Surface Water Impact Study

Sand & Gravel Mining and Accessory Uses
Empire Township, Dakota County, MN

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1.0 INTRODUCTION

1.1 Project Description

A consortium of mine operators and landowners (Mining Consortium) propose to open new mines and expand existing aggregate mining areas to include a total area of approximately 3,600 acres in the northwest portion of Empire Township, Dakota County. Mining would be conducted in a similar manner to the current practices at existing mines within and adjacent to the Mining Area. Routine functions as well as ancillary operations are described in detail below.

Mining and Aggregate Processing

- Clearing and grubbing the site of vegetation and structures, as necessary
- Relocation of infrastructure, as necessary
- Excavation and transport of the raw aggregate materials
- Excavation, stockpiling, and transporting of other soils materials, including clay and topsoil, which may be present within the Mining Area for shipment to sites out of the Mining Area or for use in reclamation
- Washing, grading and stockpiling aggregate materials for sale or later internal use
- Transporting and stockpiling waste "fines" for potential later use in reclamation
- Transporting finished aggregate materials internally for subsequent processing and to construction sites beyond the Mining Area
- Transporting, accepting, and stockpiling clean, compactable fill materials, typically referred to as "backhauled", for potential later use in reclamation
- Transporting, accepting, and stockpiling clean organic soil materials (i.e., peat) for potential later use in reclamation
- Eventual redistribution, compacting, grading of overburden and clean fill materials to reclaim the sites

Ancillary Manufacturing

- Manufacture and transport of asphalt products
- Manufacture, stockpiling, warehousing and transporting of ready-mixed concrete, bagged mortar products, concrete block, concrete pavers, concrete pipe, concrete plank, etc.
- Importing, grading, processing and stockpiling aggregates to be blended with local aggregates in the production of various products which will increase the effective use of the local aggregates and extend the life of the resource
- Transporting, accepting and recycling products returned from construction sites, including "come-back" asphalt, ready-mixed

concrete, bagged mortar products, concrete block, concrete pavers, concrete pipe, concrete plank, etc.
- Transporting, accepting, stockpiling and processing recycled construction materials for inclusion in new products

General Operations and Administrative
- Offices and sales areas
- Equipment maintenance areas
- Fuel storage and refueling areas

Currently, various companies included in the Mining Consortium either own, lease, or have purchase options on a majority of the Mining Area. Those properties not currently controlled by the mining companies are included in this study in recognition that future mining could occur. The mine operators with current and/or future interest or ownership in the Mining Area include:
- Aggregate Industries North Central Regional (Aggregate Industries)
- Cemstone Products Company (Cemstone)
- Dakota County Transportation Department (Dakota County)
- Fischer Sand and Aggregate Company (Fischer)
- Heikes Property (Heikes)
- McNamara Contracting, Inc. (McNamara)
- Tiller Corporation (Tiller)
- Don Peterson (Peterson)

1.2 Purpose of this Study

The various mine operators have investigated the potential for aggregate production in this area. In addition, the Minnesota Geologic Survey (MGS), Minnesota Department of Natural Resources (DNR), Metropolitan Council (METC) and local governments have conducted studies of available mineral aggregates in the metropolitan area. These studies, together with investigations conducted by mining companies, have revealed extensive reserves of mineral aggregates in portions of Empire Township. Over the next 30 to 40 years the Mining Consortium will remove and process approximately 200 million tons of sand and gravel reserves within the Mining Area.

A Scoping Environmental Assessment Worksheet (Scoping EAW) was prepared for the proposed project in October 2003. Following review of this document, the Minnesota Environmental Quality Board (EQB) designated the review process as a "Related Actions Environmental Impact Statement (EIS)", since multiple companies and property owners are involved. A Scoping Decision Document was published in February 2004 declaring the need for an EIS and an outline of what it would address.

The Scoping Decision Document required that additional analysis be completed for the Mining Area, addressing a number of topics, including surface water. This Impact Study has been prepared to provide an analysis of potential surface water and wetland impacts in the Mining Area, and to identify options for mitigating these potential impacts. The findings of this Impact Study will be incorporated into the forthcoming EIS.

1.3 Project Location and Setting

The Mining Area evaluated in this Impact Study is located in Empire Township, in the central portion of Dakota County, Minnesota (**Figure 1**). The proposed Mining Area is in the northwest portion of the township, occurring in all or part of T 114N, R19W Sections 5, 6, 7, 8, 9, 10 and 16.

1.4 Study Area

The Study Area is largely contained within the proposed Mining Area, shown in **Figure 2**. This area was delineated according to current mining operations, and areas where mining operators have current and future interests in mining available aggregate deposits. In some areas the surface water drainage areas extend beyond the Mining Area boundaries.

Analysis of the entire drainage areas feeding North Creek and the Vermillion River is out of the scope of this project. However, existing and proposed drainage areas, within the proposed Mining Area boundary and draining into the proposed Mining Area boundary, were delineated and grouped according to their discharge locations.

1.5 Previous Studies

The following studies and/or reports pertaining to the project area or adjacent areas were reviewed and relevant data was incorporated within the surface water report:

The July 1995 City of Lakeville Stormwater Management Plan, September 1997 City of Farmington Surface Water Management Plan, September 2003 Farmington Seed/Genstar First Draft Alternative Urban Areawide Review (AUAR), November 2003 City of Rosemount Comprehensive Stormwater Plan and the November 2004 Vermillion River Watershed Joint Powers Organization (VRWJPO) Draft Watershed Plan were reviewed. North Creek drainage area and flow data was obtained from the City of Farmington and City of Lakeville plans. Information related to North Creek, the Vermillion River and the Farmington Seed/Genstar development, located south of and adjacent to the proposed mining boundaries, was obtained from the Farmington Seed/Genstar Draft AUAR report.

Vermillion River flow and temperature data was obtained from the USGS website. The gaging station is located near Blaine Avenue, downstream from the project area. Other general Vermillion River data was obtained from the VRWJPO website.

Empire Wastewater Treatment Plant flow data and proposed construction information was obtained from the Metropolitan Council website.

Soil data for the project area was obtained from the Soil Survey of Dakota County.

A March 31, 2003 report entitled "Storm and Groundwater Issues Related to Proposed Mining Operations for Lauer Property", prepared by Short Elliott Hendrickson, was reviewed. The Lauer Property is located within the northern portion of the proposed mining area, near trunk highway 3, between 160th Street and 170th Street.

A January 7, 1999 report entitled "Limited Groundwater Investigation, Ready Mix Facilities, Minneapolis, Monticello and Redwood Falls, MN Prepared for Aggregate Ready Mix Association of Minnesota", prepared by Braun Intertec, was reviewed.

2.0 METHODOLOGY AND ASSUMPTIONS

2.1 General Overview

The intent of the Surface Water Impact Study is to conceptually determine potential impacts of the proposed mining projects on the existing surface water features within and immediately adjacent to the proposed Mining Area. The surface water analysis is based on the project scope of work, reasonable assumptions and data available at the time of the report.

2.2 Project Drainage Areas

Estimated stormwater flows from the existing and proposed drainage areas were compared to determine changes associated with mining activities. Existing drainage areas within and adjacent to the proposed Mining Area boundaries were delineated from two-foot contour mapping obtained from Mark Hurd aerial photography, dated May 13, 2003. Proposed drainage areas and pond locations within and adjacent to the Mining Area boundaries were delineated based on the preliminary proposed end-use grading plan provided by the Mining Consortium.

2.3 Hydrology Analysis

Hydrology analysis was completed using HydroCad, a computer hydrology software package, largely based on hydrology techniques developed by the Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service (SCS). HydroCad calculates peak runoff flow rates and volumes based on user input including drainage area, slopes, land use, surface type, soil curve numbers, time of concentration and storm design frequency and duration data. Due to the conceptual nature of the proposed end-use plans, simplified HydroCad hydrology analysis was completed.

2.3.1. Soil Curve Numbers

The soil curve number is a parameter used to classify land use, soil type and predicted runoff. Soil curve numbers range between 0 and 100, with higher numbers corresponding to impervious soils and surfaces with higher runoff rates. Soil curve numbers used in HydroCad were estimated based on land use type (agricultural, developed, etc.) and Hydrologic Soil Group data (See **Table 2-1**). Land use type was identified from 2003 aerial photography and Hydrologic Soil Group data was determined based on data from the Soil Survey of Dakota County (United States Department of Agriculture, 1983). The Hydrologic Soil Group is a measure of a soil's runoff potential, with Group A having the least runoff potential and Group D having the most runoff potential. The majority of the soils within the project area consist of Group B soils.

Table 2-1. Hydrologic Soil Group Data

Soil Group	Minimum Infiltration Rate (inches/hour)	Description
A	0.30 to 0.45	Typically consist of deep, well to excessively drained sands and/or gravel with low runoff potential. High water transmission and infiltration rates even when thoroughly wetted.
B	0.15 to 0.30	Typically moderately deep to deep, moderately well to well drained soils. Moderate water transmission and infiltration rates when thoroughly wetted.
C	0.05 to 0.15	Typically consist of soils with slow water transmission and infiltration rates when thoroughly wetted. Usually have a layer that impedes the downward movement of water.
D	0.0 to 0.05	Typically consist of poorly drained soils, with high runoff potential. Very slow water transmission and infiltration rates when thoroughly wetted. Usually consist of clay soils with a high swelling potential, high permanent water table, a clay layer at or near the surface and shallow soils over nearly impervious materials.

Source: Soil Survey of Dakota County Minnesota

The majority of the land use type in the existing and proposed conditions of the proposed Mining Area consists of agricultural land. A curve number of 75, the average value for all cultivated agricultural land consisting of Hydrologic Soil Group B soils, was used in the existing and proposed hydrology analysis.

Farmsteads and other agriculture-related building areas were not separated into different land uses in the hydrology analysis, because the curve number for farmsteads is very close to that for agricultural land and thus would have a negligible effect on the results.

Roadway impervious areas were not delineated separately, however, other developed areas known to have larger impervious areas, including buildings and parking lots associated with existing mining areas and the Dakota County Empire Transportation Facility, were delineated separately. The proposed Farmington Seed/Genstar Development, located south and immediately adjacent to the proposed mining boundaries, was not delineated separately. The Draft AUAR report for this proposed future development indicates that the majority of the development will consist of low density residential units with a curve number of 75, which is the same as the curve number used for cultivated agricultural land. The report also indicates that stormwater from the development will be treated in on-site stormwater ponds, thus likely reducing the flows to pre-existing conditions. This future development is included in the 2020 City of Farmington Land Use Plan. It is likely that other surrounding developments would be required to manage generated stormwater to meet pre-existing conditions.

The soil curve numbers used in the hydrology analysis are listed in **Table 2-2**.

Table 2-2. Soil Curve Numbers

Land Use Description	HydroCad Description	Soil Curve Number
Agricultural Land	Cultivated Agricultural Land, Poor, HSG B	75
Impervious Developed Areas	85% Impervious, HSG B	92

Source: HydroCad – Obtained From SCS/NRCS TR-55 Manual

2.3.2. Time of Concentration

The time of concentration of a drainage area is defined as the time of travel from the hydraulically most remote (timewise) point in the watershed to the watershed outlet or other design point (Lindeburg, 1999). Input parameters for time of concentration calculations include flow type (sheet flow, shallow concentrated flow, ditch/swale flow, culvert/storm sewer flow, etc.), length of flow, slope, surface type (paved, unpaved, grass, woods, agricultural, range, etc.), ditch/swale bottom width and sideslopes. Slopes, sideslopes and ditch widths were estimated using existing and proposed contours. Proposed ditch/swale cross sections and slopes were obtained from the preliminary proposed end-use grading plan. Using accepted empirical equations and the user input, HydroCad calculates the time of concentration values.

2.3.3. Rainfall Design Values

Hydrology calculations are estimated using a storm design return period, which is based on statistical rainfall data for a specific geographical area. A specific rainfall amount over a specified time interval will statistically occur over a given time span, typically identified in years. This is defined as the storm return period.

Rainfall design values, corresponding to the return period and storm duration for the project area, were estimated from Rainfall Curves for the State of Minnesota obtained from Appendix B of the Mn/DOT Drainage Manual (Mn/DOT, 2000*)*. These curves were taken from the U.S. Weather Bureau's Technical Publication No. 40. Type II, 24-hour storm data was used in the hydrology analysis. Storm design frequency and rainfall values for Dakota County are listed in **Table 2-3.**

Table 2-3. Dakota County Rainfall Design Values

Design Frequency	Rainfall Depth (inches)
2-Year, 24-Hour Storm	2.78
10-Year, 24-Hour Storm	4.22
50-Year, 24-Hour Storm	5.35
100-Year, 24-Hour Storm	6.02

Source*: Mn/DOT Drainage Manual, Appendix B: TP-40 Rainfall Intensity Curves*

2.4 Wetlands

2.4.1 General Background

Wetlands were identified and characterized based on the Empire Township Wetland Inventory (Wetland Inventory) that was completed by the Dakota County Soil and Water Conservation District (SWCD), National Wetland Inventory and Dakota County Soil Survey. A field delineation was not completed for the Mining Area. URS staff conducted a site review of select areas during July 2004.

2.4.2 Impact Criteria

Excavation and filling of wetlands are identified as direct impacts as defined by state or federal regulations. Potential indirect impacts to wetlands include the increase or decrease in surface water hydrology, changes to surface water quality, and changes to groundwater discharge characteristics. Changes to watershed size and water quality were evaluated based on the stormwater calculations. Since changes to watershed size and impervious surface directly result in changes to flow volumes and quality, impacts were determined based on changes to flow volumes. Indirect impacts to wetlands, as a result of changes to surface water hydrology, were evaluated based on the following susceptibility ratings (Table 2-4).

Table 2-4. General Wetland Susceptibility to Hydrologic Changes

Wetland Type	Susceptibility to Hydrologic Alteration	Types of Changes
Pristine Wetlands (All Types)	Highly Susceptible	Inundation must be avoided. Minimize water chemistry changes.
Sedge Meadow (*Carex* dominated) (Type 2)	Highly Susceptible	Inundation must be avoided. Minimize water chemistry changes.
Shrub-carr (Type 6)	Moderately Susceptible	Can tolerate 6 to 12 inches of inundation for short periods
Shallow Marsh (not cattail dominated) (Type 3)	Moderately Susceptible	Can tolerate +12 inches of inundation but adversely affected by nutrient loading and prolonged high water levels; some exceptions
Deep Marsh (Type 5)	Moderately Susceptible	Can tolerate +12 inches of inundation but adversely affected by nutrient loading and prolonged high water levels; some exceptions
Shallow Marsh (cattail dominated) (Type 3)	Slightly Susceptible	No specific changes identified
Fresh Meadow (reed canary dominated) (Type 1)	Slightly Susceptible	No specific changes identified
Floodplain Forest (Type 7)	Slightly Susceptible	Can tolerate annual inundation of one to six feet or more, possibly more than once per year

Source: *Storm-Water and Wetlands: Planning and Evaluation Guidelines for Addressing Potential Impacts of Urban Storm-Water and Snowmelt Runoff on Wetlands*. (MN Stormwater Advisory Group, February 1997)

Potential changes to groundwater may affect those wetlands where groundwater discharge is a significant source of hydrology. The potential change to groundwater discharge was evaluated in conjunction with overall surface water impacts.

2.5 Vermillion River/Fisheries

2.5.1. General Background

Existing data from the DNR, Vermillion River Watershed and Dakota County SWCD were utilized to identify the characteristics and quality of the Vermillion River and its fishery. These data include creel surveys, water quality and hydrology data, geomorphology based on Rosgen analysis, and other surveys regarding fishery habitat and condition.

2.5.2. Impact Criteria

Potential impacts are identified based on proposed changes to water temperature, flow volumes (both groundwater and surface water), and water quality. The following criteria are identified by MN Rules 7050.0222, Subp. 2 Specific standards of quality and purity for class 2 waters of the state; aquatic life and recreation.

Table 2-5. Water Quality Standards for Impact Identification

Impact Type	Criteria
Water Temperature	No Material Increase
Turbidity Value	10 NTU (chronic standard)
PH	Not less than 6.5 nor greater than 8.5
Dissolved Oxygen	7.0 mg/l as a daily minimum

Source: MN Rules 7050.0222

A material increase in water temperature would be identified if the change would negatively affect brown trout. The following tolerances are identified for brown trout.

Table 2-6. Brown Trout Tolerance to Water Temperature (generalized)

Temperature	Tolerance
<18°C	Optimum
19-25°C	Stressful
>25°C	Lethal

Source: Report on Vermillion River Assessment

The combined changes to groundwater and stormwater flows will be evaluated to provide a qualitative evaluation of fisheries impacts.

3.0 EXISTING CONDITIONS

3.1 Land Use and Soil Types

The current land use of the proposed Mining Area consists of agricultural and mining uses. A few residential farmsteads and other buildings are also located within the proposed Mining Area.

According to the Soil Survey of Dakota County (USDA, 1983), the soils within Empire Township generally consist of the Waukegan-Wadena-Hawick soil classification (Sections 5, 6, 7, 8, 9 and 16). These soils occur on outwash plains and terraces and are generally level to very steep, well-drained and excessively drained soils formed in silty and loamy sediments over sandy outwash. This soil description is consistent with agricultural land underlain by sand/gravel deposits. According to the Minnesota Hydrologic Soil Classification (Mn/DOT 2000*)*, these soils are classified as Group B Soils.

A small portion (Section 10) within the eastern end of the proposed mining site consists of the Tallula-Port Byron-Bold soil classification. These soils occur in upland areas and are generally nearly level to steep, well-drained soils formed in loess. These soils are also classified as Group B Soils.

A small portion (Section 8) within the southern end of the proposed mining site consists of the Ostrander-Klinger-Maxfield soil classification. These soils occur on uplands and are generally nearly level to sloping well-drained, somewhat poorly drained, and poorly drained soils formed in silty and loamy sediments and glacial tills. These soils are classified as Group B/Group D Soils, indicating that they act like Group B Soils when drained and like Group D soils when undrained.

Based on the Soil Survey descriptions, Type B soils were used in the existing and proposed hydrology analyses.

3.2 General Surface Water Overview

Existing surface water features within or adjacent to the proposed Mining Area are discussed in the following subsections.

3.2.1. On-Site Interior Ponding Areas

Numerous surface depressions and ponding areas exist within the proposed Mining Area. According to the aerial photography basemapping, some appear to contain standing water while others are only identified as surface depressions.

3.2.2. North Creek

North Creek is located approximately one mile west of the west boundary of the proposed Mining Area and connects to the Vermillion River approximately 2.5 miles south of the proposed Mining Area boundaries. North Creek extends from the City of Lakeville into the City of Farmington and Empire Township where it flows into the Vermillion River southwest of the proposed Mining Area. No

USGS flow information was available for North Creek, however, the Farmington Seed/Genstar Draft AUAR indicates that the North Creek watershed encompasses 19,460 acres (approximately 30 square miles) with a mean discharge of 18.8 cfs. This information is based on annual data between April and November at a monitoring location at the mouth of North Creek at Middle Creek (Bonestroo, 2003).

According to the 1995 City of Lakeville Storm Water Management Plan (SWMP), the total area of the North Creek watershed is approximately 15,774 acres (approximately 25 square miles), including drainage areas from Lakeville, Farmington, Apple Valley, Rosemount, Burnsville and Empire Township. According to the SWMP, the following existing peak stormwater discharges (**Table 3-1**) in cubic feet per second (cfs), occur near where North Creek discharges to the Vermillion River (Barr, 1995).

Table 3-1. Existing North Creek Flows

Storm Event	Peak Flow
2-Year, 48-Hour	489 cfs
10-Year, 48-Hour	787 cfs
50-Year, 48-Hour	1,019 cfs
100-Year, 48-Hour	1,082 cfs

Source*: Lakeville Stormwater Management Plan*

According to the City of Farmington Surface Water Management Plan *(*the 100-year, 24-hour storm event (Type II) for North Creek District Discharge into Farmington is approximately 1,033 cfs based on a total drainage area of approximately 26,580 acres (approximately 42 square miles).

3.2.3. Vermillion River

The Vermillion River is located approximately one to two miles south of the southern boundary of the proposed Mining Area. The Vermillion River begins in Scott County and flows into Dakota County, ultimately discharging into the Mississippi River near Hastings, Minnesota.

According to the Farmington Seed/Genstar Draft AUAR report, the Vermillion River watershed encompasses 82,500 acres (129 square miles) with a mean discharge of 67.5 cfs. This data is based on annual data from 1974 to 2000 at a monitoring location near Empire, MN (Bonestroo, 2003).

A USGS gaging station on the Vermillion River is located next to the Vermillion River overpass on Blaine Avenue, approximately 1/3 mile north of 200th Street, downstream of the proposed Mining Area. Vermillion River statistics from USGS stream gaging records and Metropolitan Council Environmental Services (MCES) temperature records are summarized below. The USGS stream gaging records were tabulated between 1942 and 2003. The MCES temperature records, taken at

Mile 15.6 of the Empire sampling station, were tabulated between 1976 and 2003 (Dakota County, 2004; USGS, 2004; Metropolitan Council, 1976 – 2003).

- The drainage area to the Vermillion River at the gaging station is approximately 129 square miles (82,500 acres)
- Annual mean stream flow of the Vermillion River at the gaging station is approximately 73 cfs (arithmetic mean), 57 cfs (harmonic mean) and 63 cfs (geometric mean)
- The Vermillion River peak monthly stream flow of approximately 116 cfs occurs in April
- The Vermillion River monthly mean peak stream flow of 290 cfs occurred in June 1993
- The Vermillion River peak stream flow of 6,570 cfs occurred on September 16, 1992
- The Vermillion River monthly mean stream low flow of 11 cfs occurred in 1977
- The average existing monthly water temperature of the Vermillion River is 50.1°F (10.1°C)
- The average existing monthly high water temperature of the Vermillion River is 67.1°F (19.5°C) and occurs in July
- The average existing monthly low water temperature of the Vermillion River is 35.2°F (1.8°C) and occurs in January

3.2.4. Empire Wastewater Treatment Plant

The Empire Wastewater Treatment Plant (WWTP), constructed in 1979, is located within Empire Township in the SE ¼ of the SW ¼ of Section 21, Township 114 North, Range 19 West. The WWTP is located approximately two miles south of the south boundary of the proposed Mining Area. The WWTP is located approximately three miles upstream of the Butler Pond area located southeast of the proposed Mining Area. The WWTP treats approximately 10 million gallons per day and currently discharges directly to the Vermillion River. The effluent discharge from the WWTP generates approximately 16 cfs of flow to the Vermillion River.

The WWTP is currently undergoing expansion construction to increase capacity from 12 million gallons per day to approximately 24 million gallons per day. In addition to the expansion, relocation of the effluent discharge location from the Vermillion River to the Mississippi River via a 13-mile forcemain is planned. Construction is scheduled to begin in 2005 with completion in early 2007. The relocation of the WWTP effluent discharge location will likely result in water quality improvements to the Vermillion River. However, flow to the River will be reduced by approximately 16 cfs, or approximately one-fourth of annual mean flow (Metropolitan Council, 2003; O'Donnell, 2004).

3.3 Existing Hydrology Analysis

3.3.1. Drainage Areas

Interior Ponding Areas

Numerous surface depressions and ponding areas currently exist within the boundaries of the proposed Mining Area. The majority of the existing ponding areas are located in the northern and western portions of the project area, between 160th Street and 170th Street. No outlets from these ponding areas were observed on the basemapping.

For the purposes of this report, Existing Drainage Areas 1 through 7 will be classified as interior drainage areas that ultimately drain toward the interior of the proposed Mining Area boundaries, with no outlets, creating ponding areas where evaporation and infiltration will occur. The actual balance between infiltration and evaporation is difficult to predict, however, it is likely that infiltration is significant, as the Mining Area is generally underlain by sand and gravel deposits with relatively high infiltration rates.

Existing drainage information for all interior drainage areas within the proposed Mining Area is listed in **Table 3-2.**

Table 3-2. Existing Interior Drainage Area Information

Storm Event	Peak Flow (cfs)	Runoff Volume (Acre-Feet)
2-Year, 24-Hour	557	80.5
10-Year, 24-Hour	1,337	184.0
50-Year, 24-Hour	2,025	276.9
100-Year, 24-Hour	2,451	335.2

Following are descriptions of the existing interior drainage areas. These areas are also illustrated on **Figure 3** and summarized in **Table 3-3**.

<u>Drainage Area 1 (Interior)</u>

Existing Drainage Area 1 (DA 1) is located in the northwest corner of the proposed Mining Area, south of 160th Street and west of the existing Canadian Pacific Railroad tracks. The site is comprised of the existing Tiller mining area, an active sand/gravel mining and bituminous asphalt production area. Minimal existing contour mapping was available for this area, however, active mining has created an artificial depression. Overall drainage appears to be toward the site interior and eight existing ponding areas are located across the site. The basemapping indicates these ponding areas cover a total area of approximately 9.6 acres. The impervious parking lot and building area, delineated separately with a different curve number, was estimated at 10 acres.

No sand or gravel washing currently occurs at this facility. Stormwater from the site is entirely recycled on-site from the detention ponds with no off-site discharge to North Creek, the Vermillion River or other protected surface waters. One groundwater well supplies additional water, as necessary. The topsoil and overburden soils have been moved to the outside of the site, creating perimeter berms. These soils will be used later in site reclamation.

Drainage Area 2 (Interior)

Drainage Area 2 (DA 2) is located in the northern portion of the proposed Mining Area and is generally bounded by 160th Street on the north, 170th Street on the south, Biscayne Avenue on the east and the Tiller mining area on the west. The land use within this area appears to be mostly agricultural including approximately six farmsteads.

The Dakota County Empire Transportation Facility is also located within this drainage area. The impervious parking lot and building area, delineated separately with a higher curve number, was estimated at 15 acres. Stormwater runoff from this facility is treated within a separate stormwater detention pond.

The drainage area consists of numerous ridges with stormwater draining to many surface depressions and ponding areas located across the area. The aerial photography shows eight areas of standing water, encompassing approximately nine acres, with many other surface depressions. It also shows approximately 185 acres of surface depressions with varying storage depths.

Drainage Area 3 (Interior)

Drainage Area 3 (DA 3) is located in the northeastern portion of the proposed Mining Area, south of 160th Street and west of Biscayne Avenue. The land use within this area appears to be entirely agricultural.

Stormwater within this area appears to drain to three surface depressions or ponding areas located adjacent to Biscayne Avenue, however, the aerial photography does not show any standing water within the ponding areas.

Drainage Area 4 (Interior)

Drainage Area 4 (DA 4) is located in the northwestern portion of the proposed Mining Area, north of 170th Street and west of the existing Canadian Pacific Railroad tracks. The land use within this area appears to be entirely agricultural. The complete drainage area, including an additional 62 acres (DA 4A), extends approximately ¼-mile west of the proposed Mining Area boundary.

Stormwater within this area drains to a series of surface depressions that, upon overtopping, ultimately drain to a single ponding area with standing water, located within DA 4A. The aerial photography indicates that the area of standing water, located just west and outside of the proposed Mining Area, is approximately four acres in size.

Drainage Area 5 (Interior)
Drainage Area 5 (DA 5) is comprised of the existing Cemstone mining operation, an active sand/gravel mining and redi-mix concrete production area. Minimal existing contour mapping was available for this area, however, active mining has created an artificial depression and overall drainage appears to be toward the interior and 12 existing ponding areas are scattered across the site. The basemapping indicates that the area of all of the ponding areas cover approximately five acres. The impervious parking lot and building areas, delineated separately with a higher curve number, were estimated at five acres.

Sand/gravel washing currently does occur at this facility. Stormwater and wash water is entirely recycled on-site from the detention ponds with no off-site discharge to North Creek, Vermillion River or other protected surface waters. One groundwater well supplies additional water, as necessary. The topsoil and overburden soils have been pushed to the outside of the site, creating perimeter berms. These soils will be used later in site reclamation.

Drainage Area 6 (Interior)
Drainage Area 6 (DA 6) is located in the southwestern portion of the proposed Mining Area, south of 170th Street and west of Highway 3. The land use within this area appears to be entirely agricultural, including one farmstead. The complete drainage area, extends approximately ¼-mile south of the proposed Mining Area boundary, including an additional 30 acres (DA 6A).

Stormwater within this area drains to approximately three surface depressions, scattered across the site. The aerial photography does not show any standing water within these surface depressions. The largest surface depression is located in the south central portion of the drainage area.

Drainage Area 7 (Interior)
Drainage Area 7 (DA 7) is comprised of two existing mining/grading area depressions located within DA 8 (described below). Minimal existing contour mapping was available for these areas, however, active mining/grading has created artificial depressions and overall drainage appears to be toward the interior of the Mining Areas. The aerial photography indicates a single detention basin or ponding area, approximately 2.4 acres in size, in the northern mining area.

Vermillion River Wetland

Drainage Area 8 (Vermillion River Wetland)
A dammed ponding area (Butler Pond) and wetland area exists at the southeast corner of the proposed Mining Area and continues beyond the proposed Mining Area boundaries, north of the Vermillion River. Drainage Area 8 (DA 8), comprised of numerous ridges and swales, discharges stormwater into this pond and wetland and ultimately discharges to the Vermillion River. For the purposes of this study, DA 8 will be known as the Vermillion River Wetland drainage area.

DA 8 is located in the central and southeastern portions of the proposed Mining Area and extends from north of 170th Street to the southeast corner of the proposed Mining Area. The area north of 170th Street and west of Trunk Highway 3 drains from west to east via an existing culvert under Highway 3. The area north of 170th Street drains from north to south via three existing culverts under 170th Street. The land use within this area appears to be mostly agricultural including approximately 17 farmsteads.

The complete drainage area includes three areas outside of the proposed Mining Area boundaries that drain into the proposed Mining Area. The first off-site drainage area, approximately 125 acres (DA 8A), extends north beyond the proposed Mining Area, north of 170th Street and east of Biscayne Avenue. This off-site area drains from north to south via two existing culverts.

The second off-site drainage area, approximately 253 acres (DA 8B), extends east beyond the proposed Mining Area, just west of Annette Avenue. This off-site area drains from east to west via an existing swale.

The third off-site drainage area, approximately 256 acres (DA 8C), extends south beyond the proposed Mining Area, on the west side of Biscayne Avenue. This off-site area drains from south to north and west to east, crossing Biscayne Avenue, via two existing culverts.

The drainage area consists of numerous ridges and stormwater ultimately drains southeast to the Vermillion River Wetland via three main drainage swales. Two surface depressions, encompassing approximately 4.7 acres are located in the southwest portion of the drainage area. The aerial photography does not show any standing water within these surface depressions. Upon overtopping, stormwater from these surface depressions flows toward the Vermillion River Wetland. Prior to flowing into the Vermillion River, stormwater flows into a dammed water impoundment (Butler Pond), encompassing approximately 30 acres.

Station Trail Ponding Areas

<u>Drainage Area 9 (Station Trail)</u>

Two surface depressions or ponding areas are located on the west side of Station Trail, south of 170th Street. Stormwater drains to the southeast and ultimately to the Vermillion River, east of the proposed Mining Area boundaries. A single drainage area from within the proposed Mining Area discharges into the Station Trail Ponding Areas. Therefore, for the purposes of this study, Drainage Area 9 (DA 9) is labeled as the Station Trail drainage area. Stormwater within the proposed gravel mining boundaries generally drains to the north/northeast via ditches and swales along the south side of 170th Street and Station Trail.

DA 9 is located in the northeastern corner of the proposed Mining Area, south of 170th Street. The land use within this area appears to be mostly agricultural including approximately four farmsteads. The complete drainage area extends north beyond the proposed gravel Mining Area, north of 170th Street and west of

Station Trail. This off-site drainage area (DA 9A), encompassing an additional 327 acres, drains from north to south via a culvert under 170th Street.

North Creek

Drainage Area 10 (North Creek)

North Creek is located approximately one mile west of the proposed Mining Area boundaries and connects to the Vermillion River approximately 2.5 miles south of the proposed Mining Area boundaries. A single drainage area from within the proposed Mining Area discharges to North Creek. Therefore, for the purposes of this study, Drainage Area 10 (DA 10) is labeled as the North Creek drainage area.

DA 10 is located in the southwestern corner of the proposed Mining Area, on both the east and west sides of the existing Canadian Pacific railroad tracks. The land use within this area appears to be entirely agricultural. The complete drainage area, including approximately 181 additional acres, extends southeast beyond the proposed Mining Area boundaries (DA 10A). This off-site area drains to the northwest and into the proposed Mining Area.

Stormwater within DA 10 generally drains to the southwest, toward North Creek, via numerous swales. A surface depression exists on the east side of the existing Canadian Pacific railroad tracks and a culvert directs stormwater under the tracks and west to North Creek. Another surface depression exists on the north end of the drainage area, on the west side of the railroad tracks. Upon overtopping, the ponding area drains west and into North Creek. Aerial photography did not indicate standing water in these surface depressions. Upon reaching North Creek, stormwater flows southeast and into the Vermillion River.

Table 3-3. Existing Drainage Area Hydrology Model Data: Areas 1 - 10

Drainage Area	Size (Acres)	Curve #	Time of Concentration (Minutes)	2-Year, 24-Hour Storm		10-Year, 24-Hour Storm		50-Year, 24-Hour Storm		100-Year, 24-Hour Storm	
				CFS	Acre-Feet	CFS	Acre-Feet	CFS	Acre-Feet	CFS	Acre-Feet
DA1 – Interior	138	76	29	98	8.9	228	19.9	342	29.7	413	35.9
DA2 – Interior	700	75	107	175	40.6	428	93.3	653	140.9	793	170.7
DA3 – Interior	39	75	49	18	2.3	43	5.4	66	8.1	80	9.8
DA4 – Interior	141	75	85	42	8.3	103	19.0	157	28.7	191	34.7
DA5 – Interior	121	76	23	100	7.8	233	17.5	349	26.1	420	31.5
DA6 – Interior	181	75	35	105	10.9	255	25.0	387	37.6	469	45.5
DA7 – Interior	28	75	27	19	1.7	47	3.9	71	5.8	85	7.1
DA8 –Vermillion River Wetland	2,609	75	190	430	141.3	1,031	328.6	1,564	498.3	1,898	604.9
DA9 – Station Trail	465	75	174	80	25.6	196	59.4	299	89.9	364	109.1
DA10 – North Creek	317	75	54	133	19.0	326	43.4	495	65.4	601	79.1

3.4 Wetlands Existing Conditions

Ten wetlands are located within the Mining Area, with additional basins located on the perimeter. In total, the Mining Area contains approximately 62 acres of wetland (**Table 3-4**).

Table 3-4. Wetlands Located Within or adjacent to the Mining Area

Empire Twp. Wetland Inventory[3]	NWI Designation[1]	Empire Twp. Circular 39 Type[3]	Hydric Soil (yes or no) & Soil Type[2]	Empire Township. Class.[3]	Total Area[3] (acres)	Area Within Mining Boundary (acres)	Primary Water Source[4]
05-NW-01	Not Mapped	Type 1	No – Kennebeck	Utilize	0.1	0.1	Recharge
06-NE-01	PUBF	Type 3/5	Yes – Water	Preserve	4.3	4.3	Recharge
06-NE-02	PEMC	Type 1/3	No – Kennebeck	Manage I	2.1	2.1	Recharge
06-NW-01	PEMF/ PUBFx	Type 3/4/5	Yes – Colo No – Hawick	Preserve	9.1	9.1	Recharge
07-NW-01	PEMC	Type 3	No – Waukegan	Utilize	0.5	0.5	Recharge
07-SE-01	Not Mapped	Type 2	Yes – Maxfield	Utilize	1.1	0.0	Recharge
07-SE-02	Not Mapped	Type 2	Yes – Maxfield	Manage II	0.4	0.0	Recharge
10-NW-01	PSS/ FO1C	Type 6/7	Yes – Colo	Manage II	7.1	0.0	Recharge/ Discharge
15-NW-01	PEMA/ Cd	Type 1/3/5/6/7	Yes – Colo	Preserve & Manage I/II[5]	108.6	38.2	Recharge/ Discharge
15-NW-02	Not Mapped	Type 2	No – Talulla	Manage I	0.3	0.3	Recharge/ Discharge
15-NW-03	Not Mapped	Type 2	No – Tallula	Manage II	1.6	1.6	Recharge/ Discharge
15-SW-01	PEM/SS/FO/ C	Type 1/3/6/7	Yes – Colo	Preserve	377.4	4.2	Recharge/ Discharge
16-SW-01	PEMCd	Type 3	Yes – Mayer	Manage II	6.7	1.8	Recharge
19-NW-02 North Creek	PEMCd	Type 1/3/6	Yes – Palms muck	Manage II	146.1	0.0	Recharge/ Discharge
Totals					665.4	62.2	

[1] National Wetland Inventory, US Fish and Wildlife Service.
[2] Dakota County Soil Survey, Natural Resource Conservation Service.
[3] Based on Empire Township Wetland Inventory
[4] Based on the Groundwater Impact Study and information provided by Dakota SWCD and EOR.
[5] Manage I/II classification based on URS field review (2004).

A wetland that is identified primarily as recharge is one that has surface water as the primary source of hydrology, and acts to recharge/infiltrate to the groundwater. A wetland that is identified primarily as recharge/discharge is one that has groundwater and surface water sources of hydrology. These wetlands may alternate between being an area that recharges/infiltrates to the groundwater and one that exhibits groundwater discharge, depending on the climatic conditions.

The Empire Township Wetland Inventory designates wetlands in four categories based on their functions and values. The Preserve category includes wetlands that are in their natural state, have a diversity of plants, show very little impact from surrounding land uses, and have the ability to perform multiple wetland functions exceptionally. Wetlands in the Utilize category have minimal plant diversity, lack natural integrity, show extensive impact from surrounding land uses and have the ability to perform more than one wetland function adequately. Manage I and II categories have moderate functional characteristics.

The most extensive wetland areas (15-NW-01 and 15-SW-01) are located in the southeast section of the Mining Area. These wetlands extend off-site onto the neighboring property (Butler property) and include a large complex of vegetative types, including scrub shrub, forested and emergent wetland. A small area (apx. 25 acres) of this wetland is currently used for production of sod. The western portion (38 acres) of wetland 15-NW-01, within the site boundaries, is of lower overall quality because it is dominated by reed canary grass and is partially drained. This portion of 15-NW-01 should be classified as Manage I/II to reflect existing site conditions. The majority of 15-NW-01 and all of 15-NW-02 is classified as Preserve.

The wetland and uplands on the Butler property have been evaluated by the MN DNR and identified as a site of high biodiversity significance. The drainage area of these wetlands contributes to the large pond on the Butler property, and eventually feeds a tributary to the Vermillion River. A portion of this downstream tributary is a designated trout stream, as is the Vermillion River.

Wetlands 06-NE-01 and 06-NW-01 are also identified as Preserve Category wetlands. Both wetlands are within active or past mining areas, and provide moderate values for plant diversity, wildlife and water quality.

Four on-site wetlands are classified in the Manage I and II categories. Their primary functions are for water quality, wildlife and/or flood attenuation. Vegetative diversity tends to be lower in these wetlands.

The remaining two on-site wetlands, 05-NW-01 and 07-NW-01 are identified in the Utilize category. These wetlands provide minimal function for water quality.

According to the soil survey, the depth to seasonally high water is one to three feet. All of the wetlands within the north and west sections of the Mining Area are in closed depressions. While the upland soils have high rates of infiltration, the runoff that does collect in these low areas must infiltrate through fine textured soils that have slow infiltration rates. Thus, water collects within these depressions for sufficient time to create wetland conditions. Based on the groundwater study completed for this project, the wetlands located within the north and west portions of the Mining Area function, primarily, as groundwater recharge (infiltration) wetlands.

Wetlands within the southeast portion of the Mining Area are at the lower end of watersheds that have been extensively ditched and drained. Within the Mining Area boundary, the normal water table of Wetland 15-NW-01 has been substantially altered by ditching. Most of the wetland is dominated by reed canary grass. Piezometer data collected during the summer of 2004 indicates that the western portion of wetland 15-NW-01 exhibits groundwater recharge function during the summer months. The wetlands associated with and below Butler Pond exhibit groundwater discharge characteristics, based on plant community and piezometer data. Thus, the wetlands in the southeast portion of the project exhibit both recharge and discharge characteristics, depending on the location within the landscape and time of year.

3.5 Water Courses Existing Conditions

3.5.1. General Background

The Vermillion River watershed covers approximately 335 square miles in central Dakota County and southeastern Scott County (**Figure 4**). The river is approximately 38 miles long, extending from the upper watershed in New Market Township to the confluence with the Mississippi River near Hastings. The main stem of the river is located approximately 1.5 miles south of the Mining Area.

Three tributaries to the Vermillion receive surface drainage from the Mining Area. As indicated in the surface water analysis, the following drainage areas have been identified.

Table 3-5. Drainage Areas

Receiving Water	Drainage Area Identifier	Drainage Area With In Site (Acres)	Drainage Area Flowing Through Site (Acres)	Total (Acres)	Total Watershed Drainage Area (Acres)
North Creek	DA 10 & 10A	136	181	317	26,580[1]
Vermillion River Wetland (Tributary 1)	DA 8 & 8A-C	1,975	634	2,609	2,609[2]
Station Trail (Tributary 2)	DA 9 & 9A	138	327	465	465[3]
Vermillion River	DA 8 & 8A-C, DA 10 & 10A	2,111	815	2,926	82,500[4]

[1] Watershed area at confluence of North Creek and Vermillion River location in Farmington, per Farmington SWMP.
[2] Watershed area at Butler Pond location.
[3] Watershed area at Station Trail Ponding Areas
[4] Watershed area at USGS gaging station in Farmington.

Prior to the conversion of land use from prairie and woodlands to intensive agriculture, the Vermillion River was a clean, clear, cold-water fishery.

Anecdotal evidence indicates that the river supported native brook trout, a very intolerant trout species. Water quality declined and water temperatures rose with the conversion of much of the watershed to agriculture. In particular, sediment and nutrient loads increased and riparian habitat was removed. In 1959, the Department of Conservation produced a report stating that the river had poor water quality, poor riparian vegetation and did not support trout (DNR 1961).

3.5.2 Trout Stream Designation

Changes to agricultural practices and stormwater management over the last 30+ years has resulted in steady improvement in river conditions. In 1988, the conditions of the upper reaches of the Vermillion River had improved substantially, such that they were designated as a cold water fishery. Brown trout and rainbow trout were stocked and found to be naturally reproducing. These species of trout are more tolerant of warmer water temperatures and poorer water quality than the native brook trout.

In 2003, an additional 25 miles of the Vermillion River and tributaries were designated as a cold water fishery. This new area of designation was based on creel surveys and habitat assessments that provided evidence that trout were present and naturally reproducing within this stretch of the river. The most recently designated trout stream includes the mainstem and short tributaries of the Vermillion River, just south of the Mining Area (**Figure 5**). The surface water drainage areas of North Creek and the Vermillion River Wetland (Tributary 1) are tributary to designated trout streams. The project site is more than 2000 feet from the designated trout streams.

3.5.3 Stream Morphology

A stream morphology assessment was conducted on the main stem of the Vermillion River (VRWMC & DNR 1999). The assessment for the segment just south of the Mining Area indicates that the River is slightly entrenched, meandering, sand dominated, with riffle/pool channel and a well developed floodplain. The stream channel is very susceptible to shifts in both lateral and vertical stability due to direct channel disturbance and/or changes in the flow and sediment regimes of the contributing watershed. Current channel stability is Fair to Good, with the potential for moderate to high bank erodibility.

3.5.4 Trout Habitat

Main Stem Vermillion River

Grasslands with scattered trees and shrubs dominate the riparian habitat of the mainstem Vermillion, south of the Mining Area. The average monthly high water temperature is 19.5°C, and occurs in July. This temperature is in the stressful range for brown trout. The average existing monthly low water temperature is 1.8°C, and occurs in January. Peak monthly stream flow of approximately 116 cfs occurs in April. The monthly mean low stream flow of 11 cfs occurred in 1977. The segments of the Vermillion River that are designated trout stream, generally, are heavily influenced by groundwater discharge. According to the Groundwater Impact Study, simulated groundwater discharge to the Vermillion River (between Biscayne Avenue and the USGS Gage) is 6.2 cfs.

The following table provides historic water quality data for the Vermillion River.

Table 3-6. Water Quality for the Vermillion River at Biscayne Avenue Station

Parameter	Mean	Min.	Max.	Period	Number of Samples
Dissolved Oxygen (mg/L)	9.6	5.9	14.8	1993-2002	394
Suspended Solids (mg/L)	9.5	1	88	1993-2002	243
Turbidity (NTU)	4.3	1	35	1993-2002	243
Nitrate (mg/L)	1.9	0.05	16.1	1993-2002	243

Source: Draft Vermillion River Watershed 2004 Plan Revision, Section 1; MCES monitoring data at Biscayne Avenue station.

The DNR and Vermillion River WMO have completed a number of trout surveys on the Vermillion, using electroshocking and creel surveys. Between CSAH 3 and Donnely Avenue, electroshocking has captured brown trout at five locations. Creel surveys for this segment of the River indicate that heaviest fishing pressure is within Rambling River Park in Farmington (just west of CSAH 3).

North Creek

Much of North Creek has been ditched to provide for quick surface runoff for local agricultural lands. The upper watershed of North Creek is mostly developed with small lot residential properties. The main stem of North Creek includes a relatively wide buffer surrounded by agricultural lands.

Flow measurements in this perennial stream were taken in mid-July of 2004, with flows of 6.49 to 7.81 cfs in the upper reaches to 10.7 cfs near the confluence with the Vermillion River. According to the Groundwater Impact Study, simulated groundwater discharge to North Creek is 1.7 cfs. Temperature data collected by the DNR in 1998 indicated that stream temperatures during the summer are generally in the stressful range (18 to 25 degrees C) approximately 90 percent of the time (DNR Division of Fisheries Water Temperature Data Vermillion River 1998 and 2000). The DNR data indicates that trout have not been captured in North Creek.

Vermillion River Wetland/Tributary 1

This tributary is mostly ditched to provide for the removal of surface water in an agricultural area. The tributary is a perennial stream below Butler Pond and intermittent above. The tributary is surrounded by broad areas of shrub, forested and emergent wetlands near Butler Pond. Downstream of Annette Avenue, the tributary has minimal buffer and is surrounded by agriculture.

Tributary 1 was sampled by the DNR in 1998. The sample site was located just upstream of Annette Avenue. The fish survey did not find any trout in the creek. On September 10, 1998, the water temperature was recorded as 13.3 degrees C. Flows were not measured. According to the Groundwater Impact Study, simulated groundwater flows to the wetlands and Tributary 1 south of Butler Pond is 0.59 cfs.

Station Trail/Tributary 2

This tributary has very limited information available, and the nearest sample site is more than three miles from the project boundary. The upper reaches of Tributary 2, near the Mining Area, are ditched for surface water removal. Flow within the upper watershed is intermittent. Little or no buffer is present in this agricultural area.

Tributary 2 was sampled by the DNR in 1998. The sample site was located just upstream of Clayton Avenue. The fish survey did not find any trout in the creek. On September 11, 1998, the water temperature was recorded as 13.9 degrees C. Flows were not measured.

4.0 MINING IMPACT ANALYSIS

4.1 Stormwater Impacts During Mining and Production Operations

4.1.1. Mining Excavation

As indicated in the proposed mining operations (**Figure 2**), mining of sand and aggregate will begin in 2006 and finish in approximately 2040. For each mining year, project operations include those outlined in Section 1.1. **Figure 2** identifies the anticipated geographical and chronological mining phasing across the Mining Area.

Topsoil stripping, removal of overburden soils, removal of other site soils for sale or use in reclamation, grading and mining excavation will disturb the existing site vegetation and create the potential for erosion and sediment transport across all disturbed areas. Over one-third of the existing drainage across the project boundaries drain to the site interior with no outlet to the Vermillion River, North Creek or other protected surface waters (DA 1, 2, 3, 4, 5, 6, and 7). Erosion and sediment transport will not be as much of a concern within these areas. The greatest potential for impacts associated with erosion and sediment transport occurs during initial grading within drainage areas discharging to the Vermillion River, North Creek and other protected surface waters. As the mining excavation progresses, a new drainage basin will be created and stormwater will drain toward the site interior, thus minimizing the risk of off-site sediment transport.

In addition to increasing the potential for erosion and sediment transport across all disturbed areas, mining activities will create topographical depressions that will alter the existing stormwater drainage patterns and potentially change stormwater runoff rates and volumes to North Creek, Vermillion River and other protected surface waters. As the mining proceeds within each mining year, drainage patterns will change continually until final reclamation is completed. Mining excavation and grading will impact existing stormwater drainage patterns, flows and runoff volumes to adjacent wetlands and surface waters. Existing Township Ordinance No. 450 indicates that stormwater from mining areas may not be discharged off-site.

Stormwater will be captured within the mining excavations, collecting at the low points. Depending on the soil infiltration and atmospheric evaporation rates, stormwater may create temporary ponding areas within the excavations. The ponding areas, varying in location and depth, will essentially function as a combination of infiltration and sedimentation basins, removing the majority of the suspended solids during settling and groundwater infiltration. Due to the relatively high infiltration rate of the sand and gravel within the Mining Area, it is likely that stormwater will infiltrate rapidly to the groundwater. This is consistent with observations at the existing mining areas within the project boundaries. Over time, the infiltration rate will decrease as suspended solids plug the soil voids. As this happens, the ponding areas will begin to function more like sedimentation basins.

As the excavation approaches the groundwater level, the infiltration rate of stormwater to groundwater will also decrease. Wet mining below the groundwater table is proposed and will likely be completed using a backhoe or dragline. Wet mining will result in the creation of groundwater ponds, formed as groundwater enters the excavations. Site stormwater will be kept separate from these ponding areas, through infiltration ponds or surface water swales to direct water around the ponds. With no outlet, evaporation and groundwater infiltration will occur, however, groundwater infiltration will likely be much slower than it was during excavation above the groundwater table, due to the increased soil pore pressures.

If localized dewatering is used to facilitate excavation of sand and gravel below the groundwater, it would likely be completed utilizing shallow well points or sump pits (SEH, 2003). Dewatering discharge would be pumped to on-site sedimentation/infiltration basins with no direct off-site discharge to North Creek, the Vermillion River or other protected surface waters.

4.1.2. Production Operations

Processing, manufacturing and general operations were outlined in Section 1.1. Approximately five production plant facilities will be located across the proposed Mining Area. Each plant site will require an industrial groundwater supply well, supplying water for production operations. Required flow rates will vary based on the type of plant operations. Specifically, water may be used for sand and aggregate washing, concrete product production, equipment maintenance, concrete truck washout and site dust control. Water from the groundwater supply wells will supply water for production operations and will be used initially to fill detention ponds. Once the ponds are filled, the groundwater supply wells will supplement recycled site stormwater and wash water, as necessary (Bolton & Menk, Inc., 2003).

Site stormwater, sand/aggregate wash water and concrete truck wash water will typically be treated in a triple stage series of on-site detention ponds at each plant location. Water for sand/aggregate washing will be pumped from the third detention pond for reuse. The detention ponds will typically be constructed above the groundwater and will essentially function as sedimentation and infiltration ponds, removing the majority of the suspended solids. Pond depths will typically range between 10 feet and 20 feet with pond areas ranging between approximately one and three acres. Stormwater and wash water will enter the on-site detention ponds via overland flow, pressure or gravity piping.

Due to the relatively high infiltration rate of the sand and gravel within the Mining Area, rapid groundwater infiltration is initially anticipated. Over time, the infiltration rate will decrease as fines and sediment plug the soil voids of the pond, and the ponds will function more like sedimentation ponds. Sediment may need to be excavated from the ponds, as necessary, to keep them functioning properly.

No stormwater or wash water will be discharged directly to North Creek, the Vermillion River or other protected surface waters. Detention ponds created during production operations will not remain inplace upon final site reclamation. Only the end-use ponds shown in **Figure 6** will remain.

4.2 End Use Hydrology Analysis

4.2.1. End Use Plan

Upon completion of mining operations, the excavations will be backfilled with unused materials, back-hauled fill, overburden materials and topsoil. The proposed end use grading plan (**Figure 6)** identifies approximate final grading elevations, location and sizes of the proposed end use ponds. Rejected sand from the production operations will typically be placed on the bottom of the mining excavation, facilitating groundwater infiltration and subsurface flow. In areas where mining excavations extend below the groundwater table, except at end use pond locations, the excavations will be backfilled with rejected sand, followed by overburden soils and topsoil, to the end-use grades . During reclamation, the proposed Mining Area will be restored to the proposed end use grades and returned to agricultural land.

Rejected sand from production areas typically consists of 15 percent to 30 percent of the total sand/gravel excavation volume. Based on a total estimated sand/gravel excavation of 200 million tons and an assumed unit weight of 115 pounds per cubic foot (lb/ft^3), an estimated total sand/gravel volume of approximately 130 million cubic yards is anticipated. Based on a typical value of rejected sand that is 15 percent to 30 percent of the total excavated volume, approximately 19 million to 39 million cubic yards of rejected sand is anticipated. If spread uniformly across the proposed 3,591 acre Mining Area, the depth of reject sand would range from approximately three to seven feet.

Eleven end use ponds, with surface areas totaling approximately 240 acres, are proposed across the Mining Area. The pond sizes vary from approximately 6 acres to 90 acres, with depths ranging between approximately 9-feet and 42-feet. The ponds, developed from mining excavations below the groundwater, will consist mainly of groundwater. In areas where end use ponds are proposed, the excavations will not be backfilled and the ponds will fill with groundwater. Typically, the bottom of the groundwater ponds corresponds to the bottom of the sand/aggregate deposit with some exceptions.

Separate stormwater ponds and/or ditches, constructed outside of the groundwater ponds and separated by berms, will provide stormwater treatment and prevent direct mixing of stormwater and groundwater, reducing the potential for groundwater contamination. In areas where existing stormwater drains to the site interior, the stormwater ponds will provide treatment storage, with overtopping into the groundwater ponds occurring only during large storm events. In areas where existing stormwater drains directly to protected surface waters, perimeter stormwater ponds will function more like ditches, diverting stormwater flows around the groundwater ponds to prevent stormwater/groundwater mixing and minimize flow reduction impacts to the surface waters.

4.2.2. End Use Drainage Areas

Following final reclamation, the project area will be returned to agricultural land. Since final reclamation will involve replacement of the existing overburden soils and topsoil that were in place prior to mining, the same land use type and curve numbers were used in the end use hydrology analysis as in the existing conditions analysis. The end use drainage analysis is based on preliminary grading and pond information provided by the Mining Consortium. Upon final reclamation, actual end use grading may be modified to accommodate utilities and other design considerations.

Interior Ponding Areas

The majority of the existing surface depressions and ponding areas will be eliminated by the mining excavations. End use grading and final reclamation will result in the creation of three interior stormwater drainage areas (P1, P4, and P5) and three end use ponds (Ponds 1, 2, and 10) with no outlets to North Creek, the Vermillion River or other protected surface waters.

As previously indicated, the end use ponds will be constructed below the groundwater table with separate stormwater ponds located around the perimeter of the groundwater ponds. With no proposed pond outlets, evaporation and groundwater infiltration will be the only sources of pond discharge. The stormwater ponds will function as both sedimentation and infiltration ponds, removing the majority of the suspended solids. Over time, the infiltration rate will decrease as fines and sediment plug the soil voids of the pond, and the ponds will function more like sedimentation ponds.

Proposed end use drainage information for all interior drainage areas within the proposed Mining Area is listed in **Table 4-1**.

Table 4-1. End Use Interior Drainage Area Information (693 acres)

Storm Event	Peak Flow	Runoff Volume (Acre-Feet)
2-Year, 24-Hour	378 cfs	41.8
10-Year, 24-Hour	915 cfs	95.5
50-Year, 24-Hour	1,390 cfs	143.8
100-Year, 24-Hour	1,683 cfs	174.0

Following are descriptions of the proposed interior drainage areas. These areas are also illustrated in **Figure 6** and summarized in **Table 4-4**.

<u>Drainage Area P1 (Interior)</u>

Drainage Area P1 is located in the northwestern portion of the proposed Mining Area, south of 160th Street, north of 170th Street and west of the existing Canadian Pacific Railroad tracks. After mining and reclamation are completed, stormwater within this area will drain via overland flow to Pond 1, an end use pond located in the west central portion of the drainage area. The groundwater pond elevation was estimated based on an average groundwater elevation.

Drainage Area P4 (Interior)

Drainage Area P4 is located just south of Drainage Area P1, in the northwestern portion of the proposed Mining Area, south of 160th Street, north of 170th Street, and west of the existing Canadian Pacific Railroad tracks. After mining and reclamation are completed, stormwater within this area will drain via overland flow to Pond 2, an end use pond located in the west central portion of the drainage area. The groundwater pond elevation was estimated based on an average groundwater elevation.

A separate drainage area (P4A) of approximately 62 acres is located west of Drainage Area P4, outside of the proposed Mining Area boundaries. P4A will continue to drain north to an existing ponding area, located in the northern portion of Drainage Area P4A. However, the mining project will diminish stormwater flow to this existing ponding area. The pond's drainage area will be reduced from approximately 203 acres to 62 acres, as DA 4 is redirected from P4A to P4.

Drainage Area P5 (Interior)

Drainage Area P5 is located in the western portion of the proposed Mining Area, south of 170th Street and west of the existing Canadian Pacific railroad tracks. After mining is completed, stormwater within this area will drain via overland flow to Pond 10, an end use pond located in the southern portion of the drainage area. The groundwater pond elevation was estimated based on an average groundwater elevation.

Following is estimated groundwater and stormwater pond information for end use ponds located within Proposed End Use Drainage Areas P1, P4 and P5.

Table 4-2. Estimated End Use Drainage Areas P1, P4 and P5 Pond Information

End Use Pond Number	End Use Groundwater Pond Size (Acres)	Estimated Depth (Feet)	Estimated Groundwater Pond Elevation	Estimated Stormwater Pond Elevation
Pond 1	90	42	902	904 – 906
Pond 2	42	18	908	910 – 913
Pond 10	14	12	912	913 – 917

Vermillion River Wetland

Drainage Area P8 (Vermillion River Wetland)

Drainage Area P8 encompasses the majority of the proposed Mining Area east of the existing Canadian Pacific railroad tracks. Upon completion of mining excavation and reclamation, proposed end use grading will direct stormwater to Butler Pond and the Vermillion River Wetland located southeast of the Mining Area. Mining excavation and grading in this area will change the topography and drainage pattern within the mining area but the overall drainage pattern to off-site areas will generally be maintained.

Drainage Area P8 includes five other drainage areas, encompassing approximately 678 acres, that are located outside of the proposed Mining Area boundaries. These drainage areas drain into the proposed Mining Area via existing swales. Drainage Area P8A, consisting of approximately 125 acres, is located north of 170th Street. Drainage Area P8B, consisting of approximately 253 acres, is located east of the proposed Mining Area boundaries and west of Annette Avenue. Drainage Areas P8C and P8D, consisting of approximately 227 acres and 43 acres, are located south of the proposed Mining Area boundaries, between Biscayne Avenue and Highway 3. Drainage Area P8E, consisting of approximately 30 acres, is located south of the proposed Mining Area boundaries, west of Highway 3. These areas are illustrated in **Figure 6** and summarized in **Table 4-4**.

Drainage Area P8E is located within the proposed Farmington Seed/Genstar development, which is included in the 2020 City of Farmington Land Use Plan. The Draft AUAR report for this proposed future development indicates that the majority of the development will consist of low density residential units with a curve number of 75, which is the same as the curve number used for cultivated agricultural land. Stormwater flow from this proposed future development, likely required to meet existing conditions, will receive water quality treatment and peak flow attenuation in sedimentation or infiltration ponds prior to entering the proposed mining area boundaries (Bonestroo, 2003).

Table 4-3. Estimated End Use Drainage Area P8 Pond Information

End Use Pond Number	End Use Groundwater Pond Size (Acres)	Estimated Depth (Feet)	Estimated Groundwater Pond Elevation	Estimated Stormwater Pond Elevation
Pond 3	9	10	900	902 - 909
Pond 4	8	10	895	898 - 905
Pond 5	10	9	897	899 - 904
Pond 6	18	22	910	913 - 917
Pond 7	10	10	910	912 - 916
Pond 8	11	17	897	899 - 902
Pond 9	22	22	892	897 - 900
Pond 11	6	10	885	887 - 889

Stormwater from Drainage Areas P8, P8A, P8B, P8C, P8D and P8E will be directed to Butler Pond and the Vermillion River Wetlands via proposed swales and through existing or proposed culverts at Highway 3, Biscayne Avenue and 170th Street. Stormwater will be directed to eight stormwater ponds, located around the perimeter of the end use groundwater ponds (Ponds 3 through 9 and 11). As previously indicated, the end use groundwater ponds will be constructed below the groundwater table with separate storm water ponds located around the perimeter of the groundwater ponds. The stormwater ponds within Drainage Area P8 will function more like ditches in order to maintain stormwater flows to Butler Pond and the Vermillion River Wetland and prevent stormwater/groundwater mixing.

Table 4-3 shows the estimated groundwater and stormwater pond information for end use ponds located within Proposed End Use Drainage Area P8.

Station Trail Ponding Areas

Drainage Area P9 (Station Trail Ponding Areas)

Drainage Area P9 is located in the northeast portion of the proposed Mining Area, south of 170th Street and west of Station Trail. Mining excavation and grading in this area will change the topography and reduce the drainage area from approximately 138 acres to 92 acres, however, the overall drainage pattern will generally be maintained. Drainage Area P9 will continue to drain to the surface depressions or ponding areas located on the west side of Station Trail and ultimately to the Vermillion River.

The complete drainage area extends north beyond the proposed gravel Mining Area, north of 170th Street and west of Station Trail. This off-site drainage area (DA 9A), encompassing an additional 327 acres, drains from north to south via a culvert under 170th Street. These areas are illustrated in **Figure 6** and summarized in **Table 4-4**.

North Creek

Drainage Area P10 (North Creek)

Drainage Area P10 is located in the southwestern portion of the proposed Mining Area, south of 170th Street and on both the east and west sides of the existing Canadian Pacific railroad tracks. Drainage Area P10 will continue to drain to North Creek, from east to west, via a swale and culvert under the existing Canadian Pacific railroad tracks. A berm will be constructed on the south side of Drainage Area P5, preventing flow from Drainage Area P10 from entering Drainage Area P5 and Pond 10, thus diverting this flow to North Creek.

The complete drainage area, including approximately 181 additional acres (P10A), extends southeast beyond the proposed Mining Area boundaries. This off-site drainage area will continue to drain to the northwest and into the proposed Mining Area. Drainage Area P10A is located within the proposed Farmington Seed/Genstar development, which is included in the 2020 City of Farmington Land Use Plan. The Draft AUAR report for this proposed future development indicates that the majority of the development will consist of low density residential units with a curve number of 75, which is the same as the curve number used for cultivated agricultural land. Stormwater flow from this proposed future development, likely required to meet existing conditions, will receive water quality treatment and peak flow attenuation in sedimentation or infiltration ponds prior to entering the proposed mining area boundaries (Bonestroo, 2003). These areas are illustrated in **Figure 6** and summarized in **Table 4-4**.

4.2.3. Stormwater Impacts

In comparing the proposed end use plan to the existing conditions, the proposed mining project will result in some changes the stormwater drainage patterns within the Mining Area and some adjacent properties. Following is a summary of the anticipated impacts between the existing conditions and the proposed end use plan reclamation conditions.

Interior Ponding Areas

Following excavation, grading and end use reclamation, the majority of the existing depressions and ponding areas within the Mining Area boundaries will be eliminated. End use grading and final reclamation will result in the creation of approximately three interior stormwater drainage areas and three end use ponds with no outlets to North Creek, the Vermillion River or other protected surface waters. Following reclamation, the interior end use ponds will be located in the western portion of the proposed Mining Area, while the existing depressions and ponding areas are located across the northern and western portions of the proposed Mining Area.

As previously indicated, the proposed end use ponds will consist of separate stormwater and groundwater ponds, with stormwater ponds constructed around the perimeter of groundwater ponds. This separation will provide stormwater treatment and prevent direct mixing of stormwater and groundwater within the ponds. With no proposed pond outlets, evaporation and groundwater infiltration will be the only sources of pond discharge.

The stormwater ponds will function as both sedimentation and infiltration ponds, removing the majority of suspended solids through gravity settling and filtration. Over time, the infiltration rate will decrease as fines and sediment plug the soil voids of the pond, and the ponds will function more like sedimentation ponds. In both the existing and end use conditions, evaporation and groundwater infiltration are the only outflow source as the ponds and depressions have no outlets.

The proposed end use interior drainage area encompasses approximately 693 acres as compared to the existing interior drainage area of approximately 1,348 acres (See **Table 4-5**). Comparison of the existing and end use hydrology analysis indicates that the stormwater runoff volume to the proposed interior end use ponds will be reduced by approximately 50 percent as compared to the runoff volume that currently flows to the existing surface depressions and ponding areas. This change results as mining excavation and grading in the north end of the Mining Area divert stormwater to the south, toward the Vermillion River.

Table 4-4. End Use Drainage Area Hydrology Model Data: Drainage Areas 1, 4, 5, 8-10

Drainage Area	Size (Acres)	Curve No.	Time of Concentration (Minutes)	2-Year, 24-Hour Storm		10-Year, 24-Hour Storm		50-Year, 24-Hour Storm		100-Year, 24-Hour Storm	
				CFS	Acre-Feet	CFS	Acre-Feet	CFS	Acre-Feet	CFS	Acre-Feet
P1 – Interior	281	75	47	132	16.9	321	38.6	489	58.1	592	70.4
P4 – Interior	218	75	30	142	13.2	341	30.2	517	45.4	625	54.9
P5 – Interior	194	75	39	104	11.7	253	26.7	384	40.3	466	48.7
P8 – Vermillion River Wetland	3,267	75	269	401	159.9	966	376.3	1,479	573.3	1,798	697.5
P9 – Station Trail	419	75	174	72	23.1	176	53.5	270	81.0	328	98.3
P10 – North Creek	262	75	54	110	15.7	269	35.9	410	54.0	496	65.4

In addition to the interior drainage area changes within the proposed Mining Area boundaries, excavation and grading will reduce the stormwater drainage area of the existing pond, located outside of the proposed Mining Area boundaries on the north end of Existing Drainage Area DA4A. The drainage area will be reduced by approximately 69 percent from approximately 203 acres to 62 acres.

The proposed mining project will result in the following drainage area, stormwater flow and volume changes to the proposed interior end use ponds, as compared with existing interior ponding areas:

Table 4-5. Stormwater Changes To Interior Ponding Areas and Depressions

Storm Event	Existing Peak Flow (cfs)	Existing Runoff Volume (Acre-Feet)	Change in Peak Flow (cfs)	Change in Runoff Volume (Acre-Feet)
2-Year, 24-Hour	557	80.5	-179	-38.7
10-Year, 24-Hour	1,337	184.0	-422	-88.5
50-Year, 24-Hour	2,025	276.9	-635	-133.1
100-Year, 24-Hour	2,451	335.2	-768	-161.2

Note: Existing Drainage Area is 1,348 Acres. Drainage Area is estimated to decrease in size by 665 acres.

Vermillion River Wetland

Following excavation, grading and end use reclamation, the overall drainage pattern of stormwater flowing to Butler Pond and the Vermillion River Wetland will generally be maintained with some modifications. The main change is the addition of stormwater drainage from Existing Drainage Area DA2, located in the northern portion of the proposed Mining Area. Stormwater from this area will be diverted from the existing depressions or ponding areas to Butler Pond and the Vermillion River Wetland. Additionally, a small portion of stormwater drainage from Existing Drainage Area DA9, located in the northeast corner of the proposed Mining Area, will be diverted to Butler Pond and the Vermillion River Wetland (Drainage Area P8).

The proposed end use Vermillion River Wetland drainage area encompasses approximately 3,267 acres as compared to the existing Vermillion River Wetland drainage area of approximately 2,609 acres. (See **Table 4-6**). Comparison of the existing and end use hydrology analysis indicates that the stormwater runoff volume to Butler Pond and the Vermillion River Wetland will be increased by approximately 13 percent while the peak stormwater flow rates will be decreased by approximately 6 percent. The reduction in peak stormwater flow rates is caused by an increased runoff time-of-concentration due to flatter swale grades associated with mining excavation and grading.

A preliminary end use plan was evaluated that included stormwater ponding around each of the end use groundwater ponds. This resulted in increased infiltration and limited off-site discharge from each property within the Mining Area. Stormwater analysis identified a substantial decrease in stormwater runoff flow and volume to Butler Pond and the Vermillion River Wetland area.

Stormwater peak flow and runoff volume reductions of approximately 22 percent and 71 percent were observed, respectively. In an attempt to preserve stormwater flows to Butler Pond and the Vermillion River Wetland area, the preliminary plan was modified as shown in the proposed end use plan. The stormwater ponds were modified to function more like ditches, routing stormwater around the groundwater ponds, maintaining flow patterns to downstream surface waters, which are similar to the existing condition.

In comparing the proposed end use plan with existing conditions, the proposed mining project will result in the following drainage area, stormwater flow and volume changes to Butler Pond and the Vermillion River Wetland:

Table 4-6. Stormwater Changes To Butler Pond and Vermillion River Wetland

Storm Event	Existing Peak Flow (cfs)	Existing Runoff Volume (Acre-Feet)	Change in Peak Flow (cfs)	Change in Runoff Volume (Acre-Feet)
2-Year, 24-Hour	430	141.3	-29	+18.6
10-Year, 24-Hour	1,031	328.6	-65	+47.7
50-Year, 24-Hour	1,564	498.3	-85	+75.0
100-Year, 24-Hour	1,898	604.9	-100	+92.6

Note: Existing drainage area is 2,609 acres. Drainage Area is estimated to increase in size by 658 acres.

Station Trail Ponding Areas

Following excavation, grading and end-use reclamation, the overall drainage pattern of stormwater flowing to the Station Trail Ponding Areas will generally be maintained with some minor modifications. The main change is the reduction of stormwater drainage from Existing Drainage Area D9, located in the northeastern portion of the proposed Mining Area. Excavation and grading will divert stormwater from a portion of this drainage area to Butler Pond and the Vermillion River Wetland (Proposed Drainage Area P8).

The proposed end use Station Trail drainage area (Proposed Drainage Area P9) encompasses approximately 419 acres as compared to the existing Station Trail drainage area (Existing Drainage Area DA9) of approximately 465 acres. (See **Table 4-7**). Comparison of the existing and end use hydrology analysis indicates that the stormwater runoff volume and peak flow rates to the Station Trail Ponding Areas will be reduced by approximately 10 percent.

Table 4-7. Stormwater Changes To Station Trail Ponding Areas

Storm Event	Existing Peak Flow (cfs)	Existing Runoff Volume (Acre-Feet)	Change in Peak Flow (cfs)	Change in Runoff Volume (Acre-Feet)
2-Year, 24-Hour	80	25.6	-8	-2.5
10-Year, 24-Hour	196	59.4	-20	-5.9
50-Year, 24-Hour	299	89.9	-29	-8.9
100-Year, 24-Hour	364	109.1	-36	-10.8

Note: Existing drainage area is 465 acres. Drainage Area is estimated to decrease in size by 46 acres.

North Creek

Following excavation, grading and end-use reclamation, the overall drainage pattern of stormwater flowing to North Creek will generally be maintained with some minor modifications. The main change is the reduction of stormwater drainage from Existing Drainage Area DA10, located in the southwestern portion of the proposed Mining Area. Excavation and grading will divert stormwater from a portion of Existing Drainage Area DA10 to Proposed Drainage Area P5 and End Use Pond 10.

The proposed end use North Creek drainage area (Proposed Drainage Area P5) encompasses approximately 262 acres as compared to the existing North Creek drainage area of approximately 317 acres (See **Table 4-8**). Comparison of the existing and end use hydrology analysis indicates that the stormwater runoff volume and peak flow rates to North Creek will be reduced by approximately 17 percent.

A preliminary end use plan was evaluated, which diverted stormwater from Drainage Area P10 to a stormwater pond located around the perimeter of End Use Pond 10. This reduced stormwater flows and runoff volumes to North Creek. The proposed end use plan was modified from the preliminary plan to maintain drainage from P10 to North Creek via the existing swale, culvert under the Canadian Pacific railroad tracks and construction of a diversion berm.

In comparing the end use plan with existing conditions, the proposed mining project will result in the following drainage area, stormwater flow and volume changes to North Creek:

Table 4-8. Stormwater Changes To North Creek

Storm Event	Existing Peak Flow (cfs)	Existing Runoff Volume (Acre-Feet)	Change in Peak Flow (cfs)	Change in Runoff Volume (Acre-Feet)
2-Year, 24-Hour	133	19.0	-23	-3.3
10-Year, 24-Hour	326	43.4	-57	-7.5
50-Year, 24-Hour	495	65.4	-85	-11.4
100-Year, 24-Hour	601	79.1	-105	-13.7

Note: Existing drainage area is 317 acres. Drainage Area is estimated to decrease in size by 55 acres.

4.3 Direct Wetland Impacts

Direct wetland impacts, as defined for this study, include direct fill and/or excavation within a wetland. The proposed mining operation would directly affect all of the wetlands within the site boundaries through excavation, with the exception of wetlands 15-NW-01, 15-SW-01 and 16-SW-01 in the southern portion of the Mining Area. These wetlands have minimal aggregate deposits, and have therefore been identified by the Mining Consortium as areas within the Mining Area that will not be disturbed by mining activities. The total direct impact is estimated at 18.0acres based on the Empire Township wetland inventory (**Table 4-9**). A final wetland delineation would need to be conducted to refine the direct wetland impact area prior to mining.

Table 4-9. Wetlands with Direct Fill/Excavation Impacts

Empire Twp. Wetland Inventory	NWI Designation	Empire Twp. Circular 39 Type	Hydric Soil (yes or no) & Soil Type	Empire Twp. Class.	Total Area (acres)	Direct Impact (acres)	Primary Water Source
05-NW-01	Not Mapped	Type 1	No – Kennebeck	Utilize	0.1	0.1	Recharge
06-NE-01	PUBF	Type 3/5	Yes – Water	Preserve	4.3	4.3	Recharge
06-NE-02	PEMC	Type 1/3	No – Kennebeck	Manage I	2.1	2.1	Recharge
06-NW-01	PEMF/ PUBFx	Type 3/4/5	Yes – Colo No – Hawick	Preserve	9.1	9.1	Recharge
07-NW-01	PEMC	Type 3	No – Waukegan	Utilize	0.5	0.5	Recharge
15-NW-01	PEMA/ Cd	Type 1/3/5/6/7	Yes – Colo	Preserve	108.6	0	Recharge/ Discharge
15-NW-02	Not Mapped	Type 2	No – Talulla	Manage I	0.3	0.3	Recharge/ Discharge
15-NW-03	Not Mapped	Type 2	No – Tallula	Manage II	1.6	1.6	Recharge/ Discharge
15-SW-01	PEM/SS/FO/C	Type 1/3/6/7	Yes – Colo	Preserve	377.4	0	Recharge/ Discharge
16-SW-01	PEMCd	Type 3	Yes – Mayer	Manage II	6.7	0	Recharge
Totals					**510.73**	**18.0**	

4.4 Indirect Impacts to Wetlands and Watercourses

Indirect impacts may occur as a result of changes to surface water quantity, quality and groundwater hydrology. Indirect impacts were evaluated for wetlands and watercourses downstream from the project site. Direct impacts to wetlands within the project site are discussed in Section 4.3.

Several wetlands and tributaries are located in proximity to the proposed mine that may be affected by changes to surface water and/or groundwater characteristics during mining and post reclamation. The following sites are identified as having potential indirect impacts, based on the results of the Surface Water and Groundwater Impact Studies.

Wetlands 07-SE-01 and 02 are located to the south of the Mining Area, approximately 1,200 feet from the nearest proposed excavation activity. These wetlands drain toward the project site and would have no changes to the existing surface water drainage. Since these are primarily recharge wetlands, groundwater impacts are not anticipated. Wetland 07-SE-01 is identified in the Utilize category while 02 is identified as in the Manage II category, with water quality being their primary function. Based on the assumed Type 1 classification (or Type 2 with reed canary grass), these wetlands are considered slightly susceptible to hydrologic alterations (per MN Stormwater Advisory Group report). Based on this evaluation of the stormwater and groundwater studies, little to no indirect impacts are anticipated for these wetlands.

Wetland 10-NW-01 Station Trail/Tributary 2 is located along the eastern boundary of the Mining Area. The nearest excavation activity is approximately 800 feet from this wetland. Wetland 10-NW-01 would have some changes to the surface area of the watershed, with a resulting 8 cfs decrease in peak stormwater flows for the 2-year, 24-hour storm (total volume of -2.5 ac-ft). The overall change in watershed area draining to this wetland represents a 10 percent decrease, as compared to existing conditions.

While groundwater impacts were not numerically simulated, it is noted that the groundwater flow pattern to this wetland will be maintained. In fact, the groundwater study indicates that the level of groundwater in the northeast portion of the Mining Area may rise slightly in the project area due to increased infiltration, contributing to continued flows to this wetland. Potential changes to groundwater hydrology may counteract changes to surface hydrology.

This wetland is identified as Manage II, with water quality and education/ recreation as the primary functions. The Type 6/7 wetland is moderately susceptible to changes in stormwater, and can tolerate short periods of shallow inundation. Based on this evaluation of the stormwater and groundwater studies, this wetland would have minor indirect impacts; continued groundwater flows and slightly reduced surface water flows will not cause excess inundation, and will essentially maintain the existing hydrologic regime. Changes to the existing quality, function and value are not anticipated.

Wetland 15-NW-01 Butler Pond surrounds the pond and upstream ditches within the southeast portion of the project area. The watershed area of this wetland is proposed to increase by 658 acres, with a resulting increased runoff volume of 18.6 ac-ft for the 2-year, 24-hour event. Since this wetland is approximately 108 acres in size, this amounts to 0.17 feet (2 inches) of water level rise for the 2-year, 24-hour storm. The increase in watershed area is primarily due to the redirection of interior drainage area DA2 into the Butler Pond watershed. Although the volume of water entering this wetland increases, the peak stormwater flows decrease. Specifically, the 2-year, 24-hour peak stormwater flow decreases by 29 cfs. The decrease in peak stormwater flow is due to an increase in runoff time-of-concentration associated with flatter ditch grades. The existing control structure for much of this wetland is the dam and outlet control structure on Butler Pond. No changes would be made to the existing dam or outlet control structure.

The installation of ponding and shallow swales will reduce sediment and nutrient loads to this wetland. However, the temperature of surface waters may increase as compared to existing conditions, depending on the shading that is provided through reclamation. The portion of Wetland 15-NW-01 that is within the mining site, classified as Manage I/II, would buffer these effects to the downstream Preserve wetland.

The groundwater study indicates that Wetland 15-NW-01 will have a 0.06 cfs decrease in groundwater discharge, representing a 3 percent decrease from existing conditions. Associated with the groundwater change is an increase of 33 mg/L of total dissolved solids (TDS). This increase is considered minor in comparison to the estimated average groundwater TDS of 500 mg/L. Groundwater temperature is predicted to increase by 1.03 degrees C based on the reasonable worst-case scenario. The existing volume of water in Butler Pond will buffer all of these changes, as indicated in the Groundwater Impact Study.

Wetland 15-NW-01 is identified as Manage I/II and Preserve. The western portion of this wetland will buffer the surface and groundwater changes to the higher quality wetland that is located off-site. Additionally, the volume of water within Butler Pond will further buffer potential changes to hydrology. The proposed changes to surface water and groundwater characteristics, as described above, are not expected to result in an alteration to the existing wetland functions and values or overall wetland quality because of this buffering capacity and relatively small changes that are projected to occur.

Wetland 15-SW-01 Tributary 1 is located downstream of Butler Pond. The impacts to surface water entering this wetland are discussed under Wetland 15-NW-01. The storage volume and capacity of Butler Pond serve as a buffer to this downstream wetland and tributary. Thus, surface water impacts to Wetland 15-SW-01 are anticipated to be negligible given that the upstream wetland impacts would be buffered by the existing dam structure.

The Groundwater Impact Study provides specific impact description for Wetland 15-SW-01. According to the study, groundwater discharge would decrease by 0.02 cfs, TDS would increase by 5.8 mg/L and temperatures would increase by 0.18 degrees C. None of these changes are expected to alter the fishery of the downstream area that is designated as trout stream. Since the groundwater impacts will also be somewhat buffered by Butler Pond.

This wetland is identified in the Preserve Classification, with exceptional values for vegetation, water quality and education/recreation. Given this classification, the Type 1/3/6/7 wetland is considered highly susceptible to hydrologic alterations. Based on this evaluation of the predicted stormwater and groundwater changes, the proposed project is not expected to result in an alteration to the existing wetland functions and values or overall wetland quality.

Table 4-10. Indirect Impacts to Wetlands and Watercourses

Empire Twp. Wetland Inventory	NWI Designation	Empire Twp. Circular 39 Type	Empire Twp. Class.	Wetland Size (acres)	Primary Hydrologic Characteristics	Watershed Area Changes (acres & %)	Change in Peak Flow for 2-Year 24-Hour Storm (cfs & %)	Change in Runoff Volume (Ac-Ft & %)	Change in Groundwater Discharge (cfs & %)	Change in Groundwater TDS [2] (mg/L)	Change in Groundwater Temperature (°C)
07-SE-01	Not Mapped	Type 2[1]	Utilize	1.1	Recharge	0 ac 0%	N/A	N/A	N/A	N/A	N/A
07-SE-02	Not Mapped	Type 2[1]	Manage II	0.4	Recharge	0 ac 0 %	N/A	N/A	N/A	N/A	N/A
10-NW-01 Station Trail/Trib. 2	PSS/FO1C	Type 6/7	Manage II	7.1	Recharge/ Discharge?	-46 ac 10%	-8 cfs 10%	-2.5 ac-ft 9.7%	GW elev. may rise	Undetermined	Undetermined
15-NW-01 Butler Pond	PEMA/Cd	Type 1/3/5/6/7	Preserve & Manage I/II	108.6	Recharge/ Discharge	+658 ac 25%	-29 cfs 6.7%	+18.6 ac-ft 13.1%	-0.06 cfs 3%	+33 cfs	+1.03
15-SW-01 Tributary 1	PEM/SS/ FO/C	Type 1/3/6/7	Preserve	377.4	Recharge/ Discharge	+658 ac 25%	-29 cfs 6.7%	+18.6 ac-ft 13.1%	-0.02 to 0.03 cfs 5.1 to 16.7%	+0.5 to 5.8	+0.06 to 0.18
16-SW-01	PEMCd	Type 3	Manage II	6.7	Recharge	0 ac 0%	N/A	N/A	N/A	N/A	N/A
19-NW-02 North Creek	PEMCd	Type 1/3/6	Manage II	146.1	Recharge/ Discharge	-55 ac 0.2%	-23 cfs 17.3%	-3.3 ac-ft 17.4%	+0.07 cfs 4%	+0.9	+0.03

[1]Based on the soil type, groundwater study and lack of NWI classification, these wetlands are likely Type 1 (seasonally flooded) rather than Type 2 (wet meadow).
[2]Average TDS is 500 mg/L.
[3] Average Temperature is 11°C.

Wetland 16-SW-01 is located along the south central border of the Mining Area. There are no changes proposed to surface water runoff for this wetland. Groundwater impacts are not applicable since this wetland is primarily in the recharge category.

The wetland is classified as Manage II, with water quality as the primary function. This Type 3 wetland is considered slightly susceptible to hydrologic changes, assuming that cattails are the primary vegetative component. Based on this evaluation of the surface water and groundwater studies, the proposed project would have negligible indirect impacts on this wetland, with no changes to the existing wetland functions and values or overall wetland quality.

Wetland 19-NW-02 North Creek is located to the west of the Mining Area. The surface watershed draining to North Creek will decrease by 55 acres, or 0.2 percent of the total watershed area. This decrease will correspond to a 23 cfs decrease in the 2-year, 24-hour peak flows and 3.3 acre-feet decrease in overall flow volume for the 2-year, 24-hour event. The Groundwater Impact Study indicates that discharge to North Creek, under a worst-case scenario, is expected to increase by 0.07 cfs as compared to existing conditions. It is also estimated that this would be associated with a 0.9 mg/L TDS increase and 0.03 degree C increase. Existing temperatures in North Creek are in the 18 to 25 degree C range nearly 90 percent of the time.

Because the overall North Creek watershed is so large, the changes to surface water hydrology within the Mining Area are not expected to substantially alter the hydrology of the Creek. Likewise, the small increase in groundwater discharge and temperature is within the normal seasonal range for the Creek.

The wetland is designated as Manage II, with water quality as the primary function. This Type 1/3/6 wetland is considered slightly to moderately susceptible to hydrologic changes. However, it is noted that the existing channel has been ditched and is not in a natural configuration. The adjacent wetlands are partially drained by the channel. Thus, the susceptibility to hydrologic alteration is more likely on the side of slight rather than moderate. Based on the evaluation of the groundwater and surface water studies, this wetland and tributary will have minor impacts as a result of the project, with no change to wetland quality, function and value anticipated.

Vermillion River is located approximately two miles to the south of the Mining Area. The surface water drainage to the Vermillion River will increase slightly (557 acres) as a result of the proposed project. This increase is due to the redirection of isolated interior drainage basins to Butler Pond. Since the Vermillion River watershed is over 82,500 acres, the change represents less than 0.7 percent increase. The majority of the surface water changes will be buffered by Butler Pond

The Groundwater Impact Study clearly illustrates a groundwater divide within the Mining Area. Most of the groundwater within the Mining Area moves north toward the Mississippi River. Only a small portion of the site's groundwater moves toward the Vermillion River. As illustrated in the Groundwater Impact Study, which is a worst-case analysis, none of the impacts illustrated reach the Vermillion River. Based on this evaluation, the proposed project is expected to have negligible impacts to surface and groundwater within the immediate project area. No impacts are anticipated to occur to the trout habitat or water quality of the Vermillion River.

5.0 MITIGATION

5.1 National Pollutant Discharge Elimination System (NPDES) Permit and Stormwater Pollution Prevention Plan (SWPPP) Requirements

The complete list of required project permits is identified within the Scoping Environmental Worksheet. In addition to the other permits identified, mining and production activities will follow regulations established within Phase 2 of the National Pollutant Discharge Elimination System (NPDES) Permit, administered by the Minnesota Pollution Control Agency (MPCA). The program regulates stormwater discharges from construction sites, industrial facilities, municipalities and other sites. Each mining operator will be required to apply for or amend an NPDES Permit and comply with the permit requirements. The proposed project is regulated under the MPCA Stormwater Program for Construction Activities and Industrial Activities (SIC Code 1442 Construction Sand and Gravel for mining and quarrying of nonmetallic minerals).

Prior to applying for or amending an NPDES permit, each mining operator must complete a Stormwater Pollution Prevention Plan (SWPPP). For all projects greater than 50 acres that discharge to Special Waters, the NPDES permit requires review by the MPCA, in addition to review by local permitting authority, at least 30 days prior to the project start. Generally, the SWPPP should be submitted early in the project planning phase, typically at the 30 percent design level.

Portions of North Creek, the Vermillion River and the unnamed tributaries are designated as trout streams by the DNR and as Special Waters by the MPCA. All mining activities will occur more than 2000 feet from the designated trout streams. DNR Public Water Resource rules (6130.1200 Exclusion Areas for Mining) indicate that additional regulations and BMPs are not required for projects that are more than 300 feet from a designated trout stream. Likewise, MPCA stormwater regulations for discharge to Special Waters do not apply because the distance to these waters is more than 2000 feet.

The SWPPP is a combination of narrative and plans, including appropriate details, that describe the proposed construction activity and address the potential for erosion, sediment and pollutant discharge from the site and preventative mitigation measures. The SWPPP must be incorporated in the final project plans and specifications and must address implementation, installation, inspection and maintenance of the control measures. Specifically, the SWPPP includes the following elements (University of Minnesota, 2003-2004):

1. Temporary erosion prevention and sediment control Best Management Practices (BMPs)
2. Permanent erosion prevention and sediment control Best Management Practices (BMPs)
3. Permanent stormwater management system
4. Pollution prevention management measures

5.2 Best Management Practices (BMPs)

BMPs for surface water management, erosion and sediment control shall be utilized during mining, production and reclamation activities to protect on-site and adjacent surface waters and wetlands. All NPDES permit regulations shall be followed, however, it is anticipated that the following BMPs will be used throughout the project:

5.2.1 Proactive Planning and Phasing of Mining, Production and Reclamation Operations

Prior to construction, proposed mining, production and reclamation operations should be thoroughly planned and coordinated to minimize unnecessary disturbance of the project area and utilize grading practices that minimize erosion. Existing vegetation shall not be disturbed unnecessarily. Whenever possible, mining excavations should proceed vertically to full depth prior to expanding horizontally. Location of production areas, building facilities, fuel storage areas, groundwater supply wells, stockpile areas, haul roads, sand/gravel washing areas, detention ponds and other on-site facilities shall be determined in conjunction with the phased mining plan to minimize disturbance and potential impacts to on-site and adjacent surface waters.

5.2.2 Maintain Existing Stormwater Drainage Patterns

Whenever possible, the existing stormwater drainage patterns shall be maintained to reduce or eliminate changes in stormwater runoff. Removal of topsoil and overburden soils, placement of soil stockpiles, mining excavation, stockpiles, placement of fill soils, grading and end use reclamation shall be phased accordingly throughout the duration of the project to minimize alteration of the existing drainage patterns during mining, production and following reclamation.Construction of temporary and permanent ditches, swales, berms, culverts, ponds and other engineered controls shall be utilized, as necessary throughout the project, to maintain existing stormwater drainage patterns, flows and runoff volumes If existing stormwater drainage patterns are not maintained, surface waters and wetlands adjacent to the project will be impacted by a reduction in stormwater flow and runoff volume during mining excavation and grading. Maintaining existing drainage patterns during mining will require modification of an existing township ordinance No. 450 indicating that stormwater from mining areas may not be discharged offsite.

5.2.3 Erosion Control Measures

Temporary and Permanent Vegetation Establishment

Inplace vegetation is the best deterrent to erosion and should be maintained as much as possible and restored as quickly as possible throughout construction. Areas that require disturbance and discharge to surface waters should be restored with temporary or permanent vegetation immediately following active construction. Specific NPDES criteria related to temporary and permanent vegetation includes:

1) During construction, all slopes that have a continuous positive slope within 200 lineal feet of any surface water (including any potential discharges to surface waters, including but not limited to culverts, storm sewer, curb and gutter, ditches, detention ponds, etc.) must receive temporary erosion protection or permanent cover, according to **Table 5-1**.

Table 5-1. Slope and Duration

Type of Slope	Maximum Time Area Can Remain Unvegetated When It Is Not Actively Being Worked
Steeper than 3:1	7 days
10:1 to 3:1	14 days
Flatter than 10:1	21 days

Source: University of Minnesota, 2003-2004.

2) Any temporary or permanent drainage ditch that drains water from or diverts water around a construction site, must be stabilized within 200 lineal feet of the property edge, or from the point of discharge to any surface water.. Stabilization must be completed within 24 hours of connection to a surface water (University of Minnesota, 2003-2004).

3) Final stabilization of all disturbed areas and drainage ditches with a perennial vegetative cover, consisting of a minimum density of 70 percent over the entire pervious area or other equivalent means necessary to prevent soil failure under erosive conditions, must be completed as part of the project (University of Minnesota, 2003-2004).

4) As part of final stabilization, all temporary synthetic erosion prevention and sediment control BMPs (i.e. silt fence) must be removed and sediment must be cleaned out from all conveyances and detention basins (University of Minnesota, 2003-2004).

Other Engineering Controls

Other engineering controls shall be implemented and maintained, as necessary, to minimize erosion. Specific NPDES criteria related to erosion control include:

1) Slope Grading - If possible, slopes greater than 3:1 should be avoided. If slopes steeper than 3:1 are used, unbroken slope lengths greater than 75 feet, should be avoided to maintain sheet flow and minimize rills and/or gullies.

2) Erosion Control Mats, Mulch and Hydraulic Stabilizer - Depending on location, slope length and steepness, erosion control mats, mulch and/or hydraulic soil stabilizer shall be used as necessary to reduce erosion and assist in establishment of temporary or permanent vegetation.

3) Energy Dissipation and Erosion Control at Inlets/Outlets and Other High Flow/High Velocity Areas_ - Pipe outlets shall be located and aligned to prevent erosion at the outlet. Pipes should be extended to outlet at the toe of slope rather than on the slope. Erosion control shall be provided at all pipe inlets and outlets. Riprap or other approved energy dissipation methods shall be used, as necessary, to protect soils where high flows or velocities may occur. Pipe outlets shall be provided with temporary or permanent energy dissipation (i.e. riprap or other suitable material) within 24 hours of connection to a surface water. Temporary erosion control consisting of ditch checks, seed/erosion control blanket or seed/mulch shall be provided for a minimum of 200 feet from the point of discharge.

Sediment Control Measures
The following controls are proposed to control sediment transport within and from the site:

1) Implementation of Down Gradient Sediment Control Measures – Sediment control measures must be established on all down gradient perimeters before any` upgradient land disturbing activities begin. These measures shall remain inplace until final stabilization of all up gradient areas has been established. If the down gradient treatment systems are overloaded, additional up gradient sediment control measures must be installed to eliminate the overloading (University of Minnesota, 2003-2004).

2) Perimeter Surface Water Protection Measures –Measures should be used at surface water perimeters, as necessary, to minimize sediment contamination. These measures may include the use of perimeter hay bale barriers, sand bag barriers, silt fence or floating silt curtain. Whenever possible, undisturbed vegetation shall be used as a buffer strip with other surface water protection measured placed up gradient of the buffer strip (University of Minnesota, 2003-2004).

3) Temporary Soil Stockpile Measures – Temporary soil stockpiles cannot be placed in or immediately adjacent to surface waters, ditches, storm sewer or culverts. Silt fence or other approved sediment control measures shall be used at the base of the stockpiles to prevent sediment migration.

4) Vehicle Exit Measures - Adequate measures shall be taken to ensure vehicles do not track sediment from the construction site. These measures may include placement of rock construction pads at all site exits, truck washes and street sweeping, as necessary.

5) Inlet Protection Measures - Inlets of all storm sewer conveyances and culverts shall be protected with sand bags, silt fence, hay bales, sediment traps or other approved measures to eliminate sediment transport to down gradient lands or

surface waters. Inlet protection shall remain inplace until final stabilization of all up gradient areas has been completed.

6) Ditch Measures – In addition to erosion control, various ditch measures can be used to reduce sediment transport to down gradient lands or surface waters. Adequate measures shall be taken to ensure sediment does not leave the Mining Area or enter surface waters. These measures include various types of ditch checks (silt fence, biorolls (wattles), rock, etc.) and sediment traps.

7) Temporary Sedimentation Basins – In areas where 10 or more acres of disturbed soil drain to a common location, a temporary sedimentation basin must be provided prior to runoff leaving the construction site or entering surface waters. Additional temporary sedimentation basins are also encouraged adjacent to steep slopes or highly erodible soils. Temporary Sedimentation basins shall be designed and constructed to the following requirements:

   - The basins must provide storage below the outlet pipe for a calculated runoff volume from a 2-year, 24-hour storm over the entire drainage area. In no case shall the basin provide less than 1,800 cubic feet of storage from each acre drained to the basin, as measured below the outlet invert.

   - Where no such runoff calculation has been performed, a temporary sedimentation basin shall provide a minimum of 3,600 cubic feet of storage from each acre drained to the basin, as measured below the outlet invert. The temporary sedimentation basin shall remain inplace until final stabilization of the site has been achieved.

   - Temporary basin outlets must be designed to prevent short-circuiting and the discharge of floating debris. The basin must be designed with the ability to allow complete basin drawdown (e.g. pumps, perforated pipe or other means) for maintenance activities and provide a stabilized emergency overflow to prevent failure of pond integrity. Energy dissipation must be provided for the basin outlet.

   - The temporary basins must be constructed and made operational concurrent with the start of up gradient soil disturbance that contributes runoff to the pond.

   - Where temporary sedimentation basins are not attainable due to site limitations, equivalent sediment controls are required for all down gradient boundaries of the construction area. Alternative measures may include smaller sedimentation basins, sediment traps, ditch checks, silt fence, vegetative buffer strips, or any appropriate combination of measures.

- Sediment from conveyances and temporary sedimentation basins that are to be used as permanent water quality management basins, must be sufficiently cleaned out to return the basin to its design capacity. Sediment must be stabilized to prevent it from being washed back into the basin, conveyances, ditches or swales discharging off-site or to surface waters.

Permanent Stormwater Management System

When project development replaces vegetation and/or other pervious surfaces with one or more acres of cumulative impervious surface, permanent water quality treatment is required for the new impervious area created by the project. Prior to runoff leaving the construction site or entering surface waters, a volume equal to ½-inch) over the impervious area created by the project must be treated. Treatment may occur via any of the following methods:

1) Wet Sedimentation Basin - The basin must have a minimum permanent volume of 1,800 cubic feet of storage for each acre that drains to the basin, as measured below the outlet invert. The basin's permanent volume must have a minimum depth of 3-feet and a maximum depth of 10-feet and must be configured such that the scour or resuspension of solids is minimized.

    - Basin outlets shall be designed such that the water quality volume is discharged at no more than 5.66 cfs per acre of pond surface area.

    - Basin outlets must be designed to prevent short-circuiting and the discharge of floating debris and must have energy dissipation.

    - The basin must provide a stabilized emergency overflow to accommodate storm events in excess of the basin's hydraulic design.

    - Adequate maintenance access must be provided (typically 8-feet wide) along with a maintenance plan identifying responsibility for future maintenance.

2) Infiltration/Filtration – Infiltration/filtration options include but are not limited to: infiltration basins, infiltration trenches, rainwater gardens, sand filters, organic filters, bioretention areas, enhanced swales, dry storage ponds with underdrain discharge, off-line retention areas and natural depressions. Infiltration must be used only if appropriate to the site and land uses. Settleable solids, floating materials, oil and grease should be removed from the runoff to the maximum extent practicable before runoff enters the infiltration/filtration system. Filtration systems must have a reasonable chance of achieving approximately 80 percent removal of total suspended solids. Evaluation of the impacts of the infiltration system on existing hydrologic features (e.g. wetlands) must be determined with an effort to maintain pre-existing conditions. Other criteria include the following:

- Infiltration systems should not be excavated to final grade until the contributing drainage area has been constructed and fully stabilized.

- During construction of an infiltration system, rigorous sediment and erosion controls (e.g. diversion berms) should be used to keep runoff and sediment away from the infiltration area. In an effort to avoid soil compaction, the area must be staked off and marked to keep heavy equipment away.

- Pretreatment devices such as a vegetated filter strip, small sedimentation basin or grit chamber must be used to settle particulates before the stormwater discharges into the infiltration or filtration system.

- The water quality volume shall discharge through the soil or filter media in 48 hours or less. Additional flow that cannot be infiltrated or filtered in 48 hours should be routed to bypass the system through a stabilized discharge point. A method to visually verify system operation must be provided.

- Appropriate on-site testing shall be conducted to ensure a minimum of 3-feet of separation between the seasonally saturated soils or bedrock and the bottom of the proposed infiltration system. Calculations and computer model results that demonstrate the design adequacy must be included as part of the SWPPP.

- Adequate maintenance access must be provided (typically 8-feet wide) along with a maintenance plan identifying responsibility for future maintenance.

- Use of designed infiltration systems from industrial areas with exposed contaminated materials or from vehicle fueling and maintenance areas is prohibited.

3) Regional Ponds – Regional ponds may be used provided they are constructed ponds, not natural wetlands or water bodies and are designed, per design requirements, to accommodate water from all impervious surfaces that reach the pond. Basin outlets shall be designed such that the water quality volume is discharged at no more than 5.66 cubic feet per second (cfs) per acre of pond surface area. The owner must obtain written documentation from the applicable local governmental unit (LGU) or private entity that owns and maintains the regional pond.

4) Combination of Practices – A combination of permanent practices, which meet the design requirements (wet sedimentation basins, infiltration/filtration and regional ponds) may be used. The water quality treatment volume shall be accounted for from each treatment system. If any combination of these

practices is used, the SWPPP must contain documentation (e.g. LGU or private entity's authorization, infiltration computer model results or calculations, etc.) identifying the volume that each practice addresses.

5) Alternative Method – When an alternative, innovative treatment system is proposed and demonstrated by calculation, design or other independent methods to achieve approximately 80 percent removal of total suspended solids on an annual average basis, the Commissioner will approve the method if the application process is completed and the following information is submitted:

- All calculations, drainage areas, plans and specifications for the proposed alternative method and a graphic representation of the area to be served by the method. These items must be included in the SWPPP and submitted to the MPCA at least 90 days prior to the proposed starting date of the construction activity.

- A 2-year monitoring plan to sample runoff from the proposed method. The plan must include a discussion of the methods used to collect samples, sample location (upstream and downstream of the proposed method), sample frequency (minimum of six runoff events), identify lab used to analyze samples and QA/QC methods to be used. The plan must include a schedule for submitting annual monitoring data.

- A mitigation plan that addresses how the water quality volume will be treated in the event that monitoring data shows the proposed alternative treatment method does not function as designed.

- The alternative method must achieve approximately 80 percent removal of total suspended solids on an average annual basis for the conditions expected at the site. The design must also consider public safety, health and water quality concerns. Proprietary information on effectiveness will not be considered for alternative treatment method review and approval. No construction activity on the project is covered until the applicant receives an alternative treatment approval letter from the MPCA.

6) Dewatering and Basin Draining – All dewatering or basin discharge water that may have turbid or sediment laden water, must be discharged to a temporary or permanent sedimentation basin prior to draining off-site or entering a surface water. If the water cannot be discharged to a sedimentation basin prior to entering a surface water, it must be treated with other appropriate BMPs, such that the discharge does not adversely affect the receiving waters or downstream landowners. Adequate sedimentation control measures are required for discharge water that contains suspended solids. The discharge points must be adequately protected from erosion and scour by accepted energy dissipation measures (riprap, sand bags, etc.). All water from

dewatering or basin draining activities must be discharged in a manner that does not cause nuisance conditions, erosion in receiving channels or on down grade properties, or inundation of wetlands causing significant adverse impacts to the wetland.

7) Pollution Prevention Measures – The following pollution prevention management measures shall be implemented on the site:

- All solid waste shall be managed appropriately on-site and disposed off-site per MPCA disposal requirements.

- All hazardous materials shall be properly stored and include secondary containment to prevent spills, leaks and other discharges. Restricted access to hazardous material storage areas must be provided to prevent vandalism. Storage and disposal of hazardous waste must be in compliance with MPCA regulations.

- External washing of trucks and other construction vehicles shall be limited to a defined area of the site. All runoff must be contained and waste shall be properly disposed. No engine degreasing is allowed on-site.

8) Inspections and Maintenance – The Mining Area must receive routine inspection to ensure that erosion/sediment control and pollution prevention measures are functioning properly and determine if additional measures are necessary. The following inspection and maintenance procedures shall be implemented:

- The owner or operator (whoever is identified in the SWPPP), must routinely inspect the construction site at least once every seven days during active construction and within 24 hours after a rainfall event greater than 0.5 inches in 24 hours.

- All inspections and maintenance must be recorded in writing and retained with the SWPPP. Records of each inspection and maintenance activity shall include the following:

  - Date and time of inspection
  - Name of person conducting inspection
  - Findings of inspection, including recommendations for corrective actions
  - Corrective actions taken (include dates, times and party completing maintenance activities)
  - Date and amount of rainfall events greater than 0.5 inches in 24 hours
  - Documentation of changes made to the SWPPP

- Inspections within areas where final stabilization has been completed may be reduced to once per month.

- When work is suspended due to frozen ground conditions, inspection must take place as soon as runoff occurs at the site or prior to resuming construction, whichever comes first.

- All erosion and sediment control BMPs and temporary and permanent water quality management BMPs must be inspected to ensure integrity and effectiveness. All nonfunctional BMPs must be repaired, replaced or supplemented with functional BMPs. The Permittee is responsible for operation and maintenance of all BMPs for the duration of site construction work, until final stabilization has been achieved and accepted by the agencies. The following specific inspection and maintenance requirements shall be followed:

  - All silt fence must be repaired, replaced or supplemented when it becomes nonfunctional or the sediment reaches 1/3 of the fence height. Repairs must be made within 24 hours of discovery or as soon as field conditions allow access.

  - Temporary and permanent sedimentation basins must be drained and the sediment removed when the sediment depth reaches ½ the storage volume. Drainage and removal must be completed within 72 hours of discovery or as soon as field conditions allow access.

  - Surface waters, including ditches and conveyance systems, must be inspected for evidence of sediment deposition by erosion. All deposited sediment shall be removed from surface waters, including ditches, swales, catchbasins, storm sewer, culverts and other drainage systems. All areas of erosion and sediment deposition that result in exposed soil shall be restabilized. The removal and stabilization must take place within seven days of discovery unless precluded by legal, regulatory or physical access constraints. All reasonable efforts shall be made to achieve access, however, if access is precluded, removal and stabilization must take place within seven calendar days of obtaining access. The Permittee is responsible for contacting all local, regional, state and federal authorities and obtaining all required permits, prior to conducting any work.

  - Construction site vehicle exit locations must be inspected for evidence of off-site sediment tracking onto paved surfaces. Tracked sediment must be removed from all off-site paved surfaces, within 24 hours of discovery.

- Any off-site accumulations of sediment must be removed in a manner and frequency sufficient to minimize off-site safety or water quality impacts (i.e. sediment within streets could enter into storm sewer system and/or pose safety hazard to street users).

- All infiltration areas must be inspected to ensure that no sediment from construction activities is reaching the infiltration area and the area is protected from compaction by construction equipment.

5.3 Mitigation for Direct Wetland Impacts

In accord with the State and Federal wetland regulations, each mine operator will need to provide a detailed wetland delineation and mitigation plan for the direct wetland impacts. All wetlands within the Mining Boundary will be affected through excavation, with the exception of wetlands 15-NW-01, 15-SW-01 and 16-SW-01 in the southeast corner of the site. These wetlands are near the groundwater elevation and have minimal aggregate deposits and have been identified by the Mining Consortium as areas within the Study Area that will not be disturbed by mining activities.

Current Minnesota Wetland Conservation Act regulations require that mitigation be provided for "excavation in the permanently and semi-permanently flooded areas of type 3, 4, or 5 wetlands, and *in all wetland types if excavation* includes filling or draining or *results in conversation to nonwetland*". Since the proposed excavation activities will result in the conversion of wetlands to non-wetlands, all wetland fill or excavation must be mitigated.

State regulations require that mitigation be completed at a 2:1 ratio. Given that 18.0 acres of wetland will be directly impacted, the mitigation requirement is 32.0 acres. This can be completed through creation and/or restoration of 18.0 acres of wetland plus creation, preservation or restoration of 18.0 acres of stormwater ponds and upland buffers.

The current end use plan includes nearly 240 acres of ponding. Some of these areas could be designated and constructed to meet the wetland mitigation requirements for on-site wetland losses. Additional mitigation, in the form of wetland restoration and upland buffer establishment, could be provided at select areas within the Mining Area Each mining operator will be responsible for mitigating wetland impacts that occur on their site.

5.4 Mitigation for Indirect Wetland and Watercourse Impacts

5.4.1. Surface Water Changes

The surface water analysis provides an evaluation of the potential impacts between the existing conditions and end use conditions. As indicated in the surface water impact evaluation, wetlands and water courses with potential indirect impacts are expected to maintain their existing functions and values during the mining operation and post reclamation.

On a broad scale, the most substantial indirect impact is the increase in the size of the watershed area draining to Butler Pond. This change is associated with an increase in flow volume to the receiving waters and wetlands. Although this change is anticipated to have a minor impact, there is opportunity to reduce the flows to Butler Pond by creating additional stormwater ponds in the upstream watershed. Construction of stormwater ponding within the mining area will reduce the sediment and nutrient loads to surface waters and wetlands.

Mitigation for indirect impacts are identified in Section 5.2 of this report. No additional mitigation for indirect surface water impacts are necessary.

5.4.2. Groundwater Changes

The groundwater analysis provides a worst-case evaluation of potential impacts. As indicated in the evaluation, none of the wetlands or watercourses are expected to have decreased function and value as a result of the mining operation. Groundwater impacts are primarily associated with the construction of stormwater ponds that provide infiltration. These ponds provide a long-term source of total dissolved solids and increased temperatures. They also are largely responsible for the potential raising of the groundwater table through focused recharge.

Stormwater swales are proposed to prevent mixing of groundwater and stormwater, improve water quality, and to reduce runoff volumes and flow rates. The need for surface water controls must be balanced with the need to minimize groundwater impacts. Based on this need for balance, the following mitigation is proposed:

Permanent stormwater ponds will be constructed, as shown in the surface water study, around end use groundwater Ponds 1, 2 and 10. In addition, a stormwater pond will be constructed at Pond 8. The stormwater pond will provide storage for runoff from the 2-year, 24-hour precipitation event. This pond will reduce the runoff rate, as compared to pre-construction conditions. This pond location is proposed because it provides the best opportunity to improve the quality of water from a large watershed while minimizing potential groundwater impacts. It minimizes groundwater impacts to the Vermillion River and its tributaries, since the groundwater at this location moves to the north toward the Mississippi River. It is further recommended that the end use groundwater pond at this location be removed to provide adequate space for the stormwater pond and to minimize the potential for groundwater/surface water mixing. All other groundwater pond locations will be surrounded by a shallow swale to maintain stormwater flows and prevent surface water from directly entering the groundwater system. The implementation of these mitigation measures will result in the following:

- Reduce rate and volume of stormwater draining to the Vermillion River Wetlands to more closely mimic existing conditions
- Improve the quality of water entering the Vermillion River Wetlands
- Reduce the simulated TDS, temperature and surface elevation effects on groundwater associated with Ponds 3, 4, 5, 6, 7, 9, and 10.

5.5 Environmental Monitoring and Contingency Plan

In addition to the environmental monitoring and contingency plan outlined in the groundwater impact study, the following is recommended:

- Continue monitoring operations in North Creek and south of Butler Pond (Tributary 1). As necessary, develop monitoring plan that evaluates multiple parameters such as flow, turbidity, sediment, phosphorous, nitrogen and temperature on a more frequent schedule (weekly to monthly). Biological monitoring, such as Stream Watch, should also be considered if appropriate habitat conditions exist.
- Conduct biological monitoring of wetlands at select sites within the Butler Pond wetlands. Utilize MPCA Vegetative and Invertebrate protocol, or other suitable methodology.

6.0 EXECUTIVE SUMMARY

The following section provides a general summary of the Surface Water Impact Study prepared for Empire Township. The contents of each chapter are briefly summarized. However, a significant amount of the information provided in the study is not discussed in this Chapter. It is recommended that the reader review the document in its entirety to understand the methodology, results and conclusions made in preparing the surface water analysis.

6.1 Project Description and Purpose

A consortium of mine operators and landowners propose to open new mines and expand existing aggregate mining areas to include a total area of approximately 3,600 acres in the northwest portion of Empire Township, Dakota County. Mining will be conducted in a similar manner to the current practices at existing mines within and adjacent to the Mining Area.

The various mine operators have investigated the potential for aggregate production in this area. In addition, the Minnesota Geologic Survey (MGS), Minnesota Department of Natural Resources (DNR), Metropolitan Council (METC) and local governments have conducted studies of available mineral aggregates in the metropolitan area. These studies, together with investigations conducted by mining companies, have revealed extensive reserves of mineral aggregates in portions of Empire Township. Over the next 30 to 40+ years the Mining Consortium will remove and process approximately 200 million tons of sand and gravel reserves within the Mining Area.

A Scoping Environmental Assessment Worksheet (Scoping EAW) was prepared for the proposed project in October 2003. Following review of this document, the Minnesota Environmental Quality Board (EQB) designated the review process as a "Related Actions Environmental Impact Statement (EIS)", since multiple companies and property owners are involved. A Scoping Decision Document was published in February 2004 declaring the need for an EIS and an outline of what it would address.

The Scoping Decision Document required that additional analysis be completed for the Mining Area, addressing a number of topics, including surface water. This Impact Study has been prepared to provide an analysis of potential surface water and wetland impacts in the Mining Area, and to identify options for mitigating these potential impacts. The findings of this Impact Study will be incorporated into the forthcoming EIS.

6.2 Project Methodology and Assumptions

The analysis approach for the Empire Township Surface Water Impact Study was to evaluate the existing conditions and proposed mining conditions to determine potential impacts of the mining project on adjacent surface waters and wetlands. Specifically, key surface water features were identified; existing and proposed end use drainage areas were delineated; and a simplified hydrology analysis was performed to determine anticipated stormwater runoff changes to these areas.

The stormwater analysis was performed in accordance with generally accepted professional engineering standard practices based on the project scope of work, reasonable assumptions and data available at the time of the analysis. The following specific methodology and assumptions were used in the hydrology analysis:

- Based on the geography of the site and key surface water features within or adjacent to the project boundaries, the project area was divided into the following four general drainage patterns:

  Interior Ponding Areas – located within the project boundaries

  Vermillion River Wetland – located southeast of the project boundaries and including Butler Pond

  Station Trail Ponding Areas – located northeast of the project boundaries, south of 170th Street and adjacent to Station Trail

  North Creek – located southwest of the project boundaries

- Existing drainage areas and time of concentration values were delineated from two-foot contour mapping generated from May 13, 2003 aerial photography.

- Proposed drainage areas and time of concentration values were delineated from preliminary end use reclamation grading and pond information provided by the Mining Consortium.

- Hydrology modeling was completed for the 2-year, 10-year, 50-year and 100-year, 24-hour, Type II Dakota County storm values using HydroCAD, Version 7.0.

- Due to the conceptual nature of the proposed end-use plans, simplified HydroCad hydrology analysis was completed.

- Existing and end use agricultural land was modeled as Cultivated Agricultural Land with a curve number of 75, based on Hydrologic Soil Group B soils. Developed impervious areas, including buildings and parking lots associated with existing mining areas and the Dakota County Empire Transportation Facility, were modeled as Impervious Developed , 85 percent impervious with a curve number of 92, based on Hydrologic Soil Group B soils.

Farmsteads and roadways were not delineated separately. Other proposed adjacent developments that drain into the proposed mining boundaries, such as the Seed/Genstar Development, were not delineated separately. It is very likely that these developments will be required to manage stormwater on-site and meet pre-existing stormwater flows. The Draft AUAR report for the Seed/Genstar Development indicates that the majority of the development will consist of low density residential units with a curve number of 75, which is the same as the curve number used for cultivated agricultural land (Bonestroo, 2003). Wetlands were identified and characterized based on the Empire Township Wetland Inventory, as well as a site review of select areas in July 2004. The impact criteria for wetlands consisted of the direct impacts of excavation and filling as defined by state and federal regulations. Indirect impact criteria considered were based on the increase or decrease in surface water hydrology, changes to surface water quality, and changes to groundwater discharge characteristics.

Existing data from the DNR, Vermillion River Watershed and Dakota County SWCD were utilized to identify the characteristics and quality of the Vermillion River and its fishery. Potential impacts were identified based on proposed changes to water temperature, flow volumes (both groundwater and surface water), and water quality.

6.3 Existing Conditions

6.3.1. Land Use and Soil Types

The current land use of the proposed Mining Area consists of agricultural and mining uses. A few residential farmsteads and other buildings are also located within the proposed Mining Area. Type B soils were used in the existing and proposed hydrology analyses.

6.3.2. On-Site Interior Ponding Areas

Numerous surface depressions and ponding areas exist within the proposed Mining Area. According to the aerial photography basemapping, some appear to contain standing water while others are only identified as surface depressions.

6.3.3. North Creek

North Creek is located approximately one mile west of the west boundary of the proposed Mining Area. North Creek extends from the City of Lakeville into the City of Farmington and Empire Township where it flows into the Vermillion River, southwest of the proposed Mining Area. The North Creek watershed size is approximately 42 square miles with a mean discharge of 18.8 cfs. The North Creek watershed includes drainage from Lakeville, Farmington, Apple Valley, Rosemount, Burnsville and Empire Township (Barr, 1995; Bonestroo, 1997; Bonestroo, 2003).

6.3.4. Vermillion River

The Vermillion River is located approximately one to two miles south of the southern boundary of the proposed Mining Area. The Vermillion River begins in Scott County and flows into Dakota County, ultimately discharging into the Mississippi River near Hastings, Minnesota. The Vermillion River watershed size is approximately 129 square miles with a mean discharge of 67.5 cfs at the USGS station in Farmington (Bonestroo, 2003).

6.3.5. Empire Wastewater Treatment Plant

The Empire Wastewater Treatment Plant (WWTP) is located within Empire Township, approximately two miles south of the boundary of the proposed Mining Area. The WWTP is located approximately three miles upstream of the Butler Pond area, located southeast of the proposed Mining Area.

The WWTP currently treats approximately 10 million gallons per day and currently discharges directly to the Vermillion River. The effluent discharge from the WWTP generates approximately 16 cfs of flow to the Vermillion River. In 2005 to 2007, construction will expand the WWTP capacity to approximately 24 million gallons per day. The expansion will also include construction of a 13-mile forcemain, relocating the forcemain from the Vermillion River to the Mississippi River. The relocation of the WWTP effluent discharge location will likely result in water quality improvements to the Vermillion River. However, flow to the River will be reduced by approximately 16 cfs, approximately one-fourth of annual mean flow (Metropolitan Council, 2003; O'Donnell, 2004).

6.3.6. Existing Hydrology Analysis

The following descriptions are provided for the subwatershed identified within the Mining Boundary. A summary of the hydrologic analysis is provided in **Table 6-1.**

Interior Ponding Areas

Numerous surface depressions and ponding areas currently exist within the boundaries of the proposed Mining Area. The majority of the existing ponding areas are located in the northern and western portions of the project area, between 160th Street and 170th Street. No outlets from these ponding areas were observed on the basemapping.

For the purposes of this report, Existing Drainage Areas 1 through 7 were classified as interior drainage areas that ultimately drain toward the interior of the proposed Mining Area boundaries, with no outlets, creating ponding areas where evaporation and infiltration will occur. The actual balance between infiltration and evaporation is difficult to predict, however, it is likely that infiltration is significant as the Mining Area is generally underlain by sand and gravel deposits with relatively high infiltration rates.

Existing drainage information for all interior drainage areas within the proposed Mining Area is listed in **Table 6-1** and illustrated on **Figure 3**.

Vermillion River Wetland

A dammed water impoundment (Butler Pond) and wetland area exists at the southeast corner of the proposed Mining Area and continues beyond the proposed Mining Area boundaries, north of the Vermillion River. Drainage Area 8 (DA 8), comprised of numerous ridges and swales, discharges stormwater into this pond

Table 6-1. Existing Drainage Area Hydrology Model Data: Areas 1 - 10

Drainage Area	Size (Acres)	Curve #	Time of Concentration (Minutes)	2-Year, 24-Hour Storm		10-Year, 24-Hour Storm		50-Year, 24-Hour Storm		100-Year, 24-Hour Storm	
				CFS	Acre-Feet	CFS	Acre-Feet	CFS	Acre-Feet	CFS	Acre-Feet
DA1 – Interior	138	76	29	98	8.9	228	19.9	342	29.7	413	35.9
DA2 – Interior	700	75	107	175	40.6	428	93.3	653	140.9	793	170.7
DA3 – Interior	39	75	49	18	2.3	43	5.4	66	8.1	80	9.8
DA4 – Interior	141	75	85	42	8.3	103	19.0	157	28.7	191	34.7
DA5 – Interior	121	76	23	100	7.8	233	17.5	349	26.1	420	31.5
DA6 – Interior	181	75	35	105	10.9	255	25.0	387	37.6	469	45.5
DA7 – Interior	28	75	27	19	1.7	47	3.9	71	5.8	85	7.1
DA8 –Vermillion River Wetland	2,609	75	190	430	141.3	1,031	328.6	1,564	498.3	1,898	604.9
DA9 – Station Trail	465	75	174	80	25.6	196	59.4	299	89.9	364	109.1
DA10 – North Creek	317	75	54	133	19.0	326	43.4	495	65.4	601	79.1

and wetland and ultimately discharges to the Vermillion River. For the purposes of this study, DA 8 will be known as the Vermillion River Wetland drainage area. DA 8 is located in the central and southeastern portions of the proposed Mining Area and extends from north of 170th Street to the southeast corner of the proposed Mining Area. The complete drainage area includes three areas (DA 8A, DA 8B and DA 8C) outside of the proposed Mining Area boundaries that drain into the proposed Mining Area via culverts and swales. These areas are illustrated on **Figure 3** and summarized in **Table 6-1**.

Station Trail Ponding Areas

Two surface depressions or ponding areas are located on the west side of Station Trail, south of 170th Street. Stormwater drains to the southeast and ultimately to the Vermillion River, east of the proposed Mining Area boundaries. A single drainage area from within the proposed Mining Area discharges into the Station Trail Ponding Areas. Therefore, for the purposes of this study, Drainage Area 9 (DA 9), located in the northeast corner of the proposed Mining Area, is labeled as the Station Trail drainage area. Stormwater within the proposed gravel mining boundaries generally drains to the north/northeast via ditches and swales along the south side of 170th Street and Station Trail. The complete drainage area includes one area (DA 9A) outside of the proposed Mining Area boundaries that drains into the proposed Mining Area via a culvert under 170th Street. These areas are illustrated on **Figure 3** and summarized in **Table 6-1**.

North Creek

North Creek is located approximately one mile west of the proposed Mining Area boundaries and connects to the Vermillion River approximately 2.5 miles south of the proposed Mining Area boundaries. A single drainage area from within the proposed Mining Area discharges to North Creek. Therefore, for the purposes of this study, Drainage Area 10 (DA 10) is labeled as the North Creek drainage area. DA 10 is located in the southwestern corner of the proposed Mining Area, on both the east and west sides of the existing Canadian Pacific railroad tracks. Stormwater within DA 10 generally drains to the southwest, toward North Creek, via numerous swales. A surface depression exists on the east side of the existing Canadian Pacific railroad tracks and a culvert directs stormwater under the tracks and west to North Creek. The complete drainage area includes one area (DA 10A) outside of the proposed Mining Area boundaries that drains into the proposed Mining Area. Upon reaching North Creek, stormwater flows southeast and into the Vermillion River. These areas are illustrated on **Figure 3** and summarized in **Table 6-1**.

6.3.7 Existing Wetlands

Ten wetlands are located within the Mining Area, with additional basins located on the perimeter. In total, the Mining Area contains approximately 62 acres of wetlands(See **Table 3-4**). The most extensive wetland areas are located in the southeast section of the Mining Area.

Six of the on-site wetlands are recharge wetlands, and the remaining four are recharge/discharge wetlands. A wetland that is identified primarily as recharge is one that has surface water as the primary source of hydrology, and acts to recharge/infiltrate to the groundwater. A wetland that is identified primarily as recharge/discharge is one that has groundwater and surface water sources of hydrology. These wetlands may alternate between being an area that recharges/infiltrates to the groundwater and one that exhibits groundwater discharge, depending on the climatic conditions.

6.3.8 Designated Trout Streams

In 1988, the conditions of the upper reaches of the Vermillion River had improved substantially, such that they were designated as a cold water fishery. Brown trout and rainbow trout were stocked and found to be naturally reproducing. In 2003, an additional 25 miles of the Vermillion River and tributaries were designated as a cold water fishery. The most recently designated trout stream includes the main stem and short tributaries of the Vermillion River, just south of the Mining Area (**Figure 5**). The surface water drainage areas of North Creek and the Vermillion River Wetland (Tributary 1) are tributary to designated trout streams.

Of the suitable trout habitat of the main stem of the Vermillion River, North Creek, and Tributaries 1 and 2, past studies have found brown trout only in the main stem of the Vermillion River.

6.4 Mining Impact Analysis

6.4.1 Stormwater Impacts During Mining Excavation

Topsoil stripping, removal of overburden soils, removal of other site soils for sale or use in reclamation, grading and mining excavation will disturb the existing site vegetation and create the potential for erosion and sediment transport across all disturbed areas. The greatest potential for impacts associated with erosion and sediment transport occurs during initial grading within drainage areas discharging to the Vermillion River, North Creek and other protected surface waters. As the mining excavation progresses, a new drainage basin will be created and stormwater will drain toward the site interior, thus minimizing the risk of off-site sediment transport.

Stormwater will be captured within the mining excavations, collecting at the low points. Depending on the soil infiltration and atmospheric evaporation rates, stormwater may create temporary ponding areas within the excavations. The ponding areas, varying in location and depth, will essentially function as a combination of infiltration and sedimentation basins, removing the majority of the suspended solids during settling and groundwater infiltration. Due to the relatively high infiltration rate of the sand and gravel within the Mining Area, it is likely that, initially, stormwater will infiltrate rapidly to the groundwater. This is consistent with observations at the existing mining areas within the project boundaries.

Wet mining below the groundwater table is proposed and will likely be completed using a backhoe or dragline. Wet mining will result in the creation of groundwater ponds, formed as groundwater enters the excavations. Site stormwater will be kept separate from these ponding areas, through infiltration ponds or surface water swales to direct water around the ponds. With no outlet, evaporation and groundwater infiltration will occur, however, groundwater infiltration will likely be much slower than it was during excavation above the groundwater table, due to the increased soil pore pressures.

Should localized dewatering be allowed, it would likely be completed utilizing shallow well points or sump pits (SEH 2003). Dewatering discharge will be pumped to on-site sedimentation/infiltration basins with no direct off-site discharge to North Creek, the Vermillion River or other protected surface waters.

6.4.2 Stormwater Impacts During Production Operations

Processing, manufacturing and general operations were outlined in Section 1.1. Approximately five production plant facilities will be located across the proposed Mining Area. Each plant site will require an industrial groundwater supply well, supplying water for production operations. Required flow rates will vary based on specific plant operations. Specifically, water may be used for sand and aggregate washing, concrete product production, equipment maintenance, concrete truck washout and site dust control. Water from the groundwater supply wells will supply water for production operations and be used initially to fill detention ponds. Once the ponds are filled, the groundwater supply wells will supplement recycled site stormwater and wash water, as necessary (Bolton & Menk, Inc., 2004).

Site stormwater, sand/aggregate wash water and concrete truck wash water will typically be treated in a triple stage series of on-site detention ponds at each plant location. The detention ponds will typically be constructed above the groundwater and will essentially function as sedimentation and infiltration ponds, removing the majority of the suspended solids. Pond depths will typically range between 10 feet and 20 feet with pond areas ranging between approximately one and three acres. Stormwater and wash water will enter the on-site detention ponds via overland flow, pressure or gravity piping.

No stormwater or wash water will be discharged directly to North Creek, the Vermillion River or other protected surface waters. Detention ponds created during production operations will not remain inplace upon final site reclamation. Only the end-use ponds shown in **Figure 6** will remain.

6.4.3 Drainage Area Impacts

Upon completion of mining operations, the excavations will be backfilled with unused materials, back-hauled fill, overburden materials and topsoil. The preliminary end use grading plan (**Figure 6**) identifies approximate final grading elevations, location and sizes of the proposed end use ponds. In areas where mining excavations extend below the groundwater table, except at end use pond locations, the excavations will be backfilled with rejected sand, followed by overburden soils and topsoil, to the end-use grades . During reclamation, the proposed Mining Area will be restored to the proposed end use grades and returned to agricultural land.

Eleven end use ponds, with surface areas totaling approximately 240 acres, are proposed across the Mining Area. The pond sizes vary from approximately 6 acres to 90 acres, with depths ranging between approximately 9-feet and 42-feet. The ponds, developed from mining excavations below the groundwater, will consist mainly of groundwater. In areas where end use ponds are proposed, the excavations will not be backfilled and the ponds will fill with groundwater. Typically, the bottom of the groundwater ponds will correspond to the bottom of sand/aggregate deposit with some exceptions.

Separate stormwater ponds and/or ditches, constructed outside of the groundwater ponds and separated by berms, will provide stormwater treatment and prevent direct mixing of stormwater and groundwater, reducing the potential for groundwater contamination. In areas where stormwater drains to the site interior, the stormwater ponds will provide treatment storage, with overtopping into the groundwater ponds occurring only during large storm events. In areas where stormwater drains directly to protected surface waters, perimeter stormwater ponds will function more like ditches, diverting stormwater flows around the groundwater ponds to prevent stormwater/groundwater mixing and minimize flow impacts to the surface waters.

Interior Ponding Areas

Following excavation, grading and end use reclamation, the majority of the existing depressions and ponding areas within the Mining Area will be eliminated. End use grading and final reclamation will result in the creation of three interior stormwater drainage areas and three end use ponds with no outlets to North Creek, the Vermillion River or other protected surface waters. Following reclamation, the interior end use ponds will be located in the western portion of the proposed Mining Area, while the existing depressions and ponding areas are located across the northern and western portions of the proposed Mining Area.

Table 6-2. Stormwater Changes To Interior Ponding Areas and Depressions

Storm Event	Existing Peak Flow (cfs)	Existing Runoff Volume (Acre-Feet)	Change in Peak Flow (cfs)	Change in Runoff Volume (Acre-Feet)
2-Year, 24-Hour	557	80.5	-179	-38.7
10-Year, 24-Hour	1,337	184.0	-422	-88.5
50-Year, 24-Hour	2,025	276.9	-635	-133.1
100-Year, 24-Hour	2,451	335.2	-768	-161.2

Note: Existing Drainage Area is 1,348 Acres. Drainage Area is estimated to decrease in size by 665 acres.

The proposed end use interior drainage area encompasses approximately 693 acres as compared to the existing interior drainage area of approximately 1,348 acres (See **Table 6-2**). Comparison of the existing and end use hydrology analysis indicates that the stormwater runoff volume to the proposed interior end use ponds will be reduced by approximately 50 percent as compared to the runoff volume that currently flows to the existing surface depressions and ponding areas. This change results as mining excavation and grading in the north end of the Mining Area divert stormwater to the south, toward the Vermillion River.

In addition to the interior drainage area changes within the proposed Mining Area boundaries, excavation and grading will reduce the stormwater drainage area of the existing pond, located outside of the proposed Mining Area boundaries on the north end of Existing Drainage Area DA4A. The drainage area will be reduced by approximately 69 percent from approximately 203 acres to 62 acres.

Vermillion River Wetland

Following excavation, grading and end use reclamation, the overall drainage pattern of stormwater flowing to Butler Pond and the Vermillion River Wetland will generally be maintained with some modifications. The main change is the addition of stormwater drainage from Existing Drainage Area DA2, located in the northern portion of the proposed Mining Area. Stormwater from this area will be diverted from the existing depressions or ponding areas to Butler Pond and the Vermillion River Wetland. Additionally, a small portion of stormwater drainage from Existing Drainage Area DA9, located in the northeast corner of the proposed Mining Area, will be diverted to Butler Pond and the Vermillion River Wetland (Drainage Area P8).

The proposed end use Vermillion River Wetland drainage area encompasses approximately 3,267 acres as compared to the existing Vermillion River Wetland drainage area of approximately 2,609 acres. (See **Table 6-3**) Comparison of the existing and end use hydrology analysis indicates that the stormwater runoff volume to Butler Pond and the Vermillion River Wetland will be increased by approximately 13 percent while the peak stormwater flow rates will be decreased by approximately 6 percent. The reduction in peak stormwater flow rates is caused by an increased runoff time-of-concentration due to flatter swale grades associated with mining excavation and grading.

Table 6-3. Stormwater Changes To Butler Pond and Vermillion River Wetland

Storm Event	Existing Peak Flow (cfs)	Existing Runoff Volume (Acre-Feet)	Change in Peak Flow (cfs)	Change in Runoff Volume (Acre-Feet)
2-Year, 24-Hour	430	141.3	-29	+18.6
10-Year, 24-Hour	1,031	328.6	-65	+47.7
50-Year, 24-Hour	1,564	498.3	-85	+75.0
100-Year, 24-Hour	1,898	604.9	-100	+92.6

Note: Existing drainage area is 2,609 acres. Drainage Area is estimated to increase in size by 658 acres.

A preliminary end use plan was evaluated that included stormwater ponding around each of the end use groundwater ponds. This resulted in increased infiltration and limited off-site discharge from each property within the Mining Area. Stormwater analysis indicated a substantial decrease in stormwater runoff flow and volume to Butler Pond and the Vermillion River Wetland area. Stormwater peak flow and runoff volume reductions of approximately 22 percent and 71 percent were observed, respectively. In an attempt to preserve stormwater flows to Butler Pond and the Vermillion River Wetland area, the stormwater ponds were modified to function more like ditches, bypassing stormwater to these areas.

Station Trail Ponding Areas

Following excavation, grading and end-use reclamation, the overall drainage pattern of stormwater flowing to the Station Trail Ponding Areas will generally be maintained with some minor modifications. The main change is the reduction of stormwater drainage from Existing Drainage Area D9, located in the northeastern portion of the proposed Mining Area. Excavation and grading will divert stormwater from a portion of this drainage area to Butler Pond and the Vermillion River Wetland (Proposed Drainage Area P8).

The proposed end use Station Trail drainage area (Proposed Drainage Area P9) encompasses approximately 419 acres as compared to the existing Station Trail drainage area (Existing Drainage Area DA9) of approximately 465 acres (see **Table 6-42**). Comparison of the existing and end use hydrology analysis indicates that the stormwater runoff volume and peak flow rates to the Station Trail Ponding Areas will be reduced by approximately 10 percent.

Table 6-4. Stormwater Changes To Station Trail Ponding Areas

Storm Event	Existing Peak Flow (cfs)	Existing Runoff Volume (Acre-Feet)	Change in Peak Flow (cfs)	Change in Runoff Volume (Acre-Feet)
2-Year, 24-Hour	80	25.6	-8	-2.5
10-Year, 24-Hour	196	59.4	-20	-5.9
50-Year, 24-Hour	299	89.9	-29	-8.9
100-Year, 24-Hour	364	109.1	-36	-10.8

Note: Existing drainage area is 465 acres. Drainage Area is estimated to decrease in size by 46 acres.

North Creek

Following excavation, grading and end-use reclamation, the overall drainage pattern of stormwater flowing to North Creek will generally be maintained with some minor modifications. The main change is the reduction of stormwater drainage from Existing Drainage Area DA10, located in the southwestern portion of the proposed Mining Area. Excavation and grading will divert stormwater from a portion of Existing Drainage Area DA10 to Proposed Drainage Area P5 and End Use Pond 10.

The proposed end use North Creek drainage area (Proposed Drainage Area P5) encompasses approximately 262 acres as compared to the existing North Creek drainage area of approximately 317 acres (See **Table 6-5**). Comparison of the existing and end use hydrology analysis indicates that the stormwater runoff volume and peak flow rates to North Creek will be reduced by approximately 17 percent.

Table 6-5. Stormwater Changes To North Creek

Storm Event	Existing Peak Flow (cfs)	Existing Runoff Volume (Acre-Feet)	Change in Peak Flow (cfs)	Change in Runoff Volume (Acre-Feet)
2-Year, 24-Hour	133	19.0	-23	-3.3
10-Year, 24-Hour	326	43.4	-57	-7.5
50-Year, 24-Hour	495	65.4	-85	-11.4
100-Year, 24-Hour	601	79.1	-105	-13.7

Note: Existing drainage area is 317 acres. Drainage Area is estimated to decrease in size by 55 acres.

A preliminary end use plan diverted stormwater from Drainage Area P10 to a stormwater pond located around the perimeter of End Use Pond 10. This reduced stormwater flows and runoff volumes to North Creek. The proposed end use plan was modified from the preliminary plan to maintain drainage from P10 to North Creek via the existing swale, culvert under the Canadian Pacific railroad tracks and construction of a diversion berm.

6.4.4 Impacts to Wetlands

The proposed mining operation will have direct impacts on seven of the ten wetlands located within the Mining Area, totaling 18 acres. The wetlands in the southeast corner of the Mining Area will be preserved. A final wetland delineation will need to be conducted to refine the wetland impact area prior to mining activities in any wetlands.

Eight wetlands and tributaries are located in proximity to the Mining Area that may experience indirect impacts, such as changes to surface water and/or groundwater characteristics. None of these impacts are anticipated to result in changes to the existing wetland quality, functions or values.

6.4.5 Indirect Impacts to Trout Streams

North Creek

As indicated in the surface water review, peak flows to North Creek would decrease as a result of the mining project. Since the overall watershed is so large, the changes to surface water hydrology within the Mining Area are not expected to substantially alter the hydrology of North Creek. Likewise, the small increase in groundwater discharge and temperature is within the normal seasonal range for the Creek.

Butler Pond Tributary 1
Butler Pond will receive a larger volume of surface water runoff. This increased volume, however, will be characterized by a lower peak flow. The installation of ponding and shallow swales will reduce sediment and nutrient loads to the Butler Pond wetland. The groundwater study identified potential for decreased groundwater discharge and increased temperatures. These changes are minimal, and within the normal seasonal range for the wetland and pond. Butler Pond and the associated wetland complex will buffer potential impacts to the designated trout stream, which is located south of the project site. No impacts to the designated trout stream are anticipated.

Vermillion River
The Vermillion River is located approximately two miles to the south of the Mining Area. The surface water drainage to the Vermillion River will increase slightly (557 acres) as a result of the proposed project. This increase is due to the redirection of isolated interior drainage basins to Butler Pond. Since the Vermillion River watershed is over 82,500 acres, the change represents less than 0.7 percent increase. The majority of the surface water changes will be buffered by Butler Pond

The Groundwater Impact Study clearly illustrates a groundwater divide within the Mining Area. Most of the groundwater within the Mining Area moves north toward the Mississippi River. Only a small portion of the site's groundwater moves toward the Vermillion River. As illustrated in the Groundwater Impact Study, which is a worst case analysis, none of the impacts illustrated reach the Vermillion River. Based on this evaluation, the proposed project is expected to have negligible impacts to surface and groundwater within the immediate project area. No impacts are anticipated to occur to the trout habitat or water quality of the Vermillion River.

6.5 Mitigation

6.5.1 National Pollutant Discharge Elimination (NPDES) Permit and Stormwater Pollution Prevention Plan (SWPPP) Requirements

The complete list of required project permits is identified within the Scoping Environmental Worksheet. In addition to the other permits identified, mining and production activities will follow regulations established within Phase 2 of the National Pollutant Discharge Elimination System (NPDES) Permit, administered by the Minnesota Pollution Control Agency (MPCA). The program regulates stormwater discharges from construction sites, industrial facilities, municipalities and other sites. Each mining operator will be required to apply for or amend an NPDES Permit and comply with the permit requirements.

Prior to applying for or amending an NPDES permit, each mining operator must complete a Stormwater Pollution Prevention Plan (SWPPP). For all projects greater than 50 acres that discharge to Special Waters, the NPDES permit requires review by the MPCA, in addition to review by local permitting authority, at least

30 days prior to the project start. Generally, the SWPPP should be submitted early in the project-planning phase, typically at the 30 percent design level.

Portions of North Creek, the Vermillion River and all tributaries are designated trout streams by the DNR and as Special Waters by the PCA. However, the designated areas are more than 2000 feet from the Mining Area, thus special permit requirements are not applicable or necessary.

The SWPPP is a combination of narrative and plans, including appropriate details that describe the proposed construction activity and address the potential for erosion, sediment and pollutant discharge from the site and preventative mitigation measures. The SWPPP must be incorporated in the final project plans and specifications and must address implementation, installation, inspection and maintenance of the control measures. Specifically, the SWPPP includes the following elements (University of Minnesota, 2003-2004):

- Temporary erosion prevention and sediment control Best Management Practices (BMPs)
- Permanent erosion prevention and sediment control Best Management Practices (BMPs)
- Permanent stormwater management system
- Pollution prevention management measures

6.5.2 Best Management Practices

BMPs for surface water management, erosion and sediment control shall be utilized during mining, production and reclamation activities to protect on-site and adjacent surface waters and wetlands. All NPDES permit regulations shall be followed. It is anticipated that the following BMPs will be used throughout the project:

- Proactive Planning and Phasing of Mining, Production and Reclamation Operations
- Maintain Existing Stormwater Drainage Patterns
- Erosion Control Measures, such as temporary and permanent vegetation establishment
- Sediment Control Measures, such as silt fence, ditch checks, temporary sediment basins
- Permanent Stormwater Management System, such as wet detention ponds, infiltration basins
- Dewatering and Basin Draining
- Pollution Prevention Measures
- Inspections and Maintenance

6.5.3 Mitigation for Direct Wetland Impacts

In accord with the State and Federal wetland regulations, each mine operator will need to provide a detailed wetland delineation and mitigation plan for the direct wetland impacts. All wetlands within the Mining Boundary will be affected through excavation, with the exception of wetlands 15-NW-01, 15-SW-01 and 16-SW-01 in the southeast corner of the site. These wetlands are near the groundwater elevation and have minimal aggregate deposits and have been identified by the Mining Consortium as areas within the Study Area that will not be disturbed by mining activities.

State regulations require that wetland mitigation be completed at a 2:1 ratio. Given that 18 acres of wetland will be directly impacted, the mitigation requirement is 32 acres. This can be completed through creation and/or restoration of 18 acres of wetland plus creation, preservation or restoration of 18 acres of stormwater ponds and upland buffers.

The current end use plan includes nearly 240 acres of ponding. These areas could be designated and constructed to meet the mitigation requirements for on-site wetland losses. Additional mitigation, in the form of wetland restoration and upland buffer establishment, could be provided at select areas within the Mining Area.

6.5.4 Mitigation for Indirect Wetland and Watercourse Impacts

As indicated in the surface water impact evaluation, wetlands and water courses with potential indirect impacts are expected to maintain their existing functions and values during the mining operation and post reclamation.

On a broad scale, the most substantial indirect impact is the increase in the size of the watershed area draining to Butler Pond. This change is associated with an increase in flow volume to the receiving waters and wetlands. Although this change is anticipated to have a minor impact, there is opportunity to reduce the flows to Butler Pond by creating additional stormwater ponds in the upstream watershed. Construction of stormwater ponding within the mining area will reduce the potential for sediment and nutrient loads to surface waters and wetlands.

The groundwater analysis provides a worst-case evaluation of potential impacts. As indicated in the evaluation, none of the wetlands or watercourses are expected to have decreased function and value as a result of the mining operation. Groundwater impacts are primarily associated with the construction of stormwater ponds that provide infiltration. These ponds provide potential for a long-term source of total dissolved solids and increased temperatures, as well as potential raising of the groundwater table through focused recharge.

Stormwater swales are proposed to prevent mixing of groundwater and stormwater, improve water quality, and to reduce runoff volumes and flow rates. The need for surface water controls must be balanced with the need to minimize groundwater impacts. Based on this need for balance, the following mitigation is proposed:

- Permanent stormwater ponds will be constructed, as shown in the surface water study, around end use groundwater Ponds 1, 2 and 10.
- A stormwater pond will be constructed at Pond 8 to reduce the runoff rate and improve water quality within the Butler Pond watershed.
- It is further recommended that the end use groundwater pond associated with Pond 8 be eliminated to provide adequate space for the stormwater pond and to minimize the potential for groundwater/surface water mixing.
- All other groundwater pond locations will be surrounded by a shallow swale to maintain stormwater flows and prevent surface water from directly entering the groundwater system.
- Wetland creation will be coordinated with the design of stormwater ponds and swales to meet mitigation requirements for wetland impacts.

6.5.5 Environmental Monitoring and Contingency Plan

In addition to the environmental monitoring and contingency plan outlined in the groundwater impact study, the following is recommended:

- Continue monitoring operations in North Creek and south of Butler Pond (Tributary 1). As necessary, develop monitoring plan that evaluates multiple parameters such as flow, turbidity, sediment, phosphorous, nitrogen and temperature on a more frequent schedule (weekly to monthly). Biological monitoring, such as Stream Watch, should also be considered if appropriate habitat conditions exist.
- Conduct biological monitoring of wetlands at select sites within the Butler Pond wetlands. Utilize MPCA Vegetative and Invertebrate protocol, or other suitable methodology

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APPENDIX A

APPENDIX B