Mahler Aggregate Mine

Environmental Assessment Worksheet

July 31, 2019

Responsible Governmental Unit (RGU)

City of Hanover
11250 5th Street NE
Hanover, MN 55341
www.hanovermn.org

City of Hanover
11250 5th Street NE
Hanover, MN 55341
www.hanovermn.org

Memo

To: Minnesota Environmental Quality Board
Environmental Review Distribution List

From: Cindy Nash, City Planner

Date: August 5, 2019

Subject: Mahler Aggregate Mine EAW

As the Responsible Governmental Unit (RGU), the City of Hanover is issuing this Environmental Assessment Worksheet (EAW) for Mahler Aggregate Mine. The public comment period on this EAW begins when the public notice is published in the Minnesota Environmental Quality Board (EQB) Monitor on August 12, 2019. A public notice is being submitted for publication in the Wright County Journal Press. A public hearing will be held at the City of Hanover Planning Commission meeting on August 26, 2019. Public comments on this EAW will be accepted by the City of Hanover until 4:30pm on September 11, 2019.

Environmental Assessment Worksheet (EAW)

Mahler Aggregate Mine

CONTENTS

TABLES

FIGURES

APPENDICES

Environmental Assessment Worksheet (EAW)

Mahler Aggregate Mine

This Environmental Assessment Worksheet (EAW) form and EAW Guidelines are available at the Environmental Quality Board's website at: http://www.eqb.state.mn.us/EnvRevGuidanceDocuments.htm. The EAW form provides information about a project that may have the potential for significant environmental effects. The EAW Guidelines provide additional detail and resources for completing the EAW form.

Cumulative potential effects can either be addressed under each applicable EAW Item, or can be addresses collectively under EAW Item 19.

Note to reviewers: Comments must be submitted to the RGU during the 30-day comment period following notice of the EAW in the *EQB Monitor*. Comments should address the accuracy and completeness of information, potential impacts that warrant further investigation and the need for an EIS.

1. Project Title: **Mahler Aggregate Mine**

2. Proposer:	Fehn Companies, Inc.	**RGU:**	City of Hanover
Contact person:	Gary Fehn	Contact person:	Cindy Nash
Title:	President	Title:	City Planner
Address:	5050 Barthel Industrial Drive	Address:	11250 5th Street NE
	Albertville, MN 55301		Hanover, MN 55341
Phone:	(763) 497-2428	Phone:	(763) 497-3777
Fax:	(763) 497-3893	Fax:	(763) 497-1873
Email	gfehn@fehncompanies.com	Email	cnash@collaborative-planning.com

4. Reason for EAW Preparation

Required:
- ☐ EIS Scoping
- ☑ Mandatory EAW

Discretionary:
- ☐ Citizen petition
- ☐ RGU discretion
- ☐ Proposer initiated

If EAW or EIS is mandatory give EQB rule category subpart number(s) and name(s):

Minnesota Rules Part 4410.4300, Subp. 12.B. (Nonmetallic mineral mining: sand, gravel, or stone)

5. Project Location

County: Wright County, Minnesota
City/Township: City of Hanover
PLS Location (¼, ¼, Section, Township, Range): Part of the W ½ of Section. 30, T120N, R23W, and part of the SE ¼ of Section 25, T120N, R24W
Watershed (81 major watershed scale): North Fork Crow River (18)
GPS Coordinates: 45.170586, -93.645404
Tax Parcel Number(s): 114-800-302400, 108-500-303200, 108-500-303300, 108-500-254200, and 108-500-254400

At a minimum attach each of the following to the EAW:

- *County map showing the general location of the project;*
- *U.S. Geological Survey 7.5 minute, 1:24,000 scale map indicating project boundaries (photocopy acceptable); and*
- *Site plans showing all significant project and natural features. Pre-construction site plan and post-construction site plan.*

6. Project Description

a. Provide the brief project summary to be published in the EQB Monitor, (approximately 50 words).

Mahler Aggregate Mine is a proposed 130-acre expansion of an existing 25-acre aggregate mine located on 184.9 acres of land in the City of Hanover. The operation will include sand and gravel mining, a wash plant, concrete recycling, and stormwater management.

b. Give a complete description of the proposed project and related new construction, including infrastructure needs. If the project is an expansion include a description of the existing facility. Emphasize: 1) construction, operation methods and features that will cause physical manipulation of the environment or will produce wastes, 2) modifications to existing equipment or industrial processes, 3) significant demolition, removal or remodeling of existing structures, and 4) timing and duration of construction activities.

The Mahler Aggregate Mine will expand an existing gravel mine from 25 acres up to 155 acres. The 184.9-acre project area is located in City of Hanover, Wright County, Minnesota (**Figure 1**). The 130-acre mining expansion area is mostly cropland that has been under intensive agricultural use for decades. Areas of natural vegetation may also be affected. The eastern part of the project area includes the Crow River, natural vegetation, wetlands, and steep slopes, floodplain, and a shoreland overlay district. A 345-kV overhead transmission line runs diagonally northwest-southeast through the site (**Figure 2**). The project is located in an area of known aggregate resources (**Figure 3**) and most surface soils are sandy loams. The project area has 48 feet of topographic relief, with slopes that range from less than 1% to 34%. The highest elevation is 926 feet above mean sea level (msl), located in the northwestern part of the site. The lowest elevation, at 878 feet, is at edge of the Crow River. With few exceptions, the site generally drains toward the Crow River.

The project is located in Section 30, T120N, R23W , and Section 25, T120N, R24W (**Figure 2**). The project area is bordered on the north by 15th Street NE, a separate aggregate mining operation, and the City of St. Michael (**Figure 3**). The project is bordered on the east by the Crow River and Crow-Hassan Park Reserve; on the south by Riverside County Park and agricultural land; and on the west by single-family residential, rural residential, and River Road NE/Lander Avenue NE.

Expansion of the existing aggregate mine will start in the fall of 2019 and be phased over 15 to 20 years, depending on the demand for aggregate and market conditions. All phases of mining combined will ultimately cover up to 155 acres. Each of five phases will cover about 25 to 40 acres. The number of phases will be determined by the demand earthen materials and the pace of mining. Mining will generally be phased from the existing mine to the west and then to the south. Stormwater systems will be constructed at the start of each phase. Stormwater basins will be

periodically maintained or reclaimed and moved to new locations as mining advances through the site.

Approximately 130 additional acres of the site will be excavated for gravel extraction (**Figure 4, Appendix A**). Mining is expected to eventually remove approximately 4 million cubic yards of aggregate material over the 15- to 20-year project lifespan. Mining will remove sand and gravel to a depth of about 20 feet, leaving the reclaimed mined surface at least 10 feet above the groundwater level. Stormwater ponds, infiltration basins, and wash ponds may be located lower, but will be at least 3 feet above corresponding groundwater levels. Slopes at edges of mined areas will be as steep as 3:1, but these slopes will be flattened to at least 5:1 slopes during reclamation (**Figure 5**).

Aggregate mining will be conducted using front-end loader extraction, screening, crushing, washing, and stockpiling. The primary access will be from the northwest corner of the site. Aggregate mining equipment will be portable and will be moved across the site while mining is occurring. The aggregate mine will include a portable concrete recycling plant, a portable screening and crushing operation, and an aggregate wash plant. Concrete recycling will occur intermittently, about twice per year during the construction season and is not expected to exceed 50,000 cubic yards of recycled material per year. Portable crushing machinery will be positioned at relatively low elevations in the gravel pit to maximize the vertical distance and buffer from neighboring land uses.

The washing operation will use excavated ponds that will typically be filled with 3 to 4 feet of water pumped from an onsite well. Water will be allowed to infiltrate back into the native soils after washing operations are completed. The wash plant will include three ponds: an initial pond to catch fine native soil materials and two secondary ponds for water quality treatment and infiltration.

The project is expected to convert about 119.5 acres of cropland, 13.8 acres of grassland-shrubland mix, 0.5 acre of woodland, and up to 0.5 acre of wetland to reclaimed aggregate mine, temporary grassland, and stormwater basins. The mined area will be planted to temporary grassland as part of reclamation. Best Management Practices (BMPs) will be implemented to protect water quality and reduce the potential for soil erosion and sedimentation.

Vehicles will access the mine from 15th Street NE, and will access 15th Street from River Road NE/Lander Avenue NE. Traffic generated by the project include passenger vehicles and trucks hauling earthen material. Haul routes will follow county and state roadways that are collectors and arterials as much as possible. The Traffic Study concluded that area intersections operate at acceptable Levels of Service under existing and proposed (year 2020) conditions. The project is expected to have minimal impact on the area roadway network.

Measures to reduce effects on adjoining properties will include setbacks from property lines and creation of topsoil berms to deflect noise and provide a visual barrier. Mining activity will be setback 200 feet from property lines that adjoin residential uses and 100 feet from property lines with agricultural uses. Mining activity will be setback 30 feet from high voltage transmission line towers. Topsoil will be separated during mining and used to construct berms up to 10 feet high along property lines. Topsoil stockpiles and berms will be seeded and stabilized to prevent erosion.

Boulders and other oversized aggregate materials that are not crushed will be stockpiled and utilized as reclamation features or disposed of in the pit during the reclamation process.

There are no permanent structures existing in the project area and none are proposed or planned in the area in association with mining activity. The nearest noise receptors are the residential lots located west of the site. Measures to reduce noise and increase screening from neighbors include limiting work hours, setbacks from residential property lines, 10-foot high topsoil berms along property lines, and placement of the portable crusher at lower elevations. These measures will provide help mitigate effects of noise and dust.

Hours of mining operation will be limited to between 7:00am and 7:00pm, Monday through Friday. Mining will not be conducted in the shoreland overlay district or the floodplain of the Crow River, but the project may include stormwater features and future trails in the floodplain. A future trail along the Crow River is expected to be connected to a trail to the north in St. Michael.

The project area includes one 2.24-acre parcel of land (PID 114-800-302400) that was located in the City of St. Michael until recently. The Cities of Hanover and St. Michael approved a joint resolution to concurrently detach this parcel from St. Michael and annex it into Hanover. This concurrent detachment and annexation was approved by the Minnesota Office of Administrative Hearings on July 26, 2019, so the parcel is now part of the City of Hanover rather than St. Michael. The parcel contains agricultural field, has a wooded boundary, is located in floodplain, and could be used for stormwater treatment and a future trail connection.

Each phase of mining will be reclaimed with relatively gradual slopes consistent with City of Hanover requirements. These slopes will be suitable for future land uses such as temporary grassland or new single-family residential development (**Figure 5**). Reclaimed areas will be regraded to make slopes more gradual and to balance earthwork for future land uses.

c. *Project magnitude:*

Table 1. Project Magnitude

Characteristic	Number of Units
Total Project Acreage	184.9
Linear project length	NA
Number and type of residential units	0
Commercial building area (square feet)	0
Industrial building area (square feet)	0
Institutional building area (square feet)	0
Other uses – specify (acres)	130-acre expansion of nonmetalic mineral mining: (sand and gravel)
Structure height(s) (feet)	NA

d. Explain the project purpose; if the project will be carried out by a governmental unit, explain the need for the project and identify its beneficiaries.

The purpose of the Mahler Aggregate Mine is to respond to the need for gravel, sand, and aggregate materials to supply construction projects in the area. The project will be carried out by a private entity.

e. Are future stages of this development including development on any other property planned or likely to happen? ☐ Yes ☑ No
If yes, briefly describe future stages, relationship to present project, timeline and plans for environmental review.

Future stages are not planned or likely.

f. Is this project a subsequent stage of an earlier project? ☑ Yes ☐ No
If yes, briefly describe the past development, timeline and any past environmental review.

The project is an expansion of an existing mining operation initially approved by the City of Hanover under an Interim Use Permit (IUP) issued to Mahler Enterprises, LLC for a 37-acre parcel in 2006. The IUP was originally scheduled to expire on December 31, 2012. The Hanover City Council amended the IUP in 2011 and 2018, extending it until August 31, 2019. The existing mining area covers about 25 acres and has not undergone any past environmental review.

7. Cover Types

Estimate the acreage of the site with each of the following cover types before and after development:

Table 2. Cover Types

Land Cover	Before (acres)[1]	After (acres)[2]
Cropland	119.5	0.0
Aggregate mine	25.0	0.0
Grassland-Shrubland mix	16.1	2.3
Grassland and Reclaimed aggregate mine	1.3	151.3
Woodland	11.7	11.2
Crow River	8.5	8.5
Wetlands	1.4	0.9
Lawn and landscaping	0.0	4.0
Impervious surface (road)	1.4	2.0
Stormwater features	0.0	4.7
Totals	184.9	184.9

[1] Existing impervious surface includes part 15th Street NE.

[2] After development wetland acreage assumes up to 0.5 acre of wetland impact and replacement via wetland banking credits located offsite.

Existing cover types are shown on **Figure 6**. Delineated wetlands are shown on **Figure 7**.

8. Permits and Approvals Required

List all known local, state and federal permits, approvals, certifications and financial assistance for the project. Include modifications of any existing permits, governmental review of plans and all direct and indirect forms of public financial assistance including bond guarantees, Tax Increment Financing and infrastructure. All of these final decisions are prohibited until all appropriate environmental review has been completed. See Minnesota Rules, Chapter 4410.3100.

Table 3. Permits and Approvals Required

Unit of Government	Type of Application	Status
City of Hanover	EAW Decision	To be applied for
City of Hanover	Mining Interim Use Permit	To be applied for
City of Hanover	Grading Permit	To be applied for
City of Hanover	Stormwater Management and Erosion Control Approval	To be applied for
Wright SWCD	Wetland No-Loss Determination or Replacement Plan Approval	To be applied for if needed
Minnesota Department of Natural Resources	Water Appropriation Permit	To be applied for if needed
Minnesota Pollution Control Agency	NPDES/SDS General Permit	To be applied for
Minnesota Pollution Control Agency	Air Emissions Permit	To be applied for if needed
U. S. Army Corps of Engineers	No-Loss Determination or Nationwide Permit	To be applied for if needed

Cumulative potential effects may be considered and addressed in response to individual EAW Item Nos. 9-18, or the RGU can address all cumulative potential effects in response to EAW Item No. 19. If addressing cumulative effect under individual items, make sure to include information requested in EAW Item No. 19

9. Land Use

a. Describe:
   i. Existing land use of the site as well as areas adjacent to and near the site, including parks, trails, prime or unique farmlands.

The project area has been in agricultural use since at least the 1930s. Crops grown on the site have typically included corn and soybeans. Surrounding land uses include agricultural cropland, single-family residential, aggregate mining, and parkland (**Figure 3**). A 345-kV overhead transmission line runs northwest-southeast across the middle of the site.

Farmland ratings for soils mapped in the project area are listed in **Table 5** under **Item 10b** of this EAW. Of the 11 soil map units present in the project area, three are prime farmland, four are not prime farmland, one is prime farmland if not flooded, and three are farmland of statewide importance. Soils mapped as prime farmland cover 60% of the site. Alternatives to conversion of

prime farmland are limited because the project area is guided for residential use. The Web Soil Survey indicates that farmland classifications are intended to identify soils best suited to food, feed, fiber, forage, and oilseed crops. Prime farmland preservation measures have not been considered.

ii. Plans. Describe planned land use as identified in comprehensive plan (if available) and any other applicable plan for land use, water, or resources management by a local, regional, state, or federal agency.

The City of Hanover 2040 Comprehensive Plan shows the site guided for Neighborhood Residential use. The City of Hanover Functional Classification roadway map shows 15th Street and River Road classified as collector roadways, and a future collector roadway located near the north and east boundaries of the site. The Park and Trail map shows a proposed trail located along the Crow River and a future neighborhood park located south of the site, adjacent to or northwest of Riverside Park.

iii. Zoning, including special districts or overlays such as shoreland, floodplain, wild and scenic rivers, critical area, agricultural preserves, etc.

The City of Hanover Zoning Map shows the area zoned R-1 (Neighborhood Residential). The project area is not within or adjacent to a wild and scenic river, critical area, or agricultural preserve.

Shorelands

Approximately 29.19 acres of the 184.9-acre project area (15.8%) falls within the Shoreland Overlay District of the Crow River, which is a MN DNR public watercourse with a general development shoreland classification. The limits of MN DNR jurisdiction on the Crow River correspond to the edge of the bank of the channel. The Shoreland Overlay District extends 300 feet from the edge of the bank of the channel, or to the landward extent of the floodplain, whichever is greater (**Figure 8**).

The Shoreland Overlay District is administered under the City of Hanover Shoreland Management Overlay District Ordinance, which is intended to guide the wise development and use of shorelands for the preservation of water quality, natural characteristics, economic values, and the general health, safety and welfare of all public waters in the City. The State Legislature has delegated responsibility to local governments of the state to regulate the subdivision, use, and development of the shorelands of public waters.

The City of Hanover Mining Ordinance does not allow mining in shorelands or floodplains. The proposed project will not include any permanent structures, platting of residential lots, mining, or stockpiles of earthen material in the shoreland or floodplain of the Crow River. Construction activities in the shoreland and floodplain will be limited to stormwater management features and future recreational trails.

The project will comply with the Shoreland Management Overlay District Ordinance, which regulates use the Crow River shoreland in the following ways:

1. structures shall be setback at least 75 feet from the edge of the bank of the channel;

2. natural vegetation shall be preserved insofar as practical and reasonable to retard surface runoff, soil erosion, and excess nutrients;
3. clear cutting shall be prohibited, except as necessary for public roads, utilities, structures, and parking;
4. natural vegetation shall be restored insofar as feasible after construction projects;
5. selective cutting of trees and underbrush shall be allowed as long as sufficient cover is left to screen motor vehicles and structures when viewed from the water;
6. grading and filling shall limit the amount and time of bare ground exposure to the smallest and shortest time feasible by using temporary ground cover such as mulch and permanent vegetative cover; and
7. erosion and sediment control shall be implemented, and fill shall be stabilized to accepted engineering standards.

Review of two-foot contour mapping indicated the Crow River shoreland includes steep slopes, but the shoreland within the project area does not include any bluff. Cross-sections indicate the steepest slopes facing the Crow River range from 24 to 28%. As indicated under **Item 10.b**, about 4.9% of the project area (9.06 acres) has slopes of 12 to 18%, and about half of this area is located within the shoreland. Except for potential future trails and stormwater features, the shoreland will be maintained as open space with natural vegetation. The increase in impervious area due to future trails in the shoreland is expected to be less than 4%.

Floodplains

The Flood Insurance Rate Map (FIRM) panel number 27053C0017F, revised on November 4, 2016 by the Federal Emergency Management Agency (FEMA), shows that the eastern 24.08 acres of the project area falls in Flood Zone AE (special flood hazard area inundated by 100-year flood, base flood elevation determined) (**Figure 8**).

The project will not involve mining in the floodplain, floodplain impact, and effects on flood conveyance. Construction in the floodplain will be limited to stormwater features and future trails.

b. Discuss the project's compatibility with nearby land uses, zoning, and plans listed in Item 9a above, concentrating on implications for environmental effects.

The project is compatible with the City of Hanover 2040 Comprehensive Plan, the City of Hanover Zoning Map, and surrounding land uses, which include agricultural, residential, mining, and park. Mining will be setback 200 feet from adjacent residential land uses and 100 feet from agricultural land uses. The project area is zoned RA (Residential Agriculture) and R-1 (Neighborhood Residential). Land filling and excavation is a permitted use in both zoning districts.

c. Identify measures incorporated into the proposed project to mitigate any potential incompatibility as discussed in Item 9b above.

The proposed project will incorporate mitigation measures to minimize environmental effects. Land use mitigation measures will include setbacks and temporary berms constructed of salvaged topsoil.

10. Geology, Soils and Topography / Land Forms

a. Geology - Describe the geology underlying the project area and identify and map any susceptible geologic features such as sinkholes, shallow limestone formations, unconfined/shallow aquifers, or karst conditions. Discuss any limitations of these features for the project and any effects the project could have on these features. Identify any project designs or mitigation measures to address effects to geologic features.

The Geologic Atlas of Wright County, Minnesota (University of Minnesota Geological Survey 2013) indicates that Wright County has a thick cover of Quaternary sediments and that bedrock outcrops do not exist in Wright County. The thick surficial sediments overlying bedrock consist of postglacial alluvial sediments that are dominated by loams and clay loams in the project area. The depth to bedrock in the project area is approximately 51 to 100 feet.

The Minnesota Well Index indicates eight registered water wells are located within about 0.25 miles of project area. These include six domestic water wells, one irrigation well, and one test well (**Table 4, Appendix B**). These wells were drilled to depths ranging from 63 to 405 feet and had static water levels ranging from 8 to 65 feet below the surface. Bedrock was encountered in five wells at depths of 75 to 85 feet below the surface. The only known nearby sources of contamination identified in well logs were septic drain fields. These wells are listed and discussed further under **Item 11.a.ii.**

Table 4. Water Wells located near the Project Area

Well No.	Use	Surface Elevation (feet)	Depth (feet)	Cased Depth (feet)	Depth to		Direction from Site	Aquifer
					Static Water Level (feet)	Bedrock (feet)		
124114	Domestic	907	63	59	50	--	North[1]	Quaternary buried
503233	Domestic	926	100	95	46	--	West[1]	Quaternary buried
426321	Domestic	926	146	142	8	--	West	Quaternary buried
481754	Domestic	916	130	89	45	80	South[1]	Tunnel City
149420	Domestic	924	111	96	30	80	South[1]	St. Lawrence-Tunnel City
114358	Test well	935	405	156	35	85	East	Tunnel City-Mt. Simon
728665	Irrigation	935	300	150	38	75	East	Tunnel City
761709	Domestic	950	155	107	65	78	East	Tunnel City

[1]These are the four wells nearest to the project area.

Neither the Geologic Atlas nor the Soil Survey of Wright County identify sinkholes, or karst conditions in the project area. Minnesota Karst Lands Mapping and Sinkhole Mapping prepared by

Professor Calvin Alexander and others (2006), do not show karst lands or sinkholes to exist in Wright County. Geologic limitations for site development are not known to exist in the project area.

b. Soils and topography - Describe the soils on the site, giving NRCS (SCS) classifications and descriptions, including limitations of soils. Describe topography, any special site conditions relating to erosion potential, soil stability or other soils limitations, such as steep slopes, highly permeable soils. Provide estimated volume and acreage of soil excavation and/or grading. Discuss impacts from project activities (distinguish between construction and operational activities) related to soils and topography. Identify measures during and after project construction to address soil limitations including stabilization, soil corrections or other measures. Erosion/sedimentation control related to stormwater runoff should be addressed in response to Item 11.b.ii.

The Web Soil Survey indicates the project area includes 11 soil mapping units that consist mostly of sandy loam soils (**Table 5** and **Figure 9**).

Table 5. Soil Classifications

Symbol	Soil Name	% of Area	% Hydric	Hydric Category	Farmland Category
247	Linder loam, 0-2% slopes	0.5	10	Predominantly non-hydric	Prime farmland
294A	Rasset sandy loam, 0-2% slopes	50.9	0	Non-hydric	Prime farmland
327A	Dickman sandy loam, 0-2% slopes	3.3	5	Predominantly non-hydric	Farmland of statewide importance
327B	Dickman sandy loam, 2-6% slopes	12.6	5	Predominantly non-hydric	Farmland of statewide importance
603	Hanlon fine sandy loam, 0-2% slopes, occasionally flooded	8.6	20	Predominantly non-hydric	Prime farmland
1030	Pits, gravel-Udipsamments complex	0.9	0	Non-hydric	Not prime farmland
1066B	Malardi-Hawick complex, 1-6% slopes	8.7	0	Non-hydric	Farmland of statewide importance
1066C	Malardi-Hawick complex, 6-12% slopes	4.0	0	Non-hydric	Not prime farmland
1066E	Malardi-Hawick complex, 18-35% slopes	4.9	0	Non-hydric	Not prime farmland
1197	Suckercreek fine sandy loam, 0-2% slopes, occasionally flooded	1.8	90	Predominantly hydric	Prime farmland if not flooded
W	Water	4.0	0	NA	Not prime farmland

These soils have varying levels of limitations for dwelling units and local streets due to factors such as slope, depth to saturation, flooding, and frost action. Depth to saturation may be associated with wetlands, which are addressed under **Item 11.a.i** below. Soils in the project area are considered moderately susceptible to the sheet and rill erosion by water, as indicated by slopes and K factors that range between 0.20 and 0.32.

Excavation and grading operations for aggregate mining are expected to affect a total of 155 acres and involve removal of about 4 million cubic yards of aggregate material over the next 15 to 20 years. Mining is expected to avoid disturbance of shorelands, floodplains, wetlands, and most woodlands, which together cover about 29.19 acres within the project area.

Elevations in the project area range from 926 feet at the highest point in the northwestern part of the project area to 878 feet at the lowest point adjacent to the Crow River. Review of topographic and soils mapping indicates the site includes about 9.06 acres of slopes that equal or exceed 12% (**Table 5, Figures 2 and 9**).

The potential for groundwater contamination as a result of the proposed project is estimated to be low because various precautions will be taken with vehicle fuels and lubricants as described under **Item 12c**. The project geology indicates the potential for groundwater contamination could be fairly high because the coarse aggregate soils will be exposed, and because mining will lower the ground surface so that it is closer to the groundwater level. Sensitivity of groundwater systems to pollution is related to the approximate time it takes water to infiltrate the land surface and percolate to groundwater. Although the infiltration and percolation time is relatively short, the potential for groundwater contamination is considered relatively low because the possibility of uncontrolled contaminant spills is also low.

NOTE: For silica sand projects, the EAW must include a hydrogeologic investigation assessing the potential groundwater and surface water effects and geologic conditions that could create an increased risk of potentially significant effects on groundwater and surface water. Descriptions of water resources and potential effects from the project in EAW Item 11 must be consistent with the geology, soils *and topography/land forms and potential effects described in EAW Item 10.*

11. Water Resources

a. Describe surface water and groundwater features on or near the site in a.i. and a.ii. below.

i. Surface water - lakes, streams, wetlands, intermittent channels, and county/judicial ditches. Include any special designations such as public waters, trout stream/lake, wildlife lakes, migratory waterfowl feeding/resting lake, and outstanding resource value water. Include water quality impairments or special designations listed on the current MPCA 303d Impaired Waters List that are within 1 mile of the project. Include DNR Public Waters Inventory number(s), if any.

The project area includes about 1.4 acres of wetland distributed among four wetland basins that are located at the toe of the steep slope in floodplain near the Crow River. The project area also includes about 3,400 linear feet and 8.5 acres of the Crow River. There are no impaired waters listed by the Minnesota Pollution Control Agency (MPCA) that are located within 1 mile of the site.

Kjolhaug Environmental Services (KES) inspected the site and delineated wetlands on April 30, 2019 (**Figure 7, Table 6)**. None of the delineated wetlands correspond to areas shown as wetlands on the National Wetlands Inventory (NWI). Wetlands shown on the NWI include only the Crow River and small parts of adjacent woodland (**Figure 7**). All four of the delineated wetlands are located in the area mapped as predominantly hydric soils (**Figure 9, Table 5**), which covers only 1.8% of the project area (3.33 acres). There are no listed or mapped trout streams/lakes, wildlife

lakes, migratory waterfowl feeding/resting lakes, or outstanding resource value waters in or near the project area.

Table 6. Wetlands and Water Resources

Map ID	Acres Onsite	Classification			Dominant Vegetation	
		Circ. 39	Cowardin	Eggers and Reed	Wetland/Water	Upland
1	1.2369	1/2	PEMA/Bf	Seasonally flooded basin/Wet meadow	Reed canary grass, tilled cropland, some dogwood shrubs, boxelder	Bur oak, green ash, cottonwood, boxelder, buckthorn, prickly ash, tilled cropland
2	0.1051	1L	PFO1A/ PEMA	Bottomland hardwoods/ Seasonally flooded basin	Reed canary grass, Kentucky bluegrass, green ash	Buckthorn, prickly ash, honeysuckle, green ash, boxelder, cottonwood
3	0.0104	1	PEMA/B	Seasonally flooded basin	Reed canary grass, Kentucky bluegrass, Carex spp.	Buckthorn, prickly ash, honeysuckle, green ash, boxelder, cottonwood
4	0.0125	1	PEMA/B	Seasonally flooded basin	Reed canary grass, *Rubus* spp, Kentucky bluegrass	Buckthorn, honeysuckle
River	8.5000	River	R2UBH	River	Open water	Green ash, cottonwood, boxelder
Total	9.8649					

A Wetland Delineation Report was submitted to the Wright Soil and Water Conservation District (SWCD) and the U.S. Army Corps of Engineers (USACE) on June 28, 2019, to request wetland boundary confirmation under the Minnesota Wetland Conservation Act (WCA) and Section 404 of the Federal Clean Water Act (CWA), respectively. An excerpt of the Wetland Delineation Report (excluding data forms and historical aerial photographs) is included in **Appendix C**. The full Delineation Report is available upon request. The SWCD plans to conduct a wetland field review in early August. The Crow River is a MN DNR public watercourse and the MN DNR has jurisdiction over the Crow River below the edge of the bank of the channel.

Cropland Wetland Assessment

KES conducted an offsite and onsite review of croplands for wetlands, focused on locations of slight depressions and occasional soil wetness. Tilled cropland covers 65% of the project area, about 119.5 acres. None of the cropland is shown as wetland on the NWI map (**Figure 7**) and less than 2% of the project area is mapped as hydric soils (**Table 5, Figure 9**).

The cropland wetland assessment followed methods described in Guidance for Offsite Hydrology/Wetland Determinations (Minnesota Board of Water and Soil Resources and U.S. Army Corps of Engineers St. Paul District 2016). Aerial photography and antecedent precipitation conditions were used to identify areas with wetland hydrology signatures during periods of typical precipitation. This was supplemented by field inspection and soil borings.

Available years of Farm Service Agency (FSA) aerial photography were reviewed to assess long-term hydrology and wetland signatures. This review did not identify wetland signatures in the

cropland area that is characterized by non-hydric soils. To confirm the absence of wetlands in the croplands, soil borings were advanced in four locations of near wetland signatures. All of these soil borings confirmed the presence of non-hydric soils and the absence of wetland hydrology.

ii. Groundwater – aquifers, springs, seeps. Include: 1) depth to groundwater; 2) if project is within a MDH wellhead protection area; 3) identification of any onsite and/or nearby wells, including unique numbers and well logs if available. If there are no wells known on site or nearby, explain the methodology used to determine this.

Soil borings indicate the groundwater elevation beneath the proposed mining area is about 886 feet and the groundwater elevation below the floodplain near the Crow River is about 880 feet. The water elevation in the Crow River at the east edge of the site is about 878 to 880 feet. Depth to static groundwater levels in the four domestic water wells located nearest to the project area averages 42.75 feet, which equates to an average groundwater elevation of 875.5 feet (**Table 4, Appendix B**).

The project area does not include any registered or known unregistered groundwater wells. Review of the Minnesota Well Index identified six registered domestic water wells, one irrigation well, and one test well located within about 0.25 mile from the project area (**Table 4, Appendix B**).

The project is not located within a wellhead protection area. The nearest municipal water wells are operated by the Joint Powers Water Board (JPWB) of Albertville-Hanover-St. Michael. The JPWB well field is located in the City of Albertville, about 3 miles north of the project area. The JPWB wellhead protection area and Drinking Water Supply Management Area vulnerability zone for the well field is located about 2.75 miles north of the project area.

b. Describe effects from project activities on water resources and measures to minimize or mitigate the effects in Item b.i. through Item b.iv. below.

i. Wastewater - For each of the following, describe the sources, quantities and composition of all sanitary, municipal/domestic and industrial wastewater produced or treated at the site.

1) If the wastewater discharge is to a publicly owned treatment facility, identify any pretreatment measures and the ability of the facility to handle the added water and waste loadings, including any effects on, or required expansion of, municipal wastewater infrastructure.

Wastewater will not be discharged to a publicly owned treatment facility, a subsurface sewage treatment system, or to surface waters.

The project will generate a small amount of sanitary wastewater, which will be contained in portable toilets onsite and properly disposed of offsite by a portable toilet service provider. Portable toilets will be serviced about once per week during the active mining season (May-November). Based on about three onsite employees, about 17 truck drivers who are intermittently onsite during the construction season, and two seasonal onsite portable toilets, the project is expected to generate up to 18 gallons of sanitary wastewater per day or 3,225 gallons of sanitary wastewater per year.

2) If the wastewater discharge is to a subsurface sewage treatment systems (SSTS), describe the system used, the design flow, and suitability of site conditions for such a system.

Sanitary wastewater will not be discharged to subsurface sewage treatment systems. Wastewater will be handled by use of portable toilets.

Wastewater from equipment washing and sand and gravel wash ponds is considered industrial wastewater and is permitted under the NPDES and SDS General Permit MNG490000 for Nonmetallic Mining and Associated Activities (General Permit), which covers stormwater and wastewater. However, nearly all equipment maintenance and washing will be conducted offsite at the Fehn Companies shop in Albertville. Onsite equipment maintenance will be limited to emergency repairs.

The proposed project will to be covered under the sand and gravel mining provisions of this General Permit. This permit covers wastewater without detergents, solvents, or degreasers, from washing trucks and other equipment, as well as waters used for dust control on crushers, conveyors, other equipment, and roadways. Mining wastewater and stormwater from aggregate wash ponds and stormwater basins will infiltrate into the soils and will not discharge to surface waters. The project will not include an asphalt plant, asphalt hot mix production, or concrete ready-mix plant.

3) If the wastewater discharge is to surface water, identify the wastewater treatment methods and identify discharge points and proposed effluent limitations to mitigate impacts. Discuss any effects to surface or groundwater from wastewater discharges.

Sanitary wastewater will not be discharged to surface water. It will be pumped from portable toilets and properly disposed of offsite by a portable toilet contractor. Industrial wastewater from equipment and aggregate washing will be free of detergents and degreasers and will be allowed to infiltrate into the ground.

ii. Stormwater - Describe the quantity and quality of stormwater runoff at the site prior to and post construction. Include the routes and receiving water bodies for runoff from the site (major downstream water bodies as well as the immediate receiving waters). Discuss any environmental effects from stormwater discharges. Describe stormwater pollution prevention plans including temporary and permanent runoff controls and potential BMP site locations to manage or treat stormwater runoff. Identify specific erosion control, sedimentation control or stabilization measures to address soil limitations during and after project construction.

Pre- and Post-Project Site Runoff

Surface runoff from the project area under existing agricultural conditions likely contains some sediment, pesticides, fertilizers, and other nutrients. Pre- and post-project runoff quality and quantity are expected to similar for the area near the Crow River, which will not be mined. In the mining area, post-project runoff quality is expected to improve, and quantity is expected to decrease in comparison to pre-project conditions due to the creation of an infiltration basin and the resulting reduction in discharge to receiving waters.

Runoff routes to receiving water bodies after mining are also expected to be similar to existing runoff routes. Existing runoff drains overland, generally to the east toward the Crow River. Mining activity will create depressional areas that will allow stormwater to drain to the interior of the mining area. Stormwater conveyance channels or swales will route overflow to an infiltration basin on the east side of the site where it will infiltrate into the ground (**Figure 4, Appendix A**).

Environmental Effects

The project is expected to have little to no effect on the quality of runoff that drains to nearby waters. Stormwater discharges from the mining area will be held in the gravel pit and the adjacent stormwater basin and allowed to infiltrate. The resulting stormwater infiltration will improve stormwater quality and reduce contaminant discharge to receiving waters.

Runoff from aggregate mining areas will be drained toward the northeast part of the site where runoff will be held for infiltration. Most soils on the site are Hydrologic Soil Group A. Field infiltrometer test results indicate the native soils in the infiltration basin provide an infiltration rate slightly above 5 inches/hour. Mining will not penetrate the water table. Vegetated buffers will help ensure that surface water runoff does not leave the mined area. Final grading associated with reclamation will further ensure the containment of runoff water. The inward facing slopes and established vegetation will provide permanent erosion controls after the completion of mining operations.

The project will add about 0.6 acre of impervious surface, resulting from an improved 15th Street NE access route. The increased impervious surface area is expected to negligibly increase the extent of urban runoff pollutants in stormwater. Stormwater rate and volume controls that comply with City of Hanover and NPDES permit requirements will limit the potential for increased runoff volume and associated pollutant transport. The project will create stormwater basins and swales or conveyance channels that will provide infiltration, reduce discharges to surface waters, and mitigate potential adverse effects on water quality and quantity.

Stormwater Compliance

Compliance with City of Hanover Stormwater Ordinance and NPDES permit requirements will minimize and mitigate potential adverse effects on receiving waters. The project engineer evaluated subwatersheds within the site that are consistent with the City of Hanover 2010 Stormwater Management Plan. The project will change the land use from predominantly agricultural to aggregate mine and then to reclaimed aggregate mine and temporary grassland. This land use change is expected to have mixed minor effects on runoff water volume and quality.

The project may reduce concentrations of agricultural chemicals. The loading of suspended solids could increase occasionally within active parts of the aggregate mine, but suspended solids are not expected to affect the Crow River or other receiving waters because runoff will be routed to the infiltration basin. Post-development runoff water quality from the area near the Crow River, which will not be mined, will be similar to existing conditions.

In addition, the City of Hanover Stormwater Ordinance will require:

1. a Stormwater Pollution Prevention Plan (SWPPP) compliant with the most recent requirements of the NPDES General Stormwater Permit;
2. a drainage plan showing the direction and rate of stormwater runoff from the site and locations of stormwater ponds and infiltration areas;
3. restricted use of stormwater infiltration where vehicle fueling and maintenance occur and in areas with less than 3 feet of separation between the bottom of infiltration systems and the elevation of the seasonally saturated soils;
4. distribution of infiltration practices throughout areas containing A and B soils;
5. reduction of total suspended solids load by 85% and phosphorus loads by 60% for the site as a whole, based on the average annual rainfall, as compared to no runoff management controls; and
6. a stormwater maintenance plan and implementation of good housekeeping provisions for minimization of runoff, and for storage of materials, machinery, and equipment in a manner that limits the risk of contamination.

Stormwater ponds will be required to meet the following design standards:

1. side slopes be no greater than 5:1;
2. side slopes seeded with turf grass or native seed mix appropriate to the site conditions;
3. maintenance by the applicant appropriately during the first three years to ensure plant establishment and survival; and
4. emergency overland flow structures (e.g. swales, spillways) shall be incorporated into pond designs to prevent undesired flooding.

The stormwater system will also need to meet the following rate and volume control requirements:

1. for the 1-year, 10-year and 100-year 24-hour MSE 3 storm events and the 100-year, 10-day snowmelt event, the proposed post-project runoff rate must not exceed 0.1 cubic feet per second per acre per the City of Hanover Ordinance 9.34.B.2.a; and
2. the post-construction runoff volume shall be retained onsite for 1 inch of runoff from all impervious surfaces on the site per the City of Hanover Ordinance 9.34.B.3.a.

Stormwater and Erosion Control BMPs

BMPs will be employed during construction to reduce erosion and sediment loading of stormwater runoff. Stormwater will be permitted under the NPDES and SDS General Permit MNG490000 for Nonmetallic Mining and Associated Activities (General Permit), which covers stormwater and wastewater. Mining wastewater and stormwater from equipment washing, aggregate wash ponds, and stormwater basins will infiltrate into the soils and will not discharge to surface waters.

This permit requires the project proponent to plan for and implement appropriate construction phasing, vegetative buffer strips, horizontal slope grading, and other construction best management practices (BMPs) to minimize erosion and sedimentation, including:

1. seeding or other sediment control mechanisms to stabilize topsoil berms and other temporary stockpiles;
2. stone pads, concrete or steel wash racks, or equivalent systems to minimize vehicle tracking of sediment from the site onto paved surfaces;
3. implementation of good housekeeping practices that keep exposed runoff areas sufficiently clean to minimize or eliminate stormwater contamination; and
4. maintenance of BMPs to ensure their effectiveness.

Effects on surface waters will be minimized by controlling wash waters in a series of lined ponds configured to recycle wash water. Wash water will be routed through the series of lined ponds that will allow for settlement of suspended solids prior to being reused for continued wash operations. Excess or overflow discharge from the lined ponds will be routed with other stormwater within the mined area to the constructed infiltration basin in the northeast part of the project area. Effects of stormwater will also be minimized by keeping a 3-foot separation between infiltration basins and groundwater levels. Compliance with this General Permit will require that wastewater and stormwater discharges be collected, contained or infiltrated into the ground and that BMPs be deployed to prevent contamination of groundwater.

The project will include a stormwater infiltration basin covering about 4.7 acres. Stormwater routing will extend from each phase of mining to the ponds in the northeast part of the site. Stormwater conveyance channels or swales will advance from one phase to another as mining proceeds and the system will pretreat runoff prior to discharge into the infiltration basin (**Figures 4 and 5, Appendix A**). The stormwater system will be designed to comply with the City of Hanover Stormwater Ordinance and Mining Ordinance requirements.

Berms will be setback at least 50 feet from property boundaries. The sides of berms will be sloped at 3:1 to 4:1. Berms will be seeded and stabilized with grassland seed mixes. Slopes will generally be created to drain toward the interior of the mined area so that runoff is contained onsite. Vegetated buffers will help ensure that surface water runoff does not leave the mined area. The inward facing slopes and established vegetation will provide permanent erosion controls after the completion of mining operations.

Erosion control plans will be reviewed and accepted by the City of Hanover prior to project construction. Potential adverse effects from construction-related sediment and erosion on water quality will be minimized to the extent practical by implementation of the above BMPs during and after mining.

iii. Water Appropriation. Describe if the project proposes to appropriate surface or groundwater (including dewatering). Describe the source, quantity, duration, use and purpose of the water use and if a DNR water appropriation permit is required. Describe any well abandonment. If connecting to an existing municipal water supply, identify the wells to be used as a water source and any effects on, or required expansion of, municipal water infrastructure. Discuss environmental effects from water appropriation, including an assessment of the water resources available for appropriation. Identify any measures to avoid, minimize, or mitigate environmental effects from the water appropriation.

Groundwater Appropriation

The project is expected to require installation of a new water well and groundwater appropriation to provide a water supply for aggregate wash ponds. The wash ponds will have a clay liner that will be at least two feet thick, will contain about 3 to 4 feet of water, and will include recirculating pumps that will help minimize the quantity of groundwater appropriation. With these measures, it is anticipated that groundwater appropriation at the new water well will be less than 10,000 gallons/day and 1 million gallons/year, and that the project will not require MN DNR water appropriation permit. Water appropriation for wash ponds is expected to occur each year for the next 15 to 20 years, but will be limited to the May-November aggregate mining season. The wash ponds and other stormwater basins on the site will be configured to allow overflow from the ponds to infiltrate into native soils. Effects on downstream receiving waters and groundwater levels are not anticipated.

Well Abandonment

The project area does not include any existing wells, as indicated from review of the site, the project survey, and the Minnesota Well Index. The project is not expected to involve well abandonment.

Connection to a Public Water Supply

The project will not be connected to a public or municipal water supply.

iv. Surface Waters

a) Wetlands. Describe any anticipated physical effects or alterations to wetland features such as draining, filling, permanent inundation, dredging and vegetative removal. Discuss direct and indirect environmental effects from physical modification of wetlands, including the anticipated effects that any proposed wetland alterations may have to the host watershed. Identify measures to avoid (e.g., available alternatives that were considered), minimize, or mitigate environmental effects to wetlands. Discuss whether any required compensatory wetland mitigation for unavoidable wetland impacts will occur in the same minor or major watershed, and identify those probable locations.

Permits and Approvals

Wetland boundaries had not been approved at the time this EAW went to press. The wetland delineation and any wetland impacts will require approval from the Wright SWCD, which administers the Minnesota Wetland Conservation Act (WCA) in the project area, and the U.S. Army Corps of Engineers (USACE), which administers Section 404 of the Federal Clean Water Act. Project plans do not include any alteration of the course, current, or cross-section below the edge of the bank of the Crow River. Such an alteration would require approval from the MN DNR.

Physical Effects and Alterations

The proposed project will be required to avoid and minimize wetland impacts to the extent practicable. The project will convert much of the site to aggregate mine and reclaimed aggregate mine with infiltration basins. Although the project is not expected to result in direct or indirect effects on wetlands or surface waters, delineated wetland boundaries have not yet been confirmed. Given the current level of uncertainty, the project may affect up to a half an acre of wetland.

The proposed aggregate mine will avoid and minimize wetland impacts by keeping mining activity away from wetlands to the extent practicable. Mining is not expected to influence groundwater flow elevations because mining activity will stay 10 feet above groundwater levels. The project is unlikely to affect wetlands because:

1. known wetlands will most likely be physically avoided,
2. mining is not proposed below the water table, and
3. surface runoff from lands disturbed by mining will be retained within the depressions of the gravel mine.

If small, farmed wetlands are identified and delineated, the project proponent will need to work with wetland agencies to address wetland avoidance, minimization, and replacement in a manner consistent with state and federal requirements. Small farmed wetlands are unlikely to be identified on the site, and if identified and delineated, they will likely be unavoidable because the proposed project will excavate those wetlands to access the aggregate material beneath them. If this becomes the case, the project proponent will need to demonstrate that wetland impact avoidance and minimization, prepare and submit the necessary application, and replace unavoidable wetland impacts with acceptable wetland banking credits or permittee-responsible mitigation in compliance with the WCA and CWA.

If wetland impacts become necessary, they will be avoided, minimized and mitigated by:

1. designing the project to avoid wetlands wherever practicable;
2. minimizing wetland impacts by using 3:1 slopes and/or retaining walls;
3. implementing sedimentation and water quality protection BMPs to reduce and eliminate secondary wetland impacts over time;
4. treating stormwater from impervious surfaces to remove sediment and nutrients prior to discharge to wetlands;
5. defining upland buffers adjacent to wetlands, seeding disturbed buffers with native vegetation, and marking wetland buffers with monuments to protect wetlands in compliance with the City of Hanover Wetlands Overlay District Ordinance; and
6. providing compensatory wetland mitigation to offset unavoidable wetland impacts and replace wetland functions.

To the degree practicable, compensatory wetland mitigation for unavoidable wetland impacts will occur in the same major watershed and bank service area as the wetland impacts. Compensatory

mitigation will most likely be purchased from an existing wetland bank that is recognized by permitting authorities.

Buffers

Wetland requirements of the City of Hanover are set forth in the Wetlands Systems District Ordinance, which incorporates the WCA by reference and requires a 30-foot buffer strip of vegetation along wetlands, which may be meandered to maintain a natural appearance. The 30-foot buffer width/setback applies to structures, roadways, and trails in all zoning districts. Where buffers are not vegetated or have been cultivated or otherwise disturbed within the past 10 years, the Wetlands Ordinance requires that they be planted to native species. The project is expected to comply with the 30-foot buffer requirement.

b) Other Surface Waters. Describe any anticipated physical effects or alterations to surface water features (lakes, streams, ponds, intermittent channels, county/judicial ditches) such as draining, filling, permanent inundation, dredging, diking, stream diversion, impoundment, aquatic plant removal and riparian alteration. Discuss direct and indirect environmental effects from physical modification of water features. Identify measures to avoid, minimize, or mitigate environmental effects to surface water features, including in-water Best Management Practices that are proposed to avoid or minimize turbidity/sedimentation while physically altering the water features. Discuss how the project will change the number or type of watercraft on any water body, including current and projected watercraft usage.

The proposed project is not expected to affect other surface waters such as lakes, streams, ponds, intermittent channels, or county/judicial ditches. The site does not include or adjoin excavated agricultural drainage ditches. The Crow River is located at the east end of the project and will be avoided. The project will comply with the City of Hanover Shoreland Overlay District Ordinance as discussed in **Item 9.a.ii**.

12. Contamination / Hazardous Materials / Wastes

a. Pre-project site conditions - Describe existing contamination or potential environmental hazards on or in close proximity to the project site such as soil or ground water contamination, abandoned dumps, closed landfills, existing or abandoned storage tanks, and hazardous liquid or gas pipelines. Discuss any potential environmental effects from pre-project site conditions that would be caused or exacerbated by project construction and operation. Identify measures to avoid, minimize or mitigate adverse effects from existing contamination or potential environmental hazards. Include development of a Contingency Plan or Response Action Plan.

Much of the project area has been used as cropland since at least the 1930s. Most of the area that has not been farmed adjoins the Crow River and has been in natural vegetation. The project area is not known to include previous building sites. A 345-kV overhead transmission line runs diagonally northwest-southeast through the site (**Figures 2 and 7**). The site is not known to include environmental hazards and the agricultural land use history suggests a low potential for environmental contamination.

A search of the MPCA's "What's in My Neighborhood" (WIMN) website did not identify any potential contamination sites, environmental permits, and registrations located within the project

area. However, the WIMN website revealed eight sites located within approximately 0.25 mile of the project area (**Table 7**). These include four hazardous waste generators, three construction stormwater permits, and one registered feedlot. The construction stormwater permit for Spruce Tree Terrace is the only one of these eight sites that this still active. The other registrations and permits were issued between 1985 and 2008 and terminated or made inactive between 1985 and 2016. Available information suggests these sites have been properly investigated and managed. As a result, they are not expected to affect the project area.

Table 7. What's in My Neighborhood Sites within 0.5 mile of Project Area

Number	Type	Name	Status	Direction from Project
WRTC11600 Site 11731	Hazardous Waste	Norman Dehmer Excavating	Inactive	0.25 mile N
171-70310 Site 55069	Feedlot	Peter R Marx Farm	Inactive	0.20 mile NW
C00011842 Site 85465	Construction Stormwater	Spruce Tree Terrace – Hanover	Active	0.1 mile W
C00006160 Site 39075	Construction Stormwater	Esterly Oaks	Inactive	0.15 mile W
MNR000006213 Site 15561	Hazardous Waste	Firehouse Auto Repair & Towing Inc.	Inactive	0.1 mile W
MND985770866 Site 12251	Hazardous Waste	Rhino Imported Auto Parts, Inc.	Inactive	0.25 mile SW
C00025834 Site 123220	Construction Stormwater	Crow River Heights Park Grading	Inactive	0.20 mile SW
MND985765361 Site 17448	Hazardous Waste	Hennepin Parks District Nursery	Inactive	0.25 mile E

b. *Project related generation/storage of solid wastes - Describe solid wastes generated/stored during construction and/or operation of the project. Indicate method of disposal. Discuss potential environmental effects from solid waste handling, storage and disposal. Identify measures to avoid, minimize or mitigate adverse effects from the generation/storage of solid waste including source reduction and recycling.*

Solid waste generation will be typical of commercial aggregate operations. The mining process is not expected to generate substantial solid or hazardous wastes, solid animal manure, sludge, or ash. Solid waste generated by employees working at the aggregate mine and will either be collected in receptacles inside a vehicle or trailer and transported to the company headquarters for disposal, or waste will be collected in a commercial dumpster and disposal will be collected by a licensed solid waste company, which will dispose of the waste at an approved facility such as the Rolling Hills Landfill in Buffalo, the Elk River Landfill, or the Elk River Energy Recovery Station. The Elk River Energy Recovery Station converts mixed municipal waste to refuse derived fuel (RDF) to generate energy. The mining operation will minimize and mitigate adverse effects from solid waste generation and storage by recycling solid waste to the degree practicable.

c. *Project related use/storage of hazardous materials - Describe chemicals/hazardous materials used/stored during construction and/or operation of the project including method of storage. Indicate the number, location and size of any above or below ground tanks to store petroleum or other materials. Discuss potential environmental effects from accidental spill or release of hazardous materials. Identify measures to avoid, minimize or mitigate adverse effects from the use/storage of chemicals/hazardous materials including source reduction and recycling. Include development of a spill prevention plan.*

Hazardous materials to be stored at the site include small quantities of used oil, gasoline, diesel fuel, and other machinery fluids commonly used in aggregate mining machinery. Other than vehicle fuels and lubricants, use of toxic or hazardous materials is not expected to occur at the site.

Petroleum products such as diesel fuel will be stored onsite, particularly during periods of mining. The project will include an onsite double-walled 500-gallon aboveground diesel fuel tank. A second double-walled aboveground 500-gallon diesel fuel tank will be onsite intermittently during the construction season when the concrete crusher is onsite. Small amounts of other liquid lubricants (grease, lubricating oils, etc.) will be stored onsite in a closed, lockable container such as a semi-trailer.

It is not anticipated that the gravel mine expansion will involve installation of permanent aboveground or underground storage tanks capacities exceeding 500 gallons capacity. Tanks stored onsite for more than six months will be 500 gallons or smaller. The project will not exceed the 1,320-gallon petroleum storage capacity threshold that would trigger the need for a spill prevention control and countermeasure plan (SPCC).

It is expected that fuel will be brought in on a transport truck when the mine is active and removed from the site when the mine is inactive. Portable gravel crushing equipment will be powered by a portable diesel generator. Onsite refueling of mobile equipment will be completed using tankers and following MPCA procedures, with liners and spill cleanup equipment onsite. Most equipment maintenance will be conducted offsite. Used oil resulting from any emergency onsite equipment maintenance will be transferred to a mobile service vehicle and then removed from the site. Fuel management will be conducted in compliance with MPCA requirements.

Secondary containment of fuel and lubricant storage will minimize the potential for an accidental spill and other adverse effects of hazardous material storage. Soil and groundwater could be affected if a spill does occur. If petroleum products are spilled onsite in spite of the precautions listed above, the mining company will respond to the spill with absorbent materials and other clean up equipment stored onsite to contain the spill.

d. *Project related generation/storage of hazardous wastes - Describe hazardous wastes generated/stored during construction and/or operation of the project. Indicate method of disposal. Discuss potential environmental effects from hazardous waste handling, storage, and disposal. Identify measures to avoid, minimize or mitigate adverse effects from the generation/storage of hazardous waste including source reduction and recycling.*

Hazardous wastes such as used oil and lubricants will be generated by the maintenance of mining equipment on site. These wastes will be petroleum-based and will be removed from the site by

mobile maintenance vehicles and returned to the Fehn Companies headquarters in Albertville to be disposed of in accordance with state and federal rules.

13. Fish, Wildlife, Plant Communities and Sensitive Ecological Resources (Rare Features)

a. Describe fish and wildlife resources as well as habitats and vegetation on or in near the site.

Fish and wildlife resources on and near the site are related to the composition, quality, size, and connectivity of plant communities such as cultivated cropland, wetlands, and grasslands. Vegetative cover types on the project area were mapped based on aerial photography and the wetland delineation (**Figures 6 and 7**). The project area is roughly 65% cropland, 14% active mining, 10% grassland/shrubland, 6% woodland, and 5% wetlands and waters. Habitats in the project area are likely used by wildlife adapted to agricultural and riparian environments, such as white-tailed deer, songbirds, small mammals, and amphibians.

The project area falls in the Eastern Broadleaf Forest Province of the MN DNR Ecological Classification System and the Big Woods Level IV Ecoregion of the U.S. EPA. This region generally consists of rolling plains covered mostly by row crops with some lakes, pastures, and suburban development. Prior to modern settlement, much of this ecoregion was covered by extensive hardwood forest.

Much of the project area has limited wildlife habitat value because it is occupied by annually tilled agricultural crops. Cropland has recently consisted of corn and soybeans. Wetlands in the project area were dominated by reed canary grass, tilled cropland, Kentucky bluegrass, and other species (**see Table 6**). Woodlands and shrublands on the site include bur oak, green ash, cottonwood, boxelder, boxelder, buckthorn, and prickly ash. Grasslands are mostly dominated by smooth brome and Kentucky bluegrass.

*b. Describe rare features such as state-listed (endangered, threatened or special concern) species, native plant communities, Minnesota County Biological Survey Sites of Biodiversity Significance, and other sensitive ecological resources on or within close proximity to the site. Provide the license agreement number (**LA-890**) and/or correspondence number (**ERDB 20190358**) from which the data were obtained and attach the Natural Heritage letter from the DNR. Indicate if any additional habitat or species survey work has been conducted within the site and describe the results.*

State

A Natural Heritage Inventory System (NHIS) was requested from the MN DNR to assess whether known locations of rare plant or animal species or other significant natural features are known to occur within an approximate one-mile radius of the project area. The MN DNR response is included in **Appendix D**. Kjolhaug Environmental Services also queried a licensed copy of the NHIS database to identify rare species documented within one mile of the project area.

The only threatened or endangered species identified to occur within a one-mile radius of the project area was the Blanding's turtle (*Emydoidea blandingii*), which was recorded north and east of the project area as recently as 2015. The MN DNR reported that Blanding's turtles have been reported in

the project vicinity during nesting season. The Blanding's turtle is a state threatened reptile that prefers calm shallow water and rich aquatic vegetation. They select open grassy uplands with sandy soils for nesting. The best Blanding's turtle habitat includes wetland complexes larger than 10 acres that are surrounded by open sandy uplands. Blanding's turtles do not typically lay eggs under forest cover.

Other occurrences of rare species within a one-mile radius of the project, which are not listed as threatened or endangered, include one bat, three birds, one snake, one insect, and one species of vascular plants (**Table 8**). These observations were recorded between 1983 and 2015. Most observations were associated with the Crow-Hassan Park Reserve, which is located east of the project area, across the Crow River in Hennepin County.

Table 8. Rare Species Known to Occur within one mile of Project Area

Common Name	Type	Status		Habitat
		State	Federal	
Big brown bat	Mammal	Special Concern	None	Roost under bark and in cavities and crevices of live/dead trees during April-October.
Lark Sparrow	Bird	Special Concern	None	Dry grasslands with short and/or sparse grasses (usually native), sand or gravel soils, at least some bare ground and widely-scattered or patchy trees.
Trumpeter Swan	Bird	Special Concern	None	Small ponds and lakes or bays on larger water bodies with extensive emergent vegetation such as cattails, bulrushes, and sedges
Upland Sandpiper	Bird	Species of Greatest Conservation Need	None	Prairies, pastures, and sparse grasslands
Blanding's Turtle	Reptile	Threatened	None	Wetland complexes and adjacent sandy uplands. Calm, shallow waters, including wetlands associated with rivers and streams with rich aquatic vegetation.
Gopher Snake	Reptile	Special Concern	None	Well-drained, loose sandy and gravel soils. Dry sand prairies and bluff prairies are prime habitat.
Leadplant Flower Moth	Insect	Special Concern	None	Remnant, dry sand prairies and open oak barrens
American Ginseng	Vascular plant	Special Concern	None	Rich hardwood forest with shade or part shade

Federal

Online information on rare species information maintained by the U.S. Fish and Wildlife Service (USFWS) was reviewed for the project area. The USFWS listed the northern long-eared bat (*Myotis septentrionalis*) as federally threatened on May 4, 2015. On February 2, 2017, the USFWS listed the rusty patched bumble bee (*Bombus affinis*) as federally endangered.

The northern long-eared bat hibernates in caves during winter and establishes maternity roosting colonies under the loose bark of trees during the summer. The project area is not known to include caves and tree cover on the site is mostly located near the Crow River where it will be preserved. The wooded Crow River corridor provides suitable habitat for bats, but the northern long-eared bat has not been documented in the project area. As of April 1, 2019, MN DNR data showed no documented maternity roost trees or hibernacula entrances of the northern long-eared bat in the project vicinity.

Rusty patched bumble bees once occupied grasslands and tallgrass prairies of the Upper Midwest and Northeast, but most grasslands and prairies have been lost, degraded, or fragmented by conversion to other uses. Bumble bees need nectar and pollen from flowers, nesting sites (underground and abandoned rodent cavities or clumps of grasses), and overwintering sites for hibernating queens (undisturbed soil). The project area contains 16.1 acres of grassland-shrubland mix. However, grassland on the site is dominated by smooth brome and Kentucky bluegrass. It lacks the wildflowers that typically provide nectar for bees. The project is expected to avoid about 2.3 acres of grassland-shrubland during the aggregate mining and reclamation process.

The USFWS species profile for the rusty patched bumble bee indicates the nearest potentially occupied habitat of the rusty patched bumble bee is located about one mile north of the project area, across the Crow River and within the Crow-Hassan Park Reserve.

Review of the USFWS Information for Planning and Consultation (IPaC) website with a polygon encompassing the project area identified only the northern long-eared bat as threatened or endangered and noted that there are no critical habitats at this location.

c. *Discuss how the identified fish, wildlife, plant communities, rare features and ecosystems may be affected by the project. Include a discussion on introduction and spread of invasive species from the project construction and operation. Separately discuss effects to known threatened and endangered species.*

The project is expected to convert about 119.5 acres of cropland, 13.8 acres of grassland-shrubland mix, 0.5 acre of woodland, and up to 0.5 acre of wetland to reclaimed aggregate mine, temporary grassland, and stormwater basins. The mined area is expected to transition to residential use in the future. The project may affect the number and type of wildlife species in the area, but changes in wildlife abundance are not expected to be regionally significant. The existing croplands provide wildlife food, but have limited value as wildlife cover. Wildlife species that depend on agricultural cropland will be displaced by the project. The project will likely have short-term negative effects and long-term positive effects on species adapted to suburban habitats. Non-migratory species with small home ranges such as small mammals may experience more adverse effects, including mortality during project construction.

Aggregate mining operations may affect, but are not expected to substantially affect, rare species and sensitive natural communities. The MN DNR indicated the project has the potential to affect Blanding's turtles through direct fatalities and habitat disturbance related to mining activities. The project has the potential to affect other rare species through disturbance of woodland and grassland.

Although the project might increase the potential for the spread of invasive and weedy species, the project area has been disturbed by agricultural practices for decades. Left unattended for prolonged periods of time, gravel pits may become germinating grounds for invasive plant species as seeds may be introduced by wind, water, or animals. BMPs could include the cleaning of construction equipment before transport, which might reduce the potential spread of invasive species.

d. Identify measures that will be taken to avoid, minimize, or mitigate adverse effects to fish, wildlife, plant communities, and sensitive ecological resources.

Measures to minimize and mitigate adverse effects on wildlife include preservation of about 20 acres of habitat in the Crow River riparian corridor, creation of 4.7 acres of stormwater features, and reclamation of mined areas by seeding to temporary grasslands.

The project will minimize potential effects on Blanding's turtles and other rare species by:

1. minimizing wetland impacts;
2. using erosion control materials that do not contain plastic mesh netting or other plastic components;
3. selecting mulch products that do not contain synthetic (plastic) fiber additives;
4. limiting most tree removal to between August 15 and March 31 to avoid wildlife breeding and young-rearing seasons;
5. distributing MN DNR Blanding's turtle flyers, fact sheets, and recommendations (**Appendix D**) to workers and advising workers that they may see Blanding's turtles during June; and
6. Monitoring active mining areas for turtles, reporting Blanding's turtle sightings to the MN DNR, and moving observed turtles away from mining areas and vehicle travel corridors.

14. Historic Properties

Describe any historic structures, archeological sites, and/or traditional cultural properties on or in close proximity to the site. Include: 1) historic designations, 2) known artifact areas, and 3) architectural features. Attach letter received from the State Historic Preservation Office (SHPO). Discuss any anticipated effects to historic properties during project construction and operation. Identify measures that will be taken to avoid, minimize, or mitigate adverse effects to historic properties.

A search of the historical property information database was requested from the Minnesota State Historic Preservation Office (SHPO) for the project area to assess whether known historic structures or archaeological sites exist in the project vicinity. The SHPO queried the Minnesota Archaeological and Historic Structures Inventory and did not identify any archaeological sites or historic structures known to exist in the project area.

Nienow Cultural Consultants, LLC (NCC) completed a Phase I Archaeological Survey of the project area on April 24 to 26, 2019. No prehistoric cultural resources were documented during either surface survey or shovel testing. **Appendix E** includes correspondence from the SHPO and an Archaeological Letter Report summarizing the results of the field survey.

Prior to the archaeological survey, NCC reviewed literature at the Minnesota Office of the State Archaeologist (OSA) and the SHPO. This review found no previously documented sites within the project area, but it identified 15 archaeological sites located within 3 miles of the project. Most were found along the west bank of the Crow River.

Archaeological survey methods consisted of a surface survey over plowed fields with two discontinuous transects of shovel testing. Surface visibility in tilled fields was generally good (> 60%) and transects were typically spaced 7 to 10 meters apart. Shovel testing was completed at 15m intervals along the upper bluff edge of the Crow River and down along its lower terrace. A total of 57 shovel tests were excavated, typically to 80-100cm below ground surface.

No prehistoric cultural materials were identified during the pedestrian survey. Modern trash (plastic, cardboard, hygiene products, etc.), scattered 20th century ceramics (whitewares), discarded/broken farm implements (plowshares, bolts, etc.) and recreation materials (golf balls) were identified in several locations. All shovel tests were negative for prehistoric materials. Three tests had late 19th through mid-20th century nails, window glass, whiteware, a .22 spent rifle shell, and one piece of deer bone. No archaeological sites were recorded, and no additional archaeological survey was recommended. The project is not expected to affect intact archaeological sites. A professional archaeologist will be consulted if archaeological materials or human remains are encountered during aggregate mining.

15. Visual

Describe any scenic views or vistas on or near the project site. Describe any project related visual effects such as vapor plumes or glare from intense lights. Discuss the potential visual effects from the project. Identify any measures to avoid, minimize, or mitigate visual effects.

There are no scenic views or vistas located on or adjacent to the project area. The site is located in an area of agricultural and residential land use. Substantial effects on visual resources are not anticipated in conjunction with the project. Project development is expected to result in routine effects on visual resources. The project will not involve installation of intense lights that would cause glare, nor will it include an asphalt plant. The operational mining season will extend from about May through November.

Measure to reduce visual impacts include placing the portable crushing machinery in the lower elevations of the pit and keeping mining activity setback of 200 feet from residential uses and 100 feet from agricultural uses. Site visibility to the traveling public and neighboring landowners is already partially screened by residential uses. A tree row behind the nearest homes screens these residences from the proposed aggregate mine. To provide additional screening, berms approximately 10 feet high will be constructed within setbacks near adjacent property boundaries to provide additional visual barriers.

16. Air

a. *Stationary source emissions. Describe the type, sources, quantities and compositions of any emissions from stationary sources such as boilers or exhaust stacks. Include any hazardous air pollutants, criteria pollutants, and any greenhouse gases. Discuss effects to air quality including any sensitive receptors, human health or applicable regulatory criteria. Include a discussion of any methods used assess the project's effect on air quality and the results of that assessment. Identify pollution control equipment and other measures that will be taken to avoid, minimize, or mitigate adverse effects from stationary source emissions.*

Air emissions from aggregate mining will include exhaust emissions from diesel equipment used to excavate, transport, and crush aggregate materials; and dust emissions from the crushing, conveying, and loading operations. Stationary emission sources for aggregate mines are covered under the existing MPCA Air Emission General Permit 00900035-003 for nonmetallic mineral processing. Stationary sources of air emissions at the site covered by this permit include exhaust from diesel generator engines. Mining-related air emissions were reviewed using the MPCA's: (1) Aggregate: Sand and Gravel Air Emissions Calculator, and (2) Qualifications Review Checklist for Nonmetallic Mineral Processing General Permit. The project is expected to qualify for the Air Emissions General Permit because: (1) the project will use a mobile concrete crushing plant powered by a diesel internal combustion engine rated at less than 500 horsepower, and (2) the internal combustion is expected to have a displacement of less than 30 liters per cylinder.

b. *Vehicle emissions. Describe the effect of the project's traffic generation on air emissions. Discuss the project's vehicle-related emissions effect on air quality. Identify measures (e.g. traffic operational improvements, diesel idling minimization plan) that will be taken to minimize or mitigate vehicle-related emissions.*

The proposed project will generate a small amount of increased traffic and include operation of mining equipment powered by diesel fuel within the site. The traffic and mining equipment will result in a relatively small corresponding increase in carbon monoxide, carbon dioxide and other vehicle-related air emissions. The project is expected to have negligible to minor effects on air quality as a result of vehicle emissions. The project does not include air quality monitoring, modeling, or measures to mitigate effects on air quality from vehicle emissions.

c. *Dust and odors - Describe sources, characteristics, duration, quantities, and intensity of dust and odors generated during project construction and operation. (Fugitive dust may be discussed under item 16a). Discuss the effect of dust and odors in the vicinity of the project including nearby sensitive receptors and quality of life. Identify measures that will be taken to minimize or mitigate the effects of dust and odors.*

The project is not expected to generate dust or odors at levels considered unusual for aggregate mining. The project will not include an asphalt plant and therefore will generate less odor than comparable aggregate mines with onsite asphalt plants. Odor and dust generation is expected to be consistent with applicable regulations of the MPCA and local governments.

The mining process is expected to generate some fugitive dust, but dust is not expected to be generated in objectionable quantities. The dust receptors nearest to the project area include the single-family residences near the west boundary of the site. Odors routinely generated during

mining will be typical of those associated with construction activity, such as exhaust from diesel- and gasoline-powered equipment.

Sand and gravel mining processing operations that emit dust include crushing, screening, size classification, material handling, storage operations, and truck loading/unloading. Minnesota Rule 7011.0150 does not allow the "handling, use, transporting, or storage of any material in a manner which may allow avoidable amounts of particulate matter [i.e., dust] to become airborne."

A Dust Control Plan has been prepared to identify fugitive dust control practices for the Mahler Aggregate Mine (**Appendix F**). Aggregate mining has occurred at the project location since 2006. The project will prevent avoidable visible dust emissions beyond the property boundary by applying water, approved commercial dust suppressants (such as magnesium chloride), use of a reduced speed limit on haul roads (e.g., 15 mph), and/or tarping of truck loads prior to leaving the mining area. Application of water often provides sufficient dust suppression. These measures are expected to reduce fugitive dust emissions to a reasonable level. Other dust control measures to be considered include:

1. use of conveyors to transport aggregate material onsite;
2. limiting the number and distance of internal truck trips by using conveyors; and
3. sequenced mining of smaller subphases.

17. Noise

Describe sources, characteristics, duration, quantities, and intensity of noise generated during project construction and operation. Discuss the effect of noise in the vicinity of the project including 1) existing noise levels/sources in the area, 2) nearby sensitive receptors, 3) conformance to state noise standards, and 4) quality of life. Identify measures that will be taken to minimize or mitigate the effects of noise.

It is anticipated that local noise levels will temporarily increase during mining activity, but noise levels are expected to be at or near existing levels after mining is complete. Noise levels on and adjacent to the project area will vary considerably during mining, depending on the amount of mining that occurs at one time, the time of operation, and the distance between mining activity and receptors. The noise receptors nearest to the project area are the residential lots located west of the site. Noise generated by mining equipment will be limited to daylight hours when noise levels are commonly higher than at night.

Noise will be generated from excavation, crushing and hauling activities. Sources of noise will include the crusher, diesel engines, and associated mobile equipment (loaders, trucks, dozers).

MPCA and EPA noise standards for daytime and nighttime operations apply to this operation. Noise standards are set by the MPCA and vary with land use and time of day. Noise from operations must meet the residential noise standards at nearby residential buildings. Daytime is defined as 6:00am to 10:00pm. Minnesota noise standards are listed in **Table 9**. These standards are measured in decibels. The L10 standard is the level that may be exceeded up to 10% of the time during a one-hour period. The L50 standard is the level that may be exceeded up to 50% of the time during a one-hour period.

Table 9. Minnesota Residential Noise Standards

Type	Daytime dB(a)	Nighttime dB(a)
L10	65	50
L50	60	55

To mitigate noise effects, gravel mining and hauling operations will be restricted to between 7:00am and 7:00pm. Due to the limited hours of operation, mining will not occur during times when the nighttime standard applies. Measures to reduce noise and increase screening from neighbors will include: (1) mining setbacks of 200 feet from residential property lines, (2) creation of topsoil berms about 10 feet high along property lines, and (3) placement of the portable crusher at lower elevations and near the mining face to deflect sound upward. These measures will provide barriers for sight, noise, and dust. In addition, the crushing machinery will be located at relatively low elevations to provide vertical and horizontal separation from neighbors. Extraction depths will be around 24-28 feet in the deepest locations and the crushing equipment is less than 20 feet tall. This separation is expected to help direct noise up from the crushing operation, rather than out toward neighboring land uses. The Noise Study completed for the project concluded that noise levels from aggregate mine operations and haul trucks operating on County Road 146 and 15th Street NE are expected to generally be below Minnesota noise standards (**Appendix G)**.

18. Transportation

a. Describe traffic-related aspects of project construction and operation. Include: 1) existing and proposed additional parking spaces, 2) estimated total average daily traffic generated, 3) estimated maximum peak hour traffic generated and time of occurrence, 4) indicate source of trip generation rates used in the estimates, and 5) availability of transit and/or other alternative transportation modes.

SRF Consulting completed a Traffic Study to estimate the trips generated by the proposed mining operation and evaluate the potential need for transportation or roadway improvements. The complete Traffic Study is included in **Appendix H**.

Existing and Proposed Parking Spaces

The project area does not include parking stalls under existing or proposed conditions.

Estimated Traffic Generation

Trip generation was estimated using data provided by the project proponent, which was generated from existing mining operations and adjusted to account for the anticipated magnitude of future mining. Seasonal operation of the aggregate mine is expected to run from May through November. The peak arrival period was identified as 7:00 to 8:00am and the peak employee departure time is expected to occur after 6:00pm. Hauling trips are expected to be distributed evenly over the course of the day and 3:00 to 4:00pm was selected as the peak hauling period, as this time typically represents the highest background traffic. The project is expected to generate up to 206 average daily trips (**Table 10**). About 94% of the trips are expected to be trucks hauling aggregate or recycled concrete and the other 6% are expected to be employee passenger vehicles.

Table 10. Project Trip Generation Estimates

Land Use (Trip Type)	Daily Trips	Arrival Peak Hour Trips			Hauling Peak Hour Trips		
		In	Out	Total	In	Out	Total
Aggregate Mine (passenger vehicles)	12	3	0	3	0	0	0
Aggregate Mine (trucks)	194	10	10	20	10	10	20
Aggregate Mine (total)	206	13	10	23	10	10	20

The peak hours traffic in the study area occur between 7:30 and 8:30a.m. and between 4:15 and 5:15p.m. It is expected that traffic from the project will also peak during these times. The project is expected to generate 23 trips during the arrival peak hour (7:00-8:00am) and 20 trips during the pm peak hour (3:00-4:00pm). The Traffic Study in **Appendix H** describes the analysis of the peak hour traffic and traffic recommendations.

Alternative Transportation and Transit

There are no alternative modes of transportation or transit available at the project site.

b. *Discuss the effect on traffic congestion on affected roads and describe any traffic improvements necessary. The analysis must discuss the project's impact on the regional transportation system. If the peak hour traffic generated exceeds 250 vehicles or the total daily trips exceeds 2,500, a traffic impact study must be prepared as part of the EAW. Use the format and procedures described in the Minnesota Department of Transportation's Access Management Manual, Chapter 5 (available at: http://www.dot.state.mn.us/accessmanagement/resources.html) or a similar local guidance.*

Effects on Traffic and Roadways

The Traffic Study concluded that study area intersections operate at an acceptable overall Level of Service (LOS) B or better during the arrival and hauling peak hours under existing and proposed (year 2020) conditions. The project is expected to have minimal impact on the area roadway network. The proposed project is expected to generate a maximum of only 206 daily trips and 23 peak hour trips. The complete Traffic Study is included in **Appendix H**. Intersections analyzed for capacity and LOS are listed below:

1. 15th Street NE and Lander Avenue NE/River Road NE,
2. CSAH 19 and 15th Street NE,
3. CSAH 19 and CSAH 34,
4. CSAH 19 and 5th Street NE, and
5. CSAH 19 and River Road NE.

c. *Identify measures that will be taken to minimize or mitigate project related transportation effects.*

The Traffic Study found that mitigation measures were not necessary to accommodate the proposed project. However, the Traffic Study recommended construction of a westbound right turn lane at the at the CSAH 19 and 15th Street NE intersection (**Appendix H**).

19. Cumulative Potential Effects

Preparers can leave this item blank if cumulative potential effects are addressed under the applicable EAW Items.

a. Describe the geographic scales and timeframes of the project related environmental effects that could combine with other environmental effects resulting in cumulative potential effects.

Several other projects are proposed, approved, or under construction within a few miles of the Mahler Aggregate Mine. Two single-family residential projects, covering about 75 acres each, are proposed or under construction on properties about 0.25 mile south and 2 miles west of the proposed aggregate mine and were both the subject of an Environmental Assessment Worksheet in 2018. A mixed medium-density residential and industrial project covering approximately 45 acres and located about .25 west of the proposed aggregate mine is anticipated to be proposed in 2020. The City of Hanover Economic Development Authority lists five commercial and industrial properties that cover 2 to 7 acres each and are available for development. In neighboring St. Michael, there is a separate aggregate mining operation underway immediately north of the proposed project, and another 75-acre residential development under construction about one mile northwest of the proposed project.

It is anticipated that aggregate mining will continue in the project area for the next 15 to 20 years. The timing of aggregate mining will overlap with some of the development projects listed above. The geographic separation, scale of environmental effects, and potential for cumulative effects vary with the proximity, size, intensity, and duration of each project. If future projects meet or exceed mandatory environmental review thresholds, their potential effects will need to be addressed under a separate review process.

b. Describe any reasonably foreseeable future projects (for which a basis of expectation has been laid) that may interact with environmental effects of the proposed project within the geographic scales and timeframes identified above.

Reasonably foreseeable future projects are discussed under **Item 19a** above. Neither the City of Hanover nor the project proponent are aware of other projects proposed in the geographic vicinity of the Mahler Aggregate Mine in the foreseeable future.

c. Discuss the nature of the cumulative potential effects and summarize any other available information relevant to determining whether there is potential for significant environmental effects due to these cumulative effects.

Reasonably foreseeable future projects may combine with the proposed project to result in cumulative effects on infrastructure and natural resources. The potential for cumulative effects varies with the type of resource affected and the geographic area of impact. The geographic separation between projects serves to reduce the potential for cumulative effects.

Potential cumulative effects on public infrastructure relate to stormwater management and transportation systems. The City of Hanover has planned for continued growth and expanded infrastructure system capacity to address these effects and serve anticipated future projects.

Potential cumulative effects of anticipated future projects on natural resources depend largely on the type, density, and location of future projects. Potential effects on natural resources such as wetlands and wildlife vary with project locations and habitat types. Cumulative effects of development on natural resources can include loss of agricultural land and fragmentation of wildlife habitat. Surface water runoff from the project area will infiltrate and ultimately discharge to the Crow River. Compliance with stormwater regulations and BMPs for erosion and sediment control are expected to minimize cumulative effects of post-project runoff on downstream waters. The mitigation measures discussed throughout this EAW will help minimize the potential for cumulative effects on the environment.

20. Other Potential Environmental Effects

If the project may cause any additional environmental effects not addressed by items 1 to 19, describe the effects here, discuss the how the environment will be affected, and identify measures that will be taken to minimize and mitigate these effects.

No other additional environmental effects are anticipated as a result of the project area. Potential environmental effects have been addressed in **Items 1** through **19**.

RGU CERTIFICATION. (The Environmental Quality Board will only accept SIGNED Environmental Assessment Worksheets for public notice in the EQB Monitor.)

I hereby certify that:

- *The information contained in this document is accurate and complete to the best of my knowledge.*
- *The EAW describes the complete project; there are no other projects, stages or components other than those described in this document, which are related to the project as connected actions or phased actions, as defined at Minnesota Rules, parts 4410.0200, subparts 9c and 60, respectively.*
- *Copies of this EAW are being sent to the entire EQB distribution list.*

Signature Cynthia Mabon Date 8-2-19

Title City Planner

This page is intentionally blank.

Figures 1 – 9

Mahler Aggregate Mine EAW

This page is intentionally blank.

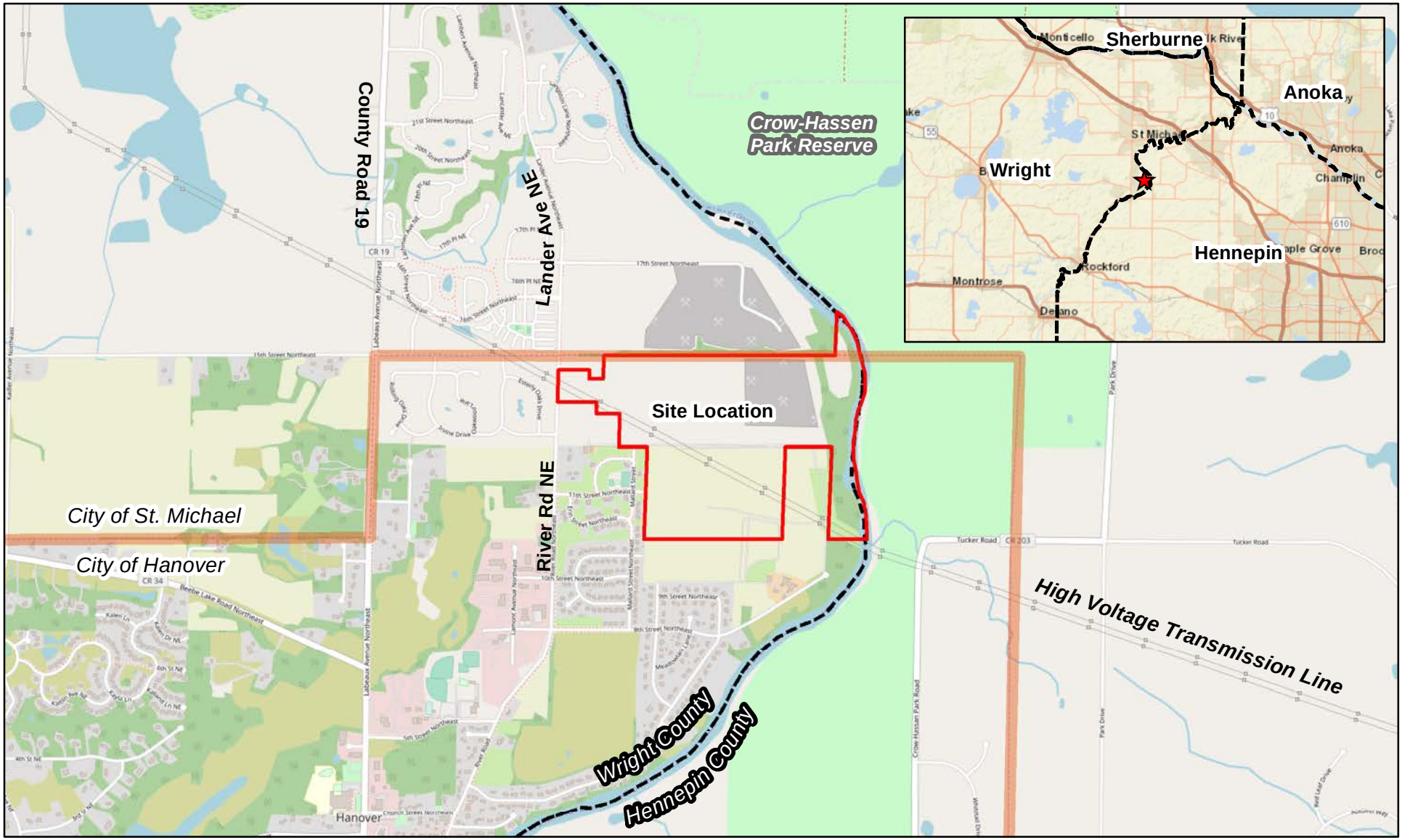


Figure 1 - Project Location

N

0 2,000 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: ESRI Streets Basemap

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

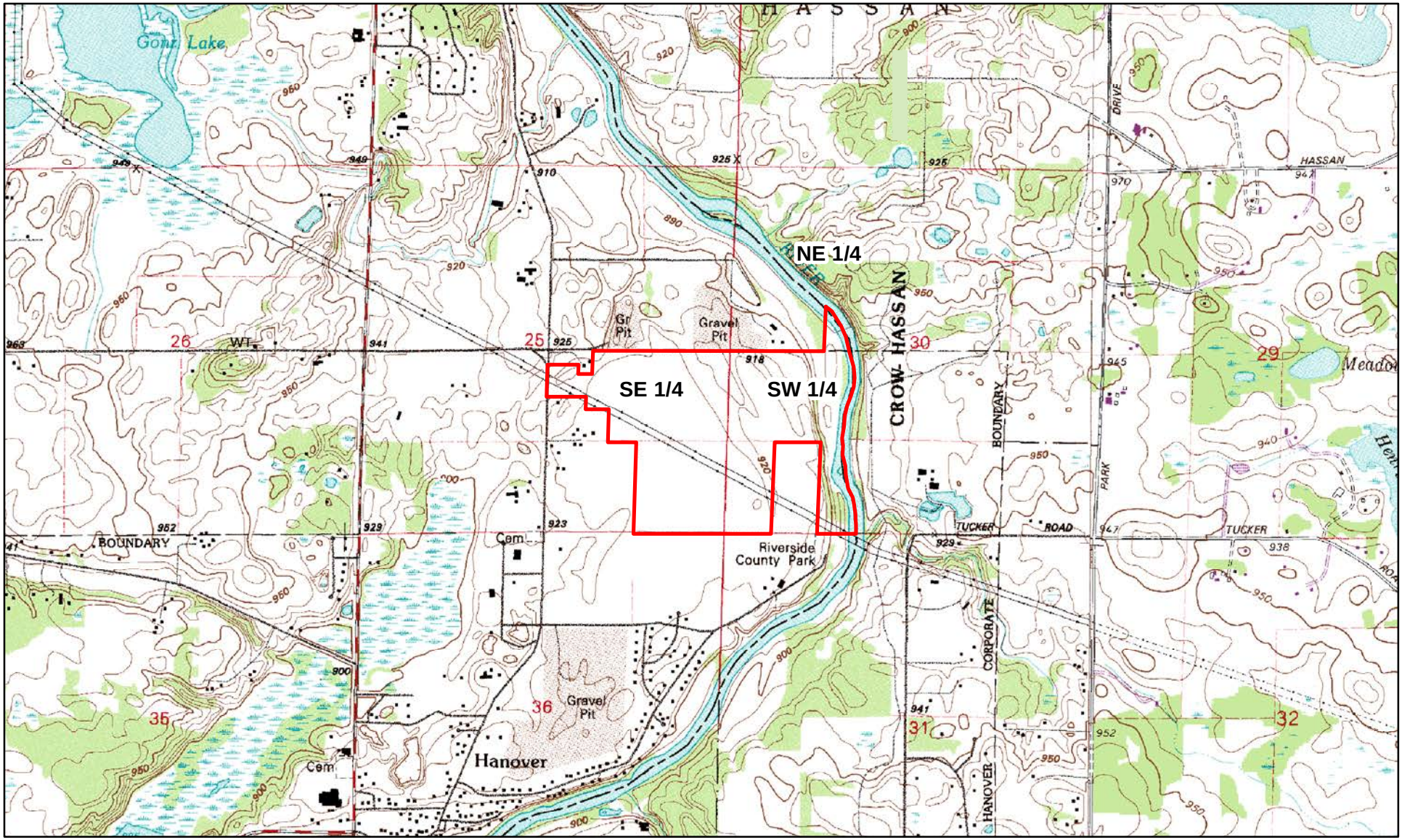


Figure 2 - USGS Topography

N

0 2,000 Feet

Project Boundary

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

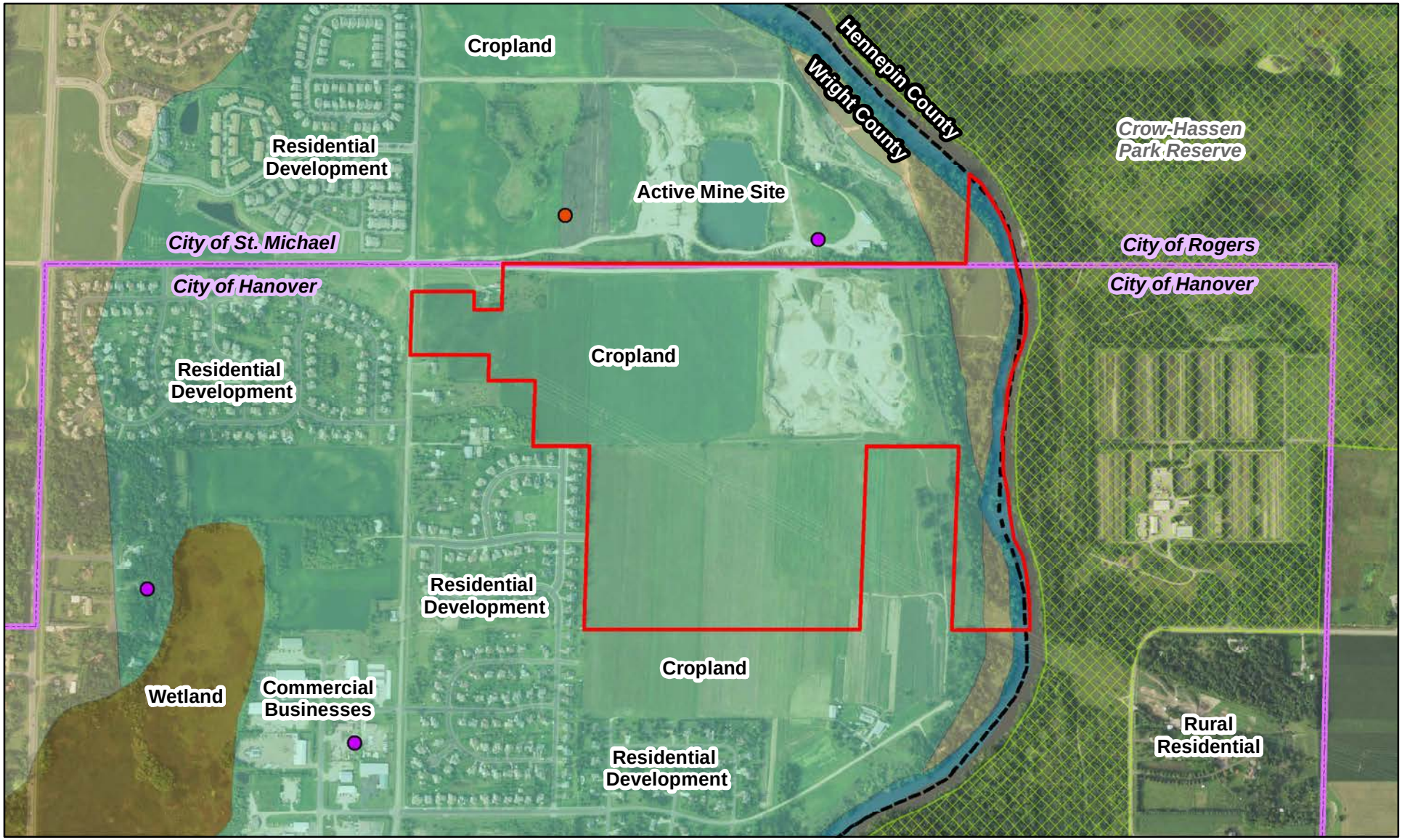


Figure 3 - Aggregate Resources and Surrounding Land Use

N

0 1,000 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

- Project Boundary
- Municipality Boundary
- Crow Hassen Park Reserve
- State Counties

Gravel Pit Type

- MNDOT Identified Aggregate Source
- Gravel Pit

Aggregate Resources

- Potential Aggregate Resource
- Limited Potential for Aggregate
- Organic
- Water

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

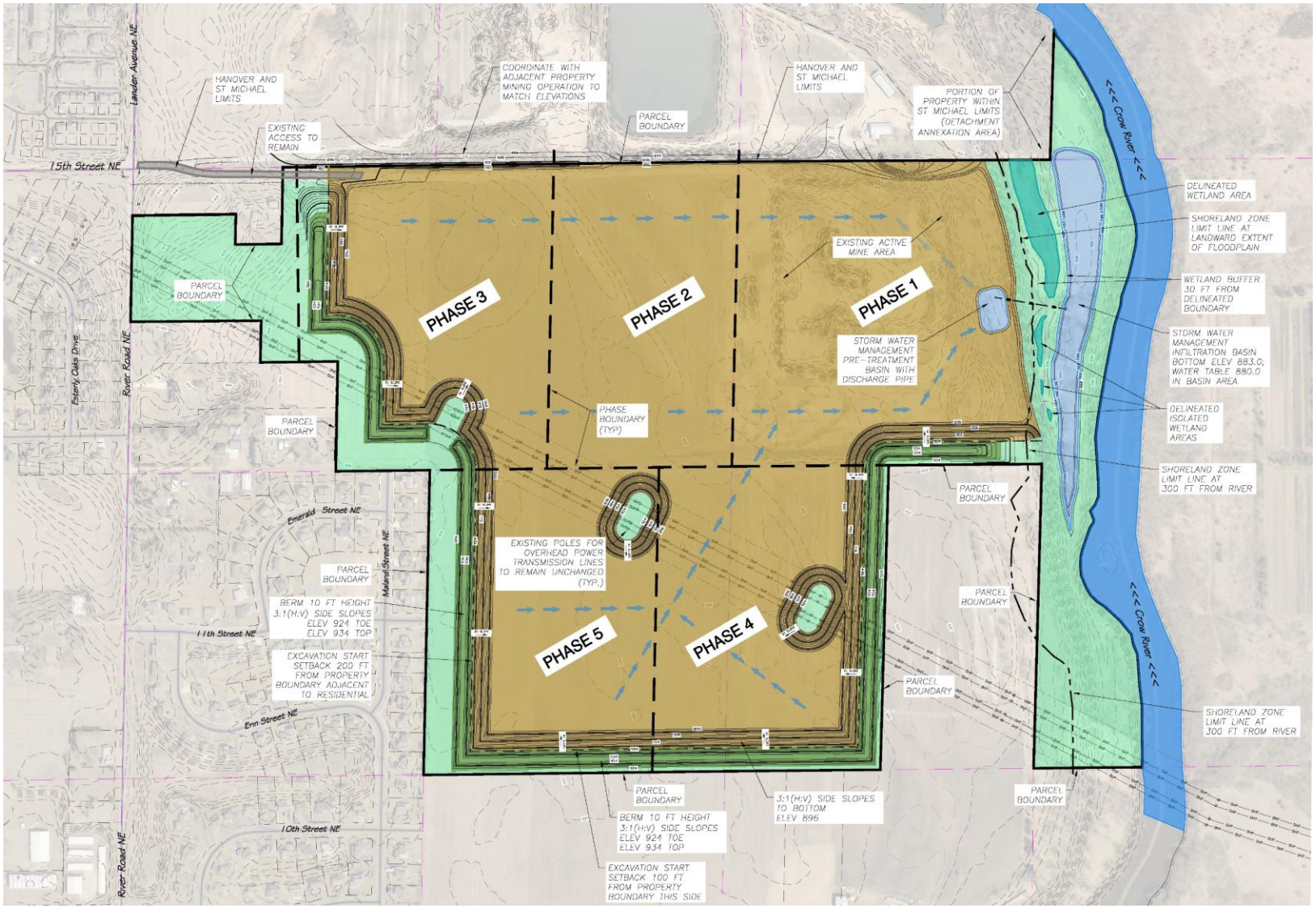


Figure 4 - Mine Expansion and Operations Plan

N

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: Civil Engineering Site Design

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

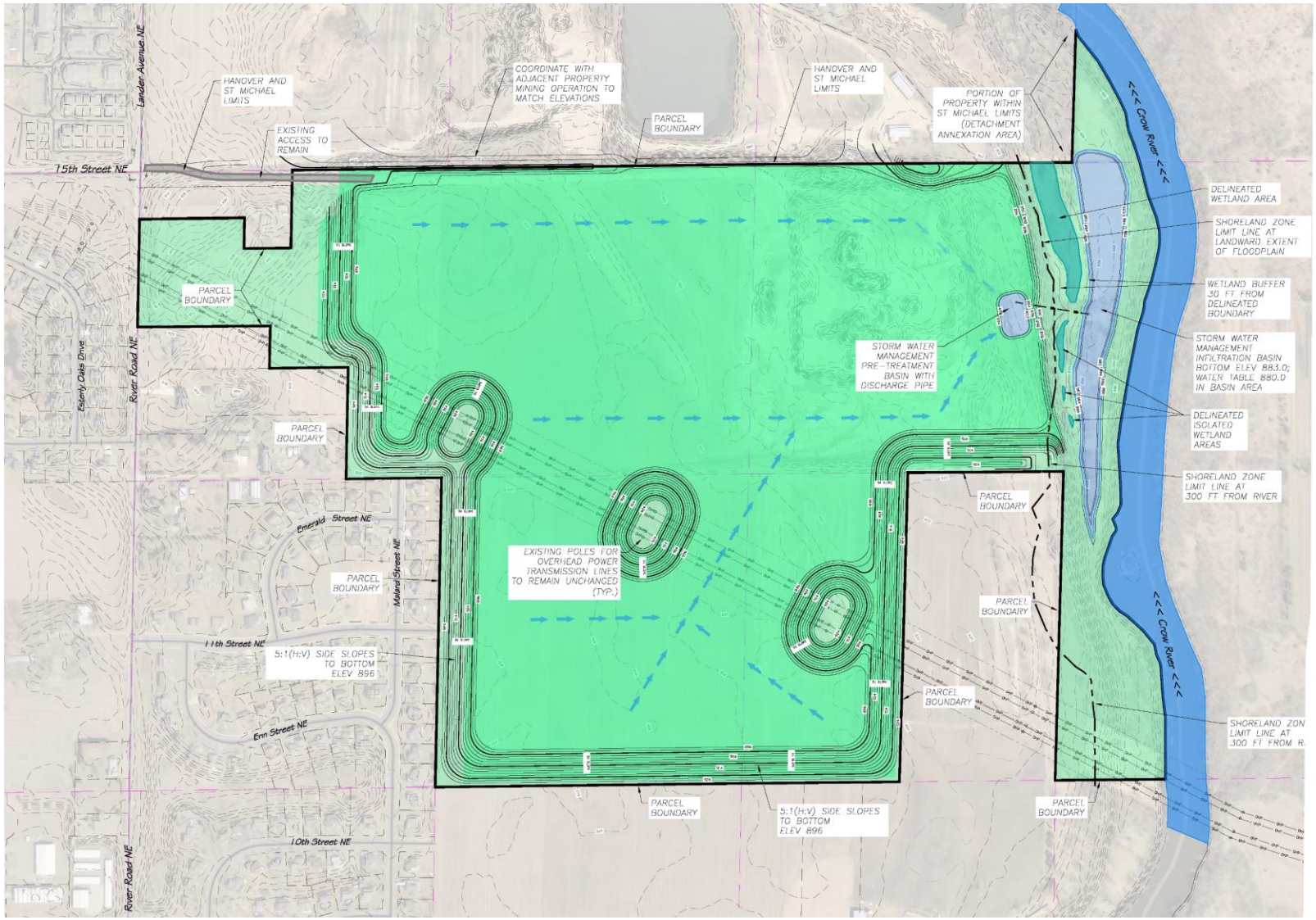


Figure 5 - Mine Reclamation Plan

N

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: Civil Engineering Site Design

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

Figure 6 - Existing Cover Types

N

0 600 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons, Kjolhaug Environmental

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

Figure 7 - Delineated Wetlands and National Wetlands Inventory

N

0 600 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons, Kjolhaug Environmental

Project Boundary

Wetland Boundaries

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

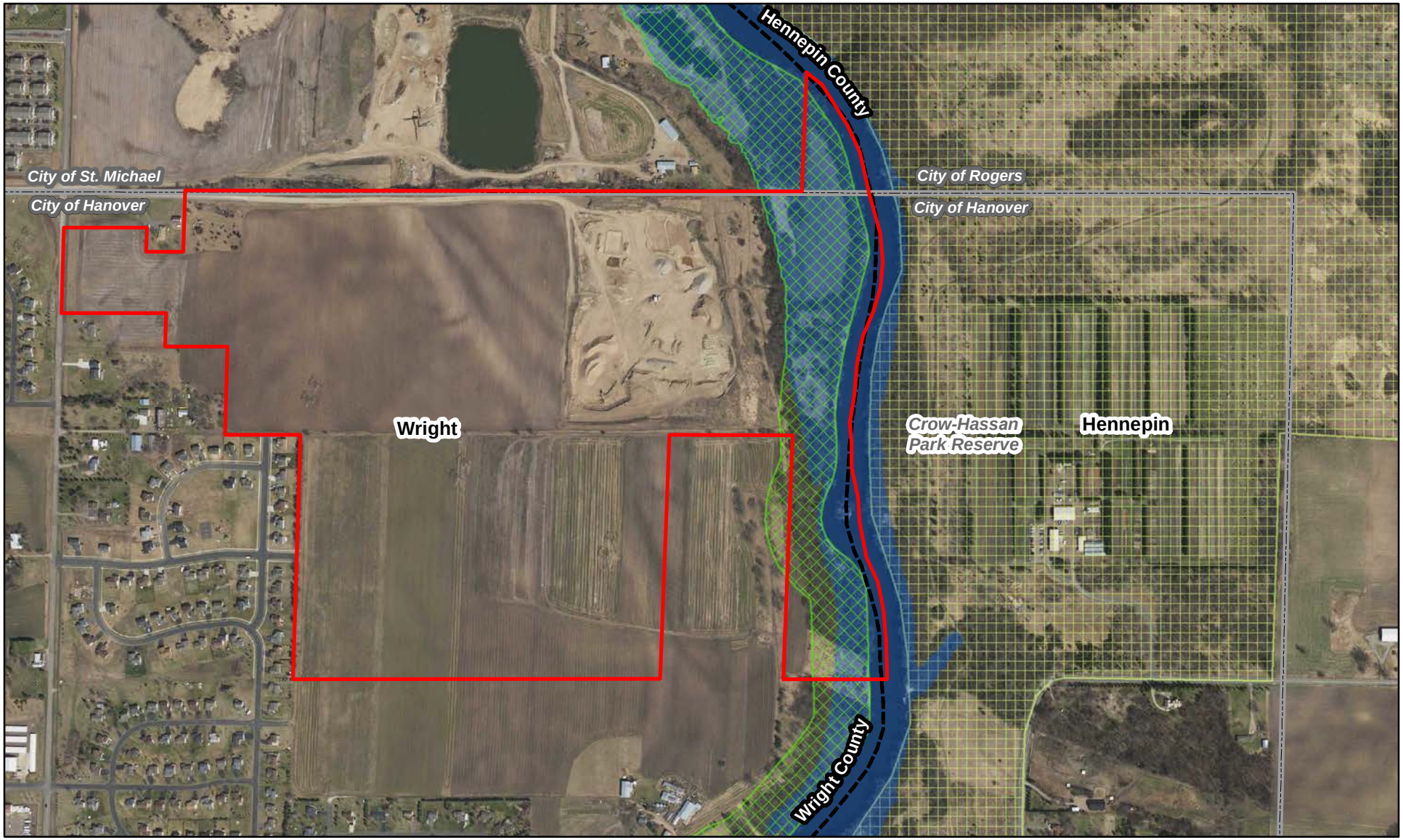


Figure 8 - Shorelands and Floodplains

N

0 750 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

- Project Boundary
- County Boundary
- Municipal Boundary
- Shoreland Zone
- 100- Year Floodplain
- Crow-Hassan Park Reserve

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

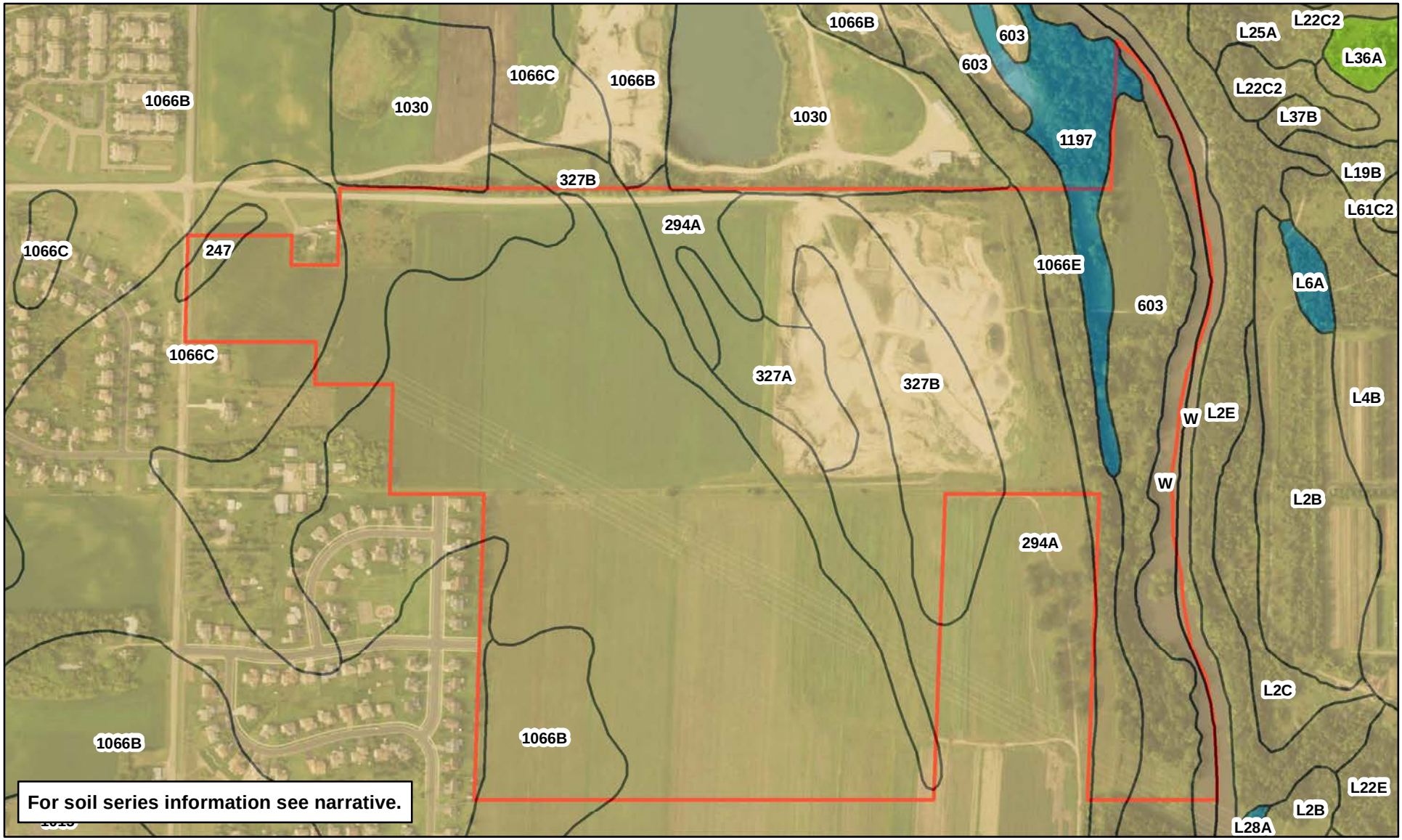


Figure 9 - Soil Types

N

0 600 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

Project Boundary

Hydric/Predominantly Hydric

Partially Hydric

Predominantly Non-Hydric/Non-Hydric

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

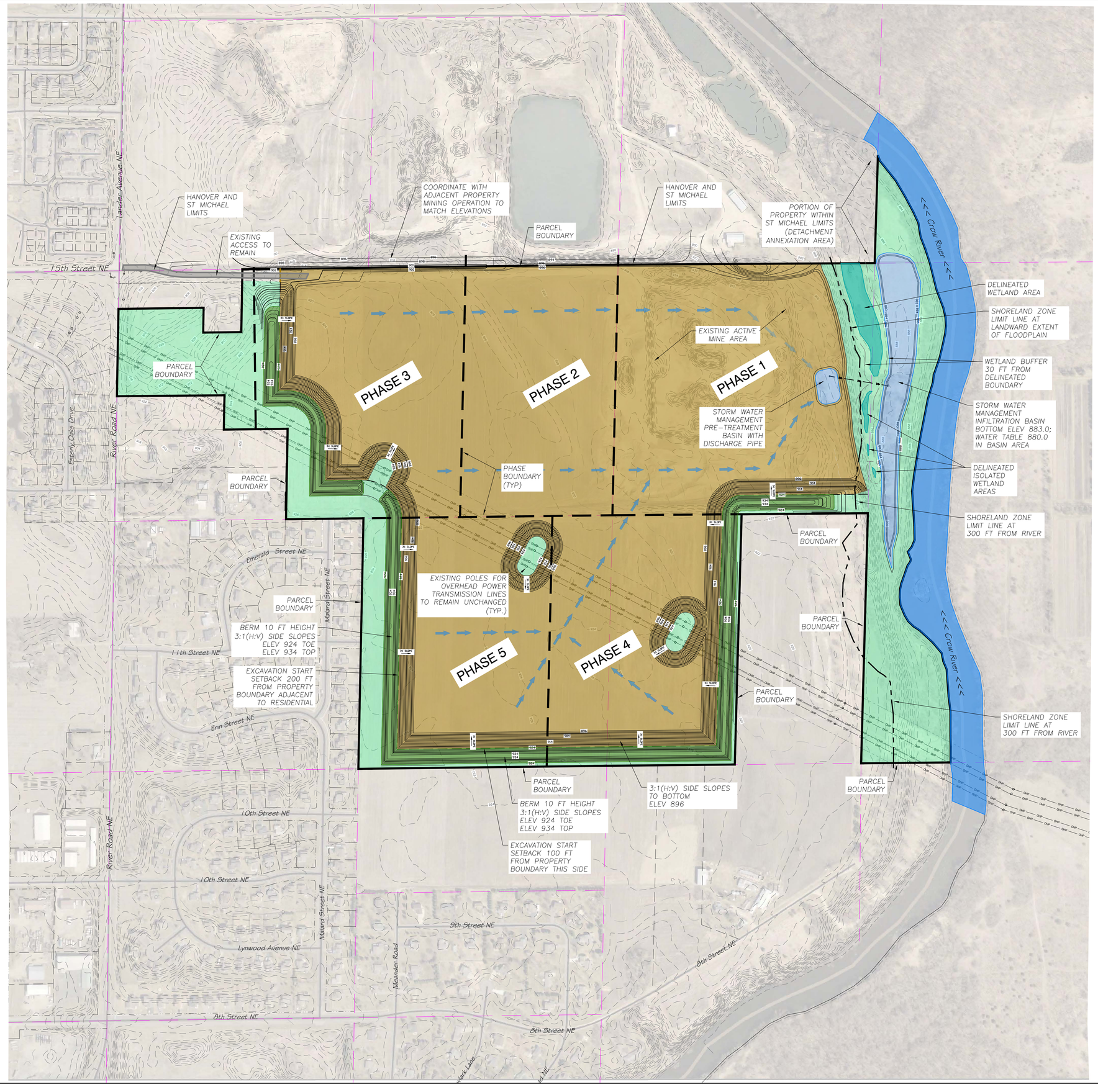
Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

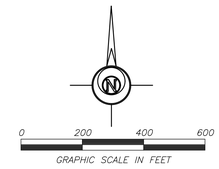
This page is intentionally blank.

Appendix A
Mine Expansion and Reclamation Plans

Mahler Aggregate Mine EAW

This page is intentionally blank.





EXISTING P.I.D. #S

108-500-303-200	HANOVER
108-500-254-200	HANOVER
108-500-254-400	HANOVER
108-500-303-300	HANOVER
114-800-302-400	ST MICHAEL

APPROXIMATE GROSS AREA

184.9 ACRES

APPROXIMATE EXCAVATION AREA

133.9 ACRES

EXCAVATION PHASE DATA

PHASE 1	36.5 AC	2019-2021 *
PHASE 2	24.2 AC	2022-2024
PHASE 3	31.2 AC	2025-2030
PHASE 4	29.9 AC	2031-2034
PHASE 5	29.9 AC	2035-2039

* PHASE 1 AREA INCLUDES EXISTING ACTIVE MINE OPERATIONS

NOTE: 10 FT HIGH BERM TO BE REPOSITIONED IN CONJUCTION WITH EXCAVATION PHASE

EXCAVATION SETBACK

200 FEET TO A RESIDENCE OR RESIDENTIAL ZONING DISTRICT

100 FEET TO NON-RESIDENTIAL ZONING DISTRICTS OR AS APPROVED BY CITY

EXCAVATION ELEVATION DATA

MINE EXCAVATION BOTTOM ELEV 896.0

STORM WATER MANAGEMENT BASIN BOTTOM ELEV 883.0

WATER ELEVATION DATA

MINE AREA WATER TABLE ELEV 886.0

STORM WATER BASIN WATER TABLE ELEV 880.0

CROW RIVER TYPICAL WATER ELEV 876.0

CROW RIVER FEMA 100YR FLOOD ELEV 889.0

LEGEND:

- PROJECT PROPERTY BOUNDARY
- EXISTING CONTOUR INDEX
- EXISTING CONTOUR INTERMEDIATE
- PROPOSED CONTOUR INDEX
- PROPOSED CONTOUR INTERMEDIATE
- PROPOSED DRAINAGE DIRECTION
- STORM WATER MANAGEMENT BASIN
- CROW RIVER
- EXISTING WETLAND AREA
- BERM 10 FT HIGH
- MINE EXCAVATION AREA
- NON-MINED AREA
- ACCESS DRIVE
- PHASE LIMIT

Fehn Companies, Inc.
5050 Barthel Industrial Dr.
Albertville, MN 55301
Gary Fehn
612-282-6542
gfehn@fehncompanies.com

MAHLER AGGREGATE MINE EXPANSION

SE Quad 15th Street and River Road
Hanover, MN 55341

OPERATIONS AND PHASING PLAN

Reg. No.

Date:

PREPARED BY:

CIVIL ENGINEERING
SITE DESIGN
1118 East Broadway St.
PO Box 966
Monticello, MN 55362
Phone: 763.271.0929
www.civilsd.com

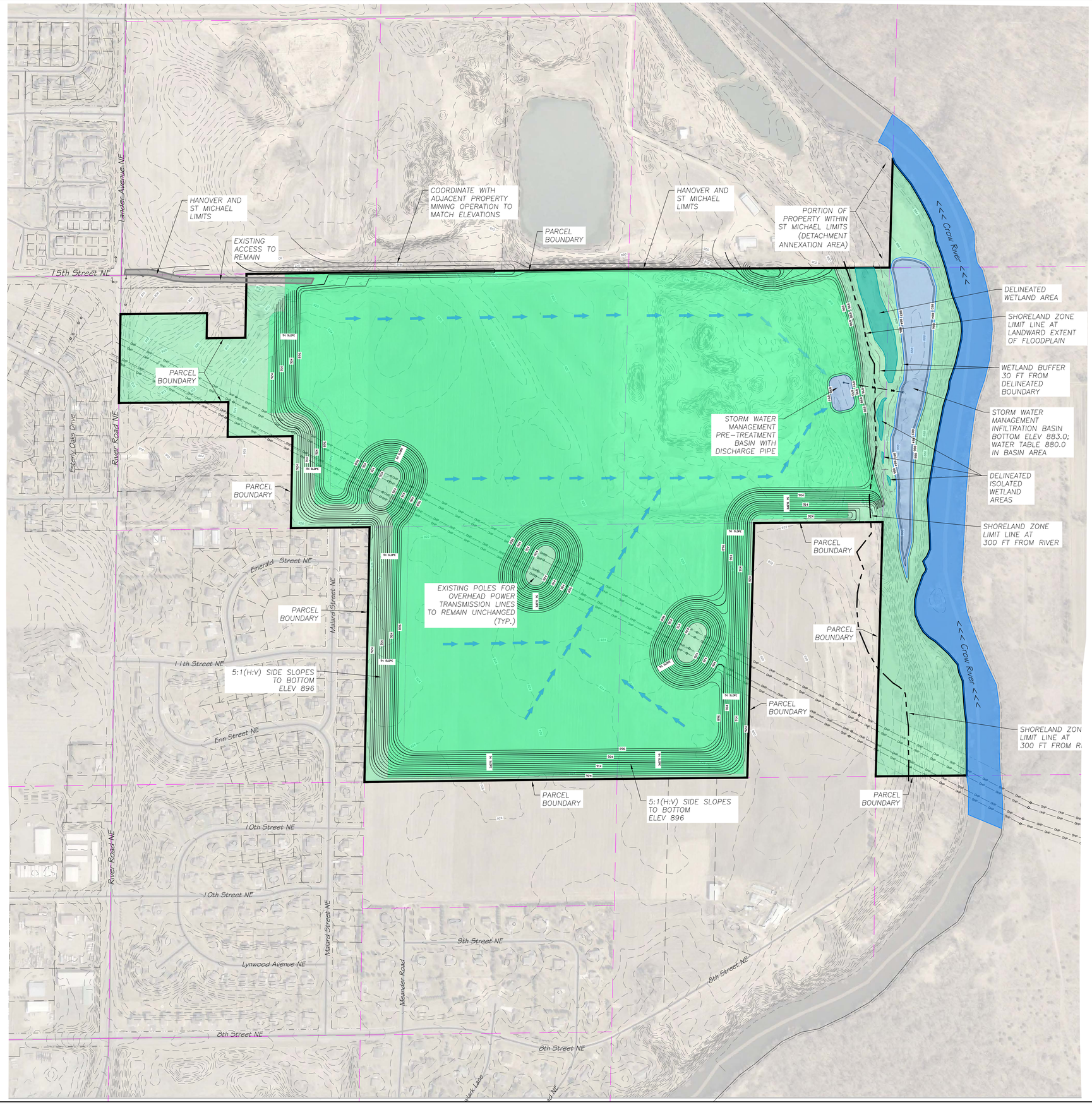
REVISIONS

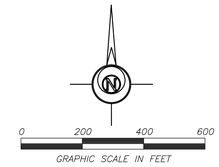
DATE	DRAWN BY	DESIGNED BY	CHECKED BY
06/13/19	SD	SD	SD

FILE NO. 00722

1/1

Operations and Phasing Plan





EXISTING P.I.D. #S

108-500-303-200	HANOVER
108-500-254-200	HANOVER
108-500-254-400	HANOVER
108-500-303-300	HANOVER
114-800-302-400	ST MICHAEL

APPROXIMATE GROSS AREA

184.9 ACRES

EXCAVATION ELEVATION DATA

MINE EXCAVATION BOTTOM ELEV 896.0

STORM WATER MANAGEMENT BASIN BOTTOM ELEV 883.0

WATER ELEVATION DATA

MINE AREA WATER TABLE ELEV 886.0

STORM WATER BASIN WATER TABLE ELEV 880.0

CROW RIVER TYPICAL WATER ELEV 876.0

CROW RIVER FEMA 100YR FLOOD ELEV 889.0

LEGEND:

- PROJECT PROPERTY BOUNDARY
- EXISTING CONTOUR INDEX
- EXISTING CONTOUR INTERMEDIATE
- PROPOSED CONTOUR INDEX
- PROPOSED CONTOUR INTERMEDIATE
- PROPOSED DRAINAGE DIRECTION
- STORM WATER MANAGEMENT BASIN
- CROW RIVER
- EXISTING WETLAND AREA
- RECLAIMED MINE EXCAVATION AREA
- NON-MINED AREA
- ACCESS DRIVE

Fehn Companies, Inc.
5050 Barthel Industrial Dr.
Albertville, MN 55301
Gary Fehn
612-282-6542
gfehn@fehncompanies.com

MAHLER AGGREGATE MINE EXPANSION

SE Quad 15th Street and River Road
Hanover, MN 55341

RECLAMATION PLAN

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Date: *Reg. No.*

PREPARED BY: ***CIVIL ENGINEERING SITE DESIGN***

118 East Broadway St.
PO Box 566
Monticello, MN 55362
Phone: 763.271.0929
www.civilsd.com

REVISIONS

DATE	DRAWN BY	DESIGNED BY	CHECKED BY
06/13/19	SD	SD	SD

FILE NO. 00722

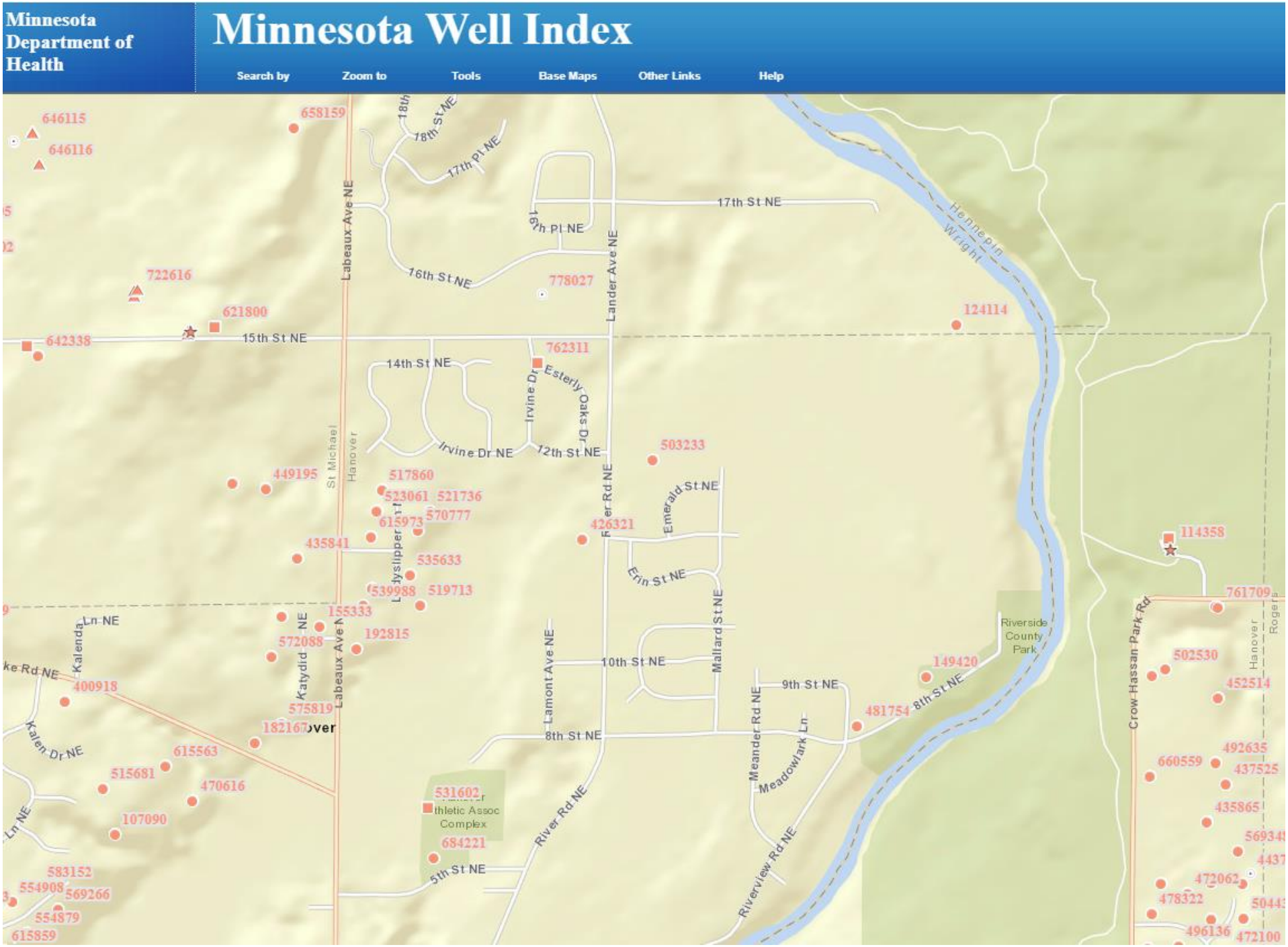
1/1

Reclamation Plan

Appendix B
Well Logs

Mahler Aggregate Mine EAW

This page is intentionally blank.


Minnesota Department of Health
Minnesota Well Index
Search by
Zoom to
Tools
Base Maps
Other Links
Help
646115
646116
658159
722616
621800
642338
778027
124114
762311
503233
449195
517860
523061
521736
570777
615973
435841
535633
539988
519713
426321
114358
761709
155333
572088
192815
400918
575819
615563
515681
470616
107090
531602
684221
583152
554908
569266
554879
615859
149420
481754
502530
452514
492635
660559
437525
435865
472062
478322
496136
472100
18th St NE
17th Pl NE
17th St NE
16th St NE
15th St NE
14th St NE
12th St NE
10th St NE
9th St NE
8th St NE
5th St NE
Irvine Dr NE
Esterly Oaks Dr
Labeaux Ave NE
Lander Ave NE
River Rd NE
Emerald St NE
Erin St NE
Mallard St NE
Lamont Ave NE
Meander Rd NE
Meadowlark Ln
Riverview Rd NE
Hennepin
Wright
Riverside County Park
Crow Hassan Park Rd
Hanover
Rogers
St Michael
Hanover
Athletic Assoc Complex

Minnesota Unique Well Number

124114

County Wright
Quad St Michael
Quad ID 121B

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 04/17/1988
Update Date 02/14/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
DEHMER,	120	23	W	30	BCDCCA

Elevation 907 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Contact HANOVER MN 55374

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
GRAVEL	0	40	BROWN	HARD
CLAY	40	50	BROWN	HARD
WATER SAND	50	63	BROWN	SOFT

Remarks

Well Depth 63 ft. **Depth Completed** 63 ft. **Date Well Completed** 06/30/1975

Drill Method Non-specified Rotary **Drill Fluid**

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint** Threaded

Drive Shoe? Yes ☒ No ☐ **Above/Below** 1.5 ft.

Casing Diameter **Weight**

4 in. To 59 ft. 11 lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** HOWARD SMITH

Diameter	Slot/Gauze	Length	Set
4 in.	10	4 ft.	59 ft. 63 ft.

Static Water Level

50 ft. land surface Measure 06/30/1975

Pumping Level (below land surface)

50 ft. 2 hrs. Pumping at 20 g.p.m.

Wellhead Completion

Pitless adapter manufacturer Model

☐ Casing Protection ☒ 12 in. above grade

☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☐ No ☐ Not Specified

Nearest Known Source of Contamination

100 feet South Direction Septic tank/drain field Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 07/07/1975

Manufacturer's name MYERS

Model Number HP 0.5 Volt 120

Length of drop pipe 50 ft Capacity 12 g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. buried

Last Strat sand-brown Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method Digitized - scale 1:24,000 or larger (Digitizing Table)

System UTM - NAD83, Zone 15, Meters X 449540 Y 5002521

Unique Number Verification Information from Input Date 04/12/1995

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Torgerson, Art & Son	02203	TORGERSON, A.

Minnesota Unique Well Number

503233

County Wright
Quad St Michael
Quad ID 121B

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 04/18/1991
Update Date 03/10/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
MAHLER,	120	24	W	25	DBCDCD

Elevation 926 ft. **Elev. Method** CALC FROM 2-FOOT COUNTY DEM

Address

C/W 1263 RIVER RD NE ST MICHAEL MN 55376

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	66		
CLAY	66	78		
SHALE	78	91		
WATER SAND	91	100		

Remarks

Well Depth 100 ft. **Depth Completed** 100 ft. **Date Well Completed** 10/17/1989

Drill Method Non-specified Rotary **Drill Fluid**

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter		Weight
4	in. To 95 ft.	lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** SMITH

Diameter	Slot/Gauze	Length	Set	
in.	12	ft.	ft.	ft.

Static Water Level
46 ft. land surface Measure 10/17/1989

Pumping Level (below land surface)
ft. hrs. Pumping at 15 g.p.m.

Wellhead Completion
Pitless adapter manufacturer WHITEWATER Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement		0 ft.	30 ft.

Nearest Known Source of Contamination
feet Direction Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 10/19/1989
Manufacturer's name JACUZZI
Model Number HP 0.5 Volt
Length of drop pipe 80 ft Capacity g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Aquifer Quat. buried
Last Strat sand Depth to Bedrock ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 448622 Y 5002122
Unique Number Verification Tax Records Input Date 01/27/2010

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Torgerson Well Co.	27056	TORGERSON, R.

Minnesota Unique Well Number

426321

County Wright
Quad St Michael
Quad ID 121B

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 04/05/1989
Update Date 03/10/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
SCHENDEL,	120	24	W	25	CDDABA

Elevation 926 ft. **Elev. Method** CALC FROM 2-FOOT COUNTY DEM

Address

Well 1112 RIVER RD NE ST MICHAEL MN 55376

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
GRAVEL	0	70		
WATER SAND	70	85		

Remarks

Well Depth 85 ft. **Depth Completed** 85 ft. **Date Well Completed** 03/02/1987

Drill Method Non-specified Rotary **Drill Fluid**

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight
4 in. To 80 ft.	lbs./ft.

Open Hole From ft. To ft.

Screen? ☒ **Type** stainless **Make** JOHNSON

Diameter	Slot/Gauze	Length	Set
2 in.		ft.	ft. ft.

Static Water Level

8 ft. land surface Measure 03/02/1987

Pumping Level (below land surface)

ft. hrs. Pumping at 25 g.p.m.

Wellhead Completion

Pitless adapter manufacturer Model

☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement		ft.	ft.

Nearest Known Source of Contamination

feet Direction Type

Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 03/03/1987

Manufacturer's name MYERS

Model Number HP 0.75 Volt

Length of drop pipe 40 ft Capacity g.p. Typ Submersible

Abandoned

Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance

Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous

First Bedrock Aquifer Quat. Water

Last Strat sand Depth to Bedrock ft

Located by Minnesota Geological Survey

Locate Method GPS SA Off (averaged) (15 meters)

System UTM - NAD83, Zone 15, Meters X 448408 Y 5001886

Unique Number Verification Tax Records Input Date 01/27/2010

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Torgerson Well Co.	27056	OTTEN, D.

Minnesota Unique Well Number

481754

County Wright
Quad St Michael
Quad ID 121B

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 05/17/1993
Update Date 08/18/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
RUTER, MARTIN	120	24	W	36	AADDDD

Elevation 916 ft. **Elev. Method** CALC FROM 2-FOOT COUNTY DEM

Address

Well 11959 RIVERVIEW RD NE HANOVER MN 55341

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
GRAVEL	0	32		
CLAY W/GRAVEL	32	68	BROWN	
SAND & GRAVEL	68	80		
SHALE & SANDROCK	80	130		

Remarks

Well Depth	Depth Completed	Date Well Completed
130 ft.	130 ft.	07/20/1992

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☒ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 89 ft.	lbs./ft.	6.5 in. To 89 ft.
		4 in. To 130 ft.

Open Hole From 89 ft. To 130 ft.

Screen? ☐ **Type** **Make**

Static Water Level
45 ft. land surface Measure 07/20/1992

Pumping Level (below land surface)
ft. hrs. Pumping at 35 g.p.m.

Wellhead Completion
Pitless adapter manufacturer WHITEWATER Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Nearest Known Source of Contamination
75 feet North Direction Septic tank/drain field Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 07/24/1992
Manufacturer's name TAIT
Model Number HP 0.5 Volt
Length of drop pipe 60 ft Capacity g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock Tunnel City Group Aquifer Tunnel City
Last Strat Tunnel City Group Depth to Bedrock 80 ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 449232 Y 5001318
Unique Number Verification Tax Records Input Date 01/27/2010

Angled Drill Hole

Well Contractor

Licensee Business	Lic. or Reg. No.	Name of Driller
Torgerson Well Co.	27056	TORGERSON, R.

Minnesota Unique Well Number

149420

County Wright
Quad St Michael
Quad ID 121B

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 04/17/1988
Update Date 09/15/2014
Received Date

Well Name	Township	Range	Dir	Section	Subsection
RUTER, MARTIN	120	23	W	31	BBCAAD

Elevation 924 ft. **Elev. Method** CALC FROM 2-FOOT COUNTY DEM

Address

C/W 12119 8TH ST NE HANOVER MN 55341

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	30	BROWN	
CLAY	30	80	BROWN	
SHALE & ROCK	80	111	WHT/BLU	

Remarks

Well Depth	Depth Completed	Date Well Completed
111 ft.	111 ft.	03/27/1978

Drill Method Non-specified Rotary **Drill Fluid**

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint** Threaded
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 96 ft.	lbs./ft.	4 in. To 111 ft.

Open Hole From 96 ft. To 111 ft.

Screen? ☐ **Type** **Make**

Static Water Level
30 ft. land surface Measure 03/27/1978

Pumping Level (below land surface)
40 ft. 3 hrs. Pumping at 30 g.p.m.

Wellhead Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Nearest Known Source of Contamination
feet Direction Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 03/29/1978
Manufacturer's name AERMOTOR
Model Number HP 0.5 Volt
Length of drop pipe 54 ft Capacity g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock St.Lawrence-Tunnel City Aquifer St.Lawrence-
Last Strat St.Lawrence-Tunnel City Depth to Bedrock 80 ft
Located by Minnesota Geological Survey
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 449441 Y 5001463
Unique Number Verification Tax Records Input Date 01/27/2010

Angled Drill Hole

Well Contractor
Torgerson Well Co. 27056 TORGERSON, B.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

114358

County Hennepin
Quad St Michael
Quad ID 121B

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 08/24/1991
Update Date 12/12/2016
Received Date

Well Name	Township	Range	Dir	Section	Subsection
CROW HASSEN	120	23	W	30	DCCABC

Elevation 935 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Contact MAPLE PLAIN MN
Well ROGERS MN 55374

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SAND	0	21	BROWN	
GRAVEL & CLAY	21	81	BRN/GRY	
CLAY & STONES	81	85	GRAY	
SHALE	85	96	GREEN	
SHALE & SANDSTONE	96	145	VARIED	SOFT
SHALE SANDSTONE	145	150	TAN/GRN	M.HARD
SANDSTONE SHALE	150	183	RED/GRN	M.HARD
SANDSTONE SHALE	183	195	TAN/RED	HARD
SANDSTONE SHALE	195	200	GRN/TAN	M.HARD
SANDSTONE SHALE	200	213	RED/TAN	M.HARD
SHALE	213	228	GREEN	SOFT
SANDSTONE SHALE	228	290	TAN/GRN	M.HARD
SANDSTONE SHALE	290	300	TAN/GRN	M.HARD
SHALE	300	316	RED	HARD
SANDSTONE SHALE	316	360		HARD
SANDSTONE SHALE	360	405		HARD

Remarks

M.G.S. NO. 1096.
SOUTH REFUGE W-7 MP=1.55. DICK SCHUMACHER 1-972-3941.

Well Depth 405 ft. **Depth Completed** 405 ft. **Date Well Completed** 12/26/1975

Drill Method Non-specified Rotary **Drill Fluid**

Use test well **Status** Active

Well Hydrofractured? Yes ☐ No ☐ **From** **To**

Casing Type Single casing **Joint** Threaded
Drive Shoe? Yes ☒ No ☐ **Above/Below** 1 ft.

Casing Diameter		Weight		Hole Diameter	
4 in. To 156 ft.		10.7 lbs./ft.		4 in. To 405 ft.	

Open Hole From 156 ft. To 405 ft.

Screen? ☐ **Type** **Make**

Static Water Level
35 ft. land surface Measure 12/26/1975

Pumping Level (below land surface)
43 ft. hrs. Pumping at 20 g.p.m.

Wellhead Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☐ Yes ☐ No ☐ Not Specified

Nearest Known Source of Contamination
feet Direction Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☒ Not Installed Date Installed
Manufacturer's name
Model Number HP Volt
Length of drop pipe ft Capacity g.p. Typ

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☐ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Miscellaneous
First Bedrock St.Lawrence Formation Aquifer Tunnel City-Mt.
Last Strat Mt.Simon Sandstone Depth to Bedrock 85 ft
Located by Minnesota Geological Survey
Locate Method Digitized - scale 1:24,000 or larger (Digitizing Table)
System UTM - NAD83, Zone 15, Meters X 450180 Y 5001841
Unique Number Verification Information from Input Date 01/01/1990

Angled Drill Hole

Well Contractor
Renner E.H. & Sons 27015 WOLTERS, P.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

728665

County Hennepin
Quad St Michael
Quad ID 121B

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING REPORT

Minnesota Statutes Chapter 1031

Entry Date 01/27/2006
Update Date 08/18/2014
Received Date 01/30/2006

Well Name	Township	Range	Dir	Section	Subsection
SUBURBAN	120	23	W	30	DCCBAA

Elevation 935 ft. **Elev. Method** 7.5 minute topographic map (+/- 5 feet)

Address

Contact 300 XENIUM LA N PLYMOUTH MN 55441
Well HANOVER MN 55341

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
SILTY SANDS/GRAVEL	0	75	BRN/RED	SOFT
SHALE AQUA	75	140		MEDIUM
SANDROCK TAN/AQUA	140	225		HARD
SANDSTONE	225	290	TAN	HARD
SANDSTONE/SHALE	290	300		HARD

Remarks

ADDRESS: CROW HASSAN PARK RD & TURNER RD HANOVER, 55341.

"ADDITIONAL DEVELOPMENT PERFORMED ON THIS WELL, AIR SURGE & AIR COMPRESSION
PERFORMED. THEN AIR LIFTING MATERIAL FROM BOTTOM REMOVED 10-15 YDS OF
SANDSTONE."

05-T-20843

Well Depth 300 ft. **Depth Completed** 300 ft. **Date Well Completed** 06/17/2005

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use irrigation **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint** Welded
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
6 in. To 150 ft.	lbs./ft.	10 in. To 150 ft.
		6 in. To 300 ft.

Open Hole From 150 ft. To 300 ft.

Screen? ☐ **Type** **Make**

Static Water Level
38 ft. land surface Measure 06/17/2005

Pumping Level (below land surface)

Wellhead Completion
Pitless adapter manufacturer MONITOR Model BAKER
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
neat cement	65 Sacks	ft.	150 ft.

Nearest Known Source of Contamination
0 feet Direction Type
Well disinfected upon completion? ☐ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name
Model Number HP 15 Volt 480
Length of drop pipe 120 ft Capacity 125 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock St.Lawrence-Tunnel City Aquifer Tunnel City-Eau
Last Strat Eau Claire Formation Depth to Bedrock 75 ft
Located by Minnesota Department of Health
Locate Method GPS SA Off (averaged) (15 meters)
System UTM - NAD83, Zone 15, Meters X 450179 Y 5001875
Unique Number Verification Info/GPS from data Input Date 12/28/2005

Angled Drill Hole

Well Contractor
Bergerson-Caswell 27058 HOLMEN, G.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Unique Well Number

761709

County Hennepin
Quad St Michael
Quad ID 121B

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date 09/02/2011
Update Date 11/07/2016
Received Date 10/09/2009

Well Name	Township	Range	Dir	Section	Subsection
LANE, RANDY	120	23	W	31	ABABBD

Elevation 950 ft. **Elev. Method** LiDAR 1m DEM (MNDNR)

Address

C/W 11640 CROW HASSAN PARK DR HANOVER MN 55341

Stratigraphy Information

Geological Material	From	To (ft.)	Color	Hardness
ROCKS & GRAVEL	0	25	BROWN	SOFT
GRAVEL	25	78	BROWN	SOFT
SHALE & ROCK	78	105	WHITE	HARD
HARDROCK	105	107	WHITE	HARD
SANDROCK	107	155		

Remarks

WELL SEALED ON PROPERTY

Well Depth	Depth Completed	Date Well Completed
155 ft.	155 ft.	09/25/2009

Drill Method Non-specified Rotary **Drill Fluid** Bentonite

Use domestic **Status** Active

Well Hydrofractured? Yes ☐ No ☒ **From** **To**

Casing Type Single casing **Joint**
Drive Shoe? Yes ☐ No ☐ **Above/Below**

Casing Diameter	Weight	Hole Diameter
4 in. To 107 ft.	lbs./ft.	8 in. To 107 ft.

Open Hole From 107 ft. To 155 ft.

Screen? ☐ **Type** **Make**

Static Water Level
65 ft. land surface Measure 09/25/2009

Pumping Level (below land surface)
80 ft. 1 hrs. Pumping at 25 g.p.m.

Wellhead Completion
Pitless adapter manufacturer AQUASEAL Model WELLS 4X1
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

Grouting Information Well Grouted? ☒ Yes ☐ No ☐ Not Specified

Material	Amount	From	To
cuttings		50 ft.	97 ft.
neat cement		97 ft.	107 ft.
other	4 Sacks	ft.	50 ft.

Nearest Known Source of Contamination
35 feet South Direction Sewer Type
Well disinfected upon completion? ☒ Yes ☐ No

Pump ☐ Not Installed Date Installed 09/25/2009
Manufacturer's name AERMOTOR
Model Number T-20 HP 1 Volt 230
Length of drop pipe 80 ft Capacity 20 g.p. Typ Submersible

Abandoned
Does property have any not in use and not sealed well(s)? ☐ Yes ☒ No

Variance
Was a variance granted from the MDH for this well? ☐ Yes ☒ No

Miscellaneous
First Bedrock St.Lawrence Formation Aquifer Tunnel City
Last Strat Tunnel City Group Depth to Bedrock 78 ft
Located by Minnesota Geological Survey
Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or
System UTM - NAD83, Zone 15, Meters X 450323 Y 5001667
Unique Number Verification Address verification Input Date 02/17/2015

Angled Drill Hole

Well Contractor
Macs Well and Pump Service 1913 MCALPINE, D.
Licensee Business Lic. or Reg. No. Name of Driller

Minnesota Well Index Report | **761709** | Printed on 04/16/2019
HE-01205-15

This page is intentionally blank.

Appendix C

Wetland Delineation Report Excerpt

Mahler Aggregate Mine EAW

This page is intentionally blank.

Mahler Aggregate Mine

Hanover, Wright County, Minnesota

Wetland Delineation Report

Prepared for

Fehn Companies

by

Kjolhaug Environmental Services Company, Inc.
(KES Project No. 2019-035)

June 28, 2019

Mahler Aggregates Mine

Hanover, Wright County, Minnesota

Wetland Delineation Report

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

Mahler Aggregate Mine

Hanover, Wright County, Minnesota

Wetland Delineation Report

1. WETLAND DELINEATION SUMMARY

- The 184.47-acre Mahler Aggregate Mine site was inspected on April 30, 2019 for the presence and extent of wetland.
- The National Wetlands Inventory (NWI) map showed one R2UBH wetland and two PFO1A wetlands mapped within the site boundaries.
- Hydric soils on the property included Suckercreek fine sandy loam soils.
- The DNR Public Waters Inventory showed the Crow River (DNR Public Watercourse M-064) located along the eastern property boundary. No other DNR Public Waters, Wetlands or Watercourses were mapped within 1,000 feet of the site boundaries.
- The National Hydrography Dataset showed one river located within the site boundaries.
- Seven wetlands that were delineated within the site boundaries are summarized below in **Table 1**.

Table 1. Wetlands delineated on the Mahler Aggregate Mine site

Wetland ID	Acres	Wetland Type			Dominant Vegetation
		Circular 39	Cowardin	Eggers and Reed	
1	1.2369	1/2	PEM1A/Bf	Seasonally flooded basin/Wet meadow	Reed canary grass, tilled cropland
2	0.1051	1	PFO1A	Forested seasonally flooded basin	Reed canary grass, common buckthorn, green ash, American elm
3	0.0104	1	PEM1A	Seasonally flooded basin	Reed canary grass, sedges, box elder, common buckthorn
4	0.0125	1	PEM1A	Seasonally flooded basin	Reed canary grass

2. OVERVIEW

The 184.47-acre Mahler Aggregate Mine site was inspected on April 30, 2019 for the presence and extent of wetland. The property was located in the Southeast ¼ of Section 25, Township 120 North, Range 24 West and the Southwest ¼ Section 30, Township 120 North, Range 23 West, City of Hanover, Wright County, Minnesota. The site was situated west of River Road NE, east of the Crow River, north of 8th street NE (**Figure 1**). The property corresponded to Wright County PIDs: 114800302400, 108500303200, 108500303300, 108500254400, and 108500254200.

The site consisted of annually-tilled cropland that was planted with corn and soybean for the 2018 growing season, an active aggregate mine, and hillslopes down to river bottoms. The topography sloped from an elevation of 936 feet msl in the northern portion of the site down to a low of 876 feet msl in the northeastern corner of the site. The property drained towards the east to the Crow River.

The property was bordered on the west by single-family homes and River Road NE, on the east by the Crow River (DNR Public Watercourse M-064), on the south by cropland, Riverside County Park, single-family homes, and on the north by aggregate mining operations and wetlands.

Four wetlands were delineated within the site boundaries. The delineated wetland boundaries and existing conditions are shown on **Figure 2**.

Appendix A of this report includes a Joint Application Form for Activities Affecting Water Resources in Minnesota, which is submitted in request for: (1) a wetland boundary and type determination under the Minnesota Wetland Conservation Act (WCA), and (2) delineation concurrence under Section 404 of the Federal Clean Water Act.

3. METHODS

3.1 Wetland Delineation

Wetlands were identified using the Routine Determination method described in the Corps of Engineers Wetlands Delineation Manual (Waterways Experiment Station, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (Version 2.0) as required under Section 404 of the Clean Water Act and the Minnesota Wetland Conservation Act.

Wetland boundaries were identified as the upper-most extent of wetland that met criteria for hydric soils, hydrophytic vegetation, and wetland hydrology. Wetland-upland boundaries were marked with pin flags that were located by a Trimble Juno GPS unit.

Soils, vegetation, and hydrology were documented at a representative location along the wetland-upland boundary. Plant species dominance was estimated based on the percent aerial or basal

coverage visually estimated within a 30-foot radius for trees and vines, a 15-foot radius for the shrub layer, and a 5-foot radius for the herbaceous layer within the community type sampled.

Soils were characterized to a minimum depth of 24 inches (unless otherwise noted) using a Munsell Soil Color Book and standard soil texturing methodology. Hydric soil indicators used are from Field Indicators of Hydric Soils in the United States (USDA Natural Resources Conservation Service (NRCS) in cooperation with the National Technical Committee for Hydric Soils, Version 8.1, 2017).

Mapped soils are separated into five classes based on the composition of hydric components and the Hydric Rating by Map Unit color classes utilized on Web Soil Survey. The five classes include Hydric (100 percent hydric components), Predominantly Hydric (66 to 99 percent hydric components), Partially Hydric (33 to 65 percent hydric components), Predominantly Non-Hydric (1 to 32 percent hydric components), and Non-Hydric (less than one percent hydric components).

Plants were identified using standard regional plant keys. Taxonomy and indicator status of plant species was taken from the 2016 National Wetland Plant List (U.S. Army Corps of Engineers 2016. National Wetland Plant List, version 3.3, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, NH).

3.2 Aerial Review for Offsite Hydrology Determinations

Areas in agricultural cropland that exhibited potential wetland signatures on aerial photography and with low or depressional topography were reviewed generally following methods described in Guidance for Offsite Hydrology/Wetland Determination (Minnesota Board of Water and Soil Resources (BWSR) and USACE 2017) and Guidance for Submittal of Delineation Reports to the St. Paul District Corps of Engineers and Wetland Conservation Act Local Governmental Units in Minnesota, Version 2.0 (USACE 2015). These methods use aerial photography and antecedent precipitation conditions to identify areas that have wetland hydrology signatures during periods of typical precipitation.

Available years of Farm Service Agency (FSA) aerial photography were reviewed for the site to determine long-term hydrology. In cases where additional aerial photography was relevant, available, and necessary to make hydrology determinations, we reviewed aerial photography from other sources such as the Minnesota Geospatial Information Office (MnGEO) and Google Earth.

Signatures at locations of potential wetlands on aerial photographs were interpreted and classified using seven codes (**Table 2**). Wetland hydrology was assumed to be present within areas exhibiting wetland signatures in more than 50% of years with normal climatic conditions based on antecedent precipitation.

Table 2. Aerial photograph interpretation codes

Code	Classification
CS	Crop stress
DO	Drowned out

Table 2. Aerial photograph interpretation codes

Code	Classification
NC	Not cropped
SW	Standing water
WS	Wetland signature
AP	Altered pattern
NV	Normal vegetation

This analysis used only aerial photographs taken following periods of precipitation within the normal range as determined using the Wetland Delineation Precipitation Data Retrieval tool (Minnesota Climatology Office 2015). This tool classifies antecedent precipitation as Normal (N), Wet (W) or Dry (D) by comparing precipitation during the three months preceding the estimated date of aerial photography to the 30-year average from 1981-2010. July 1 was used as the estimated date of FSA aerial photography.

4. RESULTS

4.1 Review of NWI, Soils, Public Waters and NHD Information

The National Wetlands Inventory (NWI) (Minnesota Geospatial Commons 2009-2014 and U.S. Fish and Wildlife Service) showed one R2UBH wetland and two PFO1A wetlands mapped within the site boundaries (**Figure 3**).

The Soil Survey (USDA NRCS 2015) showed predominately-hydric soil types was on and near the property which included Suckercreek soils. Predominantly non-hydric soils included Harlon, Malardi-Hawick complex, Rasset, Dickman, and Linder soils. Soil types mapped on the property are listed in **Table 3** below and a map showing soil types is included in **Figure 4**.

Table 3. Soil types mapped on the Mahler Aggregate Mine site

Symbol	Soil Name	Acres	% of Area	% Hydric	Hydric Category
247	Linder loam, 0 to 2 percent slopes	1.0	0.5%	10	Predominantly non-hydric
294A	Rasset sandy loam, 0 to 2 percent slopes	99.5	52.7%	0	Non-hydric
327A	Dickman sandy loam, 0 to 2 percent slopes	6.0	3.2%	0	Non-hydric
327B	Dickman sandy loam, 2 to 6 percent slopes	25.6	13.6%	0	Non-hydric
603	Hanlon fine sandy loam, 0 to 2 percent slopes, occasionally flooded	15.9	8.4%	20	Predominately non-hydric
1030	Pits, gravel-Udipsamments complex	0.3	0.2%	0	Non-hydric

Table 3. Soil types mapped on the Mahler Aggregate Mine site

Symbol	Soil Name	Acres	% of Area	% Hydric	Hydric Category
1066B	Malardi-Hawick complex, 1 to 6 percent slopes	17.3	9.2%	0	Non-hydric
1066C	Malardi-Hawick complex, 6 to 12 percent slopes	6.9	3.7%	0	Non-hydric
1066E	Malardi-Hawick complex, 18 to 35 percent slopes	8.9	4.7%	0	Non-hydric
1197	Suckercreek fine sandy loam, 0 to 2 percent slopes, occasionally flooded	3.2	1.7%	90	Predominately hydric
W	Water	4.0	2.1%	0	Non-hydric

The Minnesota DNR Public Waters Inventory (Minnesota Department of Natural Resources 2015) showed the Crow River (DNR Public Watercourse M-064) located along the eastern property boundary. No other DNR Public Waters, Wetlands or Watercourses were mapped within 1,000 feet of the site boundaries (**Figure 5**).

The National Hydrography Dataset (U.S. Geological Survey 2015) showed one river located within the site boundaries (**Figure 6**).

4.2 Wetland Determinations and Delineations

Potential wetlands were evaluated during field observations on April 30, 2019. Four wetlands were identified and delineated on the property (**Figure 2**). Corresponding data forms are included in **Appendix B**. The following descriptions of the wetlands and adjacent uplands reflects conditions observed at the time of the field visit. Herbaceous vegetation was actively growing at the time of the wetland delineation. Precipitation conditions were within the normal range based on available 30-day rolling total precipitation and wetter than the typical based on the three-month antecedent precipitation data (**Appendix C**) and field observations.

Wetland 1 was a partially farmed Type 1/2 (PEM1A/Bf) wet meadow and seasonally flooded basin wetland located in northeastern portion of the property. The wetland fringe consisted of cropland in the southern portion of the wetland and a natural vegetative community transition on the north side of the wetland. The central part of the wetland was dominated by reed canary grass with scattered sedges. Much of the central portion of the wetland was inundated with a couple inches of water. Wetland 1 is located on the Crow Rivers floodplain and was flooded in the early spring due to high river levels. This wetland covered 1.2369 acres within the site boundaries.

Adjacent upland consisted of tilled cropland and areas avoided by farmers (dominated by red raspberries, prickly ash, and common buckthorn). Primary and secondary hydrology indicators were not observed on the upland.

The wetland boundary corresponded to a topographic rise that coincided with a transition from reed canary grass to with a FACU plant community. The wetland was not shown on the NWI

map but fell in an area mapped as predominantly hydric soil (Suckercreek fine sandy loam) on the soil survey. Wetland 1 drained to the north off-site.

Wetland 2 was a Type 1 (PFO1A) forested seasonally flooded basin wetland located in the northeastern part of the property. The wetland was dominated by reed canary grass with American elm and green ash trees. Surface saturation was observed in the central portion of the wetland. Wetland 2 is located on the Crow Rivers floodplain and was flooded in the early spring due to high river levels. This wetland covered 0.0104 acres within the property boundary.

Adjacent upland was dominated by red raspberries and ground ivy with a common buckthorn shrub layer. Primary and secondary hydrology indicators were not observed on the upland.

The wetland edge followed a gradual increase in the slope accompanied by a transition from reed canary grass to upland plant community dominated by red raspberry. The wetland was mapped as predominantly hydric soil (Suckercreek fine sandy loam) on the soil survey. Wetland 2 was an isolated depression surrounded by upland.

Wetland 3 was a Type 1 (PEM1A) seasonally flooded basin wetland. The wetland was a shallow depressional basin dominated by reed canary grass and sedges with a few small green ash and box elder trees located near the wetland edge. Saturation was observed within the wetland. Wetland 3 is located on the Crow Rivers floodplain and was flooded in the early spring due to high river levels. This wetland covered 0.0104 acres within the property boundaries.

The adjoining upland consisted of mowed ATV trail dominated by Kentucky bluegrass with patches of white clover and ground ivy and scattered red raspberry plants.

The wetland boundary corresponded to a topographic rise that coincided with a transition from sparsely vegetative surface to mowed turf mixed on the eastern side and FACU dominant plants on the western side. The wetland was not shown on the NWI map but fell within an area mapped as predominantly-hydric Suckcreek fine sandy loam on the soil survey.

Wetland 4 was a small Type 1 (PEM1A) Seasonally flooded basin dominated by reed canary grass was located in the east-central portion of the property. An ATV trail adjacent to the eastern fringe of this wetland was dominated by Kentucky bluegrass. Saturation was observed in the center of the wetland. Wetland 4 is located on the Crow Rivers floodplain and was flooded in the early spring due to high river levels. This wetland covered 0.0125 acres within the property boundary.

The adjacent upland was dominated by Kentucky bluegrass with scattered cup plants and common buckthorn. Primary and secondary hydrology indicators were not observed on the upland.

The delineated boundary followed a change in vegetation composition from an FACW wetland plant community to a FAC plant community. Wetland 4 was not mapped as an NWI wetland, but it was located in an area mapped as predominately-hydric soil (Suckercreek fine sandy loam) on the soil survey.

4.3 Other Areas

Other areas were investigated because they were: (1) observed to support a hydrophytic plant community, (2) had visible wetland hydrology indicators, (3) were shown as wetland on the NWI map, or (4) were depressional and mapped as hydric soil. Field investigation led to the conclusion that these areas were not wetland.

Sample Point A was a depressional area located in the north-central portion of the site that showed a wetland signature within the offsite hydrological review during a wet year. This area was dominated by corn stubble from the prior season. Soils in this area consisted of black loam over light olive brown loam. High chroma soil color from 17-24 inches indicated the soils were non-hydric and the area lacked primary and secondary indicators of wetland hydrology.

Sample Point B was a depressional area located in the south-central portion of the site. This area was dominated by soybean stubble from the prior season, horseweed and curly dock. Soils in this area consisted of black loam over light brown sand. High chroma soil color from 10-24 inches indicated the soils were non-hydric and the area lacked primary and secondary indicators of wetland hydrology.

Sample Point C was a flat area located in the central portion of the site that showed erosional features along the eastern portion of the area. This area drained into the area into the aggregate pit mine area. This area was dominated by prior seasons crop stubble and upland grasses. Soils in this area consisted of black loam over light brown sand. High chroma soil color from 9-24 inches indicated the soils were non-hydric and the area lacked primary and secondary indicators of wetland hydrology.

Sample Point D was a depressional area located in the center of the site. This area was dominated by horseweed. Soils in this area consisted of black loam over light olive brown loam. High chroma soil color from 10-24 inches indicated the soils were non-hydric and the area lacked primary and secondary indicators of wetland hydrology.

4.4 Aerial Review for Offsite Hydrology Determinations

Aerial photography was reviewed between years 2006 and 2018. Years 2006, 2008-2010, 2013, and 2015-2018 were assessed for wet/normal/dry climatic conditions using the Wetland Delineation Precipitation Data Retrieval tool and an estimated photo date of July 1 for the FSA aerials. Five years (2006, 2008, 2015, 2016, and 2018) were determined have precipitation in the normal range during the three months preceding the estimated photo dates. Areas showing at least one wetland signature during the selected years were included in the aerial review. The results are summarized in **Table 4** and review areas are shown on **Figure 7**. Aerial photographs showing review areas and interpretations are included in **Appendix D**.

Areas exhibiting potential wetland signatures that were located in agricultural cropland, were all reviewed according to the BWSR (2010) protocol. Areas exhibiting wetland signatures in more than 50% of the years with precipitation in the normal range are generally assumed to meet wetland hydrology criteria. Areas exhibiting wetland signatures in 30% to 50% of the years with precipitation in the normal range were also reviewed in the field (**Table 4, Figures 7**).

Table 4. Offsite hydrology determinations

Area	No. of Photo Years w/ Normal Precipitation	No. of Normal Precipitation Years w/ Wetland Signatures	% of Normal Precipitation Years w/ Wetland Signatures	Hydrology Determination
ZZ	5	5	100	Hydrology present
YY	5	1	20	Hydrology absent
XX	5	0	0	Hydrology absent
WW	5	0	0	Hydrology absent

Areas ZZ showed sufficient wetland hydrology signatures (100% occurrence) and was delineated in the field as Wetland 1. Both primary and secondary wetland hydrology indicators were observed within area ZZ. This area corresponds to SP1-1 in **Appendix B**.

Area YY failed to show sufficient wetland hydrology signatures (20% occurrence). Other than geomorphic position, no primary or secondary indicators of wetland hydrology were observed. Area YY was determined to be non-wetland based on a lack of wetland signatures during a majority of years with precipitation in the normal range and wetland hydrology indicators.

Area XX and WW failed to show sufficient wetland hydrology signatures (0% occurrence respectively) during normal precipitation years. Other than geomorphic position, no primary or secondary indicators of wetland hydrology were observed. Sample Point SP-A was taken within review Area WW and non-hydric soils were observed. Other than geomorphic position, no primary or secondary indicators of wetland hydrology were observed in either. Both areas were determined to be non-wetland based on a lack of wetland signatures during a majority of years with precipitation in the normal range and wetland hydrology indicators.

No other areas with hydrophytic vegetation or wetland hydrology were observed on the site.

4.5 Request for Wetland Boundary and Jurisdictional Determination

Appendix A of this report includes a Joint Application Form for Activities Affecting Water Resources in Minnesota, which is submitted in request for: (1) a wetland boundary and type determination under the Minnesota Wetland Conservation Act (WCA), and (2) delineation concurrence under Section 404 of the Federal Clean Water Act.

5. CERTIFICATION OF DELINEATION

The procedures utilized in the described delineation are based on the U.S. Army Corps of Engineers 1987 Wetlands Delineation Manual as required under Section 404 of the Clean Water Act and the Minnesota Wetland Conservation Act. This wetland delineation and report were prepared in compliance with the regulatory standards in place at the time the work was performed.

Site boundaries indicated on figures within this report are approximate and do not constitute an official survey product.

Delineation completed by: Adam Cameron, Wetland Ecologist
Minnesota Certified Wetland Delineator No. 1321

Kyle Uhler, GIS/Remote Sensing Specialist

Report prepared by: Kyle Uhler, GIS/Remote Sensing Specialist

Report reviewed by: _____ Date: June 28, 2019
Mark Kjolhaug, Professional Wetland Scientist No. 000845

Mahler Aggregate Mine Site

Wetland Delineation Report

FIGURES

1. Site Location
2. Existing Conditions
3. National Wetlands Inventory
4. Soil Survey
5. DNR Protected Waters Inventory
6. National Hydrography Dataset
7. Offsite Hydrology Assessment Areas

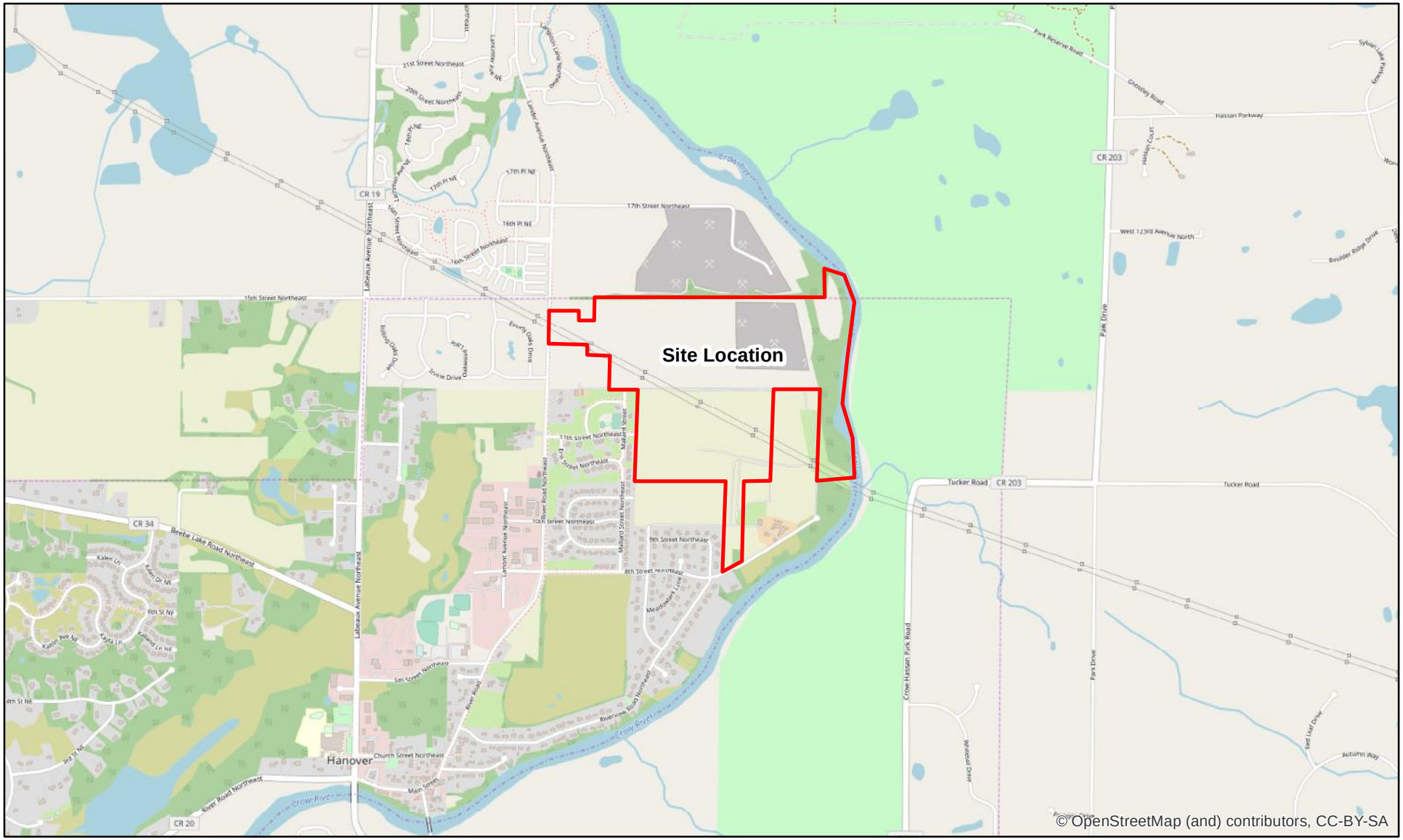


Figure 1 - Site Location

N

0 2,000 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: ESRI Streets Basemap

Mahler Aggregate Mine
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

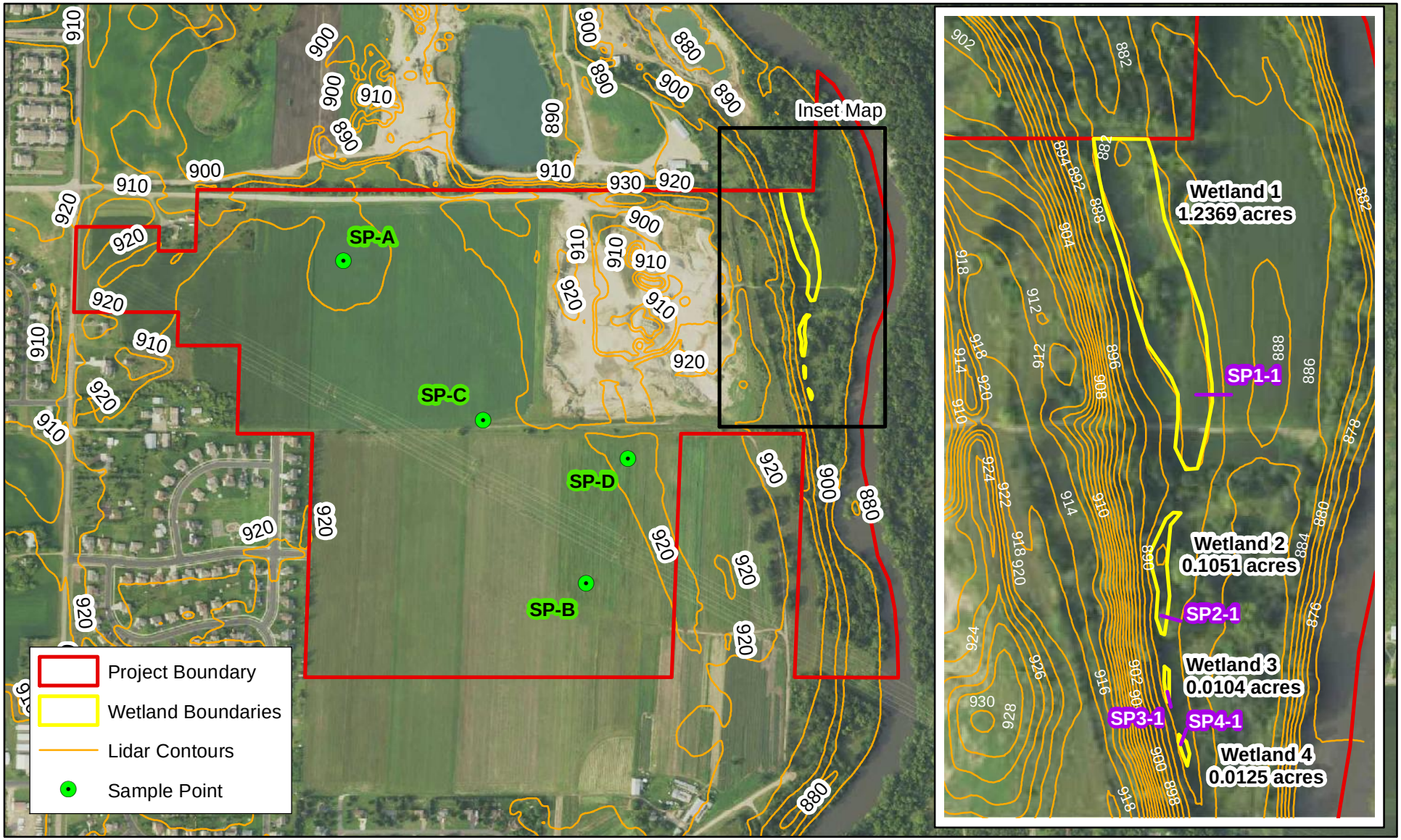


Figure 2 - Existing Conditions (2017 FSA Imagery)

N

0 750 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

Mahler Aggregate Mine (KES 2019-035)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

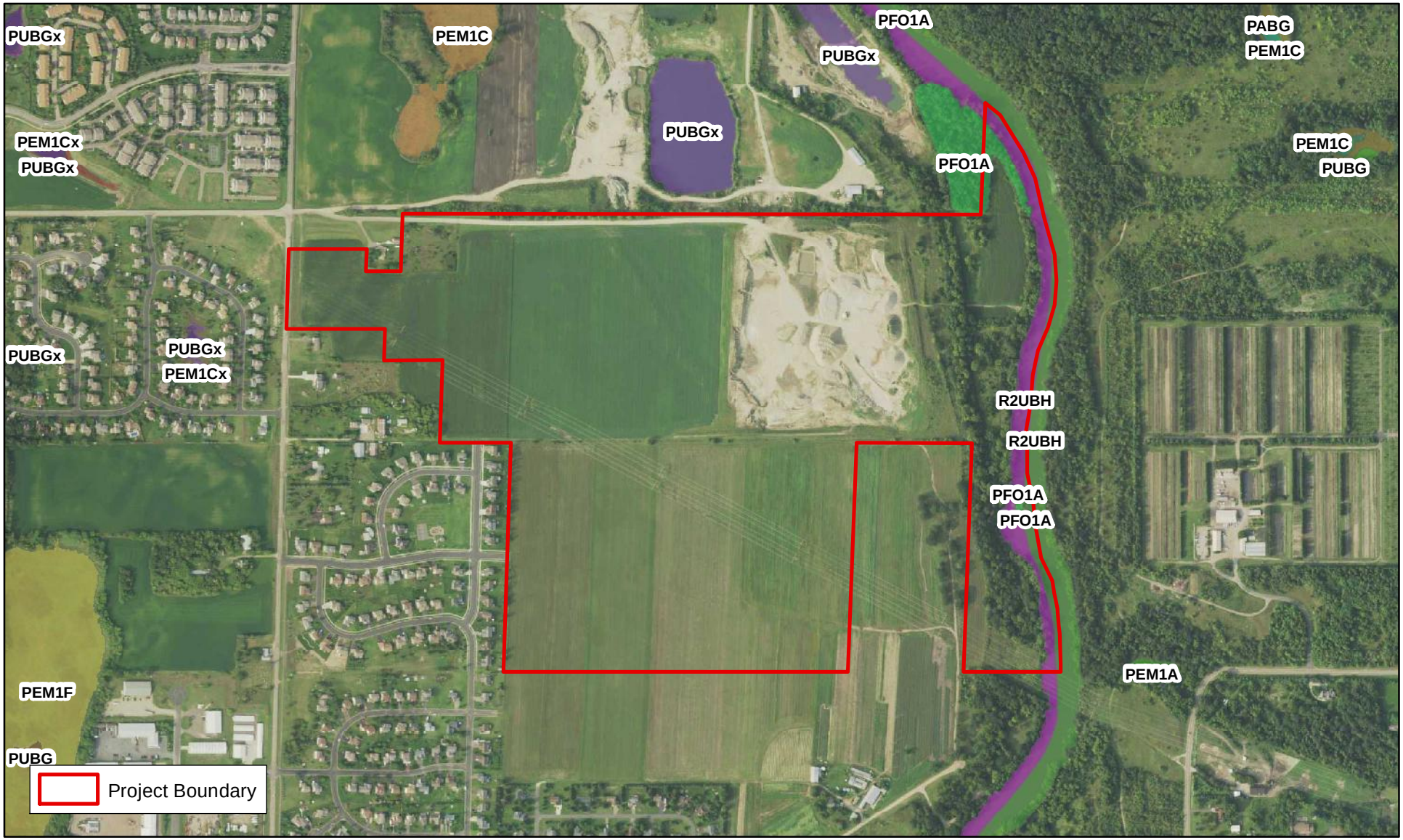


Figure 3 - National Wetlands Inventory

N

0 800 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons, USFWS

Mahler Aggregate Mine (KES 2019-035)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

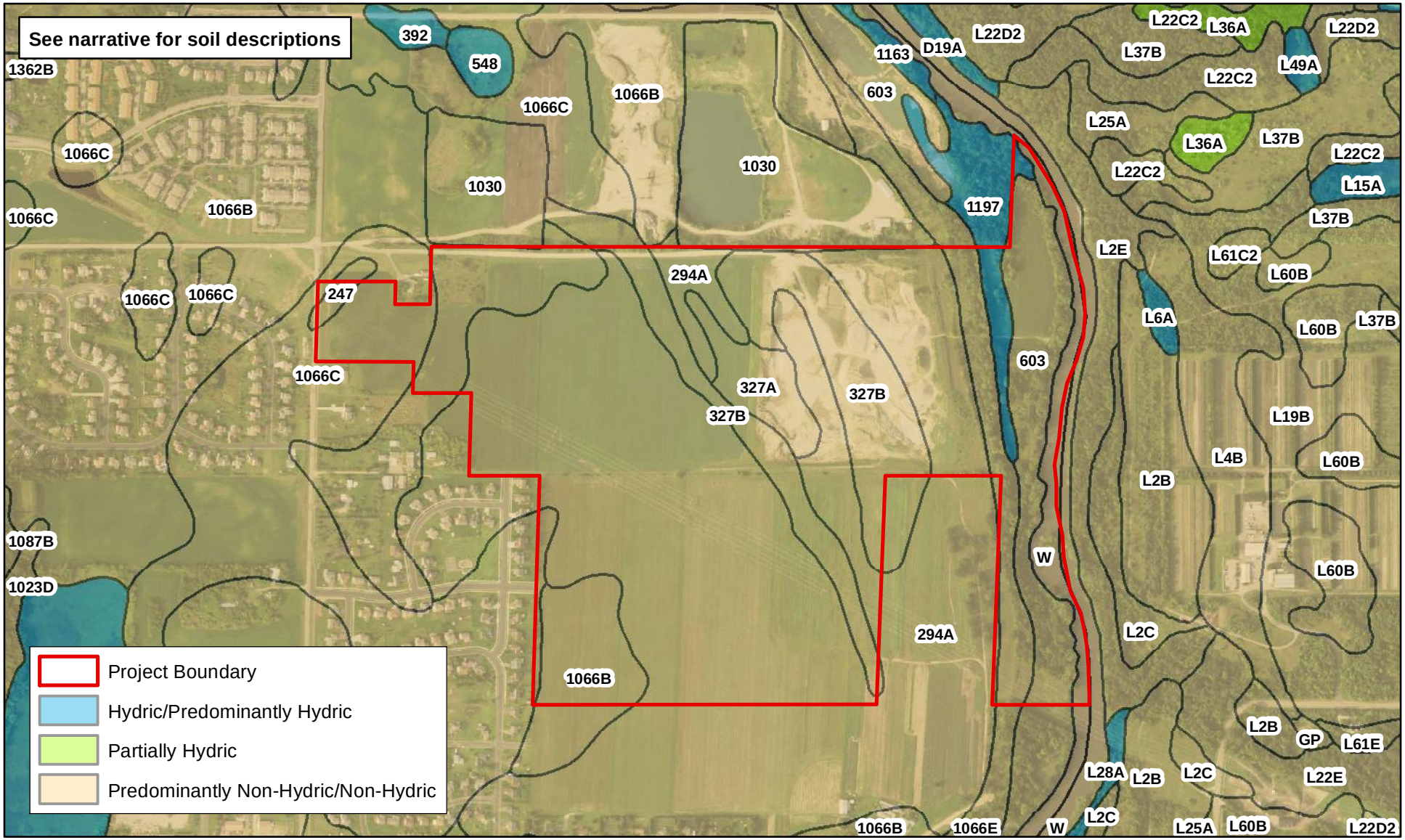


Figure 4 - Soil Survey

N

0 800 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons, USDA, NRCS

Mahler Aggregate Mine (KES 2019-035)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

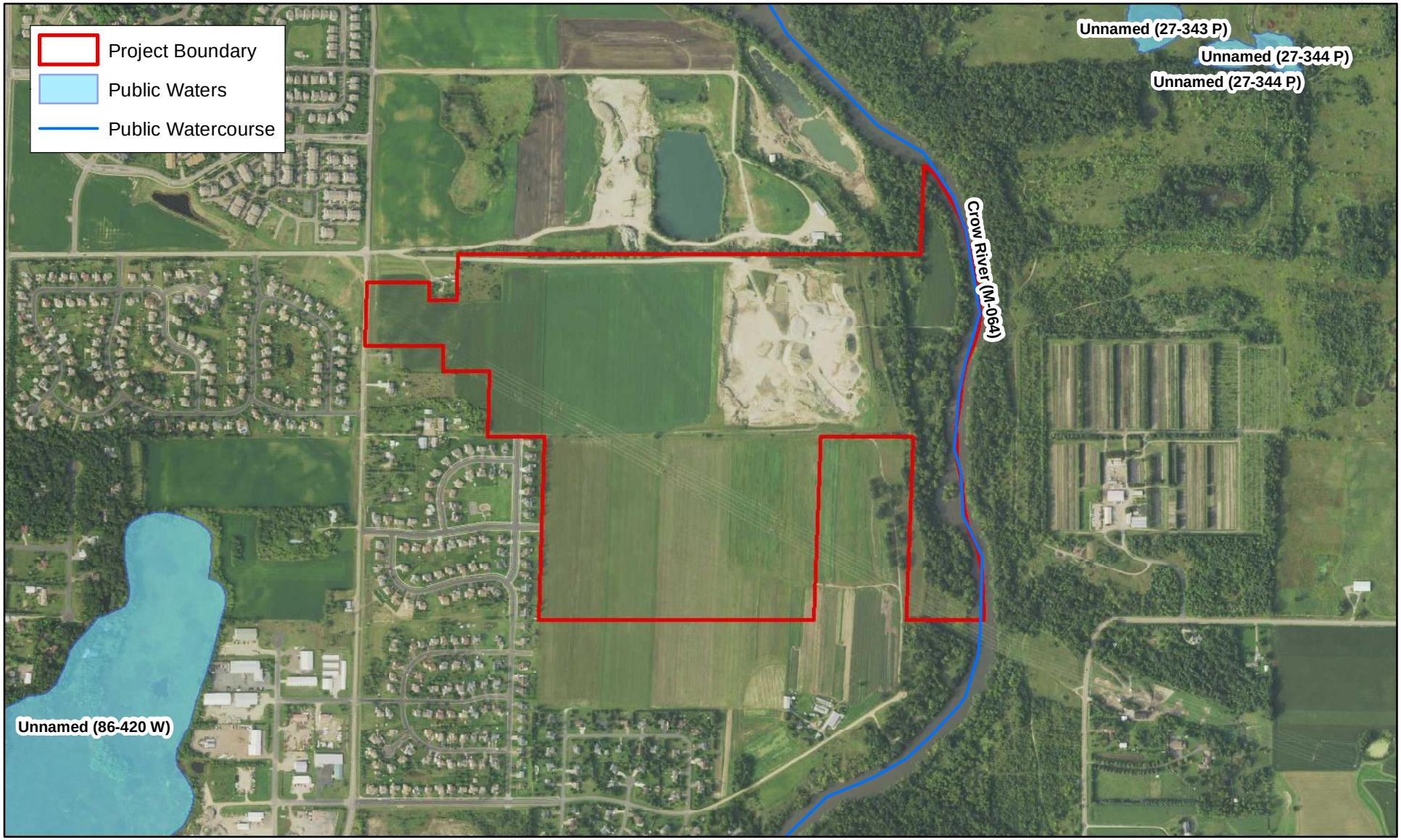


Figure 5 - DNR Public Waters Inventory

N

0 1,000 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons, MN DNR

Mahler Aggregate Mine (KES 2019-035)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

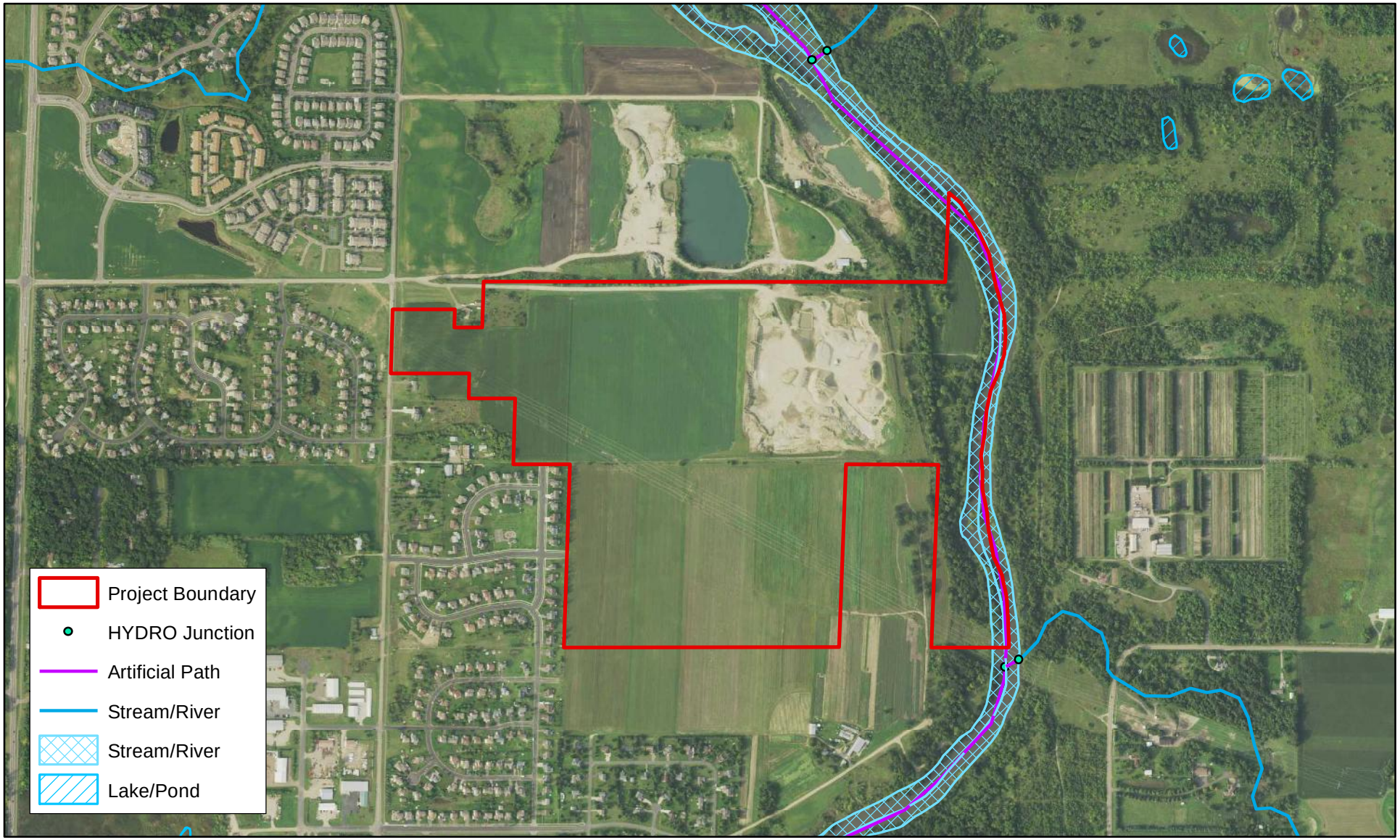


Figure 6 - National Hydrography Dataset

N

0 1,000 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons, USGS

Mahler Aggregate Mine (KES 2019-035)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

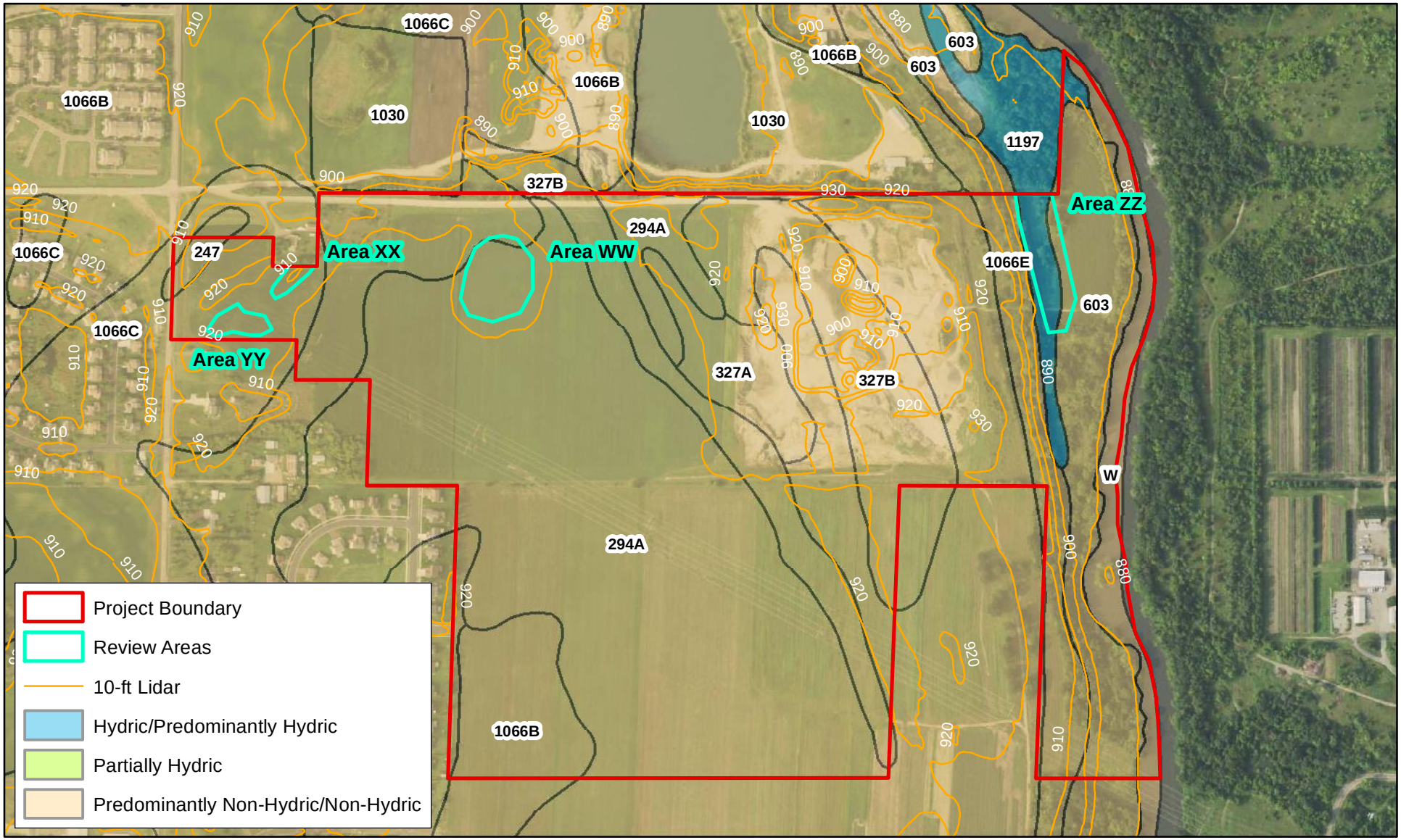


Figure 7 - Offsite Hydrology Assessment Areas (2017 FSA Imagery)

N

0 625 Feet

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: MNGEO Spatial Commons

Mahler Aggregate Mine (KES 2019-035)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

Mahler Aggregate Mine Site

Wetland Delineation Report

APPENDIX A

Joint Application Form for Activities Affecting Water Resources in Minnesota

Joint Application Form for Activities Affecting Water Resources in Minnesota

PART ONE: Applicant Information

If applicant is an entity (company, government entity, partnership, etc.), an authorized contact person must be identified. If the applicant is using an agent (consultant, lawyer, or other third party) and has authorized them to act on their behalf, the agent's contact information must also be provided.

Project Name: **Mahler Aggregate Mine**

Applicant/Landowner Name: Fehn Companies, Inc.
Mailing Address: 5050 Barthel Industrial Drive, Albertville, MN 55301
Phone: (763) 497-2428
E-mail Address: gfehn@fehncompanies.com

Authorized Contact (do not complete if same as above): Kyle Uhler, Kjolhaug Environmental Services Co.
Mailing Address: 2500 Shadywood Road, Suite 130, Orono, MN 55331
Phone: (952) 401-8757 Ext. 103
E-mail Address: kyle@kjolhaugenv.com

Agent Name: Kyle Uhler, Kjolhaug Environmental Services Co.
Mailing Address: 2500 Shadywood Road, Suite 130, Orono, MN 55331
Phone: (952) 401-8757 Ext. 103
E-mail Address: kyle@kjolhaugenv.com

PART TWO: Site Location Information

County: Wright County **City/Township:** City of Hanover
Parcel ID and/or Address: PIDs: 114-800-302400, 108-500-303200, 108-500-303300, 108-500-254200, and 108-500-254400
Legal Description (Section, Township, Range): Part of the W ½ of Section. 30, T120N, R23W, and part of the SE ¼ of Section 25, T120N, R24W
Lat/Long (decimal degrees): 45.170586, -93.645404
Attach a map showing the location of the site in relation to local streets, roads, highways. See attached **Figure 1.**
Approximate size of site (acres) or if a linear project, length (feet): 184.9 acres

If you know that your proposal will require an individual Permit from the U.S. Army Corps of Engineers, you must provide the names and addresses of all property owners adjacent to the project site. This information may be provided by attaching a list to your application or by using block 25 of the Application for Department of the Army permit which can be obtained at:

http://www.mvp.usace.army.mil/Portals/57/docs/regulatory/RegulatoryDocs/engform_4345_2012oct.pdf

PART THREE: General Project/Site Information

If this application is related to a delineation approval, exemption determination, jurisdictional determination, or other correspondence submitted ***prior to*** this application then describe that here and provide the Corps of Engineers project number.

Describe the project that is being proposed, the project purpose and need, and schedule for implementation and completion. The project description must fully describe the nature and scope of the proposed activity including a description of all project elements that effect aquatic resources (wetland, lake, tributary, etc.) and must also include plans and cross section or profile drawings showing the location, character, and dimensions of all proposed activities and aquatic resource impacts.

PART FOUR: Aquatic Resource Impact[1] Summary

If your proposed project involves a direct or indirect impact to an aquatic resource (wetland, lake, tributary, etc.) identify each impact in the table below. Include all anticipated impacts, including those expected to be temporary. Attach an overhead view map, aerial photo, and/or drawing showing all of the aquatic resources in the project area and the location(s) of the proposed impacts. Label each aquatic resource on the map with a reference number or letter and identify the impacts in the following table.

Aquatic Resource ID (as noted on overhead view)	**Aquatic Resource Type** (wetland, lake, tributary etc.)	**Type of Impact** (fill, excavate, drain, or remove vegetation)	**Duration of Impact** Permanent (P) or Temporary (T)[1]	**Size of Impact**[2] (acres)	**Overall Size of Aquatic Resource** [3] (acres)	**Existing Plant Community Type(s)** in Impact Area[4]	**County, Watershed, & Bank Service Area** [5]

[1]If impacts are temporary; enter the duration of the impacts in days next to the "T". For example, a project with a temporary access fill that would be removed after 220 days would be entered "T (220)".
[2]Impacts less than 0.01 acre should be reported in square feet. Impacts 0.01 acre or greater should be reported as acres and rounded to the nearest 0.01 acre. Tributary impacts must be reported in linear feet of impact and an area of impact by indicating first the linear feet of impact along the flowline of the stream followed by the area impact in parentheses). For example, a project that impacts 50 feet of a stream that is 6 feet wide would be reported as 50 ft (300 square feet).
[3]This is generally only applicable if you are applying for a de minimis exemption under MN Rules 8420.0420 Subp. 8, otherwise enter "N/A".
[4]Use *Wetland Plants and Plant Community Types of Minnesota and Wisconsin* 3rd Ed. as modified in MN Rules 8420.0405 Subp. 2.
[5]Refer to Major Watershed and Bank Service Area maps in MN Rules 8420.0522 Subp. 7.

If any of the above identified impacts have already occurred, identify which impacts they are and the circumstances associated with each: No impacts have already occurred.

PART FIVE: Applicant Signature

☐ Check here if you are requesting a pre-application consultation with the Corps and LGU based on the information you have provided. Regulatory entities will not initiate a formal application review if this box is checked.

By signature below, I attest that the information in this application is complete and accurate. I further attest that I possess the authority to undertake the work described herein.

Signature: _____ Date: 6/27/19

I hereby authorize **Kjolhaug Environmental Services** to act on my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this application.

[1] **The term "impact" as used in this joint application form is a generic term used for disclosure purposes to identify activities that may require approval from one or more regulatory agencies. For purposes of this form it is not meant to indicate whether or not those activities may require mitigation/replacement.**

Attachment A
Request for Delineation Review, Wetland Type Determination, or Jurisdictional Determination

By submission of the enclosed wetland delineation report, I am requesting that the U.S. Army Corps of Engineers, St. Paul District (Corps) and/or the Wetland Conservation Act Local Government Unit (LGU) provide me with the following (check all that apply):

☒ **Wetland Type Confirmation**

☒ **Delineation Concurrence**. Concurrence with a delineation is a written notification from the Corps and a decision from the LGU concurring, not concurring, or commenting on the boundaries of the aquatic resources delineated on the property. Delineation concurrences are generally valid for five years unless site conditions change. Under this request alone, the Corps will not address the jurisdictional status of the aquatic resources on the property, only the boundaries of the resources within the review area (including wetlands, tributaries, lakes, etc.).

☒ **Preliminary Jurisdictional Determination**. A preliminary jurisdictional determination (PJD) is a non-binding written indication from the Corps that waters, including wetlands, identified on a parcel may be waters of the United States. For purposes of computation of impacts and compensatory mitigation requirements, a permit decision made on the basis of a PJD will treat all waters and wetlands in the review area as if they are jurisdictional waters of the U.S. PJDs are advisory in nature and may not be appealed.

☐ **Approved Jurisdictional Determination**. An approved jurisdictional determination (AJD) is an official Corps determination that jurisdictional waters of the United States are either present or absent on the property. AJDs can generally be relied upon by the affected party for five years. An AJD may be appealed through the Corps administrative appeal process.

In order for the Corps and LGU to process your request, the wetland delineation must be prepared in accordance with the 1987 Corps of Engineers Wetland Delineation Manual, any approved Regional Supplements to the 1987 Manual, and the *Guidelines for Submitting Wetland Delineations in Minnesota* (2013).
http://www.mvp.usace.army.mil/Missions/Regulatory/DelineationJDGuidance.aspx

This page is intentionally blank.

Appendix D

Minnesota DNR Natural Heritage Information System Report

Mahler Aggregate Mine EAW

This page is intentionally blank.

DEPARTMENT OF NATURAL RESOURCES

Minnesota Department of Natural Resources
Division of Ecological & Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025

June 13, 2019
Correspondence # ERDB 20190358

Mr. Rob Bouta
Kjolhaug Environmental Services Company
2500 Shadywood Road, Suite 130
Orono, MN 55331

RE: Natural Heritage Review of the proposed Mahler Aggregate Mine,

County	Township (N)	Range (W)	Section(s)
Wright	120	24	25 & 36
Wright	120	23	30 & 31

Dear Mr. Bouta,

As requested, the Minnesota Natural Heritage Information System has been queried to determine if any rare species or other significant natural features are known to occur within an approximate one-mile radius of the proposed project. Based on this query, rare features have been documented within the search area (for details, please visit the Rare Species Guide Website for more information on the biology, habitat use, and conservation measures of these rare species). Please note that the following rare features may be adversely affected by the proposed project:

State-listed Species

- Blanding's turtles (*Emydoidea blandingii*), a state-listed threatened species, have been reported recently during nesting season in the close vicinity to the proposed project and may be encountered on site. Blanding's turtles use upland areas up to and over a mile distant from wetlands, waterbodies, and watercourses. Uplands are used for nesting, basking, periods of dormancy, and traveling between wetlands. Factors believed to contribute to the decline of this species include collisions with vehicles, wetland drainage and degradation, and the development of upland habitat. Any added fatality can be detrimental to populations of Blanding's turtles, as these turtles have a low reproduction rate that depends upon a high survival rate to maintain population levels.

  This project has the potential to impact this rare turtle through direct fatalities and habitat disturbance/destruction due to excavation, fill, and other construction activities associated with the project. Minnesota's Endangered Species Statute (*Minnesota Statutes*, section 84.0895) and associated

Rules (*Minnesota Rules*, part 6212.1800 to 6212.2300 and 6134) prohibit the take of threatened or endangered species without a permit. As such, **the following avoidance measures are required:**

- Use of erosion control blanket shall be limited to 'bio-netting' or 'naturalnetting' types, and specifically not products containing plastic mesh netting or other plastic components. Also be aware that hydro-mulch products may contain small synthetic (plastic) fibers to aid in its matrix strength. These loose fibers could potentially re-suspend and make their way into Public Waters. As such, please review mulch products and not allow any materials with synthetic (plastic) fiber additives in areas that drain to Public Waters.
- The Blanding's turtle flyer should be given to all workers in the area.
- Workers in the area should be aware that Blanding's turtles nest in June, generally after 4 pm, and should be advised to minimize disturbance if turtles are seen.
- Monitor for turtles during construction and report any sightings to the DNR Nongame Specialist, Erica Hoaglund at 651-259-5772 or Erica.Hoaglund@state.mn.us.
  - If turtles are encountered on site, please remember that state law and rules prohibit the destruction of threatened or endangered species, except under certain prescribed conditions. If turtles are in imminent danger they should be moved by hand out of harm's way, otherwise they should be left undisturbed.

If the above avoidance measures are not possible, please contact me as further review will be needed.

For additional information, please see the Blanding's turtle fact sheet, which describes the habitat use and life history of this species. The fact sheet also provides two lists of recommendations for avoiding and minimizing impacts to this rare turtle. **Please refer to the both lists of recommendations for your project.** If feasible, we recommend installing silt fencing before June to keep turtles from nesting in active mining areas. Also, we recommend a buffer of vegetation should remain between the mine and the Crow River, and sound erosion and sediment control practices should be implemented and maintained for the duration of the project. Please contact the DNR Regional Nongame Specialist, Erica Hoaglund at 651-259-5772 or Erica.Hoaglund@state.mn.us, for further assistance regarding this species.

- Big brown bat (*Eptesicus fuscus*), a state-listed as special concern, has been documented in the vicinity of the proposed project. During the winter these species typically hibernate in caves and mines. During the active season (approximately April-October) they roost underneath bark, in cavities, or in crevices of both live and dead trees; and in human structures such as buildings and bridges. Pup rearing is during June and July. Activities that may impact this species include, but are not limited to, wind farm operation, any disturbance to hibernacula, and destruction/degradation of habitat. As such, we recommend avoiding tree removal during pup rearing season, June 1st though July 31st.

- The Lark Sparrow (*Chondestes grammacus*), a state-listed bird species of special concern, has been documented in the vicinity of the project. This bird species is found in open, grass land areas with scattered trees and shrubs. They build their nest on the ground, in a shrub or a small tree. If feasible, avoid initial disturbance to grassland areas and tree/shrub removal from May 15th through August 15th to avoid disturbance of nesting birds.

- The gopher snake (*Pituophis catenifer*), a state-listed species of special concern, has been documented in the vicinity of the proposed project and may be encountered on site. These snakes prefer grassy areas

with sandy and gravel soils. Given the presence of these rare snakes, the DNR recommends that the use of erosion control mesh, if any, be limited to wildlife-friendly materials.

Federally Protected Species

- The rusty patched bumble bee (*Bombus affinis*), a federally-listed endangered species, was documented in the vicinity of the proposed project. The rusty patched bumble bee typically occurs in grasslands and urban gardens with flowering plants from April through October. This species nests underground in abandoned rodent cavities or in clumps of grasses. Please reference the guidance at the USFWS rusty patched bumble bee website to determine if the project has the potential to impact this protected species.

Environmental Review and Permitting

- The Environmental Assessment Worksheet should address whether the proposed project has the potential to adversely affect the above rare features and, if so, it should identify specific measures that will be taken to avoid or minimize disturbance. Sufficient information should be provided so the DNR can determine whether a takings permit will be needed for any of the above protected species.

- Please include a copy of this letter in any state or local license or permit application. Please note that measures to avoid or minimize disturbance to the above rare features may be included as restrictions or conditions in any required permits or licenses.

The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location (noted above) and the project description provided on the NHIS Data Request Form. Please contact me if project details change or for an updated review if construction has not occurred within one year.

The Natural Heritage Review does not constitute review or approval by the Department of Natural Resources as a whole. Instead, it identifies issues regarding known occurrences of rare features and potential effects to these rare features. If needed, please contact your DNR Regional Environmental Assessment Ecologist to determine whether there are other natural resource concerns associated with the proposed project. Please be aware that additional site assessments or review may be required.

Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources. An invoice will be mailed to you under separate cover.

Sincerely,

Samantha Bump

Samantha Bump
Natural Heritage Review Specialist
Samantha.Bump@state.mn.us

Links: Rare Species Guide
http://www.dnr.state.mn.us/rsg/index.html
DNR Regional Environmental Assessment Ecologist Contact Info
http://www.dnr.state.mn.us/eco/ereview/erp_regioncontacts.html
USFWS Rusty Patched Bumble Bee
https://www.fws.gov/midwest/endangered/insects/rpbb/guidance.html
Blanding's Turtle Fact Sheet
http://files.dnr.state.mn.us/natural_resources/animals/reptiles_amphibians/turtles/blandings_turtle/factsheet.pdf
Blanding's Turtle Flyer
http://files.dnr.state.mn.us/natural_resources/animals/reptiles_amphibians/turtles/blandings_turtle/flyer.pdf
Wildlife Friendly Erosion Control
http://files.dnr.state.mn.us/eco/nongame/wildlife-friendly-erosion-control.pdf

Cc: Becky Horton
Leslie Parris
Erica Hoaglund

CAUTION

BLANDING'S TURTLES

MAY BE ENCOUNTERED IN THIS AREA

The unique and rare Blanding's turtle has been found in this area. Blanding's turtles are state-listed as Threatened and are protected under Minnesota Statute 84.095, Protection of Threatened and Endangered Species. Please be careful of turtles on roads and in construction sites. For additional information on turtles, or to report a Blanding's turtle sighting, contact the DNR Nongame Specialist nearest you: Bemidji (218-308-2641); Grand Rapids (218-327-4518); New Ulm (507-359-6033); Rochester (507-206-2820); or St. Paul (651-259-5772).

DESCRIPTION: The Blanding's turtle is a medium to large turtle (5 to 10 inches) with a black or dark blue, dome-shaped shell with muted yellow spots and bars. The bottom of the shell is hinged across the front third, enabling the turtle to pull the front edge of the lower shell firmly against the top shell to provide additional protection when threatened. The head, legs, and tail are dark brown or blue-gray with small dots of light brown or yellow. A distinctive field mark is the bright yellow chin and neck.

BLANDING'S TURTLES DO NOT MAKE GOOD PETS
IT IS ILLEGAL TO KEEP THIS THREATENED SPECIES IN CAPTIVITY

SUMMARY OF RECOMMENDATIONS FOR AVOIDING AND MINIMIZING IMPACTS TO BLANDING'S TURTLE POPULATIONS

(see Blanding's Turtle Fact Sheet for full recommendations)

- This flyer should be given to all contractors working in the area. Homeowners should also be informed of the presence of Blanding's turtles in the area.
- Turtles that are in imminent danger should be moved, by hand, out of harm's way. Turtles that are not in imminent danger should be left undisturbed to continue their travel among wetlands and/or nest sites.
- If a Blanding's turtle nests in your yard, do not disturb the nest and do not allow pets near the nest.
- Silt fencing should be set up to keep turtles out of construction areas. It is critical that silt fencing be removed after the area has been revegetated.
- Small, vegetated temporary wetlands should not be dredged, deepened, or filled.
- All wetlands should be protected from pollution; use of fertilizers and pesticides should be avoided, and run-off from lawns and streets should be controlled. Erosion should be prevented to keep sediment from reaching wetlands and lakes.
- Roads should be kept to minimum standards on widths and lanes.
- Roads should be ditched, not curbed or below grade. If curbs must be used, 4" high curbs at a 3:1 slope are preferred.
- Culverts under roads crossing wetland areas, between wetland areas, or between wetland and nesting areas should be at least 36 in. diameter and flat-bottomed or elliptical.
- Culverts under roads crossing streams should be oversized (at least twice as wide as the normal width of open water) and flat-bottomed or elliptical.
- Utility access and maintenance roads should be kept to a minimum.
- Because trenches can trap turtles, trenches should be checked for turtles prior to being backfilled and the sites should be returned to original grade.
- Terrain should be left with as much natural contour as possible.
- Graded areas should be revegetated with native grasses and forbs.
- Vegetation management in infrequently mowed areas -- such as in ditches, along utility access roads, and under power lines -- should be done mechanically (chemicals should not be used). Work should occur fall through spring (after October 1st and before June 1st).

Compiled by the Minnesota Department of Natural Resources Division of Ecological and Water Resources, Updated August 2012
Endangered Species Review Coordinator, 500 Lafayette Rd., Box 25, St. Paul, MN 55155 / 651-259-5109

Environmental Review Fact Sheet Series

Endangered, Threatened, and Special Concern Species of Minnesota

Blanding's Turtle

(*Emydoidea blandingii*)

Minnesota Status:	Threatened	State Rank[1]:	S2
Federal Status:	none	Global Rank[1]:	G4

HABITAT USE

Blanding's turtles need both wetland and upland habitats to complete their life cycle. The types of wetlands used include ponds, marshes, shrub swamps, bogs, and ditches and streams with slow-moving water. In Minnesota, Blanding's turtles are primarily marsh and pond inhabitants. Calm, shallow water bodies (Type 1-3 wetlands) with mud bottoms and abundant aquatic vegetation (e.g., cattails, water lilies) are preferred, and extensive marshes bordering rivers provide excellent habitat. Small temporary wetlands (those that dry up in the late summer or fall) are frequently used in spring and summer -- these fishless pools are amphibian and invertebrate breeding habitat, which provides an important food source for Blanding's turtles. Also, the warmer water of these shallower areas probably aids in the development of eggs within the female turtle. Nesting occurs in open (grassy or brushy) sandy uplands, often some distance from water bodies. Frequently, nesting occurs in traditional nesting grounds on undeveloped land. Blanding's turtles have also been known to nest successfully on residential property (especially in low density housing situations), and to utilize disturbed areas such as farm fields, gardens, under power lines, and road shoulders (especially of dirt roads). Although Blanding's turtles may travel through woodlots during their seasonal movements, shady areas (including forests and lawns with shade trees) are not used for nesting. Wetlands with deeper water are needed in times of drought, and during the winter. Blanding's turtles overwinter in the muddy bottoms of deeper marshes and ponds, or other water bodies where they are protected from freezing.

LIFE HISTORY

Individuals emerge from overwintering and begin basking in late March or early April on warm, sunny days. The increase in body temperature which occurs during basking is necessary for egg development within the female turtle. Nesting in Minnesota typically occurs during June, and females are most active in late afternoon and at dusk. Nesting can occur as much as a mile from wetlands. The nest is dug by the female in an open sandy area and 6-15 eggs are laid. The female turtle returns to the marsh within 24 hours of laying eggs. After a development period of approximately two months, hatchlings leave the nest from mid-August through early-October. Nesting females and hatchlings are often at risk of being killed while crossing roads between wetlands and nesting areas. In addition to movements associated with nesting, all ages and both sexes move between wetlands from April through November. These movements peak in June and July and again in September and October as turtles move to and from overwintering sites. In late autumn (typically November), Blanding's turtles bury themselves in the substrate (the mud at the bottom) of deeper wetlands to overwinter.

IMPACTS / THREATS / CAUSES OF DECLINE

- loss of wetland habitat through drainage or flooding (converting wetlands into ponds or lakes)
- loss of upland habitat through development or conversion to agriculture
- human disturbance, including collection for the pet trade* and road kills during seasonal movements
- increase in predator populations (skunks, raccoons, etc.) which prey on nests and young

*It is illegal to possess this threatened species.

RECOMMENDATIONS FOR AVOIDING AND MINIMIZING IMPACTS

These recommendations apply to typical construction projects and general land use within Blanding's turtle habitat, and are provided to help local governments, developers, contractors, and homeowners minimize or avoid detrimental impacts to Blanding's turtle populations. **List 1** describes minimum measures which we recommend to prevent harm to Blanding's turtles during construction or other work within Blanding's turtle habitat. **List 2** contains recommendations which offer even greater protection for Blanding's turtles populations; this list should be used *in addition to the first list* in areas which are known to be of state-wide importance to Blanding's turtles (contact the DNR's Natural Heritage and Nongame Research Program if you wish to determine if your project or home is in one of these areas), or in any other area where greater protection for Blanding's turtles is desired.

List 1. Recommendations for all areas inhabited by Blanding's turtles.	**List 2. *Additional* recommendations for areas known to be of state-wide importance to Blanding's turtles.**
GENERAL	
A flyer with an illustration of a Blanding's turtle should be given to all contractors working in the area. Homeowners should also be informed of the presence of Blanding's turtles in the area.	Turtle crossing signs can be installed adjacent to road-crossing areas used by Blanding's turtles to increase public awareness and reduce road kills.
Turtles which are in imminent danger should be moved, by hand, out of harms way. Turtles which are not in imminent danger should be left undisturbed.	Workers in the area should be aware that Blanding's turtles nest in June, generally after 4pm, and should be advised to minimize disturbance if turtles are seen.
If a Blanding's turtle nests in your yard, do not disturb the nest.	If you would like to provide more protection for a Blanding's turtle nest on your property, see "Protecting Blanding's Turtle Nests" on page 3 of this fact sheet.
Silt fencing should be set up to keep turtles out of construction areas. It is critical that silt fencing be removed after the area has been revegetated.	Construction in potential nesting areas should be limited to the period between September 15 and June 1 (this is the time when activity of adults and hatchlings in upland areas is at a minimum).
WETLANDS	
Small, vegetated temporary wetlands (Types 2 & 3) should not be dredged, deepened, filled, or converted to storm water retention basins (these wetlands provide important habitat during spring and summer).	Shallow portions of wetlands should not be disturbed during prime basking time (mid morning to mid- afternoon in May and June). A wide buffer should be left along the shore to minimize human activity near wetlands (basking Blanding's turtles are more easily disturbed than other turtle species).
Wetlands should be protected from pollution; use of fertilizers and pesticides should be avoided, and run-off from lawns and streets should be controlled. Erosion should be prevented to keep sediment from reaching wetlands and lakes.	Wetlands should be protected from road, lawn, and other chemical run-off by a vegetated buffer strip at least 50' wide. This area should be left unmowed and in a natural condition.
ROADS	
Roads should be kept to minimum standards on widths and lanes (this reduces road kills by slowing traffic and reducing the distance turtles need to cross).	Tunnels should be considered in areas with concentrations of turtle crossings (more than 10 turtles per year per 100 meters of road), and in areas of lower density if the level of road use would make a safe crossing impossible for turtles. Contact your DNR Regional Nongame Specialist for further information on wildlife tunnels.
Roads should be ditched, not curbed or below grade. If curbs must be used, 4 inch high curbs at a 3:1 slope are preferred (Blanding's turtles have great difficulty climbing traditional curbs; curbs and below grade roads trap turtles on the road and can cause road kills).	Roads should be ditched, not curbed or below grade.

ROADS cont.	
Culverts between wetland areas, or between wetland areas and nesting areas, should be 36 inches or greater in diameter, and elliptical or flat-bottomed.	Road placement should avoid separating wetlands from adjacent upland nesting sites, or these roads should be fenced to prevent turtles from attempting to cross them (contact your DNR Nongame Specialist for details).
Wetland crossings should be bridged, or include raised roadways with culverts which are 36 in or greater in diameter and flat-bottomed or elliptical (raised roadways discourage turtles from leaving the wetland to bask on roads).	Road placement should avoid bisecting wetlands, or these roads should be fenced to prevent turtles from attempting to cross them (contact your DNR Nongame Specialist for details). This is especially important for roads with more than 2 lanes.
Culverts under roads crossing streams should be oversized (at least twice as wide as the normal width of open water) and flat-bottomed or elliptical.	Roads crossing streams should be bridged.
UTILITIES	
Utility access and maintenance roads should be kept to a minimum (this reduces road-kill potential).	
Because trenches can trap turtles, trenches should be checked for turtles prior to being backfilled and the sites should be returned to original grade.	
LANDSCAPING AND VEGETATION MANAGEMENT	
Terrain should be left with as much natural contour as possible.	As much natural landscape as possible should be preserved (installation of sod or wood chips, paving, and planting of trees within nesting habitat can make that habitat unusable to nesting Blanding's turtles).
Graded areas should be revegetated with native grasses and forbs (some non-natives form dense patches through which it is difficult for turtles to travel).	Open space should include some areas at higher elevations for nesting. These areas should be retained in native vegetation, and should be connected to wetlands by a wide corridor of native vegetation.
Vegetation management in infrequently mowed areas -- such as in ditches, along utility access roads, and under power lines -- should be done mechanically (chemicals should not be used). Work should occur fall through spring (after October 1st and before June 1st).	Ditches and utility access roads should not be mowed or managed through use of chemicals. If vegetation management is required, it should be done mechanically, as infrequently as possible, and fall through spring (mowing can kill turtles present during mowing, and makes it easier for predators to locate turtles crossing roads).

Protecting Blanding's Turtle Nests: Most predation on turtle nests occurs within 48 hours after the eggs are laid. After this time, the scent is gone from the nest and it is more difficult for predators to locate the nest. Nests more than a week old probably do not need additional protection, unless they are in a particularly vulnerable spot, such as a yard where pets may disturb the nest. Turtle nests can be protected from predators and other disturbance by covering them with a piece of wire fencing (such as chicken wire), secured to the ground with stakes or rocks. The piece of fencing should measure at least 2 ft. x 2 ft., and should be of medium sized mesh (openings should be about 2 in. x 2 in.). It is ***very important*** that the fencing be **removed before August 1st** so the young turtles can escape from the nest when they hatch!

REFERENCES

[1]Association for Biodiversity Information. "Heritage Status: Global, National, and Subnational Conservation Status Ranks." NatureServe. Version 1.3 (9 April 2001). http://www.natureserve.org/ranking.htm (15 April 2001).

Coffin, B., and L. Pfannmuller. 1988. Minnesota's Endangered Flora and Fauna. University of Minnesota Press, Minneapolis, 473 pp.

REFERENCES (cont.)

Moriarty, J. J., and M. Linck. 1994. Suggested guidelines for projects occurring in Blanding's turtle habitat. Unpublished report to the Minnesota DNR. 8 pp.

Oldfield, B., and J. J. Moriarty. 1994. Amphibians and Reptiles Native to Minnesota. University of Minnesota Press, Minneapolis, 237 pp.

Sajwaj, T. D., and J. W. Lang. 2000. Thermal ecology of Blanding's turtle in central Minnesota. Chelonian Conservation and Biology 3(4):626-636.

Preventing Entanglement by Erosion Control Blanket

Plastic mesh netting is a common component in erosion control blanket. It is utilized to hold loose fibrous materials in place (EG straw) until vegetation is established. Erosion control blanket is being utilized extensively and is effective for reducing soil erosion, benefitting both soil health and water quality. Unfortunately there is a negative aspect of the plastic mesh component: It is increasingly being documented that its interaction with reptiles and amphibians can be fatal (Barton and Kinkead, 2005; Kapfer and Paloski, 2011). Mowing machinery is also susceptible to damage due to the long lasting plastic mesh.

Potential Problems:

- Plastic netting remains a hazard long after other components have decomposed.
- Plastic mesh netting can result in entanglement and death of a variety of small animals. The most vulnerable group of animals are the reptiles and amphibians (snakes, frogs, toads, salamanders, turtles). Ducklings, small mammals, and fish have also been observed entangled in the netting.
- Road maintenance machinery can snag the plastic mesh and pull up long lengths into machinery, thus binding up machinery and causing damage and/or loss of time cleaning it out.

Suggested Alternatives:

- Do not use in known locations of reptiles or amphibians that are listed as Threatened or Endangered species.
- Limit use of blanket containing welded plastic mesh to areas away from where reptiles or amphibians are likely (near wetlands, lakes, watercourses, or rock outcrops) or habitat transition zones (prairie – woodland edges, rocky outcrop – woodland edges, steep rocky slopes, etc.)
- Select products with biodegradable netting (preferably made from natural fibers, though varieties of biodegradable polyesters also exist on the market). Biodegradable products will degrade under a variety of moisture and light conditions.
- DO NOT use products that require UV-light to degrade (also called “photodegradable”) as they do not degrade properly when shaded by vegetation.

Solution: Most categories of erosion control blanket and sediment control logs are available in natural net options.

- Specify ‘Natural Netting’ for rolled erosion control products, per MnDOT Spec 3885. See Table 3885-1.
- Specify ‘Natural Netting’ for sediment control logs, per MnDOT Spec 3897

The plastic mesh component of erosion control blanket becomes a net for entrapment.

Literature Referenced

Barton, C. and K. Kinkead. 2005. Do erosion control and snakes mesh? Soil and Water Conservation Society 60:33A-35A.
Kapfer, J.M., and R.A. Paloski. 2011. On the threat to snakes of mesh deployed for erosion control and wildlife exclusion. Herpetological Conservation and Biology 6:1-9.

This page is intentionally blank.

Appendix E

State Historic Preservation Office Response and Archaeological Survey

Mahler Aggregate Mine EAW

This page is intentionally blank.

Rob Bouta

From: MN_MNIT_Data Request SHPO <DataRequestSHPO@state.mn.us>
Sent: Thursday, May 2, 2019 2:34 PM
To: Rob Bouta
Subject: RE: SHPO Data Review Request for Mahler Aggregate Mine

Hello Rob,

Our database has no historic records for the given area.

Jim

SHPO Data Requests
Minnesota State Historic Preservation Office
50 Sherburne Avenue, Suite 203
Saint Paul, MN 55155
(651) 201-3295
datarequestshpo@state.mn.us

Notice: This email message simply reports the results of the cultural resources database search you requested. The database search is only for previously known archaeological sites and historic properties. **IN NO CASE DOES THIS DATABASE SEARCH OR EMAIL MESSAGE CONSTITUTE A PROJECT REVIEW UNDER STATE OR FEDERAL PRESERVATION LAWS –** please see our website at https://mn.gov/admin/shpo/protection/ for further information regarding our Environmental Review Process.
Because the majority of archaeological sites in the state and many historic/architectural properties have not been recorded, important sites or properties may exist within the search area and may be affected by development projects within that area. Additional research, including field surveys, may be necessary to adequately assess the area's potential to contain historic properties or archaeological sites.
Properties that are listed in the National Register of Historic Places (NRHP) or have been determined eligible for listing in the NRHP are indicated on the reports you have received, if any. The following codes may be on those reports:
NR – National Register listed. The properties may be individually listed or may be within the boundaries of a National Register District.
CEF – Considered Eligible Findings are made when a federal agency has recommended that a property is eligible for listing in the National Register and MN SHPO has accepted the recommendation for the purposes of the Environmental Review Process. These properties need to be further assessed before they are officially listed in the National Register.
SEF – Staff eligible Findings are those properties the MN SHPO staff considers eligible for listing in the National Register, in circumstances other than the Environmental Review Process.
DOE – Determination of Eligibility is made by the National Park Service and are those properties that are eligible for listing in the National Register, but have not been officially listed.
CNEF – Considered Not Eligible Findings are made during the course of the Environmental Review Process. For the purposes of the review a property is considered not eligible for listing in the National Register. These properties may need to be reassessed for eligibility under additional or alternate contexts.
Properties without NR, CEF, SEF, DOE, or CNEF designations in the reports may not have been evaluated and therefore no assumption to their eligibility can be made. Integrity and contexts change over time, therefore any eligibility determination made ten (10) or more years from the date of the current survey are considered out of date and the property will need to be reassessed.
If you require a comprehensive assessment of a project's potential to impact archaeological sites or historic/architectural properties, you may need to hire a qualified archaeologist and/or historian. If you need assistance with a project review, please contact Kelly Gragg-Johnson, Environmental Review Specialist @ 651-201-3285 or by email at kelly.graggjohnson@state.mn.us.
The Minnesota SHPO Archaeology and Historic/Architectural Survey Manuals can be found at https://mn.gov/admin/shpo/identification-evaluation/.
MN SHPO research hours are **8:30 AM – 4:00 PM Tuesday-Friday**. Please call ahead at 651-201-3295 to ensure staff is available to assist you, if necessary. Thank you.

From: Rob Bouta <robb@kjolhaugenv.com>
Sent: Wednesday, May 1, 2019 1:06 PM
To: MN_MNIT_Data Request SHPO <DataRequestSHPO@state.mn.us>
Subject: SHPO Data Review Request for Mahler Aggregate Mine

SHPO Staff,

We are requesting a historical property information/database search for a 184.9-acre site located in Part of the W ½ of Section. 30, T120N, R23W, and part of the SE ¼ of Section 25, T120N, R24W, City of Hanover, Wright County, Minnesota. The Lat/Long coordinates of the site are 45.170586, -93.645404.

We are requesting this search because we are preparing an EAW for the aggregate mine, which will expanded from about 25 acres to about 155 acres. The project area includes about 119.5 acres of tilled cropland, 25 acres of aggregate mine, 17.4 acres of grassland-shrubland, and 1.4 acres of impervious surface. The project will convert most of the cropland to aggregate mine and reclaimed aggregate mine.

Attached please find a site location map and project boundary shapefile to support this request. I would appreciate your prompt attention to this review.

Thank you,

Rob Bouta, CSE, WDC
Senior Environmental Scientist
Kjolhaug Environmental Services Company
2500 Shadywood Road, Suite 130, Orono, MN 55331
RobB@kjolhaugenv.com
Office: 952-401-8757 Ext. 105
Mobile: 612-581-0546
http://www.kjolhaugenv.com

Nienow Cultural
Consultants, LLC
Jeremy L. Nienow, PhD, RPA
574 Blair Avenue
St.Paul, MN 55103

May 5, 2019

Kjolhaug Environmental Services Company
c/o Rob Bouta, CSE, WDC
2500 Shadywood Road, Suite 130
Orono, MN 55331

RE: 2019 Phase I Archaeological Survey for Mahler Aggregate Mine.

In April 2019, Fehn Companies, via Kjohaug Environmental, contracted with Nienow Cultural Consultants, LLC (NCC) to complete a Phase I archaeological survey related to their aggregate mine development project in Hanover, Wright County, Minnesota (Figures 1 and 2). The project area is located within parts of Sections 25 and 36, Township 120N, Range 24W and Sections 30 and 31, Township 120N, Range 23W. The project is adjacent to an active aggregate mine and NCC was sought out proactively ahead of SHPO comments to conduct archaeological survey. All aspects of the project were overseen by Jeremy L. Nienow, Ph.D., RPA who has a 2019 license to complete Phase I Archaeological Survey within the state of Minnesota (19-040).

Prior to archaeological survey NCC conducted a literature review at both the Minnesota Office of the State Archaeologist (OSA) and the Minnesota State Historic Preservation Office (SHPO). This review identified no previously documented sites within the project area, however, 15 sites were documented within three miles (Table 1), with the majority of sites found along the western shore of the Crow River. Nine of these sites are lithic scatters or single lithic tool findspots. Of the remaining sites, four are camp or village sites with 21WR190 (the Mill Creek Site), including several shell middens along with other debitage along a tributary stream to Crow River two miles north, upstream, from the project area.

Table 1: Archaeological Sites Within Three Miles of Project Area

Site Number	Distance to Project Area	Site Type
21HE329	1.85 miles	Lithic Scatter or Isolated Find
21HE330	1.85 miles	Lithic Scatter or Isolated Find
21HE336	2.95 miles	Farmstead
21HE473	2.4 miles	Native Camp site or Village
21HE474	1.5 miles	Lithic Scatter or Isolated Find
21WR55	1.6 miles	Lithic Scatter or Isolated Find
21WR59	1.8 miles	Lithic Scatter or Isolated Find
21WR73	2.25 miles	Native ceramics / lithics
21WR98	1.92 miles	Lithic Scatter or Isolated Find
21WR190	2.3 miles	Native Camp site or Village
21WR194	1.82 miles	Native Camp site or Village
21WR195	1.8 miles	Native Camp site or Village
21WRav (alpha site)	2.8 miles	Lithic Scatter or Isolated Find
21WRm (alpha site)	1.5 miles	Lithic Scatter or Isolated Find
21Wrp (alpha site)	2.25 miles	Lithic Scatter or Isolated Find

Survey work was completed on April 24 to 26, 2019 and was conducted by Jeremy L. Nienow, Ph.D., RPA with literature review and survey assistance from subconsultants Anastasia Walhovd (Makoons Consulting), Fred Sutherland (Sutherland Relics and Rust), Mike Nowak (Nowak Consulting), and John Strot (John's Archaeological Consulting). All survey work was completed using standard methods laid out by both the OSA and SHPO archaeology manuals. Survey method consisted primarily of surface survey over all plowed fields (All fields had 30% or greater visibility) with two discontinuous transects of shovel testing. Surface survey extended from the project's western boundary all the way to the Crow River. Generally, surface visibility was good (greater than 60%) and transects were typically seven to ten meters apart (Figures 3 and 4). As surface survey drew closer to the Crow River, survey transects were tightened to five meters or less. No prehistoric cultural materials were identified during pedestrian survey. Modern trash (plastic, cardboard, hygiene products, etc.), scattered 20th century ceramics (whitewares), discarded/broken farm implements (plowshares, bolts, etc.) and recreation materials (golf balls) were identified in several locations. Soils were well drained and noted as having gravels and cobbles present.

Shovel testing was completed along the upper bluff edge for the Crow River (Figure 5) as well as down along its lower terrace (Figure 6). Shovel tests were completed typically to 80-100cm below ground surface with documentation of soils color, texture, and stratigraphy done via notes and photography. Tests along the bluff edge were done within 15m of bluff edge and at 15m intervals. Soils were generally sandy loam over gravel lenses with cobbles and sand at depths of 75cm or greater. Soils along the terrace were sandy loam with much less gravel and darker soils typically to 100cm below ground surface. Water infiltration was common at 95cm to 100cm below ground surface. Tests were done at 15m intervals and within 15m of the shore edge. A total of 57 shovel tests were excavated. All shovel tests were negative for prehistoric materials. Three tests had late 19th through mid-20th century nails, window glass, whiteware, a .22 spent rifle shell, and one piece of deer bone. Historic artifacts were typically identified near trash or architectural material dumps. They were documented but not collected.

To summarize, pedestrian survey was completed in plowed fields and at tight intervals given proximity of documented archaeological sites in the vicinity and the area's higher probability for archaeological site potential. Shovel tests were completed at standard methodology spacing and along both the upper bluff edge as well as on the lower river terrace. No prehistoric cultural resources were documented during either surface survey or shovel testing. Late 19th century through modern Euro-American cultural materials related to trash/dumping and farming landscapes were documented but not collected. No archaeological sites were recorded and no additional archaeological survey is recommended at this time.

With any project there is the chance of unanticipated discovery. Should archaeological materials surface during any future construction, it is advised a professional archaeologist be consulted. Minnesota Statute 307.08 protects unplatted cemeteries (including burial mounds) and issues guidelines for dealing with unexpected finds. Should human remains be encountered during earth moving activity, all work must stop and local law enforcement must be called. If you have any additional questions or future project work, please do not hesitate to contact us.

Sincerely,

Jeremy L. Nienow, Ph.D.
Nienow Cultural Consultants, LLC
Attachments: Figures 1-8.

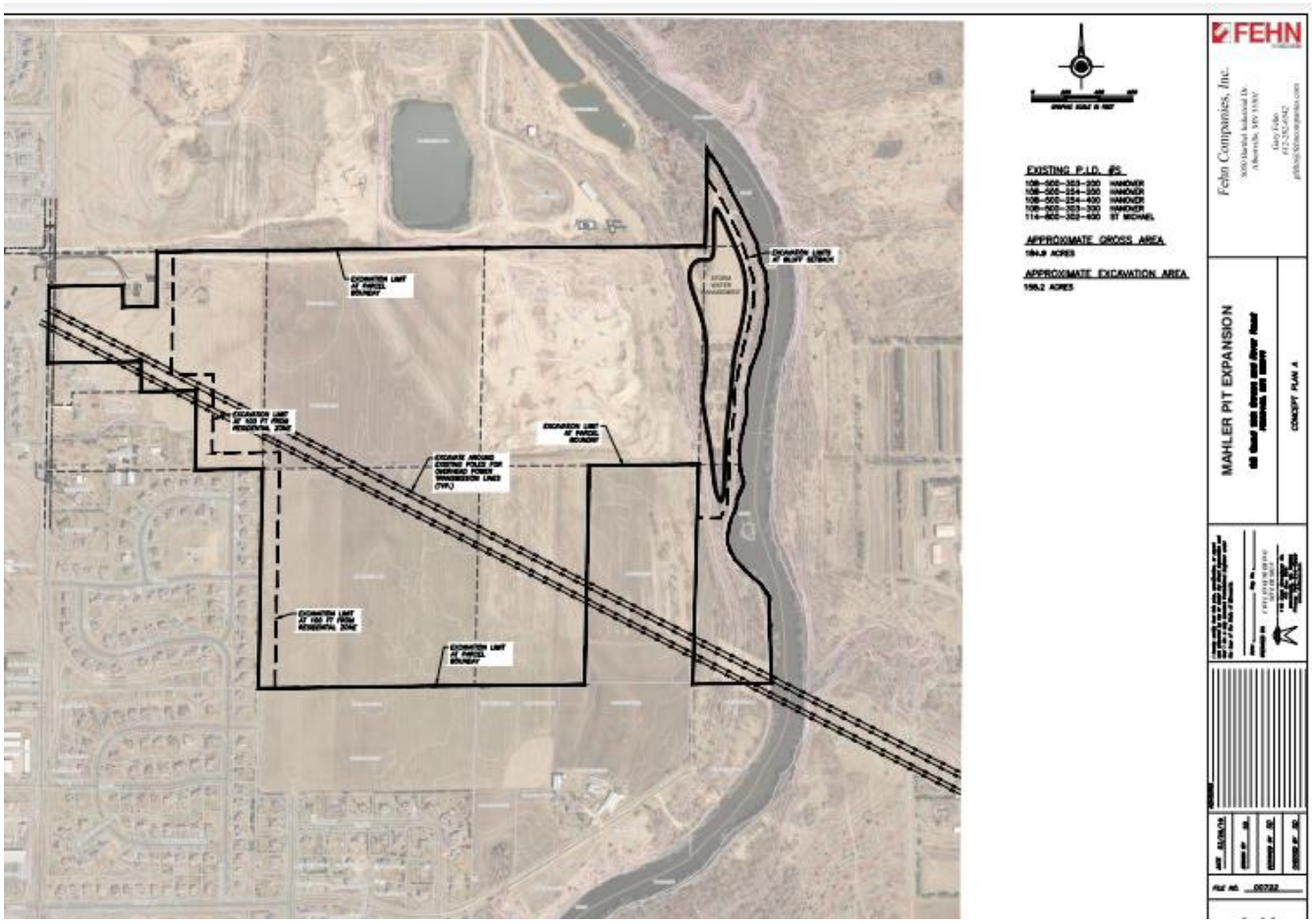


Figure 1: Project Area as Provided by Fehn Companies.

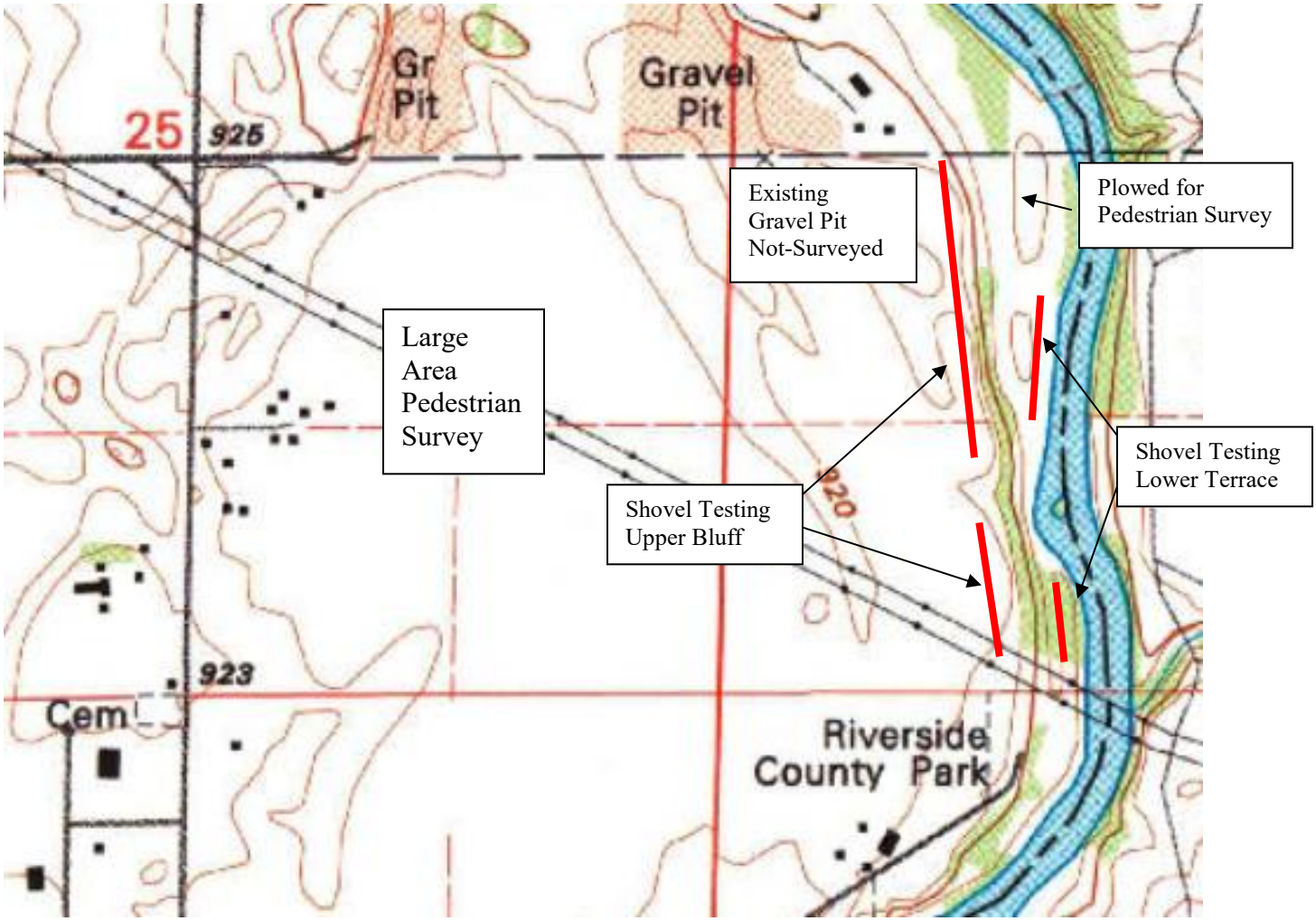


Figure 2: General Project Area on St. Michael 1991 Topographic Map. Showing areas of pedestrian and shovel test survey.

Figure 3: Surface Survey Conducted Along Western Edge of Project Area.

Figure 4: Surface Survey at Closer Intervals Conducted Along Eastern Edge of Project Area.

Figure 5: Shovel Test Area Along Upper Bluff Edge.

Figure 6: Shovel Test Area Along Lower Terrace.

Appendix F

Dust Control Plan

Mahler Aggregate Mine EAW

This page is intentionally blank.

Dust Control Plan

Mahler Aggregate Mine

City of Hanover, Wright County, Minnesota

Prepared for
Fehn Companies, Inc.

by
Kjolhaug Environmental Services Company, Inc.
(KES Project No. 2019-012)

June 12, 2019

Dust Control Plan

Mahler Aggregate Mine

City of Hanover, Wright County, Minnesota

TABLE OF CONTENTS

Dust Control Plan

Mahler Aggregate Mine

City of Hanover, Wright County, Minnesota

1. Project Description

The Mahler Aggregate Mine is proposing a 130-acre expansion of an existing 25-acre aggregate mine. The mine will be located on 184.9 acres of land in the City of Hanover. The operation will include sand and gravel mining, a wash plant, concrete recycling, and stormwater management. Expansion of the existing aggregate mine will start in September of 2019 and be phased over 15 to 20 years, depending on the demand for aggregate and market conditions.

2. Project Location and Surrounding Land Use

The project is located in Section 30, T120N, R23W , and Section 25, T120N, R24W. The project area is bordered on the north by 15th Street NE, a separate aggregate mining operation, and the City of St. Michael. The project is bordered on the east by the Crow River; on the south by Riverside County Park and agricultural land; and on the west by single-family residential, rural residential, and River Road NE/Lander Avenue NE.

3. Plan Purpose

This dust control plan is prepared to identify practices that will be employed to control fugitive dust emissions at the Mahler Aggregate Mine. Aggregate mining has occurred at the project location since 2006. Mining is to be expanded to cover up to 155 acres, in five phases consisting of about 25 to 40 acres each over the next to 15 to 20 years.

This plan addresses fugitive dust emissions created by mining operations and reclamation activities related to the mine. This plan establishes methods to control fugitive dust emissions from vehicles traveling on unpaved roads, material handling, and wind erosion from disturbed areas. These measures will be implemented, as needed, for the duration of the project.

4. State and Federal Requirements

Minnesota Rule 7011.0150 (Preventing Particulate Matter from Becoming Airborne) does not allow the "handling, use, transporting, or storage of any material in a manner which may allow avoidable amounts of particulate matter to become airborne." It requires "reasonable precautions to prevent the discharge of visible fugitive dust emissions beyond the property line on which the emissions originate." The Minnesota Pollution Control Agency (MPCA) requires operators of crushed stone and sand and gravel plants to use dust control measures in their operations. The term "fugitive dust" when referring to emissions from aggregate processing, means the dust does

not come from an emission "smoke stack," but from areas exposed to wind such as unpaved roads, stockpiles, or transfer points between conveyors.

Aggregate processing equipment (crushers, screens, conveyors) are subject to the U.S. Environmental Protection Agency (EPA) Standards of Performance for Nonmetallic Mineral Processing Plants (40 CFR Part 60). This rule sets opacity limits for dust emissions from equipment. Opacity refers to the obstruction of light transmittance caused by plumes of dust or gases.

5. Dust Assessment

Sand and gravel mining processing operations include crushing, screening, size classification, material handling, storage operations, and truck loading/unloading. Portable crushing plants consist of an assortment of individual pieces of equipment that are used to physically reduce, size and/or separate earth materials. All of these processes can result in dust emissions. If not properly controlled, dust can be carried by into surrounding neighborhoods by wind.

Dust can become airborne by wind and/or machine movement. Emissions occur at conveyors and drop or transfer points from one conveyor to the next. Storage piles can emit dust under atmospheric conditions such as dry winds. Similarly, unpaved haul roads emit dust under windy conditions and during use by trucks and passenger vehicles. Factors affecting emissions include the amount of activity at the site (dumping, crushing, hauling), the amount of wind, and the moisture content of the aggregate material.

Wash plants do not generate substantial dust because the earthen material becomes wet and stops emitting dust at the start of the wash plant. The moisture content of washed material is high enough to control particulate emissions.

6. Dust Mitigation Measures

The project will prevent avoidable visible dust emissions beyond the property boundary by applying water, approved commercial dust suppressants (such as magnesium chloride), use of a reduced speed limit on haul roads (e.g., 15 mph), and/or tarping of truck loads prior to leaving the mining area. Allowing greater vehicle speeds on unpaved roads can increase the potential for dust generation. These measures are expected to reduce fugitive dust emissions to a reasonable level.

Application of water often provides sufficient dust suppression. Chemical suppression should be used if water does not reduce visible dust enough to keep it from crossing the site boundary. Gravel roads will be sprayed with water or chemical dust suppressants when warranted by dust emissions and site conditions (dry, frequent truck trips, etc.).

Fugitive dust from loading operations will be controlled primarily by spraying problem areas with water. Disturbed areas such as stockpiles and temporary roads are susceptible to wind-blown fugitive dust generation. Fugitive dust emissions from these areas will be limited by using

best management practices such as applying water or chemical dust suppressants, covering, and temporary seeding.

7. Conclusions

Mitigation of dust emissions from aggregate processing and handling operations includes two basic options:

1. reducing the number of processing and/or handling operations; and
2. applying dust control agents such as water or chemical dust suppressants.

Dust control measures to be considered include:

1. use of conveyors to transport aggregate material onsite;
2. limiting the number and distance of internal truck trips by using conveyors;
3. active reclamation to minimize exposed soil areas;
4. use of water (wet suppression) to minimize fugitive dust emissions;
5. covering truckloads prior to aggregate transport during dry or windy conditions;
6. chemical dust suppression; and
7. sequenced mining of smaller subphases.

These dust control measures are expected to reduce emissions of dust and particulate matter from the proposed mining operation.

This page is intentionally blank.

Appendix G
Noise Study

Mahler Aggregate Mine EAW

This page is intentionally blank.

SBP Associates, Inc.

22502 Beach Road
Deerwood, MN 56444
Phone: 952-920-1500

Mahler Aggregate Mine
Gravel Mine Expansion Project
Noise Impact Analysis
June 17, 2019

I. Project Description

Fehn Companies, Inc. is proposing to expand an existing aggregate mine in Hanover, Minnesota. The proposed expansion requires that an Environmental Assessment Worksheet (EAW) be prepared. This report presents the SBP Associates, Inc. (SBP) noise impact assessment for the EAW.

The existing mine is referred to as the Mahler Aggregate Mine. The proposed expansion will move operations to the west and south. The proposed mine and expansion area are shown in the figure in Attachment A. There is a proposed 200-foot buffer area and 10-foot berm between the mining limits of the expansion area and the nearest residential properties.

Sources of noise at and near the aggregate mine include:

- The aggregate screening process
- The aggregate crushing process,
- On-site mobile equipment,
- Haul trucks on adjacent roadways, including County Road 146 and 15th Street NE.

SBP used a combination of noise monitoring and noise impact modeling to predict the maximum impact of mine operations and of the haul trucks on project-area residences. Additionally, SBP conducted background monitoring at two locations adjacent to the mine property.

II. Minnesota Noise Rules

Minnesota Rules Chapter 7030 provide the Minnesota standards for noise. These standards describe the limiting levels of sound established on the basis of present knowledge for the preservation of health and welfare. These standards are designed to be consistent with sleep, speech, annoyance, and hearing conservation requirements for receivers within areas grouped according to land use activities. The Minnesota standards are as follows:

	7:00 AM to 10:00 PM		10:00 PM to 7:00 AM	
	L_{10}	L_{50}	L_{10}	L_{50}
NAC-1 (Residential)	65	60	55	50
NAC-2 (Commercial)	70	65	70	65
NAC-3 (Industrial)	80	75	80	75

L_{10} means the sound level which is exceeded for 10 percent of the time for a one-hour period. L_{50} means the sound level which is exceeded 50 percent of the time for a one-

hour period. Sound levels are expressed in dBA. A dBA is a unit of sound level expressed in decibels and weighted for the purpose of determining the human response to sound.

III. Noise Monitoring Results

Background Monitoring
SBP conducted background monitoring at two locations representing the residential areas surrounding the mine. The locations are shown in the Figure provided in Attachment B.

Table 1
Background Noise Monitoring Results (dBA)

Location	Date	Time	L_{10}	L_{50}
M1	5/23/19	3:50 pm	46.1	41.4
M2	6/5/19	3:20 pm	54.0	47.0

Location M1 is in a residential area near Mallard Drive and 11th Street NE. Location M2 is adjacent to a residential area near the intersection of County Road 146 and 15th Street NE.

Operations – Stationary Equipment
To assist in predicting the noise impacts of the crushing and screening processes, SBP conducted noise monitoring tests of the existing screening and crushing operations. Maximum monitored results of these tests are provided in Table 2.

Table 2
Noise Monitoring Results
Screening and Crushing Operations - (dBA)

Equipment/Process	Distance from Source	L_{10}	L_{50}
Screening	133 feet	73.0	72.0
Crushing	237 feet	72.0	70.0

IV. Gravel Mine Operations Impact

The proposed mine will have a 200-foot buffer and 10-foot berm between the mining limits and the nearest residential properties. SBP calculated the maximum impacts at the nearest residences by using the results of the monitoring of the screening and crushing processes and normalizing them to a distance of 220 feet. The resulting predicted impacts were reduced by calculating the mitigation provided by the proposed 10-foot berm, and assuming the noise sources from the crushing screening operations will be 10 feet below the ground surface and 20 feet below the top of the proposed berm. Table 3 presents the results of the impact analysis.

Table 3
Predicted Maximum Mine Operations Noise Impact (dBA)

Equipment/Process	L_{10}	L_{50}
Screening Process	69.0	68.0
Crushing Process	73.0	71.0
Total Impact w/o Mitigation	**74.5**	**72.8**
Mitigation	(17.0)	(17.0)
Total Maximum Impact	**57.5**	**55.8**

The predicted maximum impact for the screening and crushing operations is within the State daytime standard for impact on a residential area.

V. Mobile Equipment

SBP used the FHWA road construction noise (RCNM) model to predict the potential impact of a front end loader or bulldozer on the nearest. The results of the modeling showed an L10 impact of 65.3 dBA for equipment operating at 220 feet from the nearest residence. This is just over the Standard of L10 = 65 dBA and does not include any reduction for the proposed berm or from the mine face when operating within the mine. Therefore, it is anticipated that mobile equipment operating within the proposed mine area will not cause an exceedance of the State standard.

The construction of the berm will involve the operation of mobile equipment relatively close to the residences for a period of time. The impact will vary based on the equipment used, the distance for the residences, and the hours of operation.

VI. Vehicle Road Noise

SBP used predicted 2020 traffic and peak-hour haul truck volumes to predict the potential noise impact of the facility-related truck traffic on residential locations near County Road 146 and 15th Street NE. The MINNOISEV3.1 traffic noise model was used to predict the peak 2020 noise levels at eight representative receptor locations along the roadways. MINNOISEV3.1 is a FHWA traffic noise model modified by MnDOT to predict noise levels from Minnesota roadways.

The modeled receptor locations are shown in the Figure in Attachment B. Results of the modeling are provided in the following Table 4.

Table 4
Modeled Peak Hour Haul Truck Impacts (dBA)

Receptor	L_{10}	L_{50}
R0	55.5	45.2
R1	53.1	43.5
R2	57.0	46.4
R3	55.3	45.3
R4	44.1	37.7
R5	57.6	49.4
R6	57.7	46.2

The predicted maximum impacts from haul trucks operating on County Road 146 and 15th Street NE near the facility are below the Minnesota Daytime noise standards for residential areas.

VII. Conclusions

Noise impacts for the proposed aggregate mine operations and from the haul trucks operating on County Road 146 and 15th Street NE are expected to generally be below the Minnesota State Standards.

Noise produced during the construction of the berm and other portions of the expansion could be mitigated by assuring equipment is properly muffled and by limiting the hours of operation.

Attachment A

Proposed Mine Expansion Plan

Attachment A – Proposed Mine Expansion Plan

N

KJOLHAUG ENVIRONMENTAL SERVICES COMPANY

Source: Civil Engineering Site Design

Mahler Aggregate Mine (KES 2019-036)
Hanover, Minnesota

Note: Boundaries indicated on this figure are approximate and do not constitute an official survey product.

Attachment B

Noise Monitoring (M#) and Haul Truck Noise Receptor (R#) Locations


17TH PL NE
17TH PL NE
R7
17TH S
16TH PL NE
PRIVATE DR
16TH ST NE
ANDER AVE NE
RR6
R4
15TH ST NE
M2
R5
14TH ST NE
LAMBERT CT
OAKWOOD LN NE
ESTERLY OAKS DR
R3
R8
IRVINE DR NE
12TH ST NE
R2
RIVER RD NE
R1
EMERALD ST NE
MALLARD ST NE
M1
11TH ST NE
R0
ERIN ST NE
MEADOWBROOK AVE NE

This page is intentionally blank.

Appendix H

Traffic Study

Mahler Aggregate Mine EAW

This page is intentionally blank.

Memorandum

SRF No. 01912731

To: Gary Fehn
Fehn Companies

From: Tom Sachi, PE, Associate
Zach Toberna, Engineer

Date: July 30, 2019

Subject: Mahler Aggregate Mine Expansion Traffic Study

Introduction

SRF has completed a traffic study for the proposed Mahler Aggregate Mine in the City of Hanover, MN. The proposed site is located east of the intersection of 15th Street NE and Lander Avenue NE/River Road NE (see Figure 1: Project Location). The main objectives of this study are to review existing operations within the study area, evaluate traffic impacts to the adjacent roadway network, and recommend any necessary improvements or mitigation strategies to accommodate the proposed mine development with safe and efficient operations. The following information provides the assumptions, analysis and study recommendations offered for consideration.

Existing Conditions

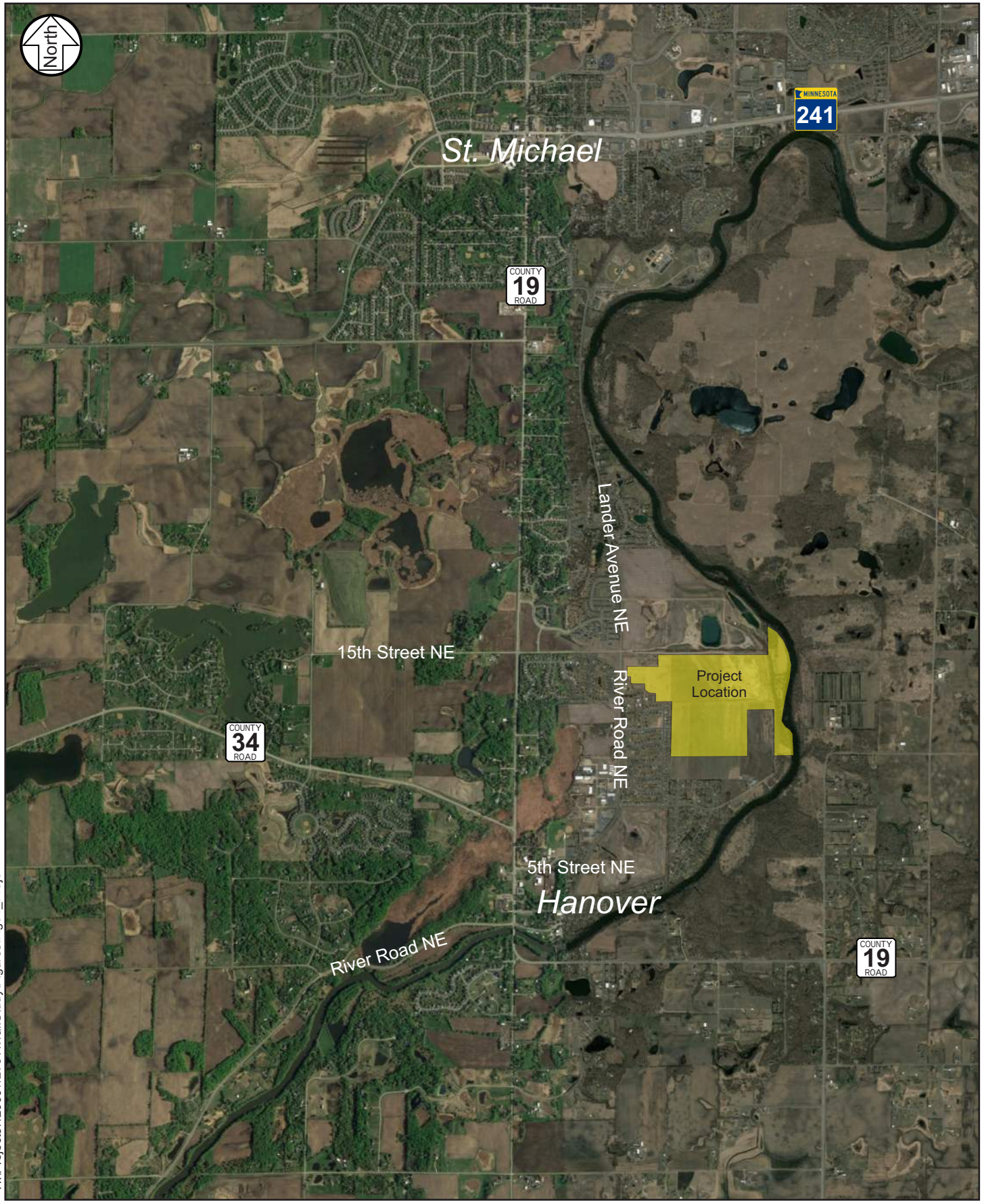
The existing conditions were reviewed to establish a baseline in order to identify any future impacts associated with the proposed site. The evaluation of existing conditions includes intersection turning movement counts, field observations, and an intersection capacity analysis.

Data Collection

Turning movement counts were collected during peak arrival, departure, and hauling periods by SRF during the week of April 22, 2019 at the following intersections:

- 15th Street NE/Lander Avenue NE
- CSAH 19/15th Street NE
- CSAH 19/CSAH 34
- CSAH 19/5th Street NE
- CSAH 19/River Road NE

Based on information provided by the development team, it was identified that that peak departure period (of employees) is expected to occur after 6:00 p.m. when background traffic volumes are lower and include only a minimal amount of trips generated, and therefore was not analyzed. The peak arrival period was identified as 7:00 a.m. to 8:00 a.m. The peak hauling period is expected to be steady over the course of the day between 8:00 a.m. and 4:00 p.m., therefore 3:00 p.m. to 4:00 p.m. was selected as this period typically represents the highest background traffic.



H:\Projects\12000\12731\TraffStudy\Figures\Fig01_Project Location.cdr

SRF Consulting Group, Inc.

Project Location

Mahler Aggregate Mine Traffic Study
City of Hanover, MN

Figure 1

01912731
June 2019

In addition to the intersection turning movement counts, field observations were completed to identify roadway characteristics within the study area (i.e. roadway geometry and posted speed limits). Currently, CSAH 19 is a rural two-lane, minor arterial roadway with a posted speed limit of 30 miles per hour (mph) between Rosedale Avenue and 5th Street NE. CSAH 34 and River Road NE, west of CSAH 19, are rural two-lane, minor arterial roadways. The remaining roadways within the study area are rural two-lane local roads. The intersections of CSAH 19/CSAH 34 and CSAH 19/River Road NE are signalized intersections, while the intersections of CSAH 19/15th Street NE and CSAH 19/5th Street NE are side-street stop controlled and the intersection of 15th Street NE/Lander Avenue NE is all-way stop controlled. Existing geometrics and volumes within the study area are shown in Figure 2.

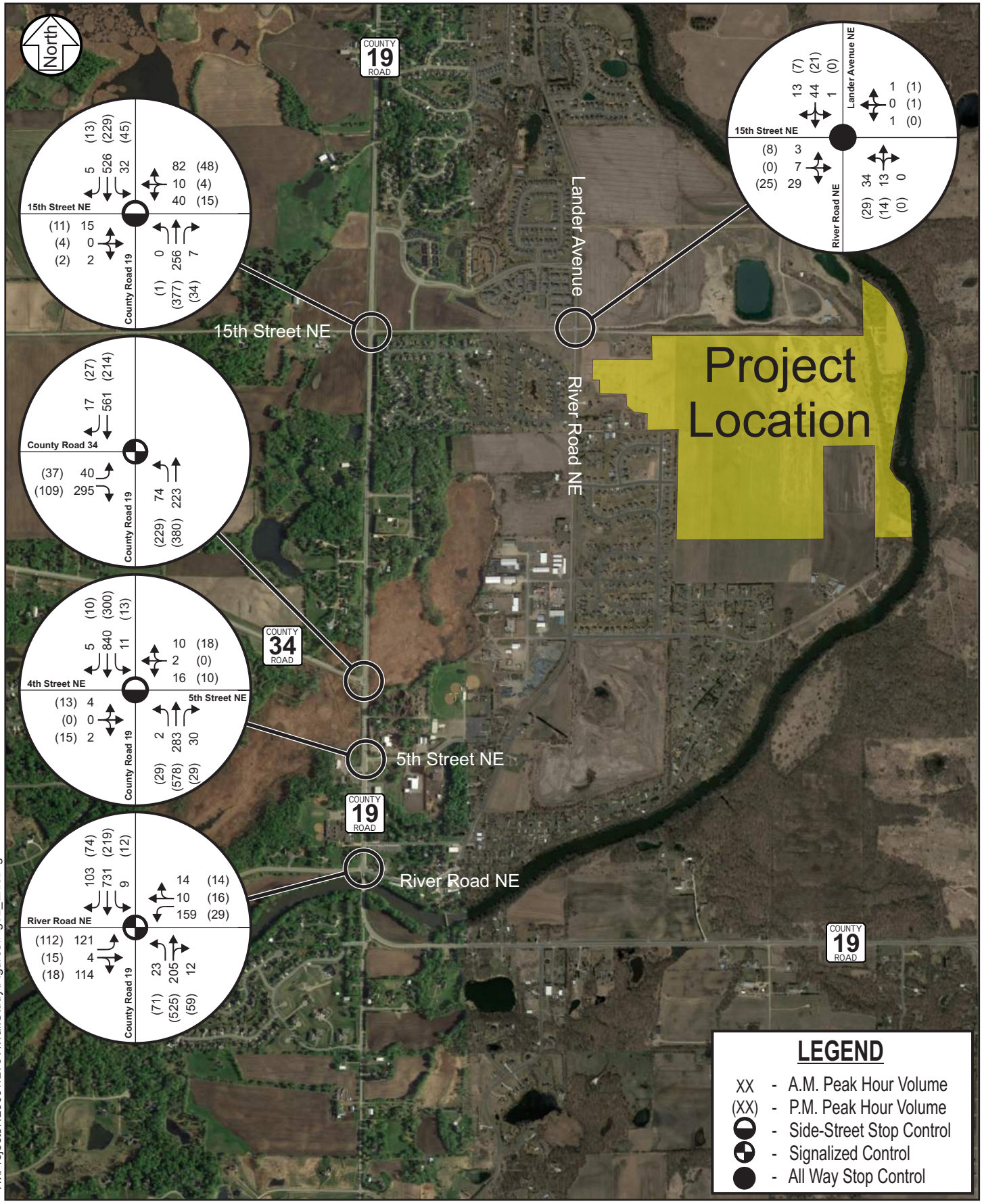
Existing Intersection Capacity Analysis

An existing intersection capacity analysis was completed to establish a baseline condition to which future traffic operations could be compared. The study intersections were analyzed using Synchro/ SimTraffic software (V9.0) and the *Highway Capacity Manual* (HCM). Capacity analysis results identify a Level of Service (LOS) which indicates how well an intersection is operating. Intersections are ranked from LOS A through LOS F. The LOS results are based on average delay per vehicle, which correspond to the delay threshold values shown in Table 1. LOS A indicates the best traffic operation, while LOS F indicates an intersection where demand exceeds capacity. Overall intersection LOS A though LOS C is generally considered acceptable in rural Wright County.

Table 1. Level of Service Criteria for Signalized and Unsignalized Intersections

LOS Designation	Signalized Intersection Average Delay/Vehicle (seconds)	Unsignalized Intersection Average Delay/Vehicle (seconds)
A	≤ 10	≤ 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

For side-street stop or yield controlled intersections, special emphasis is given to providing an estimate for the level of service of the side-street approach. Traffic operations at an unsignalized intersection with side-street stop or yield control can be described in two ways. First, consideration is given to the overall intersection level of service. This takes into account the total number of vehicles entering the intersection and the capability of the intersection to support these volumes. Second, it is important to consider the delay on the minor approach. Since the mainline does not have to stop, the majority of delay is attributed to the side-street approaches. It is typical of intersections with higher mainline traffic volumes to experience high levels of delay (i.e. poor levels of service) on the side-street approaches, but an acceptable overall intersection level of service during peak hour conditions.



H:\Projects\12000\12731\TraffStudy\Figures\Fig02_Existing Conditions.cdr

SRF Consulting Group, Inc.

Existing Conditions

Mahler Aggregate Mine Traffic Study
City of Hanover, MN

Figure 2

01912731
June 2019

Results of the existing intersection capacity analysis shown in Table 2 indicate that all study intersections currently operate at an acceptable overall LOS B or better during the arrival and hauling peak hours. During the arrival peak hour, southbound right-turn queues block the southbound thru lane at the intersection of CSAH 19/River Road NE approximately 15 percent of the peak period. Note that the 95th percentile westbound queue at CSAH 19/15th Street NE intersection is approximately four vehicles during the arrival peak hour, which is a result of a lack of gaps along CSAH 19.

Table 2. Existing Intersection Capacity Analysis

Intersection	Arrival Peak Hour		Hauling Peak Hour	
	LOS	Delay	LOS	Delay
15th Street NE/Lander Avenue NE (1)	A	8 sec.	A	8 sec.
CSAH 19/15th Street NE (2)	A/D	27 sec.	A/C	20 sec.
CSAH 19/CSAH 34 (3)	B	16 sec.	A	9 sec.
CSAH 19/5th Street NE (2)	A/D	30 sec.	A/C	21 sec.
CSAH 19/River Road NE (3)	B	16 sec.	B	10 sec.

(1) All-way stop controlled intersection, where the overall LOS (delay) is shown.
(2) Side-stop controlled intersection, where the overall LOS (delay) is shown followed by the worst movement LOS (delay).
(3) Signal controlled intersection, where the overall LOS (delay) is shown.

Proposed Development

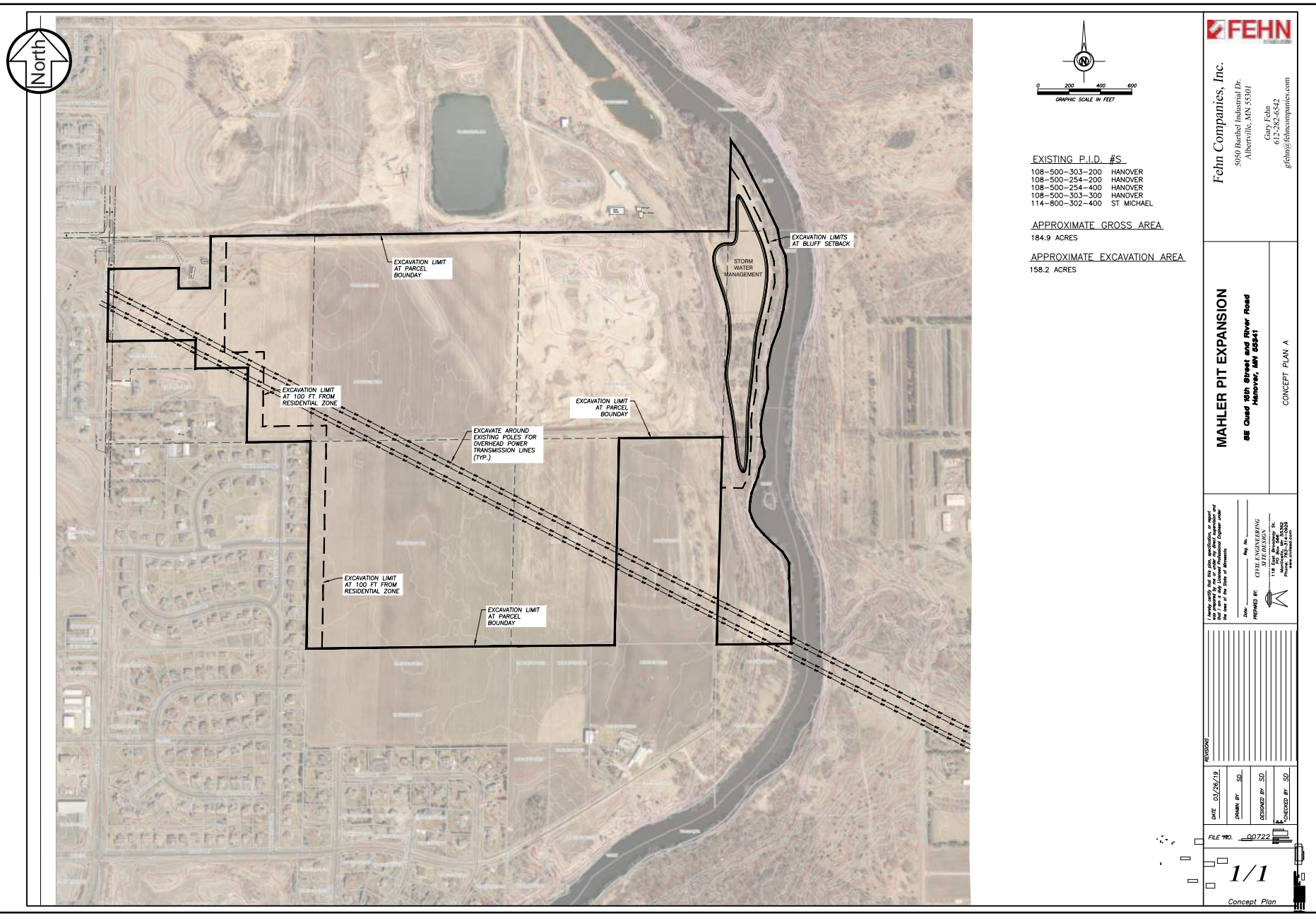
The proposed Mahler Mine expansion is planned for the southeast quadrant of the intersection of 15th Street NE/Lander Avenue NE, as shown in Figure 3. The proposed mine expansion is expected to utilize the existing access on the east approach of the 15th Street NE/Lander Avenue NE intersection.

Year 2020 Conditions

To help determine impacts associated with the proposed mine expansion, traffic forecasts were developed for year 2020 conditions (i.e. year of opening). The future conditions take into account general area background growth and traffic generated by the proposed mine development. The evaluation of year 2020 conditions includes details on the traffic forecasts and an intersection capacity analysis.

Year 2020 Traffic Forecasts

To account for general background growth in the area, a growth rate of one and a half (1.5) percent was applied to the existing traffic volumes to develop year 2020 background traffic forecasts. This growth rate is consistent with the preliminary *Wright County 2040 Transportation Plan*. This growth rate accounts for any traffic generation from additional developments within the area.



H:\Projects\12000\12731\TraffStudy\Figures\Fig03_Site Plan.cdr

SRF Consulting Group, Inc.

Site Plan

Mahler Aggregate Mine Traffic Study
City of Hanover, MN

01912731
June 2019

Figure 3

To account for traffic impacts associated with the proposed site, trip generation estimates for the arrival and hauling peak hours and on a daily basis were developed. These estimates, which consider the worst case future maximum hourly and daily loads, were developed based on information provided by the development team, and shown in the Appendix. A breakdown of future site trips is shown in Table 3. It should be noted that while residential redevelopment of the proposed mine property may be completed in the future, it is not expected until the mining work is complete in over 20 to 25 years and therefore not included within this analysis.

Table 3. Estimated Trip Generation

Land Use	Arrival Peak Hour Trips		Hauling Peak Hour Trips		Daily Trips
	In	Out	In	Out	
Mahler Aggregate Mine (1)	13	10	10	10	206

(1) Trip estimates were provided by Fehn Companies.

Results of the trip generation estimates indicate that the Mahler Mine is expected to generate approximately 23 arrival peak hour, 20 hauling peak hour, and 206 daily trips. The trips generated were distributed throughout the area based on the directional distribution shown in Figure 4, which was developed based on information provided by the development team and engineering judgement. The resultant year 2020 traffic forecasts, including general area background growth and traffic generated by the proposed site, are shown in Figure 5. It should be noted that the majority of these trips are expected to be trucks.

Year 2020 Intersection Capacity Analysis

To determine how the adjacent roadway network will accommodate year 2020 traffic forecasts, an intersection capacity analysis was completed using Synchro/SimTraffic software and the HCM. Results of the year 2020 intersection capacity analysis shown in Table 4 indicate that all study intersections are expected to continue operating at an acceptable overall LOS B or better during the arrival and hauling peak hours. During the arrival peak hour, southbound right-turn queues continue to block the southbound thru lane at the intersection of CSAH 19/River Road NE approximately 15 percent of the peak period. The 95th percentile westbound queue at CSAH 19/15th Street NE is expected to increase from four (4) to five (5) vehicles during the arrival peak hour. Given the minimal anticipated impact caused by the proposed development on study area traffic operations, no roadway improvements are required under year 2020 conditions from a traffic operations perspective.

H:\Projects\12000\12731\TraffStudy\Figures\Fig04_Trip Distribution.cdr

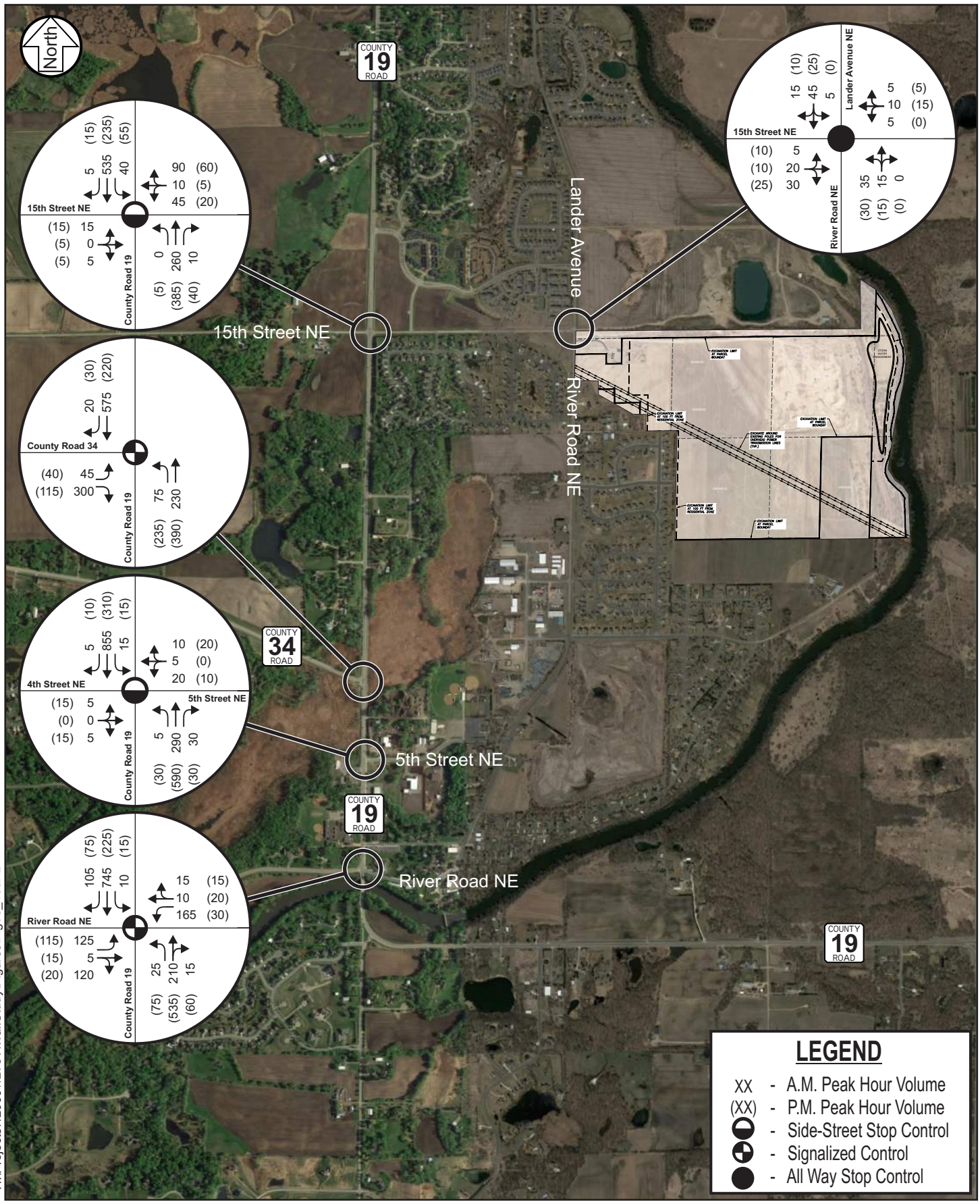
SRF Consulting Group, Inc.

Trip Distribution

Mahler Aggregate Mine Traffic Study
City of Hanover, MN

01912731
June 2019

Figure 4



H:\Projects\12000\12731\TraffStudy\Figures\Fig05_Year 2020 Conditions.cdr

SRF Consulting Group, Inc.

Year 2020 Build Conditions

Mahler Aggregate Mine Traffic Study
City of Hanover, MN

Figure 5

01912731
June 2019

Table 4. Year 2020 Intersection Capacity Analysis

Intersection	Arrival Peak Hour		Hauling Peak Hour	
	LOS	Delay	LOS	Delay
15th Street NE/Lander Avenue NE (1)	A	8 sec.	A	8 sec.
CSAH 19/15th Street NE (2)	A/D	29 sec.	A/C	21 sec.
CSAH 19/CSAH 34 (3)	B	16 sec.	A	9 sec.
CSAH 19/5th Street NE (2)	A/D	31 sec.	A/C	22 sec.
CSAH 19/River Road NE (3)	B	18 sec.	B	11 sec.

(2) All-way stop controlled intersection, where the overall LOS (delay) is shown.
(3) Side-stop controlled intersection, where the overall LOS (delay) is shown followed by the worst movement LOS (delay).
(4) Signal controlled intersection, where the overall LOS (delay) is shown.

Year 2040 Conditions

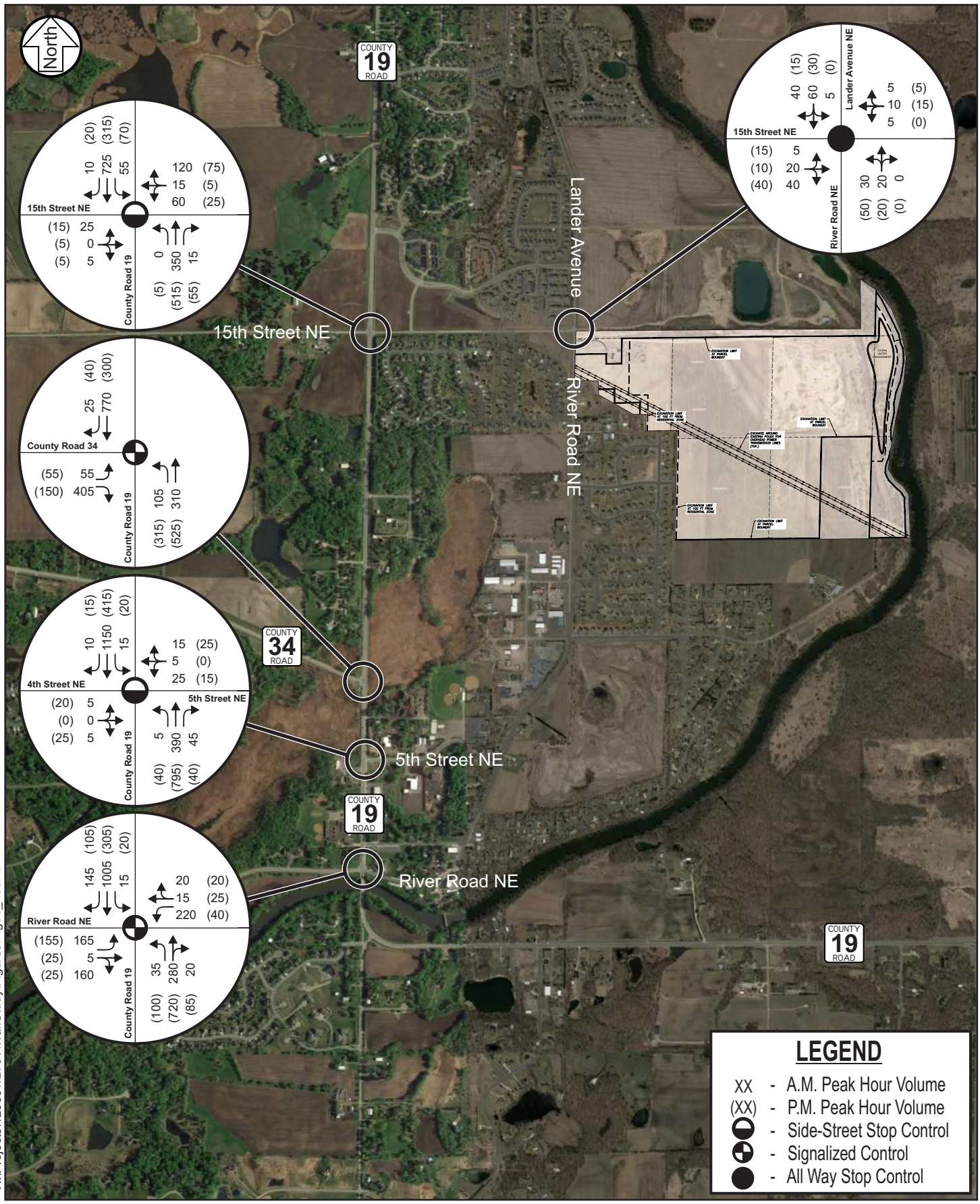
To help determine impacts associated with the proposed site, traffic forecasts were developed for year 2040 conditions (i.e. long-term build year). The future conditions take into account general area background growth and traffic generated by the proposed mine development. The evaluation of year 2040 conditions includes details on the traffic forecasts and an intersection capacity analysis.

Year 2040 Traffic Forecasts

To account for general background growth in the area, a yearly growth rate of one and a half (1.5) percent was applied to the existing traffic volumes to develop year 2040 background traffic forecasts. This growth rate is consistent with the preliminary *Wright County 2040 Transportation Plan*. The proposed development is expected to generate the same peak hour trips under year 2040 build conditions as year 2020 build conditions. The resultant year 2040 traffic forecasts, including general area background growth and traffic generated by the proposed development, are shown in Figure 6.

Year 2040 Intersection Capacity Analysis

To determine how the adjacent roadway network will accommodate year 2040 traffic forecasts, an intersection capacity analysis was completed using Synchro/SimTraffic software and the HCM. Results of the year 2040 intersection capacity analysis shown in Table 5 indicate that all study intersections are expected to operate at an acceptable overall LOS C or better during the arrival and hauling peak hours, except the CSAH 19/River Road NE intersection during the arrival peak hour, which operates at the LOS C/D threshold. The overall delay at the CSAH 19/River Road NE intersection is expected to increase by 17 seconds as compared to year 2020 build conditions. The westbound delay at the CSAH 19/River Road NE intersection is expected to exceed 80 seconds. Additionally, during the arrival peak hour, there is expected to be side-street delays of approximately 80 seconds at the CSAH 19 intersections with 5th Street NE and 15th Street NE, which is an increase of approximately 50 seconds compared to year 2020 build conditions.



H:\Projects\12000\12731\TraffStudy\Figures\Fig06_Year 2040 Conditions.cdr

SRF Consulting Group, Inc.

Year 2040 Build Conditions

Mahler Aggregate Mine Traffic Study
City of Hanover, MN

Figure 6

01912731
June 2019

Table 5. Year 2040 Intersection Capacity Analysis

Intersection	Arrival Peak Hour		Hauling Peak Hour	
	LOS	Delay	LOS	Delay
15th Street NE/Lander Avenue NE (1)	A	8 sec.	A	8 sec.
CSAH 19/15th Street NE (2)	B/**F**	**78 sec.**	A/**E**	**37 sec.**
CSAH 19/CSAH 34 (3)	C	26 sec.	B	12 sec.
CSAH 19/5th Street NE (2)	A/**F**	**85 sec.**	A/**E**	**45 sec.**
CSAH 19/River Road NE (3)	**C/D**	**35 sec.**	B	15 sec.

(1) All-way stop controlled intersection, where the overall LOS (delay) is shown.
(2) Side-stop controlled intersection, where the overall LOS (delay) is shown followed by the worst movement LOS (delay).
(3) Signal controlled intersection, where the overall LOS (delay) is shown.

Southbound right-turn queues are expected to block the southbound thru lane at the intersection of CSAH 19/River Road NE approximately 25 percent of the arrival peak hour. The 95th percentile westbound queue at 15th Street NE/CSAH 19 is approximately seven (7) to eight (8) vehicles during the arrival peak hour. Given the low amount of trips generated by the proposed development and the acceptable operations under year 2020 build conditions, it is expected that these delays/queues are a result of the expected background volume growth along CSAH 19 and not the proposed development. During the hauling peak hour, side-street delays for the CSAH 19 intersections with 5th Street NE and 15th Street are expected to increase between 16 and 23 seconds as compared to year 2020 build conditions, however, they are not considered unacceptable.

Based on the side-street congestion expected under year 2040 build conditions at unsignalized intersections along CSAH 19 during the arrival peak hour, the County could consider expanding the roadway from a three-lane roadway to a four-lane roadway in the future between River Road NE and TH 241. Note that there are no planned roadway expansion projects currently expected in the future and right-of-way is constrained within sections of the City of Hanover, which may determine the feasibility of this improvement. With a potential roadway expansion, it would be expected that side-street delays at the CSAH 19 and 5th Street NE intersection could be reduced to 33 seconds and side-street delays at the CSAH 19 and 15th Street NE intersection could be reduced to 45 seconds during the arrival peak hour, which would be within acceptable ranges for side-street stop controlled intersections. In addition to the consideration of the roadway expansion of CSAH 19, it is recommended to construct a westbound right-turn lane at the CSAH 19 and 15th Street NE intersection. This improvement would help accommodate the expected truck traffic from the proposed development and reducing trucks from blocking westbound thru and left-turn maneuvers.

Site Plan Review

Based on a review the sight distance at the study access, there is expected to be adequate sight distance available at this intersection. It should be noted that excavation operations are planned to be at least 100 feet from residential zones to minimize noise and dust impacts.

Summary and Conclusions

The following study conclusions and recommendations are offered for your consideration:

- Results of the existing intersection capacity analysis indicate that all study intersections currently operate at an acceptable overall LOS B or better during the arrival and hauling peak hours.
  - Southbound right-turn queues block the southbound thru lane at the intersection of CSAH 19/River Road NE approximately 15 percent of the arrival peak hour.
  - The 95th percentile westbound queue at 15th Street NE/CSAH 19 is approximately four (4) vehicles during the arrival peak hour.
- To account for general background growth in the area, a growth rate of one and one-half (1.5) percent was applied to the existing traffic volumes to develop both year 2020 (i.e. year of opening) and year 2040 (i.e. long-term year) background traffic forecasts.
- The proposed development is expected to generate approximately 23 a.m. peak hour, 20 p.m. peak hour, and 206 daily trips.
- Results of the year 2020 intersection capacity analysis indicate that all study intersections are expected to continue operating at an acceptable overall LOS B during the arrival and hauling peak hours.
  - Southbound right-turn queues block the southbound thru lane at the intersection of CSAH 19/River Road NE approximately 15 percent of the arrival peak hour.
  - The 95th percentile westbound queue at 15th Street NE/CSAH 19 is approximately five (5) vehicles during the arrival peak hour.
  - No mitigation is necessary to accommodate the proposed development.
- Results of the year 2040 intersection capacity analysis indicate that all study intersections are expected to operate at an overall LOS C or better during the arrival and hauling peak hours, except the CSAH 19 and River Road NE intersection, which operates at the LOS C/D threshold.
  - Southbound right-turn queues block the southbound thru lane at the intersection of CSAH 19/River Road NE approximately 25 percent of the arrival peak hour.
  - The 95th percentile westbound queue at 15th Street NE/CSAH 19 is approximately seven to eight vehicles during the arrival peak hour.
  - The congestion experienced during the arrival peak hour is expected to be a result of increased background traffic volumes and not a result of the proposed development.
- Based on the side-street congestion expected under year 2040 build conditions at unsignalized intersections along CSAH 19, the County could consider expanding the roadway from a three-lane roadway to a four-lane roadway in the future between River Road NE and TH 241.
- It is recommended to construct a westbound right-turn lane at the CSAH 19 and 15th Street NE intersection.

Appendix

Mining Traffic Estimates

Future Traffic Estimate

Mahler Pit Hanover

January	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
					20%	10%	20%	10%	10%	10%	10%	10%			
	Trucks In	2		0	0	0	0	0	0	0	0	0	0	0	0
	Trucks Out	2		0	0	0	0	0	0	0	0	0	0	0	0
	Employees In	1			1										
	Employees Out	1												1	
			132	<< Month Total 22 Days											

February	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
					20%	10%	20%	10%	10%	10%	10%	10%			
	Trucks In	14		0	3	1	3	1	1	1	1	1	0	0	0
	Trucks Out	14		0	3	1	3	1	1	1	1	1	0	0	0
	Employees In	1			1										
	Employees Out	1												1	
			352	<< Month Total 22 Days											

March	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
					20%	10%	20%	10%	10%	10%	10%	10%			
	Trucks In	3		0	1	0	1	0	0	0	0	0	0	0	0
	Trucks Out	3		0	1	0	1	0	0	0	0	0	0	0	0
	Employees In	1			1										
	Employees Out	1												1	
			176	<< Month Total 22 Days											

April	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
					20%	10%	20%	10%	10%	10%	10%	10%			
	Trucks In	4		0	1	0	1	0	0	0	0	0	0	0	0
	Trucks Out	4		0	1	0	1	0	0	0	0	0	0	0	0
	Employees In	1			1										
	Employees Out	1												1	
			220	<< Month Total 22 Days											

May	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
				10%	10%	10%	10%	10%	10%	10%	10%	10%	5%	5%	
	Trucks In	25		3	3	3	3	3	3	3	3	3	1	1	0
	Trucks Out	25		3	3	3	3	3	3	3	3	3	1	1	0
	Employees In	3		3											
	Employees Out	3													3
			1232	<< Month Total 22 Days											

June	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
				10%	10%	10%	10%	10%	10%	10%	10%	10%	5%	5%	
	Trucks In	55		6	6	6	6	6	6	6	6	6	3	3	0
	Trucks Out	55		6	6	6	6	6	6	6	6	6	3	3	0
	Employees In	3		3											
	Employees Out	3													3
			2552	<< Month Total 22 Days											

July	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
				10%	10%	10%	10%	10%	10%	10%	10%	10%	5%	5%	
	Trucks In	40		4	4	4	4	4	4	4	4	4	2	2	0
	Trucks Out	40		4	4	4	4	4	4	4	4	4	2	2	0
	Employees In	3		3											
	Employees Out	3													3
			1892	<< Month Total 22 Days											

August	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
				10%	10%	10%	10%	10%	10%	10%	10%	10%	5%	5%	
	Trucks In	70		7	7	7	7	7	7	7	7	7	4	4	0
	Trucks Out	70		7	7	7	7	7	7	7	7	7	4	4	0
	Employees In	3		3											
	Employees Out	3													3
			3212	<< Month Total 22 Days											

September	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
				10%	10%	10%	10%	10%	10%	10%	10%	10%	5%	5%	
	Trucks In	100		10	10	10	10	10	10	10	10	10	5	5	0
	Trucks Out	100		10	10	10	10	10	10	10	10	10	5	5	0
	Employees In	3		3											
	Employees Out	3													3
			4532	<< Month Total 22 Days											

October	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
				10%	10%	10%	10%	10%	10%	10%	10%	10%	5%	5%	
	Trucks In	70		7	7	7	7	7	7	7	7	7	4	4	0
	Trucks Out	70		7	7	7	7	7	7	7	7	7	4	4	0
	Employees In	3		3											
	Employees Out	3													3
			3212	<< Month Total 22 Days											

November	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
				10%	10%	10%	10%	10%	10%	10%	10%	10%	5%	5%	
	Trucks In	35		4	4	4	4	4	4	4	4	4	2	2	0
	Trucks Out	35		4	4	4	4	4	4	4	4	4	2	2	0
	Employees In	3		3											
	Employees Out	3													3
			1,672	<< Month Total 22 Days											

December	Description	Daily Count	Total per Month	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM
					20%	10%	20%	10%	10%	10%	10%	10%			
	Trucks In	2		0	0	0	0	0	0	0	0	0	0	0	0
	Trucks Out	2		0	0	0	0	0	0	0	0	0	0	0	0
	Employees In	1			1										
	Employees Out	1												1	
			132	<< Month Total 22 Days											
			19316	<< Year Total											

Existing Operations Analysis

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	15	0	2	40	10	82	0	256	7	32	526	5
Future Vol, veh/h	15	0	2	40	10	82	0	256	7	32	526	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	300	-	300	270	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	0	2	47	12	95	0	298	8	37	612	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1037	984	612	985	984	298	612	0	0	298	0	0
Stage 1	686	686	-	298	298	-	-	-	-	-	-	-
Stage 2	351	298	-	687	686	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	209	248	493	227	248	741	967	-	-	1263	-	-
Stage 1	438	448	-	711	667	-	-	-	-	-	-	-
Stage 2	666	667	-	437	448	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	172	241	493	221	241	741	967	-	-	1263	-	-
Mov Cap-2 Maneuver	172	241	-	221	241	-	-	-	-	-	-	-
Stage 1	438	435	-	711	667	-	-	-	-	-	-	-
Stage 2	570	667	-	422	435	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	26.6	19.7	0	0.5
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	967	-	-	186	396	1263	-	-
HCM Lane V/C Ratio	-	-	-	0.106	0.388	0.029	-	-
HCM Control Delay (s)	0	-	-	26.6	19.7	7.9	-	-
HCM Lane LOS	A	-	-	D	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	1.8	0.1	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	2	16	2	10	2	283	30	11	840	5
Future Vol, veh/h	4	0	2	16	2	10	2	283	30	11	840	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	180	50	-	300
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	0	2	19	2	12	2	329	35	13	977	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1343	1336	977	1337	1336	329	977	0	0	329	0	0
Stage 1	1002	1002	-	334	334	-	-	-	-	-	-	-
Stage 2	341	334	-	1003	1002	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	129	153	304	130	153	712	706	-	-	1231	-	-
Stage 1	292	320	-	680	643	-	-	-	-	-	-	-
Stage 2	674	643	-	292	320	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	124	151	304	128	151	712	706	-	-	1231	-	-
Mov Cap-2 Maneuver	124	151	-	128	151	-	-	-	-	-	-	-
Stage 1	291	317	-	678	641	-	-	-	-	-	-	-
Stage 2	659	641	-	287	317	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	29.5	28.7	0.1	0.1
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	706	-	-	154	184	1231	-	-
HCM Lane V/C Ratio	0.003	-	-	0.045	0.177	0.01	-	-
HCM Control Delay (s)	10.1	-	-	29.5	28.7	8	-	-
HCM Lane LOS	B	-	-	D	D	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.6	0	-	-

Intersection	
Intersection Delay, s/veh	7.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	7	29	1	0	1	34	13	0	1	44	13
Future Vol, veh/h	3	7	29	1	0	1	34	13	0	1	44	13
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	8	34	1	0	1	40	15	0	1	51	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7	7.1	7.5	7.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	72%	8%	50%	2%
Vol Thru, %	28%	18%	0%	76%
Vol Right, %	0%	74%	50%	22%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	47	39	2	58
LT Vol	34	3	1	1
Through Vol	13	7	0	44
RT Vol	0	29	1	13
Lane Flow Rate	55	45	2	67
Geometry Grp	1	1	1	1
Degree of Util (X)	0.064	0.047	0.003	0.074
Departure Headway (Hd)	4.212	3.716	3.981	3.927
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	850	955	890	911
Service Time	2.24	1.772	2.043	1.955
HCM Lane V/C Ratio	0.065	0.047	0.002	0.074
HCM Control Delay	7.5	7	7.1	7.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0.1	0	0.2

10: County Rd 19 & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.7	0.4
Total Del/Veh (s)	6.0	6.9	4.8	1.1	3.0

20: County Rd 19 & County Rd 34 Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.9	0.0	0.0	0.5
Total Del/Veh (s)	18.2	7.0	18.2	15.5

30: County Rd 19 & 5th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.2	0.1	0.0	0.0	0.0
Total Del/Veh (s)	76.4	22.7	1.8	2.7	3.1

40: County Rd 19 & River Rd NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.0	3.4	0.5	0.0	0.8
Total Del/Veh (s)	25.0	37.4	6.5	10.7	15.6

50: River Rd NE/Lander Ave NE & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.8	1.7	4.5	5.2	4.2

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	29.5

Intersection: 10: County Rd 19 & 15th St NE

Movement	EB	WB	SB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	24	73	28
Average Queue (ft)	7	33	4
95th Queue (ft)	21	56	19
Link Distance (ft)	3761	2560	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			270
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: County Rd 19 & County Rd 34

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	61	225	94	103	261	27
Average Queue (ft)	15	89	34	34	138	5
95th Queue (ft)	43	175	66	77	233	21
Link Distance (ft)	2689			943	4434	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		400	160			330
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 30: County Rd 19 & 5th St NE

Movement	EB	WB	SB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	39	52	26
Average Queue (ft)	5	17	3
95th Queue (ft)	24	42	16
Link Distance (ft)	546	2377	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			50
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 40: County Rd 19 & River Rd NE

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	188	120	212	75	43	114	125	401	200
Average Queue (ft)	74	44	98	11	13	44	8	170	42
95th Queue (ft)	136	90	177	45	36	94	51	317	150
Link Distance (ft)		1161		864		1561		1220	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	230		215		180		90		100
Storage Blk Time (%)	0		0	0				13	
Queuing Penalty (veh)	0		0	0				15	

Intersection: 50: River Rd NE/Lander Ave NE & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	31	27	50	50
Average Queue (ft)	19	2	25	27
95th Queue (ft)	40	14	45	47
Link Distance (ft)	2560	1290	1816	1138
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 15

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	4	2	15	4	48	1	377	34	45	229	13
Future Vol, veh/h	11	4	2	15	4	48	1	377	34	45	229	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	300	-	300	270	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	5	2	18	5	58	1	454	41	54	276	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	872	841	276	845	841	454	276	0	0	454	0	0
Stage 1	384	384	-	457	457	-	-	-	-	-	-	-
Stage 2	488	457	-	388	384	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	271	301	763	283	301	606	1287	-	-	1107	-	-
Stage 1	639	611	-	583	568	-	-	-	-	-	-	-
Stage 2	561	568	-	636	611	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	233	286	763	268	286	606	1287	-	-	1107	-	-
Mov Cap-2 Maneuver	233	286	-	268	286	-	-	-	-	-	-	-
Stage 1	639	581	-	583	568	-	-	-	-	-	-	-
Stage 2	503	568	-	598	581	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.7	14.8	0	1.3
HCM LOS	C	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1287	-	-	266	449	1107	-	-
HCM Lane V/C Ratio	0.001	-	-	0.077	0.18	0.049	-	-
HCM Control Delay (s)	7.8	-	-	19.7	14.8	8.4	-	-
HCM Lane LOS	A	-	-	C	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.6	0.2	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	0	15	10	0	18	29	578	29	13	300	10
Future Vol, veh/h	13	0	15	10	0	18	29	578	29	13	300	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	180	50	-	300
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	0	18	12	0	22	35	696	35	16	361	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1170	1159	361	1168	1159	696	361	0	0	696	0	0
Stage 1	393	393	-	766	766	-	-	-	-	-	-	-
Stage 2	777	766	-	402	393	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	170	196	684	170	196	442	1198	-	-	900	-	-
Stage 1	632	606	-	395	412	-	-	-	-	-	-	-
Stage 2	390	412	-	625	606	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	156	187	684	160	187	442	1198	-	-	900	-	-
Mov Cap-2 Maneuver	156	187	-	160	187	-	-	-	-	-	-	-
Stage 1	614	595	-	383	400	-	-	-	-	-	-	-
Stage 2	360	400	-	598	595	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	20.5	20.2	0.4	0.4
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1198	-	-	266	271	900	-	-
HCM Lane V/C Ratio	0.029	-	-	0.127	0.124	0.017	-	-
HCM Control Delay (s)	8.1	-	-	20.5	20.2	9.1	-	-
HCM Lane LOS	A	-	-	C	C	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.4	0.4	0.1	-	-

Intersection	
Intersection Delay, s/veh	7.2
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	0	25	0	1	1	29	14	0	0	21	7
Future Vol, veh/h	8	0	25	0	1	1	29	14	0	0	21	7
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	0	30	0	1	1	35	17	0	0	25	8
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	6.9	6.9	7.5	7.1
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	67%	24%	0%	0%
Vol Thru, %	33%	0%	50%	75%
Vol Right, %	0%	76%	50%	25%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	43	33	2	28
LT Vol	29	8	0	0
Through Vol	14	0	1	21
RT Vol	0	25	1	7
Lane Flow Rate	52	40	2	34
Geometry Grp	1	1	1	1
Degree of Util (X)	0.06	0.041	0.003	0.036
Departure Headway (Hd)	4.167	3.677	3.812	3.895
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	861	969	934	919
Service Time	2.186	1.717	1.856	1.921
HCM Lane V/C Ratio	0.06	0.041	0.002	0.037
HCM Control Delay	7.5	6.9	6.9	7.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0.1	0	0.1

10: County Rd 19 & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	1.0	0.4
Total Del/Veh (s)	5.1	4.6	5.1	0.8	3.5

20: County Rd 19 & County Rd 34 Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.6	0.0	0.0	0.2
Total Del/Veh (s)	8.0	6.6	12.9	8.4

30: County Rd 19 & 5th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0
Total Del/Veh (s)	14.4	15.0	3.0	2.0	3.2

40: County Rd 19 & River Rd NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.9	2.1	0.8	0.0	0.9
Total Del/Veh (s)	19.5	18.0	8.8	6.7	10.0

50: River Rd NE/Lander Ave NE & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.2	0.1	0.1	0.1
Total Del/Veh (s)	1.1	3.2	4.5	6.1	3.0

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	19.1

Intersection: 10: County Rd 19 & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	L	L
Maximum Queue (ft)	22	44	5	43
Average Queue (ft)	7	19	0	11
95th Queue (ft)	20	33	4	34
Link Distance (ft)	3761	2560		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			300	270
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 20: County Rd 19 & County Rd 34

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	62	57	117	107	142	45
Average Queue (ft)	14	17	51	47	63	10
95th Queue (ft)	39	41	97	95	114	33
Link Distance (ft)	2689			943	4434	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		400	160			330
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 30: County Rd 19 & 5th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	L	L
Maximum Queue (ft)	43	49	10	34
Average Queue (ft)	14	14	1	6
95th Queue (ft)	34	35	6	24
Link Distance (ft)	546	2377		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			100	50
Storage Blk Time (%)				0
Queuing Penalty (veh)				0

Intersection: 40: County Rd 19 & River Rd NE

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	119	48	81	37	59	283	28	144	85
Average Queue (ft)	49	14	19	11	25	109	8	54	22
95th Queue (ft)	94	37	57	30	54	206	29	114	60
Link Distance (ft)		1161		864		1561		1220	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	230		215		180		90		100
Storage Blk Time (%)						1		2	
Queuing Penalty (veh)						1		1	

Intersection: 50: River Rd NE/Lander Ave NE & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	31	28	42	35
Average Queue (ft)	17	2	22	18
95th Queue (ft)	38	12	43	42
Link Distance (ft)	2560	1290	1816	1138
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 3

Year 2020 Build Conditions Operations Analysis

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	15	0	2	43	10	90	0	260	9	40	534	5
Future Vol, veh/h	15	0	2	43	10	90	0	260	9	40	534	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	300	-	300	270	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	5	2	9	2	2	22	20	2	2
Mvmt Flow	17	0	2	50	12	105	0	302	10	47	621	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1074	1016	621	1017	1016	302	621	0	0	302	0	0
Stage 1	714	714	-	302	302	-	-	-	-	-	-	-
Stage 2	360	302	-	715	714	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.15	6.52	6.29	4.12	-	-	4.3	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.15	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.15	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.545	4.018	3.381	2.218	-	-	2.38	-	-
Pot Cap-1 Maneuver	198	238	487	213	238	721	960	-	-	1163	-	-
Stage 1	422	435	-	701	664	-	-	-	-	-	-	-
Stage 2	658	664	-	417	435	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	158	228	487	205	228	721	960	-	-	1163	-	-
Mov Cap-2 Maneuver	158	228	-	205	228	-	-	-	-	-	-	-
Stage 1	422	417	-	701	664	-	-	-	-	-	-	-
Stage 2	553	664	-	398	417	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	28.6	21.8	0	0.6
HCM LOS	D	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	960	-	-	172	378	1163	-	-
HCM Lane V/C Ratio	-	-	-	0.115	0.44	0.04	-	-
HCM Control Delay (s)	0	-	-	28.6	21.8	8.2	-	-
HCM Lane LOS	A	-	-	D	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	2.2	0.1	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	2	16	2	10	2	289	30	11	855	5
Future Vol, veh/h	4	0	2	16	2	10	2	289	30	11	855	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	180	50	-	300
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	0	2	19	2	12	2	336	35	13	994	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1368	1361	994	1362	1361	336	994	0	0	336	0	0
Stage 1	1020	1020	-	341	341	-	-	-	-	-	-	-
Stage 2	348	341	-	1021	1020	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	124	148	297	125	148	706	696	-	-	1223	-	-
Stage 1	285	314	-	674	639	-	-	-	-	-	-	-
Stage 2	668	639	-	285	314	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	119	146	297	123	146	706	696	-	-	1223	-	-
Mov Cap-2 Maneuver	119	146	-	123	146	-	-	-	-	-	-	-
Stage 1	284	311	-	672	637	-	-	-	-	-	-	-
Stage 2	653	637	-	280	311	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	30.3	29.9	0.1	0.1
HCM LOS	D	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	696	-	-	149	177	1223	-	-
HCM Lane V/C Ratio	0.003	-	-	0.047	0.184	0.01	-	-
HCM Control Delay (s)	10.2	-	-	30.3	29.9	8	-	-
HCM Lane LOS	B	-	-	D	D	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.7	0	-	-

Intersection	
Intersection Delay, s/veh	7.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	17	29	1	10	1	35	13	0	1	45	13
Future Vol, veh/h	3	17	29	1	10	1	35	13	0	1	45	13
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	100	2	2	100	2	2	2	2	2	2	2
Mvmt Flow	3	20	34	1	12	1	41	15	0	1	52	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.1	7.3	7.6	7.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	73%	6%	8%	2%
Vol Thru, %	27%	35%	83%	76%
Vol Right, %	0%	59%	8%	22%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	48	49	12	59
LT Vol	35	3	1	1
Through Vol	13	17	10	45
RT Vol	0	29	1	13
Lane Flow Rate	56	57	14	69
Geometry Grp	1	1	1	1
Degree of Util (X)	0.066	0.06	0.016	0.076
Departure Headway (Hd)	4.256	3.817	4.161	3.971
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	839	929	851	899
Service Time	2.294	1.88	2.229	2.01
HCM Lane V/C Ratio	0.067	0.061	0.016	0.077
HCM Control Delay	7.6	7.1	7.3	7.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0.2	0	0.2

10: County Rd 19 & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.8	0.5
Total Del/Veh (s)	6.1	7.8	5.1	1.1	3.3

20: County Rd 19 & County Rd 34 Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.9	0.0	0.0	0.5
Total Del/Veh (s)	16.6	7.4	18.6	15.3

30: County Rd 19 & 5th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0
Total Del/Veh (s)	28.7	31.6	1.8	2.8	3.4

40: County Rd 19 & River Rd NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.0	3.4	0.5	0.0	0.8
Total Del/Veh (s)	27.1	41.6	7.0	12.3	17.4

50: River Rd NE/Lander Ave NE & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.1	0.1
Total Del/Veh (s)	3.4	5.9	4.7	5.0	4.5

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	31.0

Intersection: 10: County Rd 19 & 15th St NE

Movement	EB	WB	SB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	24	84	62
Average Queue (ft)	7	38	10
95th Queue (ft)	21	69	39
Link Distance (ft)	3761	2560	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			270
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 20: County Rd 19 & County Rd 34

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	50	167	72	105	280	28
Average Queue (ft)	14	77	34	38	138	6
95th Queue (ft)	39	152	64	82	227	24
Link Distance (ft)	2689			943	4434	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		400	160			330
Storage Blk Time (%)					0	
Queuing Penalty (veh)					0	

Intersection: 30: County Rd 19 & 5th St NE

Movement	EB	WB	SB
Directions Served	LTR	LTR	L
Maximum Queue (ft)	30	62	26
Average Queue (ft)	3	20	2
95th Queue (ft)	17	49	14
Link Distance (ft)	546	2377	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			50
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 40: County Rd 19 & River Rd NE

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	179	138	227	31	49	152	100	489	200
Average Queue (ft)	78	52	102	8	15	50	8	191	45
95th Queue (ft)	145	109	190	25	40	108	50	375	151
Link Distance (ft)		1161		864		1561		1220	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	230		215		180		90		100
Storage Blk Time (%)			1			0		15	
Queuing Penalty (veh)			0			0		17	

Intersection: 50: River Rd NE/Lander Ave NE & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	82	67	49	55
Average Queue (ft)	35	20	25	28
95th Queue (ft)	75	60	45	46
Link Distance (ft)	2560	1290	1816	1138
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 18

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	4	2	17	4	56	1	383	37	52	232	13
Future Vol, veh/h	11	4	2	17	4	56	1	383	37	52	232	13
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	300	-	300	270	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	12	2	14	2	2	5	15	2	2
Mvmt Flow	13	5	2	20	5	67	1	461	45	63	280	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	905	869	280	872	869	461	280	0	0	461	0	0
Stage 1	405	405	-	464	464	-	-	-	-	-	-	-
Stage 2	500	464	-	408	405	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.22	6.52	6.34	4.12	-	-	4.25	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.22	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.22	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.608	4.018	3.426	2.218	-	-	2.335	-	-
Pot Cap-1 Maneuver	257	290	759	260	290	576	1283	-	-	1035	-	-
Stage 1	622	598	-	560	564	-	-	-	-	-	-	-
Stage 2	553	564	-	601	598	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	213	272	759	244	272	576	1283	-	-	1035	-	-
Mov Cap-2 Maneuver	213	272	-	244	272	-	-	-	-	-	-	-
Stage 1	622	562	-	560	564	-	-	-	-	-	-	-
Stage 2	484	564	-	558	562	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	21	15.9	0	1.5
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1283	-	-	246	424	1035	-	-
HCM Lane V/C Ratio	0.001	-	-	0.083	0.219	0.061	-	-
HCM Control Delay (s)	7.8	-	-	21	15.9	8.7	-	-
HCM Lane LOS	A	-	-	C	C	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.3	0.8	0.2	-	-

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	0	15	10	0	18	29	589	29	13	307	10
Future Vol, veh/h	13	0	15	10	0	18	29	589	29	13	307	10
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	180	50	-	300
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	0	18	12	0	22	35	710	35	16	370	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1191	1181	370	1190	1181	710	370	0	0	710	0	0
Stage 1	401	401	-	780	780	-	-	-	-	-	-	-
Stage 2	790	780	-	410	401	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	164	190	676	165	190	434	1189	-	-	889	-	-
Stage 1	626	601	-	388	406	-	-	-	-	-	-	-
Stage 2	383	406	-	619	601	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	150	181	676	155	181	434	1189	-	-	889	-	-
Mov Cap-2 Maneuver	150	181	-	155	181	-	-	-	-	-	-	-
Stage 1	608	590	-	377	394	-	-	-	-	-	-	-
Stage 2	353	394	-	592	590	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	21.1	20.6	0.4	0.4
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1189	-	-	257	264	889	-	-
HCM Lane V/C Ratio	0.029	-	-	0.131	0.128	0.018	-	-
HCM Control Delay (s)	8.1	-	-	21.1	20.6	9.1	-	-
HCM Lane LOS	A	-	-	C	C	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.4	0.4	0.1	-	-

Intersection	
Intersection Delay, s/veh	7.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	10	25	0	11	1	29	14	0	0	21	7
Future Vol, veh/h	8	10	25	0	11	1	29	14	0	0	21	7
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Heavy Vehicles, %	2	100	2	2	100	2	2	2	2	2	2	2
Mvmt Flow	10	12	30	0	13	1	35	17	0	0	25	8
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.1	8.9	7.5	7.1
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	67%	19%	0%	0%
Vol Thru, %	33%	23%	92%	75%
Vol Right, %	0%	58%	8%	25%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	43	43	12	28
LT Vol	29	8	0	0
Through Vol	14	10	11	21
RT Vol	0	25	1	7
Lane Flow Rate	52	52	14	34
Geometry Grp	1	1	1	1
Degree of Util (X)	0.061	0.054	0.023	0.037
Departure Headway (Hd)	4.21	3.781	5.741	3.939
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	848	940	622	903
Service Time	2.251	1.833	3.791	1.987
HCM Lane V/C Ratio	0.061	0.055	0.023	0.038
HCM Control Delay	7.5	7.1	8.9	7.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	0.2	0.1	0.1

10: County Rd 19 & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	1.0	0.4
Total Del/Veh (s)	6.6	6.8	5.6	0.8	4.0

20: County Rd 19 & County Rd 34 Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.6	0.0	0.0	0.2
Total Del/Veh (s)	8.6	7.0	13.3	8.8

30: County Rd 19 & 5th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0
Total Del/Veh (s)	17.3	19.4	3.0	2.1	3.5

40: County Rd 19 & River Rd NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.8	2.0	0.9	0.0	0.9
Total Del/Veh (s)	20.7	17.3	9.0	7.2	10.3

50: River Rd NE/Lander Ave NE & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.1	0.1
Total Del/Veh (s)	1.9	6.6	5.2	5.9	3.8

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	20.2

Intersection: 10: County Rd 19 & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	L	L
Maximum Queue (ft)	26	83	4	50
Average Queue (ft)	7	30	0	10
95th Queue (ft)	22	62	3	35
Link Distance (ft)	3761	2560		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			300	270
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 20: County Rd 19 & County Rd 34

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	45	52	132	116	143	54
Average Queue (ft)	13	15	57	43	63	11
95th Queue (ft)	33	40	105	98	119	35
Link Distance (ft)	2689			943	4434	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		400	160			330
Storage Blk Time (%)			0	0		
Queuing Penalty (veh)			0	0		

Intersection: 30: County Rd 19 & 5th St NE

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	T
Maximum Queue (ft)	52	50	9	27	5
Average Queue (ft)	14	16	0	5	0
95th Queue (ft)	36	40	4	21	3
Link Distance (ft)	546	2377			943
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			100	50	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 40: County Rd 19 & River Rd NE

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	136	39	54	40	72	258	56	148	93
Average Queue (ft)	57	15	13	10	24	122	9	56	23
95th Queue (ft)	109	34	37	30	55	215	37	119	64
Link Distance (ft)		1161		864		1561		1220	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	230		215		180		90		100
Storage Blk Time (%)						1		2	0
Queuing Penalty (veh)						1		2	0

Intersection: 50: River Rd NE/Lander Ave NE & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	81	76	49	47
Average Queue (ft)	28	23	24	18
95th Queue (ft)	62	70	47	43
Link Distance (ft)	2560	1290	1816	1138
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 4

Year 2040 Build Conditions Operations Analysis

Intersection	
Int Delay, s/veh	12.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	0	3	57	14	120	0	350	12	52	722	7
Future Vol, veh/h	21	0	3	57	14	120	0	350	12	52	722	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	300	-	300	270	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	4	2	7	15	2	17	2	2	2
Mvmt Flow	24	0	3	66	16	140	0	407	14	60	840	8

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1445	1367	840	1369	1367	407	840	0	0	407	0	0
Stage 1	960	960	-	407	407	-	-	-	-	-	-	-
Stage 2	485	407	-	962	960	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.14	6.52	6.27	4.25	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.14	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.14	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.536	4.018	3.363	2.335	-	-	2.218	-	-
Pot Cap-1 Maneuver	110	147	365	123	147	633	742	-	-	1152	-	-
Stage 1	308	335	-	617	597	-	-	-	-	-	-	-
Stage 2	563	597	-	305	335	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	75	139	365	117	139	633	742	-	-	1152	-	-
Mov Cap-2 Maneuver	75	139	-	117	139	-	-	-	-	-	-	-
Stage 1	308	318	-	617	597	-	-	-	-	-	-	-
Stage 2	427	597	-	286	318	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	68.9	77.9	0	0.6
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	742	-	-	83	246	1152	-	-
HCM Lane V/C Ratio	-	-	-	0.336	0.903	0.052	-	-
HCM Control Delay (s)	0	-	-	68.9	77.9	8.3	-	-
HCM Lane LOS	A	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	1.3	7.8	0.2	-	-

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	5	0	3	22	3	14	3	389	41	15	1150	7
Future Vol, veh/h	5	0	3	22	3	14	3	389	41	15	1150	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	180	50	-	300
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	0	3	26	3	16	3	452	48	17	1337	8

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1841	1831	1337	1833	1831	452	1337	0	0	452	0	0
Stage 1	1372	1372	-	459	459	-	-	-	-	-	-	-
Stage 2	469	459	-	1374	1372	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	58	76	187	59	76	608	516	-	-	1109	-	-
Stage 1	180	214	-	582	566	-	-	-	-	-	-	-
Stage 2	575	566	-	180	214	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	54	74	187	57	74	608	516	-	-	1109	-	-
Mov Cap-2 Maneuver	54	74	-	57	74	-	-	-	-	-	-	-
Stage 1	179	211	-	579	563	-	-	-	-	-	-	-
Stage 2	553	563	-	174	211	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	60.5	84.6	0.1	0.1
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	516	-	-	74	87	1109	-	-
HCM Lane V/C Ratio	0.007	-	-	0.126	0.521	0.016	-	-
HCM Control Delay (s)	12	-	-	60.5	84.6	8.3	-	-
HCM Lane LOS	B	-	-	F	F	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.4	2.3	0	-	-

Intersection	
Intersection Delay, s/veh	7.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	20	40	1	10	1	60	18	0	1	60	36
Future Vol, veh/h	4	20	40	1	10	1	60	18	0	1	60	36
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	100	2	2	100	2	2	2	2	2	2	2
Mvmt Flow	5	23	47	1	12	1	70	21	0	1	70	42
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.4	7.5	7.9	7.6
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	77%	6%	8%	1%
Vol Thru, %	23%	31%	83%	62%
Vol Right, %	0%	62%	8%	37%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	78	64	12	97
LT Vol	60	4	1	1
Through Vol	18	20	10	60
RT Vol	0	40	1	36
Lane Flow Rate	91	74	14	113
Geometry Grp	1	1	1	1
Degree of Util (X)	0.109	0.083	0.017	0.123
Departure Headway (Hd)	4.327	4.032	4.423	3.936
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	821	894	814	901
Service Time	2.391	2.032	2.425	2.004
HCM Lane V/C Ratio	0.111	0.083	0.017	0.125
HCM Control Delay	7.9	7.4	7.5	7.6
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	0.3	0.1	0.4

10: County Rd 19 & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.9	0.5
Total Del/Veh (s)	12.8	13.3	5.9	1.5	4.6

20: County Rd 19 & County Rd 34 Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.9	0.0	0.0	0.5
Total Del/Veh (s)	45.0	9.5	24.9	26.4

30: County Rd 19 & 5th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.2	0.0	0.0	0.0
Total Del/Veh (s)	284.1	336.4	2.3	4.4	13.3

40: County Rd 19 & River Rd NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.0	3.3	0.5	0.0	0.8
Total Del/Veh (s)	55.4	82.6	10.3	26.6	35.3

50: River Rd NE/Lander Ave NE & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.2	0.1
Total Del/Veh (s)	3.2	6.0	4.9	5.2	4.5

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	59.7

Intersection: 10: County Rd 19 & 15th St NE

Movement	EB	WB	SB	SB
Directions Served	LTR	LTR	L	R
Maximum Queue (ft)	44	148	30	7
Average Queue (ft)	11	57	10	0
95th Queue (ft)	28	110	31	5
Link Distance (ft)	3761	2560		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			270	250
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 20: County Rd 19 & County Rd 34

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	267	412	114	139	454	119
Average Queue (ft)	47	191	52	49	209	9
95th Queue (ft)	250	387	96	106	388	78
Link Distance (ft)	2689			943	4434	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		400	160			330
Storage Blk Time (%)		4		0	3	
Queuing Penalty (veh)		2		0	1	

Intersection: 30: County Rd 19 & 5th St NE

Movement	EB	WB	SB	SB	SB
Directions Served	LTR	LTR	L	T	R
Maximum Queue (ft)	64	259	27	108	94
Average Queue (ft)	16	98	5	10	3
95th Queue (ft)	56	267	22	112	69
Link Distance (ft)	546	2377		943	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			50		300
Storage Blk Time (%)				1	
Queuing Penalty (veh)				0	

Intersection: 40: County Rd 19 & River Rd NE

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	240	287	291	357	55	201	31	913	200
Average Queue (ft)	116	125	182	72	18	82	4	463	73
95th Queue (ft)	216	255	297	324	48	162	19	863	207
Link Distance (ft)		1161		864		1561		1220	
Upstream Blk Time (%)								0	
Queuing Penalty (veh)								0	
Storage Bay Dist (ft)	230		215		180		90		100
Storage Blk Time (%)	0	5	16	0		1		26	
Queuing Penalty (veh)	0	8	5	0		0		40	

Intersection: 50: River Rd NE/Lander Ave NE & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	84	76	62	68
Average Queue (ft)	39	19	28	35
95th Queue (ft)	76	64	47	55
Link Distance (ft)	2560	1290	1816	1138
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 56

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	15	5	3	23	5	74	1	515	51	70	312	18
Future Vol, veh/h	15	5	3	23	5	74	1	515	51	70	312	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	300	-	300	270	-	250
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	9	2	11	2	2	4	11	2	2
Mvmt Flow	18	6	4	28	6	89	1	620	61	84	376	22

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1215	1168	376	1172	1168	620	376	0	0	620	0	0
Stage 1	545	545	-	623	623	-	-	-	-	-	-	-
Stage 2	670	623	-	549	545	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.19	6.52	6.31	4.12	-	-	4.21	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.19	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.19	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.581	4.018	3.399	2.218	-	-	2.299	-	-
Pot Cap-1 Maneuver	158	193	670	164	193	472	1182	-	-	918	-	-
Stage 1	523	519	-	462	478	-	-	-	-	-	-	-
Stage 2	446	478	-	508	519	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	116	175	670	148	175	472	1182	-	-	918	-	-
Mov Cap-2 Maneuver	116	175	-	148	175	-	-	-	-	-	-	-
Stage 1	523	472	-	462	478	-	-	-	-	-	-	-
Stage 2	357	478	-	453	472	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	36.4	25.2	0	1.6
HCM LOS	E	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1182	-	-	142	299	918	-	-
HCM Lane V/C Ratio	0.001	-	-	0.195	0.411	0.092	-	-
HCM Control Delay (s)	8	-	-	36.4	25.2	9.3	-	-
HCM Lane LOS	A	-	-	E	D	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.7	1.9	0.3	-	-

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	0	21	14	0	25	40	791	40	18	413	14
Future Vol, veh/h	18	0	21	14	0	25	40	791	40	18	413	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	100	-	180	50	-	300
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	0	25	17	0	30	48	953	48	22	498	17

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1605	1590	498	1603	1590	953	498	0	0	953	0	0
Stage 1	541	541	-	1049	1049	-	-	-	-	-	-	-
Stage 2	1064	1049	-	554	541	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	85	108	572	85	108	314	1066	-	-	721	-	-
Stage 1	525	521	-	275	304	-	-	-	-	-	-	-
Stage 2	270	304	-	517	521	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	72	100	572	77	100	314	1066	-	-	721	-	-
Mov Cap-2 Maneuver	72	100	-	77	100	-	-	-	-	-	-	-
Stage 1	501	505	-	263	290	-	-	-	-	-	-	-
Stage 2	233	290	-	479	505	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	44.8	39.9	0.4	0.4
HCM LOS	E	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1066	-	-	136	149	721	-	-
HCM Lane V/C Ratio	0.045	-	-	0.345	0.315	0.03	-	-
HCM Control Delay (s)	8.5	-	-	44.8	39.9	10.1	-	-
HCM Lane LOS	A	-	-	E	E	B	-	-
HCM 95th %tile Q(veh)	0.1	-	-	1.4	1.3	0.1	-	-

Intersection	
Intersection Delay, s/veh	7.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	10	40	0	11	1	46	19	0	0	29	15
Future Vol, veh/h	11	10	40	0	11	1	46	19	0	0	29	15
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Heavy Vehicles, %	2	100	2	2	100	2	2	2	2	2	2	2
Mvmt Flow	13	12	48	0	13	1	55	23	0	0	35	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.2	9.1	7.8	7.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	71%	18%	0%	0%
Vol Thru, %	29%	16%	92%	66%
Vol Right, %	0%	66%	8%	34%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	65	61	12	44
LT Vol	46	11	0	0
Through Vol	19	10	11	29
RT Vol	0	40	1	15
Lane Flow Rate	78	73	14	53
Geometry Grp	1	1	1	1
Degree of Util (X)	0.093	0.078	0.023	0.058
Departure Headway (Hd)	4.269	3.814	5.839	3.942
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	834	927	609	899
Service Time	2.324	1.889	3.918	2.007
HCM Lane V/C Ratio	0.094	0.079	0.023	0.059
HCM Control Delay	7.8	7.2	9.1	7.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.3	0.3	0.1	0.2

10: County Rd 19 & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.0	0.0	1.2	0.4
Total Del/Veh (s)	9.7	9.1	6.6	1.2	4.9

20: County Rd 19 & County Rd 34 Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.6	0.0	0.0	0.3
Total Del/Veh (s)	11.6	9.3	16.8	11.5

30: County Rd 19 & 5th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0
Total Del/Veh (s)	35.9	46.3	3.7	2.5	5.1

40: County Rd 19 & River Rd NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	2.7	1.9	1.2	0.0	1.1
Total Del/Veh (s)	30.4	26.5	12.5	8.5	14.3

50: River Rd NE/Lander Ave NE & 15th St NE Performance by approach

Approach	EB	WB	NB	SB	All
Denied Del/Veh (s)	0.0	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.0	7.1	5.0	5.2	3.5

Total Network Performance

Denied Del/Veh (s)	1.3
Total Del/Veh (s)	26.8

Intersection: 10: County Rd 19 & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	T	L
Maximum Queue (ft)	42	103	4	60
Average Queue (ft)	11	35	0	20
95th Queue (ft)	30	71	3	47
Link Distance (ft)	3761	2560	4434	
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				270
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 20: County Rd 19 & County Rd 34

Movement	EB	EB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	R
Maximum Queue (ft)	84	91	175	150	191	42
Average Queue (ft)	24	27	80	62	93	14
95th Queue (ft)	62	66	141	127	166	38
Link Distance (ft)	2689			943	4434	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		400	160			330
Storage Blk Time (%)			0	0		
Queuing Penalty (veh)			2	1		

Intersection: 30: County Rd 19 & 5th St NE

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	T
Maximum Queue (ft)	102	76	14	46	5
Average Queue (ft)	24	22	1	8	0
95th Queue (ft)	70	65	11	29	3
Link Distance (ft)	546	2377			943
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			100	50	
Storage Blk Time (%)				0	
Queuing Penalty (veh)				2	

Intersection: 40: County Rd 19 & River Rd NE

Movement	EB	EB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	T	R
Maximum Queue (ft)	200	72	80	60	125	504	55	195	78
Average Queue (ft)	87	19	25	19	34	176	10	79	26
95th Queue (ft)	158	48	63	47	83	359	39	155	56
Link Distance (ft)		1161		864		1561		1220	
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	230		215		180		90		100
Storage Blk Time (%)	0					5		6	0
Queuing Penalty (veh)	0					5		7	0

Intersection: 50: River Rd NE/Lander Ave NE & 15th St NE

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	77	69	59	50
Average Queue (ft)	32	15	27	22
95th Queue (ft)	65	56	48	45
Link Distance (ft)	2560	1290	1816	1138
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 17