	0.0007	0%	0.0357	0.0357	0%	0.8046	0.8046	0%
South Creek Watershed	0.0036	0.0014	61%	0.1851	0.0757	59%	2.7266	1.5285	44%

The flow off-site from each watershed for 2-year, 10-year, and 100-year storm events are greatly reduced from existing conditions to post-reclamation (**Figure 4; Table 5**), which would benefit the streams to which the Site is tributary by reducing risks of erosion and sedimentation. The existing peak flow rate during a 100-year event of 2.2 cfs discharging to the Zavoral Creek would be reduced to 0.6 cfs. The other existing off-site discharge points to the Middle and the South Creeks would be eliminated post-reclamation.

Table 5: Peak Flow Reductions Post Reclamation

	2-year Peak Flow (cfs)			10-year Peak Flow (cfs)			100-year Peak Flow (cfs)		
	Existing	Post-Reclamation	% Reduction	Existing	Post-Reclamation	% Reduction	Existing	Post-Reclamation	% Reduction
North (Zavoral) Creek Watershed	0.0028	0.0008	71%	0.1443	0.0400	72%	2.1838	0.5937	73%
Middle Creek Watershed	0.0007	0.0000	100%	0.0357	0.0000	100%	0.8046	0.0000	100%
South Creek Watershed	0.0036	0.0000	100%	0.1851	0.0000	100%	2.7266	0.0000	100%

After mining and reclamation have been completed, the total watershed area with off-site discharges would be reduced from 11.6 acres to 1.3 acres, three million times smaller than the St. Croix River watershed near the Site. Approximately 1.3 acres (**Figure 5**) at the north end of the Site would discharge to Zavoral Creek. **Figure 6** shows the final reclamation contours. After reclamation, the total capacity of the Site to store and infiltrate runoff would be approximately 60.1 acre-feet, compared to the 25.6 acre-feet of rain falling in the internally drained area during a 100-year 24-hour storm.

The potential for overflow from internally drained areas during a large storm event was analyzed for the proposed grading of the Site for final reclamation conditions (**Table 6**). For the final proposed Site contours, one potential overflow point exists for the Site, which would discharge to the South Creek (**Figure 5**).

Table 6: Proposed Storage

Depression Area	Overflow Elevation (ft)	Maximum Stage 100-year event (ft)	Maximum Depth 100-year event (ft)
5	856	852.2	1.2

Additional analyses were completed to determine a relative probability of the storm or snow melt event that would need to occur to create overflow from the Site post-project. A conservative analysis was completed by ignoring infiltration, evapotranspiration, and interception that would occur during any rain event. It would take more than two back-to-back 100-year 24-hour storm events (5.9 inches per storm, 11.8 inches total) before Site overflow would occur. If the losses due to infiltration and interception were included in the analysis, there would be no off-site discharge resulting from back-to-back 100-year 24-hour storms. The potential of overflow post-reclamation is seen to be very small, less than the potential under existing conditions. Prior to reclamation, the potential for overflow would be less than under existing conditions as the Site becomes more internally drained as mining occurs and as part of ongoing stormwater management (**Figures 4 and 5**).

Potential impacts to surface water during operation include:

• Potential downstream sedimentation resulting from exposed soil at excavation areas during stripping and overburden removal

• Potential pollutants originating from construction equipment operation and washing

• Potential groundwater contamination from on-site equipment fueling

• Washoff of pollutants from areas draining off-site

Immediately after soil stripping, and prior to overburden removal, there would be several relatively short periods (a matter of days or less for each occurrence) when potential impacts to downstream water resources could occur. If significant rainfall events occurred during this period, erosion in externally draining perimeter areas of the Site could potentially affect downstream resources, including the three small tributaries receiving Site drainage and the St. Croix River. After vegetative stabilization or after overburden removal, the potential for these impacts becomes very small, and less than potential impacts under existing conditions.

Potential impacts are proportional to potential impacts on flow rates. The Project, regardless of differences in phasing, would reduce peak flows off-site, reduce the risk of erosion, and greatly reduce the risk of overflow. The Project would improve infiltration, resulting in improved base flow conditions for the seeps, springs, and creeks, and enhancing the ability of area creeks to support aquatic life.

Water quality potential impacts are proportional to potential impacts on flow rates. The Project would reduce the peak flow rates from perimeter areas to downstream tributaries for both during mining and post-mining periods (**Tables 4 and 5).** Post-mining conditions peak flow rates from the northernmost externally draining area of the Site would be reduced by 71– 74% for the 2-year, 10-year, and 100-year rain events, to 100% for the middle and southernmost externally draining areas. The potential water quality impacts would be proportionally decreased by the Project.

4.0 Mitigation Measures

The Site requires permits for the management of stormwater and erosion and sedimentation control and the implementation of best management practices (BMPs). The key component is that the SWPPP, erosion and sedimentation control, and BMPs are implemented and maintained throughout the life of the Project.

BEST MANAGEMENT PRACTICES:

Best Management Practices (BMPs) are in place at the Site to control stormwater flows, prevent co-mingling of authorized non-stormwater discharges and provide treatment of stormwater that has contacted significant materials prior to discharge from the Site.

BMPs have been developed to minimize or eliminate pollution at the Site. These BMPs include perimeter controls designed to prevent sediment from leaving the Site, focusing on the three areas that contribute to off-site drainage, as well as stabilization controls that prevent erosion from being generated at the Site. These include measures to redirect surface water runoff internally as areas are stripped and prepared for mining. BMPs to reduce or eliminate the contact of stormwater with significant materials are also included in the discussion. BMPs that will be implemented are described below. Locations of BMPs are illustrated on the accompanying BMP Plan.

4.1 *Non- Structural BMPs designed and implemented at the Site:*

4.1.1 *Phasing:* Minimize the disturbed area open at any given time by stripping only those areas that will be mined in the next mining season or two and progressively reclaiming areas where mining activity has been completed. The Site will be mined in phases and not stripped all at one time in order to minimize the exposed soils. Any portion of a Site that can be maintained in its current vegetated state by using this BMP will not contribute increased stormwater runoff and will reduce the amount of treatment necessary. The phasing plans are indicated on Figure 3 through Figure 6.

Any overburden that is removed as part of stripping operations that is not used immediately in reclamation activities will be stockpiled within the mining area to prevent movement of sediment off-site.

4.1.2 *Volume/Runoff Minimization:* There are three areas within the mining and reclamation limits which contribute to off-site runoff: northern, eastern and southern. As the phases of mining progress, the potential for off-site drainage is reduced because these areas will be lowered in elevation and converted to internally drained areas, therefore mining will not increase the volume of runoff generated at the Site. The areas that currently drain off-site are indicated on (Figure 2).

Stormwater could potentially contact exposed soils during the time interval between removing vegetation and stripping the overburden from the Site. Prior to stripping perimeter controls will be established to divert stormwater from these areas to internal areas to be infiltrated, The overburden is an average of six feet deep, therefore, once the overburden has been removed, the active area will be lowered sufficiently to retain stormwater within the Site and prevent it from running off-site.

4.1.3 *Fuel Storage:* Any AST installed at the Site will be located more than 500 feet from surface water to reduce the potential for impact to surface water.

As required by rule, MPCA will be notified about all ASTs within 30 days of installation by submitting an AST Notification Form.

4.1.4 *Establishment of Vegetation:* Completed portions of the Site will be reclaimed and vegetation reestablished as mining is completed. All soils will be stabilized by a uniform perennial vegetative cover with a density of 70 percent over the entire pervious surface area, or other equivalent means necessary to prevent soil failure under erosive conditions. Portions of the Site which lie within the River District or Scenic Easement area will likely be reforested with white pine trees.

Revegetation and reforestation of the Site will help to intercept rainfall, maximize infiltration and increase evapotranspiration. Restoration grades will maintain the internal drainage patterns of the Site. Impervious surfaces after reclamation will be limited to the Site entrance and gravel surfaced internal roads. Runoff from these surfaces will infiltrate and not be discharged off-Site.

4.1.5 *Special Requirements:* For stormwater discharges within 2000 feet of Outstanding Resource Value Waters (ORVWs), an undisturbed buffer zone of not less than 100 linear feet from the receiving water (not including tributaries) shall be maintained at all times. Mining limits are located at a distance greater than or equal to 1,000 feet from any ORVWs. Mining limits are located more than 100 linear feet from any receiving waters and therefore will not disturb this buffer zone.

For stormwater discharges within 2000 feet of ORVWs and trout waters, stormwater shall infiltrate to groundwater. The operator will divert all stormwater discharges from disturbed or exposed areas internally to the floor of the mining area to infiltrate stormwater. Final reclamation grades have been designed with multiple low areas for encouraging stormwater infiltration (Figure 6). Any exposed soil areas with a slope of 3:1 or steeper, that have a continuous positive slope to an ORVW or trout waters, will have temporary erosion protection or permanent cover within 3 days after the area is no longer actively being worked.

For stormwater discharges within 2000 feet of those ORVWs and trout waters, the stormwater management system must be designed such that the pre and post project runoff rate and volume from the 1 and 2-year 24-hour precipitation events remains the same. The Environmental Impact Statement (EIS) conducted for the Site described there will be no increase in post project runoff rates.

4.1.6 *Black Ash Seepage Swamp Monitoring:* The Black Ash Seepage subtype wetland boundary originally mapped by Critical Connections Ecological Services, Inc. in 2010, will be monitored every three years once the Project has commenced.

4.1.7 *Zavoral Creek Monitoring:* The monitoring point installed in Zavoral Creek by Washington Conservation District shall continue to be monitored throughout the life of the Project.

4.1.8 *Good Housekeeping:* The Site employs good housekeeping practices to help reduce potential pollutants from contacting stormwater runoff. These include:

a) Routine pavement cleaning and sweeping of Site access points is conducted to prevent tracking of dirt and fugitive dust and to periodically remove debris. This includes watering of internal haul roads as needed and paving at the Site entrance. Street sweeping at the paved entrance to the facility is conducted one to two times per week as needed. The Site entrance will be visually inspected for tracking on a daily basis during Site operations.

b) Litter Control - an adequate number of trash receptacles are provided for employees and customers to prevent litter and waste around the Site. Litter and other wastes are routinely collected by a Tiller employee and disposed of at Tiller's Maple Grove facility where waste is picked up by a licensed solid waste hauler for disposal at a licensed waste facility.

c) Removal of unnecessary equipment.

d) Materials Storage: Any materials incidental to the operation such as grease, engine oil, hydraulic fluid and anti-freeze if stored on-site, will be stored in an enclosed trailer in compliance with state, county and city requirements and regulations.

e) Training: Employee training is conducted regularly on good housekeeping practices, and spill prevention and response.

f) Equipment/vehicle washing will occur in a designated area where the wash water is collected or directed to an infiltration area.

4.2 *Structural BMPs designed and implemented at the Site.*

4.2.1 Flow diversion, berms, and sediment traps will be used as needed for erosion and sediment control along perimeter areas to divert stormwater runoff from these areas towards the interior recessed portion of the Site to be infiltrated as indicated in Figure 3 through Figure 6.

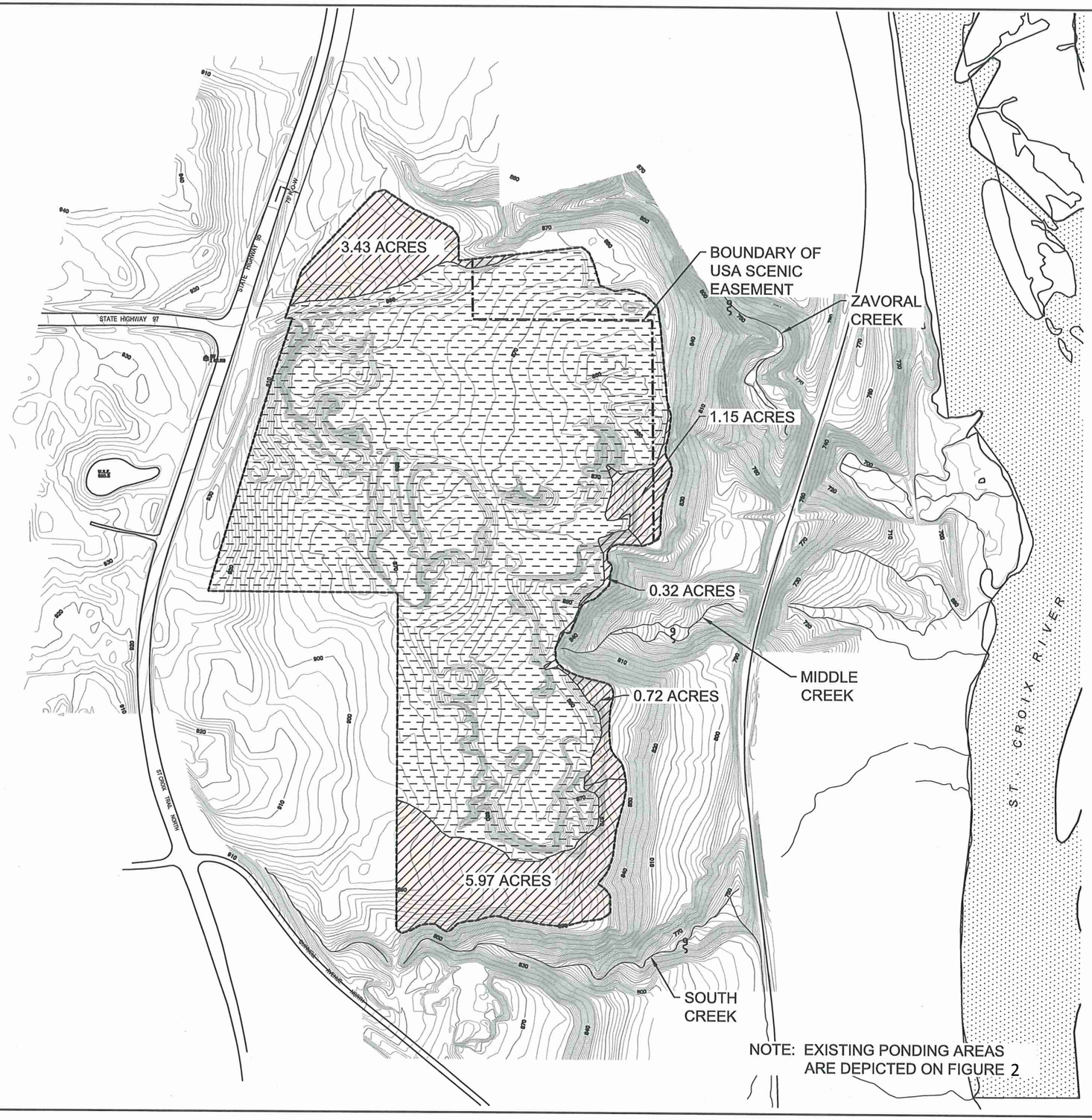
4.2.2 Silt fence: Silt fencing will be used as needed for erosion and sediment control along perimeter areas that may temporarily drain off-site during stripping and overburden removal. A double row of heavy duty silt fence will be placed and maintained just outside of the down slope limits of the mining area before mining in these areas is initiated. Where possible, a vegetative buffer of five to ten feet will be left intact between the silt fence and the mining limits to provide initial filtering and sediment removal prior to runoff reaching the silt fence. All silt fences must be repaired, replaced, or supplemented when they become nonfunctional or the sediment reaches a height of 1/3 of the height of the fence. Silt fencing will be maintained as needed and removed from the Site once mining has redirected surface water from the stripped area internally. These areas are located along a portion of the northern berm and along the entirety of the berm running along the south and east portion of the mining limits, as indicated in Figure 3 through Figure 6.

4.2.3 Diversion Berms: After vegetation has been removed from the area to be stripped, a temporary diversion berm or diversion swale will be constructed just inside of the limits of the mining area. The berm or swale will intercept stormwater that contacts exposed soils and direct it to internally drained areas of the Site during the interval of time between removal of vegetation and removal of overburden. The temporary berm or swale will be removed once the existing grade has been lowered sufficiently to eliminate off-site discharges. The limits of any disturbance will be over 100' linear feet from any receiving waters.

4.2.4 Temporary infiltration basins will be located throughout the floor of the active mine area to collect stormwater runoff and allow it to infiltrate and/or evaporate. The locations of these infiltration areas are expected to move from time to time as mining progresses through the Site.

4.2.5 Additional structural BMP's will be added as needed to insure that all discharges meet the terms of the NPDES permit and that violations of water quality standards do not occur, that floating solids or visible foams are not discharged except in trace amounts, and that oil or other substances are not discharged in amounts that create a visible color film.

4.2.6 Portions of the Site discharge to a water that appears on the current USEPA approved list of impaired waters. The entire length of the St. Croix River is designated as impaired for aquatic consumption due to Mercury and PCB in fish tissue. A total maximum daily load (TMDL) for various pollutants is being prepared at this time. The permittee will, on at least an annual basis, review the current EPA approved list of impaired waters and the TMDLs to determine if and to what extent the Site's Plan must address these impairments and TMDLs.



Prepared By:

AECOM

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SCANDIA minnesota

FIGURE 1
EXISTING SITE WATERSHED BOUNDARIES

ZAVORAL MINING AND RECLAMATION PROJECT
SCANDIA, MINNESOTA

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FEB. 2012

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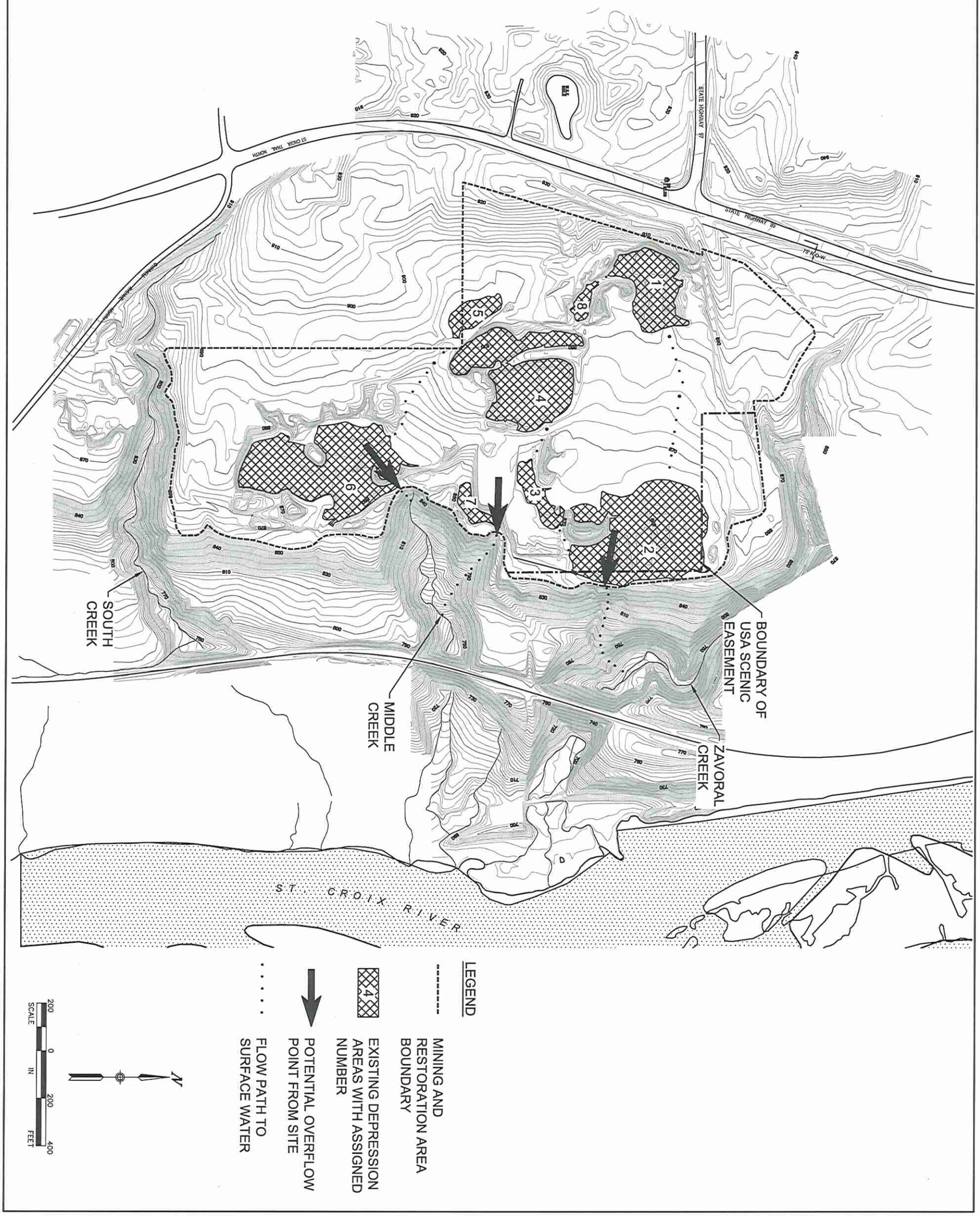

FIGURE 2
EXISTING SITE INTERNAL DEPRESSIONS

ZAVORAL MINING AND RECLAMATION PROJECT
SCANDIA, MINNESOTA

FEB. 2012

60210154

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AECOM

Prepared For:

SCANDIA minnesota

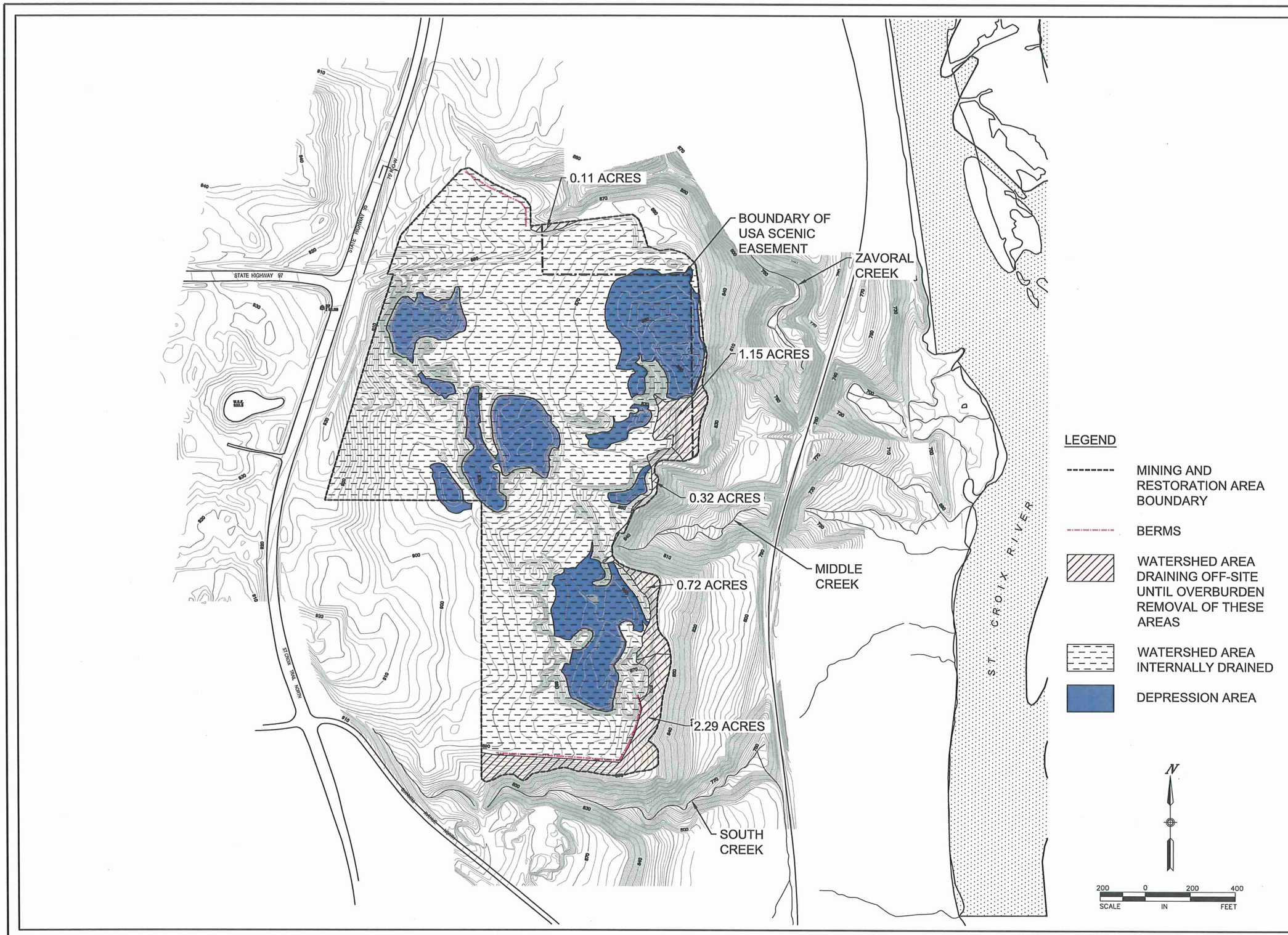

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FIGURE 3
SITE WATERSHED BOUNDARIES

ZAVORAL MINING AND RECLAMATION PROJECT
SCANDIA, MINNESOTA

60210154

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FIGURE 4
SITE WATERSHED BOUNDARIES
(POST-RECLAMATION)

ZAVORAL MINING AND RECLAMATION PROJECT
SCANDIA, MINNESOTA

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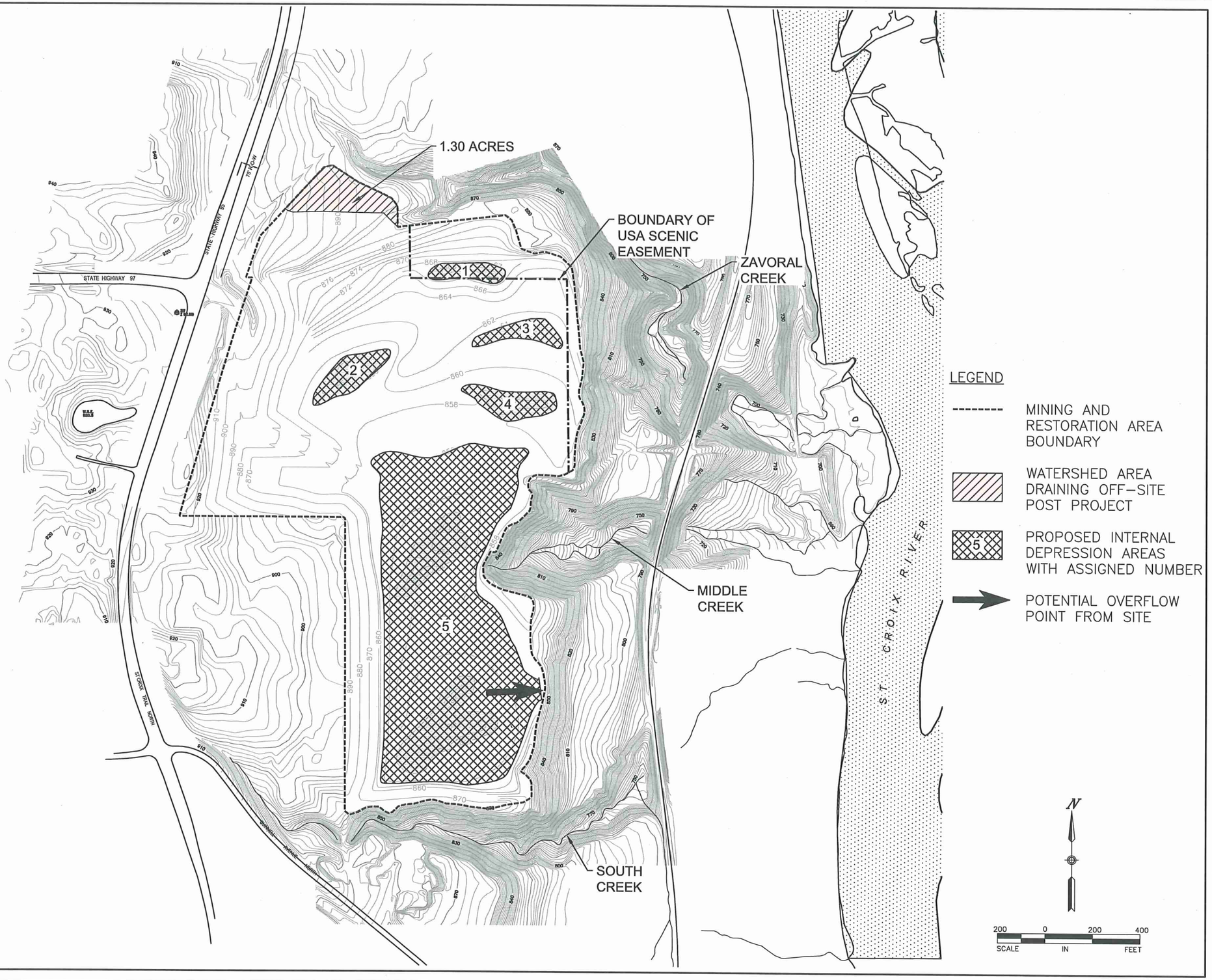

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FIGURE 5
SITE INTERNAL DEPRESSION AREAS
(POST-RECLAMATION)

ZAVORAL MINING AND RECLAMATION PROJECT
SCANDIA, MINNESOTA

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SOURCE: TILLER CORPORATION ZAVORAL MINING AND RECLAMATION PROJECT. DECEMBER 2010.

NOTES:

1. TOPOGRAPHY FROM WASHINGTON COUNTY. AERIAL PHOTOGRAPHY FROM APRIL 2000.
2. GRADES REPRESENT PROPOSED MINIMUM RESTORATION GRADES.
3. SETBACKS ARE AS FOLLOWS:
   50' FROM PROPERTY LINE.
   100' FROM ROAD RIGHT-OF-WAY.
   MINING AND RECLAMATION GRADING MAY OCCUR WITHIN 50' OF THE ROAD RIGHT-OF-WAY IF COMPLETED WITHIN ONE MINING SEASON.
4. MINING ACTIVITY WILL FOLLOW THE GENERAL PROGRESSION INDICATED ON THIS SERIES OF PLANS.
5. DEPTH OF MINING TO VARY THROUGHOUT THE SITE AND WILL DEPEND UPON THE QUALITY OF MATERIAL ENCOUNTERED. MAXIMUM EXCAVATION DEPTH WILL BE TO A MINIMUM ELEVATION OF 840 FEET ABOVE MEAN SEA LEVEL.
6. THE MINING AREA WILL BE RECLAIMED TO APPROXIMATE GRADES ILLUSTRATED ON THIS PLAN. GRADES ILLUSTRATED REPRESENT A MINIMUM RECLAMATION ELEVATION. SLOPES WILL BE GRADED TO A MAXIMUM OF 4:1. SPECIFICS OF THE PLANTING AND REVEGETATION PLAN ARE DETAILED IN THE RECLAMATION PLAN.
7. SCREENING BERMS MAY BE REMOVED AS PART OF FINAL RECLAMATION ACTIVITY.

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FIGURE 6
MINING AND RECLAMATION PLAN - RECLAMATION GRADES

ZAVORAL MINING AND RECLAMATION PROJECT
SCANDIA, MINNESOTA

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