Minnesota Department of Transportation

TH 23 North Gap: 2-Lane to 4-Lane Conversion Project from Paynesville to Richmond

Environmental Assessment Worksheet

September 2017

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I. Environmental Assessment Worksheet

This Environmental Assessment Worksheet (EAW) form and EAW Guidelines are available at the Environmental Quality Board's website[1]. 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 addressed 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.

A. Environmental Assessment Worksheet

1. Project Title:

TH 23 North Gap: 2-Lane to 4-Lane Conversion Project from Paynesville to Richmond

2. Proposer

Proposer: Minnesota Department of Transportation District 8
Contact Person: Jon Huseby, PE
Title: Transportation District Engineer
Address: 2505 Transportation Road
City, State, ZIP: Willmar, MN 56201
Phone: 320.231.5497
Fax: 320.214.6305
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3. RGU

Proposer: Minnesota Department of Transportation District 8
Contact Person: Ryan Barney, PE
Title: MnDOT Project Manager
Address: 2505 Transportation Road
City, State, ZIP: Willmar, MN 56201
Phone: 320.214.6324
Fax: 320.214.6305
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4. Reason for EAW Preparation (Check One)

Required:	Discretionary:	
☐ EIS Scoping	☐ Citizen petition	
☒ Mandatory EAW	☐ 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, subpart 22, item B

[1] http://www.eqb.state.mn.us/EnvRevGuidanceDocuments.htm

5. Project Location

County: Stearns
City/Township: Paynesville Township, Zion Township, Munson Township, Roscoe.
PLS Location (¼, ¼, Section, Township, Range): T122 R31W, T122 R32W, T123 R31W, T123 R32W
Watershed (81 major watershed scale): 18 (North Fork Crow River), 16 (Sauk River)
GPS Coordinates: N/A
Tax Parcel Number: N/A

The project map that includes the general location, county, and USGS Survey is located in ***Appendix A - Figure 1***.

Site Plans showing all significant project elements and natural features are found in ***Appendix B – Preferred Preliminary Layout: Figures 2A through 2F***.

6. Project Description

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

The project will convert TH 23 from the City of Paynesville to the City of Richmond from its current configuration as a two-lane highway section, to a four-lane divided highway section. The project length is approximately 8.7 miles and is located within Stearns County.

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.

Project Description

The project will convert approximately 8.7 miles of the existing 2-lane highway to a 4-lane divided highway. The project will retain the majority of the existing 2-lane roadway as a portion of the expanded 4-lane design.

Near Paynesville, at the westerly termini of the project, the expansion lane of the preferred alternative widens TH 23 along the north side of the existing alignment. The alignment of the additional lane remains north through the Roscoe WPA. Near the City of Roscoe both lanes of the preferred alternative shift south of the existing TH 23 alignment for approximately 0.5 miles. This shift of the highway moves the highway further from the City of Roscoe and corrects curve deficiencies (for the proposed design) along the existing highway corridor. Continuing east of the City of Roscoe, the preferred alternative ties back in with the existing highway corridor. From this point the expansion lanes are located to the south side of the existing highway for approximately 1.5 miles. Near County Road 123, east of Roscoe, the expansion lane shifts north of the existing highway corridor, and remains north of the existing travel lanes to the eastern project termini.

Appendix B contains a series of preliminary layout figures for the proposed TH 23 improvements.

Construction Methods

The construction work will consist of removing the existing roadway material and topsoil within the proposed project's construction limits, excavating material from under the proposed new roadway areas, laying culverts, and placing and compacting material for the new roadway embankments. It is anticipated that the material excavated on the project will be re-used for overlay, aggregate or embankment purposes where appropriate and in accordance with best management practices established in MnDOT's Standard Specifications for Construction.

Material will also be excavated and placed for water ponding areas related to stormwater and runoff management (see EAW Item 11.b.ii. – Water Quality: surface water runoff on page 16 for more information).

Best management practices (BMPs) will be used to control construction related sedimentation, and turf areas will be re-established (see EAW Item 11.b.ii on page 17 for more information).
Some trees and vegetation will be removed as part of the project. Tree and vegetation removal are discussed in EAW Item 13.d, on page 25.

Right of Way Acquisition/Relocation

Once the environmental review and preliminary layout are complete, right-of-way acquisition and detailed final design could begin, as funds become available. The majority of right of way will be acquired when construction funding is secured. Based on preliminary construction limits the amount of anticipated right-of-way to be acquired for the proposed improvements is approximately 211.4 acres, and approximately 9.8 acres of temporary easement. Any impacts to septic system drainage fields will be mitigated to meet Stearns County standards.

The proposed transportation improvements will result in several full acquisitions/relocations. Based on the preliminary layout up to fourteen relocations are anticipated, which will require the removal and/or demolition of existing residential and agricultural buildings. All buildings will be inspected prior to demolition and all hazardous waste materials will be handled and disposed of in accordance with local and state regulations.

Project Schedule

The project is not currently programmed for construction. Based on the preliminary layout it is anticipated that construction would occur over two construction seasons.

c. Project magnitude:

Total Project Acreage*	404 acres *(based on preliminary layout)*
Linear Project Length	8.7 miles
Number and Type of Residential Units	N/A
Commercial Building Area (in square feet)	N/A
Industrial Building Area (in square feet)	N/A
Institutional Building Area (in square feet)	N/A
Other Uses – specify (in square feet)	N/A
Structure Height(s)	N/A

* Total project acreage encompasses proposed right of way

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 TH 23 Corridor extends southwest to northeast across Minnesota from Interstate 90 (I-90) to Interstate 35 (I-35) and beyond. It connects many cities including Pipestone, Marshall, Granite Falls, Willmar and St. Cloud. The segment of TH 23 between Willmar and I-94 is a distance of approximately 53 miles. Of those 53 miles, all but 15 miles have been constructed as a four lane roadway. TH 23 between Paynesville and Richmond is one of two remaining segments of two-lane roadway from Willmar to St. Cloud, and part of the long-standing effort to construct a four-lane road for the length of the corridor.

TH 23 is an important freight route. MnDOT District 8 recently completed a Manufacturer's Perspective on Transportation Study[2] that interviewed manufacturers and carriers in Southwest and West Central Minnesota to determine their most important transportation issues. TH 23 was frequently mentioned as a critical connection to deliver goods to national and international markets.

TH 23 is an important interregional corridor that is a key artery for the regional economy. The project will meet the Corridors of Commerce objectives of providing additional capacity, improving the movement of freight, and increasing roadway safety. However, the project will also provide the design consistency of a four lane rural highway and help meet driver expectancy of a four lane facility throughout this segment of the TH 23 corridor. This corridor-wide consistency further enhances the mobility and safety benefits already provided by the project. Beneficiaries of the project will include motorists and freight traffic in the immediate area and region since the improvements are anticipated to improve operations and safety conditions.

Improvements in the design will maximize benefits in safety and mobility, and capture the opportunity to foster continued economic growth in the region. The preferred alternative must be consistent with meeting these identified needs discussed below.

- ***Improve Safety*** – Improving travel safety is a priority objective of MnDOT in managing the state trunk highway system. Over a ten-year period (2005-2014), this segment of TH 23 had 154 reported crashes. The distribution of crashes along the TH 23 occur on both roadway segments and intersections. Therefore, the proposed improvements need to address safety conditions along the entire project area rather than localized improvements (specific intersections). Minnesota's Strategic Highway Safety Plan emphasizes proactive system-wide safety improvements rather than reactive spot improvements. Therefore, the proposed TH 23 corridor-wide improvements to this segment of TH 23 compliment the plans strategy.

- ***Maintain Mobility*** – Forecasted daily traffic demand indicates the capacity of the existing two-lane highway will be exceeded prior to the design year (year 2040) and degrade travel conditions in the area. This will become a more problematic situation for vehicles attempting to enter onto or cross over the highway.

- ***Enhance System Continuity*** – The segment of TH 23 between Willmar and I-94 is a distance of approximately 53 miles. Of those 53 miles, all but 15 miles have been constructed as a four lane roadway. Providing the design consistency of a 65 mph four-lane rural highway will meet driver expectancy of a continuous four-lane facility throughout the TH 23 corridor. Corridor-wide consistency will provide enhanced mobility and safety benefits to the motoring public.

[2] Source: http://www.dot.state.mn.us/d8/projects/manufacturersperspectives

- ***Foster Economic Growth*** – TH 23 is an important freight route. Goods and services are moved to and through the project area at a growing rate. MnDOT District 8 recently completed a Manufacturer's Perspective on Transportation Study that interviewed manufacturers and carriers in Southwest and West Central Minnesota to determine their most important transportation issues. TH 23 was frequently mentioned as a critical connection to deliver goods to national and international markets. Safe, reliable, and efficient travel will promote greater economic development and employment opportunities for the local and regional economies.

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.

As noted in Section I.A.6.d (Project Purpose), the proposed project is part of a long-standing effort to construct a continuous four-lane facility for the length of approximately 53 miles between Willmar and St. Cloud. The segment between the City of Paynesville and City of Richmond is one of the last remaining two-lane highway sections along the corridor. Preliminary engineering and environmental review began on the Paynesville to Richmond segment starting in 2015. A construction timeline has not been established and the project is not formally tied to the proposed Paynesville to Richmond segment project.

Another two-lane section existing between New London and the southwest side of the Paynesville Bypass. This segment has undergone environmental review and has an approved preliminary layout. Funding for the New London to Paynesville four-lane improvements has not been programmed.

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.

While not formally tied or phased, the proposed project is an extension of previous improvements along the TH 23 corridor. A TH 23 four-lane bypass expansion around the City of Paynesville was completed in 2012, which is located immediately west of the proposed project area.

7. Cover Types

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

Table 1: Cover Types (in acres)*

Cover Type	Before	After	Gain/Loss
Cropland	115.2	82.4	-32.8
Grassland[1]	200.1	204.1	+4
Wooded/Forested	4.7	2.0	-2.7
Wetlands	18.1	0**	-18.1
Stormwater Ponding	0	17.1**	+17.1
Impervious	65.9	98.4**	+32.5
Total	**404**	**404**	

* The area of interest encompasses land within the proposed right of way. Source: MnDNR Data Deli, GAP Land Cover layer. Minnesota Land Cover Classification System (MLCCS) not available for project area.

** Acreage taken from project layout.

[1] Grassland area includes roadway sideslopes and ditches.

The “Before” and “After” area totals listed in ***Table 1*** above are preliminary estimates based on existing land cover data and preliminary design files and are subject to change through more detailed design and construction. Note “Before” and “After” acreage totals may not equal the sum of individual cover types due to factors like variability in data availability and rounding.

8. Permits and Approval 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 2: Permits and Approvals Required

Permit/Approval Type	Unit of Government	Action Required
Federal		
Section 106 (Historical/Archaeological)	U.S. Army Corps of Engineers	Determination Pending
Section 404 Permit	U.S. Army Corps of Engineers	Approval
Section 7 Review	U.S. Army Corps of Engineers	Consultation
WPA Impacts	U.S. Fish and Wildlife Service	Consultation/MOA
State		
EAW Document	MnDOT	Approval
EIS Need Decision	MnDOT	Findings of Fact & Conclusions
Construction Plans – Roadway/Geometric Layout	MnDOT	Approval
MN Wetland Conservation Act (Replacement Plan)	MnDOT	Submittal
Public Waters Work Permit (General Permit 2004-0001)	MnDNR	Permit
Cultural Resources Review (Historic/Archaeological)	MnDOT	Consultation
Incidental Take Authorization	MnDNR	Authorization (if required)
Section 401 Water Quality Certification	MPCA	Certification
NPDES Construction Stormwater Permit	MPCA	Permit
Local		
Stormwater Management Plan	County Government	Coordination
Erosion and Sediment Control Plan	County Government	Coordination
Plan Review	Local Government/District/Commission	Coordination
Watershed District Approval	North Fork Crow River Watershed District, Middle Fork Crow River Watershed District	Approval

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

Land Use and Development

Existing land use and development within the study area is rural in nature. Agricultural and rural residential uses dominate the landscape, with more dense residential and commercial/industrial uses concentrated in Paynesville, Roscoe, and Richmond. These areas are described in further detail below.

At the westerly end of the study area is the City of Paynesville, where higher density development is present. Moving northeasterly, the highway corridor passes along the southern and eastern edge of the USFWS Roscoe WPA. An analysis of alternatives involved consideration of a north and south alignment of the expansion to avoid impacting the WPA property. Expanding TH 23 to the North, and intersecting the WPA, was identified as the recommended alterative due to the cumulative benefit of reduced impacts to wetlands, farmlands, and homesteads in the area and proposed mitigation for replacement land away from the highway corridor.
The North Alignment would:

- Reduce wetland impacts from 9.1 to 5.5 acres; a difference of 3.6 less acres.
- Decrease the acres of lost farmland from 32 to 27.6 acres; a difference of 4.4 less acres.
- Reduce the parcels impacted from fifteen to eleven; a difference of four less parcels.
- Reduce the number of homesteads from seven to three; a difference of four less properties impacted.

The north alignment does increase the impact to the USFWS Roscoe WPA by 14.2 acres. However, the USFWS has expressed that they will allow this impact if it can be mitigated on site. MnDOT and USFWS have had numerous conversations and are actively engaged in moving forward with the transfer of lands to allow for the TH 23 expansion to encroach on the Roscoe WPA.

A concentration of residential land uses exist in the community of Roscoe near the intersection of TH 23 and County Road 10. Also, the Becker Lake watercourse crossing area near the intersection of TH 23 and 115th Street NE contains a higher density of residential land uses south of TH 23 adjacent to the Becker Lake shoreline.

The project is not expected to cause substantial change in land use within the vicinity of the construction limits. It is not anticipated to lead to the development of any large scale commercial, industrial, residential or other development. Future land use plans will perpetuate the ways in which project area land is used.

Access management strategies implemented throughout the project's design process were based upon MnDOT's *Access Management Manual* guidelines. As a Medium-Priority Interregional Corridor, the Access Management Manual recommends an access management strategy emphasizing mobility to serve areas planned for long-term low-density development characterized by scattered large-lot residential

development and limited commercial or industrial use. This access management strategy is anticipated to help preserve existing rural land use patterns within the project area and prevent developments inconsistent with existing land uses. In addition, the *Stearns County Comprehensive Plan*[3] identifies an objective to carefully manage land uses along transportation corridors in part to manage access. The proposed project supports this objective.

Prime or Unique Farmlands

The Natural Resources Conservation Service's (NRCS) Web Soil Survey indicates the presence of "farmland of statewide importance" adjacent to both the north and south sides of the project area.

Geospatial analysis was conducted to assess the impacts to prime or unique farmlands. The proposed right of way minus the existing right of way was used as the area of interest. Soil data was then joined to the resulting area of interest to calculate total acres of prime or unique farmland. The proposed project will result in the conversion of approximately 165 acres of land with farmland designated soils to a transportation use. This assessment is based on soil classification, and not whether land is tilled.

Access to all affected agricultural fields in the area will be maintained and remaining parcels will retain adequate size for continued farming. It is anticipated that no farmland will be triangulated or isolated. Right-of-way acquisitions will largely be focused on property edges. As a result, the project is not anticipated to cause substantial adverse impacts to agricultural land or farming operations. The project will not have a substantial effect upon agricultural production in Stearns County.

Parks and Trails

The Glacial Lakes State Trail runs north of TH 23 from approximately Roscoe to Richmond for a distance of about 6 miles. The trail is owned and operated by the MNDNR. The trail is located outside of the proposed ROW for the majority of the proposed project area. However, at the closest point the trail is only approximately 110 feet (centerline-to-centerline) north of the existing TH 23 corridor.

The Glacial Lakes Trail is immediately adjacent to TH 23 for approximately 0.5 miles starting at the bridge over the Sauk River (near Richmond) and extending to the west (see ***Figure 2F*** located in ***Appendix B***). The preferred alternative expands TH 23 to the north in this portion of the project area, and requires the relocation of the Glacial Trail. An estimated 9.6 acres of Glacial Lakes Trail right of way will be acquired in order to expand TH 23 to a four-lane highway section. The alternatives development and evaluation process involved consideration of avoidance alternatives. Screening criteria used to evaluate the alternatives included social, environmental, and economic considerations. A summary of the alternatives considered to avoid and/or minimize impacts to the Glacial Lakes Trail is provided below:

No Build Alternative
The No-Build Alternative for this project would be limited to normal pavement maintenance along this segment of TH 23. The No-Build Alternate is used as a basis of comparison, or benchmark for the Build Alternates, and is not a viable option for this project as it does not meet the purpose and need.

Widen on South Side of TH 23
Widening to the south side of existing TH 23 would avoid impacting the Glacial Lakes Trail. However, TH 23 in this area is constrained along the south side by Becker Lake and numerous homes along its shoreline.

[3] Source: http://www.co.stearns.mn.us/Government/CountyDevelopment/StearnsCountyComprehensivePlan

The proximity of the lake along with its highly erodible steep slopes would not be suitable for construction of the expanded TH 23 corridor. Furthermore, numerous wetlands and floodway and floodplain areas would have to be filled in order to accomplish the widening on the south side of existing TH 23.

Widen on the North Side of TH 23
Widening on the north side of TH 23 will require the realignment of approximately 0.5 miles of the Glacial Lakes Trail. This would require the acquisition of farmland but would result in restoring the trail and MNDNR trail right-of-way to the same width as currently exists.

Glacial Lakes Trail Evaluation Results
An evaluation matrix was developed to provide a side-by-side comparison of the alternatives. The North alignment is considered the preferred alternative due to less acres of wetland impacts, fewer impacted parcels, fewer relocations, less impact to highly erodible soils, no floodplain encroachment, and a lower estimated cost. Coordination with the Minnesota DNR will continue to occur as the project progresses.

See ***Appendix C*** for Alternatives Analysis-Relocation of the Glacial Lakes Trail

Zoning

Zoning within the project area is varied. According to city and county maps, the zoning districts adjacent to the roadway includes: Agricultural, Commercial, Residential, Transitional, and Municipality. Although MnDOT is not subject to local zoning ordinances, zoning regulations have been considered throughout the project's design process. Considerations include erosion control measures, compatibility with natural vegetation and topography, and structure setback regulations.

Shoreland Districts

Immediately adjacent to TH 23, Stearns County maintains a Shoreland Management District around Becker Lake. Shoreland district ordinance language primarily involves structure and development regulations. Although MnDOT is not subject to local zoning ordinances, zoning regulations have been considered throughout the project's design process. Per the Stearns County zoning ordinance, roads placed within shore impact zones will be designed to minimize adverse impacts.

Wild and Scenic Rivers and Nationwide Rivers Inventory

No rivers exist within the project limits that are included within the National Wild and Scenic Rivers System. The National Wild and Scenic Rivers System was created by Congress in 1968 to preserve certain rivers with outstanding natural, cultural and recreational values in a free-flowing condition for the enjoyment of present and future generations.

The Sauk River is listed in the Nationwide Rivers Inventory (NRI). NRI lists free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. The Sauk River is considered a state water trail by the MNDNR. The Sauk River originates in Lake Osakis in western Todd County and flows more than 90 miles across central Minnesota. The river flows through a variety of areas ranging from swamps to rich hardwood forests. No direct impacts to the Sauk River are anticipated as the proposed project terminates before crossing the Sauk River.

Floodplain Assessment

Stearns County has a floodplain management ordinance that regulates floodplain development. This project is not anticipated to result in any incompatible floodplain development. Appropriate coordination and permitting will occur to ensure the project complies with floodplain and shoreland regulations.

Federal Insurance Administration Flood Boundary and Floodway maps for Stearns County (Dated February 16, 2012, panel numbers 2714500783E and 27145C0784E) have been examined for this project. The project will result in minor floodplain encroachment in three locations (See figures located in ***Appendix D***). These encroachments occur in Zone A and/or 100-year floodplain (1% annual chance of flooding).

This project will encroach on the following floodplains:

Floodplain	Type of Encroachment	Length
Kolling Creek Crossing #1 (associated with Wetland #7)	Transverse	1,100-feet
Kolling Creek Crossing #2 (associated with Wetlands #4 & #30)	Transverse	140-feet
Kolling Creek Crossing #3 (County Road 43 crossing)	Transverse	85-feet

Impact Analysis

This project will not result in any significant floodplain impacts for the following reasons:

No significant interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route.

- In three locations, described above, the proposed improvements cross a Zone X (no base flood elevations determined) Special Flood Hazard Areas (SFHA). All roadway grades will be designed above the 100 year flood elevation. There is no recorded evidence of flooding or overtopping of the existing roadways at the creek crossings.

No significant adverse impact on natural and beneficial floodplain values should result from this project.

- No fisheries impacts are anticipated. Construction operations that may impact the floodplain would not occur during fish spawning and migration periods without approval from the MNDNR. Exact dates and allowable work would be subject to DNR permit conditions.
- The new bridge/culvert structures will not reduce or increase the flow velocities in the river. Therefore, fish movements should not be affected.
- Wetland impacts associated with the floodplain have been minimized during the preliminary design phase. Additional minimization measures (e.g. steeper side slopes) will be further considered during final design.
- No threatened or endangered plants or animals have been identified in the floodplains.
- Appropriate turf establishment and erosion control measures will be used.

No significant increased risk of flooding will result.

- There are no known flooding problems at the Kolling Creek crossings.
- There is no apparent flood damage potential upstream because there is no development in the floodplain.
- No significant change in headwater or tailwater elevations will result. The three crossings of Kolling Creek will require hydraulic analysis and design during final design to demonstrate

conformance with MN Rules 6115.0231, Subp. 2, A. and the local floodplain management ordinance. The replacement structures will be designed to result in no change of the existing 100-year flood stage and will obtain a "no-rise" certificate and have a stage increase for the proposed structure equal to or less than the existing structure, or result in a cumulative stage increase less than 0.50 feet while not increasing flood damage potential.

This project should not result in any incompatible floodplain development.

- No new access to a floodplain area is being created.
- No changes in public access would result from the project.
- Stearns County has a floodplain ordinance that regulates floodplain development. The County floodplain ordinance conforms to the Minnesota Department of Natural Resources Floodplain Management guidelines.

As the project involves widening the highway corridor on its existing alignment, avoiding encroachment into the floodplain is nearly impossible. All Build alternatives would encroach on the floodplain areas. The encroachment among the alternatives considered is nearly identical. The proposed improvements are not expected to result in significant impacts to the floodway or the 100-year water surface elevation.

Additional information on floodplain and wetland assessments and minimization/mitigation strategies can be found in EAW Question 11. Water Resources.

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

As noted throughout Section I.A.9.a (Land Use), the proposed improvements support and comply with existing land uses, zoning districts, and planning documents.

While state highways are not subject to local plans and ordinances cited in Section I.A.9.a above, the compatibility of the proposed project with local planning efforts is a consideration.

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

Mitigative measures to protect special resources are described in Item 9.a above. The proposed action is compatible with planned land uses in the project area.

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 project is located within the Eastern Broadleaf Forest Province and the Prairie Parkland Province.[4] Provinces are units of land defined using major climate zones, native vegetation, and biomes such as prairies, deciduous forests, or boreal forests. The project area is located within the Minnesota & NE

[4] Source: MnDNR, Ecological Classification System, http://dnr.state.mn.us/ecs/index.html

Iowa Morainal Section and North Central Glaciated Plains Section. Sections are units within Provinces that are defined by origin of glacial deposits, regional elevation, distribution of plants, and regional climate. The project area is located within the Harwood Hills Sub-Section and the Minnesota River Prairie Subsection. Sub-Sections are units within Provinces that are defined by origin of glacial deposits, regional elevation, distribution of plants, and regional climate.

Most of the Hardwood Hills Subsection bedrock is covered by 100 to 500 feet of glacial drift. Bedrock underlying the subsection is diverse. Cretaceous shale, sandstone, and clay and Lower Precambrian granite, meta-sedimentary and metaigneous gneiss, schist, and migmatite underlie the southern half (Morey 1976).[5] Most of the Minnesota River Prairie Subsection bedrock is covered by 100 to 400 feet of glacial drift. Cretaceous shales, sandstones, and clays are the most common kinds of bedrock[6].

No geologic hazards that could result in groundwater impacts (e.g., sinkholes, shallow limestone formations or near-surface karst conditions) have been identified.

b. Soils and Topography – Describe the soils on the site, giving NRCS (SCS) classifications and description, 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.

A Soil Classification System soils report of the approximate project area can be found in ***Appendix E***. ***Table 3*** below summarizes soil type information within the project area. According to the NRCS Soil Survey, the majority of the project area consists of sandy loam soils. Twelve soil types were identified. An area of note surrounds the Long Lake watercourse crossing.

To accommodate the alignment of new and existing TH 23 roadways, construction operations will include filling along new roadway segments. Based on preliminary estimates, approximately 557,000 cubic yards of excavation and 475,000 cubic yards of fill will be required. These estimates are subject to change as final design progresses.

Table 3: Project Area NRCS Soil Types

Map unit symbol	Map unit name	Erosion Rating	Acres in Study Area	Percent of Study Area
7A	Hubbard loamy sand	Slight	0.8	0.20%
41B	Estherville sandy loam	Slight	6.6	1.70%
156A	Fairhaven loam	Slight	1.4	0.40%
156B	Fairhaven loam	Moderate	0.1	0.00%
255	Marysland loam	Slight	1.7	0.40%
281	Darfur coarse sandy loam	Slight	2.9	0.70%

[5] Source: MnDNR Ecological Classification System, http://www.dnr.state.mn.us/ecs/222Ma/index.html
[6] Source: MnDNR Ecological Classification System, http://www.dnr.state.mn.us/ecs/251Ba/index.html

Map unit symbol	Map unit name	Erosion Rating	Acres in Study Area	Percent of Study Area
327A	Sverdrup sandy loam	Slight	5.2	1.30%
327B	Sverdrup sandy loam	Slight	8.6	2.20%
392	Biscay loam	Slight	9.3	2.40%
413	Osakis loam	Slight	3.7	0.90%
459	Corunna loam	Slight	4.2	1.10%
540	Seelyeville	Slight	5.1	1.30%
543	Markey muck	Slight	1.4	0.40%
544	Cathro muck	Slight	6.9	1.70%
566	Regal loam	Slight	14.5	3.70%
572	Lowlein sandy loam	Slight	2.3	0.60%
611C	Hawick loamy sand	Moderate	22.2	5.70%
611D	Hawick loamy sand	Severe	12	3.10%
875B	Estherville-Hawick complex	Moderate	32.3	8.20%
1016	Udorthents, loamy	Not rated	1.5	0.40%
1018	Udifluvents, frequently flooded	Slight	0.1	0.00%
D105A	Arvilla sandy loam	Slight	83.1	21.20%
D105B	Arvilla sandy loam	Slight	38.4	9.80%
L307B	Koronis loam	Moderate	49	12.50%
L307C2	Koronis loam	Severe	0.1	0.00%
L317A	Barry loam	Slight	20.2	5.10%
L321A	Swedegrove loam	Slight	0.5	0.10%
L324A	Forestcity, overwash-Forestcity complex	Slight	1.2	0.30%
L326B	Rohrbeck-Koronis complex	Slight	8.8	2.20%
L330A	Muskego, Blue Earth and Houghton soils	Slight	2.7	0.70%
L335A	Klossner soils	Slight	0.3	0.10%
L350A	Marcellon loam	Slight	26.4	6.70%
L356D2	Sunburg-Wadenill complex	Severe	15.6	4.00%
L357D2	Koronis-Sunburg complex	Severe	3.6	0.90%
W	Water	Not rated	0.4	0.10%
Totals for Study Area			**393**	**100%**

Steep Slopes and Highly Erodible Soils

Soils that pose a risk of erosion are evident throughout the project area, as defined by the USDA's Natural Resource Conservation Soil Survey. Approximately 31.3 acres (8%) of soils within the APE are found to have a server erosion hazard rating; and 103.6 (26.4%) acres with a moderate erosion hazard rating.

11. Water Resources

a.i. Describe surface water features on or near the site – 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 miles of the project. Include DNR Public Waters Inventory number(s), if any.

Several surface water features are located in close proximity to the project area, including Becker Lake, Big Lake, the Sauk River, and Kolling Creek. These bodies of water and other surface waters located within one mile of the project area are summarized in ***Table 4***.

Table 4: Project Area Surface Waters

No.	Name	PWI ID/Assessment Unit	Public Water	303d Impaired Water
1	Thein Lake	73-0132-00	Y	N
2	Cedar Island Lake	73-0133-04	Y	Y[1]
3	Voss Slough	73-0145-00	Y	N
4	Roschien Lake	73-0155-00	Y	N
5	Becker Lake	73-0156-00	Y	N
6	Horseshoe Lake	73-0157-00	Y	Y
7	Schroeder Lake	73-0158-00	Y	N
8	Big Lake	73-0159-00	Y	Y[1]
9	Unnamed Wetland	73-0447-00	Y	N
10	Unnamed Wetland	73-0448-00	Y	N
11	Raush Marsh	73-0449-00	Y	N
12	Unnamed Wetland	73-0450-00	Y	N
13	Unnamed Wetland	73-0466-00	Y	N
14	Sauk River	07010202-508	Y	Y[1]
15	Sauk River	07010202-557	Y	Y[1]
16	Kolling Creek	07010202-575	Y	Y[1]
17	Unnamed Creek	07010202-626	Y	N
18	North Fork Crow River	07010204-685	Y	Y
19	Roscoe North Calcareous Fen			

[1] *Non-construction related impairment, does not require any additional best management practices or plan review for compliance with NPDES/SDS construction permit.*

As noted in ***Table 4*** above, there are impaired waters as defined by the MPCA Draft 2016 TMDL (303(d)) List within the project area. These bodies of water are Cedar Island Lake, Horseshoe Lake, Big Lake, Sauk River, North Fork Crow River, and a section of Knolling Creek. However, the Cedar Island Lake, Big Lake, Kolling Creek and the Sauk River impairments are for aquatic consumption due to mercury in fish tissue, or E. Coli, which are all non-construction related parameters will not require any additional BMPs for compliance with the MPCA NPDES Permit.

a.ii. Describe 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.

Depth to Groundwater/Wells

Soil borings within the project area were collected November 22, 2016. The results show the depth of groundwater ranging from 8 feet to greater than 20 feet along the corridor. USGS ground water data was for four wells along TH 23 in the project area was reviewed. The water level depth below surface ranged from 8 to 31 feet for these wells at the time of their installation in the 1980s, with the wells closer to lakes having water levels closer to the surface. Current water level data was not available in any of these wells.

MDH Wellhead Protection Area

Wellhead protection areas (WPAs) were investigated to determine if nearby municipal wells had delineated protection areas that fall within or are located in close proximity to the proposed transportation improvements. Based on MDH mapping, there is one WPA located near the Town of Roscoe. It has been determined, based on a review of the drinking water supply management area (DWSMA) mapping, that the proposed storm water BMPs in the area are located within a classified "Low vulnerability" area.

Two additional WPAs are located in the cities of Richmond and Paynesville, but are located more than ¼-mile outside the project area.

Additional Well Information

A review of the public well index was completed to determine the location of wells. No public wells were identified in the project area. Numerous private wells are known to exist in areas of residential, commercial, and industrial development. If any wells are found within the construction limits they will be addressed in accordance with Minnesota Rules, Chapter 4725.

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

b.i. Describe effects from project activities on water resources and measures to minimize or mitigate the effects of 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.

Not applicable.

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.

Not applicable.

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.

No impacts to existing wastewater treatment or conveyance systems are anticipated.

b.ii. Describe effects from project activities on water resources and measures to minimize or mitigate the effects of 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.

Quantity of Runoff

The project will result in a net increase of approximately 32.5 acres of new impervious area across the entire project. The portion of existing and new impervious areas is summarized in ***Table 5***.

Table 5: Project Impervious Areas Summary (in acres)

Existing	Future	Net Increase
65.9	98.4	32.5

This added impervious surface will increase the rate and volume of runoff. To mitigate for runoff rate/volume increases, best management practices (BMPs) will be installed on the project. A required water quality volume of 2.34 acre-feet is needed to meet NPDES/SDS Construction Permit requirements. The preliminary design provides incorporates several infiltration and retention basins throughout the project limits (see figures in **Appendix B**). A more detailed storm water runoff and treatment plan has been developed which addresses both mitigating runoff rate increases and water quality treatment. This plan will need to be updated during the final design stage to ensure compliance with the NPDES permit requirements.

Quality of Runoff

As a result of the increase in impervious surface, the project is required to treat storm water runoff prior to discharge offsite in accordance with the National Pollution Discharge Elimination System (NPDES) Permit. Multiple named and unnamed wetlands, Kolling Creek, Sauk River, and Becker Lake are the downstream receiving water bodies. The project is proposed to use vegetated and grassed slopes and ditches and infiltration basins to treat stormwater runoff. Infiltration basins will provide for rate control and the removal of total suspended solids (TSS), Total phosphorus (TP) and other pollutants. The soils in the corridor are Hydrologic Soil Group A which typically have high infiltration rates. The basins will treat both existing and new impervious areas to a level necessary to meet the MPCA NPDES Permit requirements.

Surface Water flow

Proposed drainage patterns are maintained as close as possible to existing drainage patterns. As much surface water is directed to infiltration basins and rate control basins as possible, using special ditch grades and the natural slope of the roadway improvements. ***Figures 2a through 2f***, located in ***Appendix B,*** show the proposed infiltration basins. The size and location of these features are subject to change during final design.

Other Water Quality Best Management Practices

Temporary erosion and sediment control measure will be implemented throughout the construction activities to protect drainage areas. A NPDES Construction Storm Water Permit will be required for the project.

The NPDES permit has both temporary directives used primarily during construction, as well as permanent requirements, which the final project must meet. Below is a summary of the requirements and sediment control methods that may be used for this project.

- Horizontal slope grading, construction phasing, and other techniques designed to reduce erosion and sedimentation.
- Implementation of temporary controls to protect exposed soil areas, such as mulch cover, cover crop seeding, hydromulching, erosion control blanket, silt fence, bio-rolls and stabilization of steep slopes.
- Perimeter barriers for sediment control BMPs will be in place on down gradient perimeters where runoff will discharge off site before construction disturbance begins.
- Minimization of vehicle soil tracking onto paved surfaces will occur by limiting construction equipment use on paved roads and using rock construction entrances throughout the project.
- Permanent cover will be provided post construction using topsoil, seed and mulch, erosion control blanket, sod or hydroseeding.
- Discharge to Horseshoe Lake (nutrient impaired) and North Fork Crow River (fishes bio-assessments) are considered to be construction related parameters and may require additional best management practices found in Appendix A of the NPDES/SCS Construction Permit.

b.iii. Describe effects from project activities on water resources and measures to minimize or mitigate the effects of 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. Identify any measures to avoid, minimize, or mitigate environmental effects from the water appropriation.

Temporary dewatering may be required during construction. Should dewatering become required and exceeds the Minnesota permit threshold of withdrawing more than 10,000 gallons of water per day or 1 million gallons per year, a water appropriation permit application will be completed and submitted to the MnDNR for approval prior to any dewatering activities taking place. Dewatering will comply with the

MPCA NPDES Construction Storm water Permit, and shall be discharged in a manner that does not create nuisance conditions or adversely affect the receiving water or downstream properties. No known private or permanent public wells will be affected or installed by the project.

b.iv. Describe effects from project activities on water resources and measures to minimize or mitigate the effects of surface waters.

No substantial water quality impacts are anticipated as result of the project. Any impacts to the surface waters below the ordinary high water level will be in compliance with the Minnesota DNR Public Water Work Permit.

1) 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.

Wetland Avoidance Alternatives & Potential Alignments

The No-Build Alternative would not impact wetlands; however, it does not address the project purpose and need. Early in the planning process several access configurations and alignment shifts, including a western bypass of the Roscoe Waterfowl WPA, were developed to address the existing transportation concerns in the study area. Alternatives were first evaluated on their ability to meet the primary and secondary needs of the project that include providing the basic recommended safety, mobility, and driver expectancy improvements. Minor realignments in segments of the existing highway with substantial geometric deficiencies were considered as well and design options (access modifications) that would avoid impacts to adjacent natural features.

Alternatives and/or design options were evaluated and screened based on an array of social, economic, and environmental effects. Wetland impacts were an evaluation criteria used in this screening process and in the identification of the preferred alternative. Other criteria included safety conditions, right of way/relocation impacts, farmland loss/severance, impacts to the Glacial Lakes Trail and Roscoe Waterfowl Production Area. Comprehensive coordination with the USFWS occurred in the assessment of alternatives near the Roscoe WPA.

The preferred alternative was determined to be the least environmental damaging practicable alternative (LEDPA) based on the criteria associated with a Section 404 permitting process.

Wetland Impacts

Over thirty wetland basins were identified, delineated, and classified in the *Wetland Delineation Report-September 2016*. The report indicates the dominant species of vegetation and the soil and hydrologic characteristics at representative locations around each impact. Conversion of the two-lane to four-lane roadway will result in approximately 18.1 acres of wetland impacts. See ***Table 6*** and ***Figures 2a – 2f*** in ***Appendix B*** for information on specific wetland impacts. Wetlands and water courses are prevalent along

most of the TH 23 corridor and the project was designed to avoid these features through careful selection of the lane expansion locations.

Table 6: Wetland Impacts of Preferred Alternative

Wetland ID	Wetland Type			Wet Ditch	Natural Wetland	Public Water[a]	Impact (acres)
	Eggers and Reed	Circular 39	Cowardin				
2	Fresh (wet) Meadow	Type 2	PEMB		X		0.47
3	Fresh (wet) Meadow	Type 2	PEMB	X			0.05
4	Floodplain Forest	Type 1	PFO1B		X	X	0.59
6	Fresh (wet) Meadow	Type 2	PEMB		X		0.07
7	Shallow Marsh	Type 3	PEMC		X	X	3.02
8	Shallow Marsh	Type 3	PEMC		X		0.49
9	Fresh (wet) Meadow	Type 2	PEMB		X		0.23
10	Fresh (wet) Meadow	Type 2	PEMB	X			0.02
11	Fresh (wet) Meadow	Type 2	PEMB	X			0.12
11	Fresh (wet) Meadow	Type 2	PEMB		X		0.31
12	Shallow Marsh	Type 3	PEMC		X		0.20
13	Shallow Marsh	Type 3	PEMC		X		1.01
13	Shallow Marsh	Type 3	PEMC		X		0.15
14	Fresh (wet) Meadow	Type 2	PEMB		X		0.32
15	Fresh (wet) Meadow	Type 2	PEMB	X			1.95
16	Shallow Marsh	Type 3	PEMC		X		1.16
17	Fresh (wet) Meadow	Type 2	PEMB	X			0.35
18	Fresh (wet) Meadow	Type 2	PEMB	X			0.20
20	Shallow Marsh	Type 3	PEMC	X			0.36
21	Shallow Marsh	Type 3	PEMC		X		0.48
22	Fresh (wet) Meadow	Type 2	PEMB	X			0.16
23	Fresh (wet) Meadow	Type 2	PEMB	X			0.16
24	Shallow Marsh	Type 3	PEMC		X		0.44
25	Shallow Marsh	Type 3	PEMC		X		0.38
26	Fresh (wet) Meadow	Type 2	PEMB	X			2.20
27	Fresh (wet) Meadow	Type 2	PEMB	X			2.15
28	Floodplain Forest	Type 1	PFO1B		X	X	0.61
28	Shallow Marsh	Type 3	PEMC		X	X	0.30
29	Shallow Marsh	Type 3	PEMC		X		0.01
30	Floodplain Forest	Type 1	PFO1B		X	X	0.09
36	Fresh (wet) Meadow	Type 2	PEMB		X		0.03
Total Wetland Impacts							**18.08**
PWI Impacts							**4.61[b]**

[a] The boundary/limits of the Public Water portion of the wetland will be determined during the permitting process in coordination with the MnDNR.

[b] The PWI impact is a conservative value as it assumes all impacts to Wetlands #4, #7, #28, and #30 are below the OWH. It is anticipated that the final PWI impacts will be reduced as the OHW boundary is determined during permitting with involvement from the MnDNR.

Mitigation and Regulatory Context

In an effort to further minimize these impacts, slope modifications will be evaluated in the final design phase to minimize wetland impacts while maintaining safety. It has been assumed that the impact stated here represents the worst case for evaluation purposes and it is expected to decrease through the use of design modifications. Final wetland impacts and documentation of avoidance and minimization efforts will be included in the required permit review process with the Army Corps of Engineers and other regulatory bodies.

Based on the preliminary design, the project will impact up to 18.1 acres of wetland within Bank Service Area 7, in Sauk River (Watershed #16). It is anticipated that wetlands will be replaced at a minimum of a 2:1 ratio (i.e. 2 acres of wetland replacement for every acre of wetland impact) and a maximum of 2.5:1, depending on the location and type of available wetland credits. Wetland mitigation credits will be used to satisfy the replacement requirements of the project. However, this number is considered a maximum and replacement required will likely decrease through the minimization of impacts phase of the project design. It is anticipated that these credits will be withdrawn from available credits in MNDOT's wetland banks depending on the credit type and availability at the time of permit application review.

Potential wetland footprint impacts and functional impacts can be minimized through the use of several structural and non-structural Best Management Practices (BMPs). Functional impacts to wetlands can be minimized through the use of seasonal work windows. Seasonal construction windows can mitigate potential impacts to migratory birds. Tree clearing in the construction area and staging areas in the winter will minimize disruption to nesting bird and bat species.

Wetlands in the project area are regulated by agencies at the local, regional, state, and federal levels including the USACE and the EPA at the federal level; the Minnesota Board of Water and Soil Resources (BWSR), the MNDNR, and the Minnesota Pollution Control Agency (MPCA) at the state level; and the Minnesota Department of Transportation (MnDOT) at the local level. MnDOT will act as the LGU responsible for the enforcement of the Minnesota Wetland Conservation Act (WCA) of 1991.

Construction plans that propose any direct alteration or indirect impact to wetlands or watercourses within the project area will require permits from the appropriate regulatory agencies. Violation of wetland regulations can result in substantial civil and/or criminal penalties.

2) 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 of type of watercraft on any water body, including current and projected watercraft usage.

The current TH 23 alignment crosses a Public Water and the expansion of the roadway will further impact this Public Water. The project includes work to extend culvert crossings and grading of highway inslopes.

Existing drainage ditches along the highway will be modified to accommodate the expanded highway and new frontage roads. The ditches are intended to collect and convey surface water runoff from the roadway downstream, and in many cases to treatment/infiltration areas. Drainage culverts will be periodically placed under the highway to allow water in the ditch to drain to the infiltration areas and receiving water bodies.

Work below the ordinary high water level shall comply with the Minnesota DNR Public Waters Work Permit and MPCA NPDES Construction Stormwater Permit by providing appropriate sediment control BMPs and perimeter control methods. The project will not change the number or type of watercraft on any waterbody.

12. Contamination/Hazardous Materials/Waste

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.

A review of the Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Agriculture (MDA) databases was conducted to determine if known contaminated sites exist in the project area. Based on this review it was determined that the project has a low to medium risk of impacting potentially contaminated sites. The rural and minimally developed area of the project decreases the chances of encountering hazardous materials (contaminated soil and/or groundwater). Based on the database review, there are two former MDA spill sites within approximately 500 feet of the project area. These sites are located outside of the construction limits and proposed right of way.

As the final design develops, excavation locations and depths will be used by MnDOT in determining whether a Phase II Drilling Investigation is needed for any portion of the project. If necessary, a plan will be developed for properly handling and treating contaminated soil and/or groundwater during construction in accordance with all applicable state and federal requirements.

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.

All regulated solid wastes generated by construction of the proposed project will be disposed of properly in a permitted, licensed solid waste facility or a similarly regulated facility elsewhere. Project demolition of concrete, asphalt, and other potentially recyclable construction materials will be directed to the appropriate storage, crushing, or renovation facility for recycling or reuse.

If a spill of hazardous or toxic substances should occur during or after construction of the proposed project, it is the responsibility of the transport company to notify the Minnesota Department of Public Safety, Division of Emergency Services, to arrange for corrective measures to be taken pursuant to 6 MCAR 4.9005E. Any contaminated spills or leaks that occur during construction are the responsibility of the

contractor and would be responded to according to the MPCA containment and remedial action procedures.

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.

Toxic or hazardous materials would not be present at the construction site, with the exception of fuels and lubricants needed for construction equipment. Appropriate safety measures would be followed during construction to avoid spills. Leaks, spills, or other releases would be responded to in accordance with MPCA spill, containment and remedial action procedures.

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 or hazardous waste including source reduction and recycling.

No above or below-ground storage tanks are planned for permanent use in conjunction with this project. Temporary storage tanks for petroleum products may be located in the project area for construction equipment during construction. Appropriate measures would be taken during construction to avoid spills that could contaminate groundwater or surface water in the project area. In the event that a leak or spill occurs during construction, appropriate action to remediate the situation would be taken immediately in accordance with MPCA guidelines and regulations.

If existing guardrail posts are made of treated wood then this material must be separated and disposed of at an MPCA-permitted sanitary or industrial waste landfill. Any coatings on the interior or exterior of any of the culverts will be sampled/analyzed for asbestos.

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 near the site.

Fish and Wildlife

The project area is located within the Minnesota & NE Iowa Morainal Section and North Central Glaciated Plains Section of the MnDNR Ecological Classification System. Land use immediately adjacent to the project area is predominantly agricultural with residential and commercial/industrial uses concentrated in several portions of the project area. Species in the area are those typical of agricultural lands. Over 20 fish species have been identified within Becker Lake, including black bullhead, black crappie, bluegill, brown bullhead, channel catfish, green sunfish, hybrid sunfish, largemouth bass, northern pike, pumpkinseed, walleye, yellow bullhead, yellow perch, bowfin (dogfish), common carp, golden redhorse, greater redhorse, shorthead redhorse, silver redhorse, white sucker, and blacknose shiner.

Vegetation

Along the length of this project, MnDOT's right-of-way passes through typical central Minnesota agricultural lands. Vegetation is mostly Highway Project Development Process Category 1 native vegetation. While there are trees, some planted and some naturally occurring, the right-of-way and surrounding land is not heavily forested.

According to GIS information obtained from the MnDNR Geospatial Commons, areas of Minnesota Biological Survey (MBS) Sites of High Biodiversity exists near the east end of the project north of and adjacent to the TH 23 corridor. These are considered areas of sensitivity (AES). An AES is a generic term to be utilized on plans to identify an area as containing unique characteristics that may need to be protected during construction. These areas may be unique due to habitat, wildlife, cultural resources/properties, ecological significance, geological features, visual quality, or its sensitivity to disturbance. Further consideration on designating AES for protection during construction will occur as part of final design and will be avoided for construction staging purposes.

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-722) and/or correspondence number (ERDB) 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.

Per correspondence with MnDNR Ecological and Water Resources, the Minnesota Natural Heritage Information System (NHIS) has been queried (see ***Appendix F*** for additional information). There were over a dozen rare features identified in this query. In order to prevent the inadvertent release of the location of specific listed or rare species contained in the NHIS have not identified the species or their location. The rare features were identified in the query and may be impacted by the proposed project.

Two of the crossings of Kolling Creek are identified as also being a Site of Biodiversity significance, also ranked 'high', for its composition. 'High' sites contain very good quality occurrences of the rarest species, high quality examples of rare native plant communities, and/or important functional landscapes. These areas should be identified as an 'Area of Environmental Sensitivity' on plans.

According to a planning-level query of the U.S. Fish and Wildlife Service's Information, Planning, and Conversation System (IPAC), the project is within the distribution range of the northern long-eared bat (Myotis septentrionalis). The northern long-eared bat is federally-listed as threatened under the Endangered Species Act.

Section 7 consultation with the US Fish and Wildlife Service will be required because of federal wetland permitting needs. Consultation by the U.S. Army Corps of Engineers will occur during the permitting phase. Preliminary observations of state-listed and federally-listed species are discussed below.

See ***Appendix F*** for correspondence related to rare features.

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.

Fish and Wildlife Impacts

Typical roadway construction activities (grading, paving, culvert extensions, etc.) that encompass the nature of this projects can affect wildlife habitats. Substantial right-of-way will be required. However, right-of-way acquisition will occur immediately adjacent to the existing roadway. Therefore, wildlife corridors will not experience further fragmentation. Roadway expansion warranted consideration of existing road-kill levels, and available information indicated no substantial issue in the area. Streams and/or rivers will not be re-meandered. No substantial fish and wildlife impacts are anticipated.

Work in water is anticipated near the Becker Lake area. Potential erosion and sediment impacts to water bodies could occur from construction activities, potentially impacting fish species in the project area. See Section I.A.13.d below for avoidance, minimization, and mitigation measures that can be taken implemented to address these impacts.

Vegetation Impacts

Temporary construction-related impacts would occur as a result of staging areas and heavy equipment access. Soils disturbed from earthmoving can provide conditions suitable for infestations of invasive plant species. It is anticipated there will be tree-covered areas requiring clearing and grubbing. See Section I.A.13.d below for avoidance, minimization, and mitigation measures that can be taken implemented to address these impacts.

Invasive Species

Per MnDNR LakeFinder data, no invasive species are listed within Becker Lake. To help limit the spread of these noxious weeds during the construction phase, the following activities will be integrated into construction activities:

- Identification of weeds locations;
- Prioritization of these areas for weed control before construction begins;
- Prevention of movement of soil harboring a strong seed bank (soil under a weed infestation);
- Prevention of the spread of reproductive weed parts by cleaning equipment; and
- Monitoring for noxious weeds after construction to control as necessary

Threatened and Endangered Species

During summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. This bat is opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures like barns, sheds, and bridges. The pup season, is from June 1 to August 15. They spend winter hibernating in caves and mines. Given the location of the proposed project, the project is not anticipated to adversely affect any known occurrences of rare features. Per the US Fish and Wildlife Service/ MNDNR available data there are no documented roost trees or hibernacula in the project area. Consultation will need to occur during wetland permitting to confirm that there is in fact no adverse impact to the species.

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

Fish and Wildlife- Mitigation

Where reasonable and feasible, design modifications have been incorporated into the design of the proposed roadway improvements to avoid and minimize impacts to fish and wildlife habitat. Wildlife-friendly erosion control materials will be used where applicable. Work Exclusion Dates established by MNDNR within the General Public Waters Work Permit (GP 2004-0001) will be followed. Further, the MPCA NPDES General Storm Water Permit for Construction Activity (MNR10001) recognizes the Work Exclusion Dates. During these exclusion dates, the permit mandates all exposed soil areas within 200 feet of the water's edge and drain to these waters must have erosion prevention stabilization activities initiated immediately after construction activity has ceased and completed within 24 hours.

Vegetation-Mitigation

Minimizing the construction footprint to the extent practicable including construction staging areas and heavy equipment access routes will diminish potential impacts to plant communities in the project area. Selection of construction staging areas that are already disturbed will also help to minimize impacts to plant communities. Vegetation protection measures will be based on MnDOT Standard Specification 2572, including but not limited to temporary fence (2572.3A.1) and clean root cutting (2572.3A.2). The Standard Plan sheet 5-297.302 related specifically to vegetation protection and restoration will be followed. Additional coordination will occur with the MnDOT Office of Environmental Stewardship to ensure best practices are followed to minimize impacts to the areas with high significance of biodiversity. Rigorous weed control in construction areas will help to minimize the potential for infestations of invasive plant species. Post-construction re-grading and rapid establishment of appropriate native vegetation will minimize potential impacts.

Revegetation of disturbed soils should include native mixes in areas that are not proposed for mowed turf grass. Recommendations within MnDOT's *Turf Establishment Recommendations* dated November 13, 2015 will be followed where possible. As necessary, appropriate revegetation may also include woody vegetation, like trees and shrubs, in addition to grasses and/or forbs.

Threatened and Endangered Species- Mitigation

Section 7 consultation with the US Fish and Wildlife Service will be required because of federal wetland permitting needs. Consultation by the U.S. Army Corps of Engineers will occur during the permitting phase.

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.

The project has undergone extensive cultural resources and historic properties processes to help make decisions that meet the project objectives while avoiding impacts to historic or archaeological resources. MnDOT projects with no federal involvement (funding or licensing) do not require Section 106 review, but require MnDOT Cultural Resources Unit review under the Minnesota Historic Sites Act, the Minnesota

Private Cemeteries Act, and the Minnesota Field Archaeology Act. The review, includes findings related to archaeological, historic, and architecturally significant properties, i.e. properties listed or eligible for listing on the National Register of Historic Places (NRHP). Preliminary findings are discussed below.

The objective of the Phase I archaeological investigation was to identify known archaeological sites and any previously unrecorded archaeological sites that are potentially eligible or known to be eligible for listing in the National Register of Historic Places (National Register) within the area of potential effect (APE). Two archaeological sites, 21SN0178 (Rothstein site) and 21SN0179 (Baitinger/Schultz site), were identified during archaeological investigations for the TH 23 Project and are recommended as potentially eligible for listing in the National Register. However, based on revised project plans, these sites are no longer within the project APE. The TH 23 Project APE is disturbed, has low archaeological potential, or was found negative for important archaeological resources. No further archaeological work is therefore recommended prior to or during construction for the TH 23 Project.

A Phase I and Phase II Architectural History Evaluation has been completed (March 2016). The purpose of the investigation was to determine if any previously recorded or unrecorded buildings, structures or other architectural properties that are potentially eligible for listing in the National Register of Historic Places (NRHP) are located within the project APE. The investigation was conducted in compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (36 CFR 800). Section 106 requires governmental agencies to consider historic properties when planning and implementing undertakings that are funded, permitted, or licensed by the federal government.

The Phase I architectural history inventory identified 62 properties that are 45 years of age or older. Two properties had been previously identified as part of earlier investigations. The identified properties included 27 farmsteads, 22 houses, one church and one rectory, two schools, two cemeteries, one restaurant, three bridges or culverts, and one railroad segment. Twelve of the properties were recommended for further research and evaluation at the Phase II level to determine their potential eligibility for listing in the NRHP. The results of the Phase II investigations indicated that four properties, including three contributing to an historic district, are recommended as potentially eligible for NRHP listing.

A 1.5-mile Munson Township segment of the 1886 St. Cloud, Mankato & Austin Railroad (later St. Paul, Minneapolis & Manitoba and Great Northern, now the Glacial Lakes State Trail) is recommended as eligible for listing on the MRHP under Criterion A in the areas of Transportation, Agriculture and Commerce. The segment (SN-MUN-041) of the former railroad corridor is in Sections 22 and 23 of Munson Township. Other segments of the corridor located outside the project APE (KH-RVL-008, KH-NLT-024 and SN-PVT-008) have previously been recommended eligible within the same statewide contexts and the Munson Township segment possesses the same significance. The proposed transportation improvements will relocate approximately 0.75 miles of the Glacial Lakes Trail moving the corridor approximately 200 feet to the north, whereby impacting the original railroad corridor.

The Phase II evaluation recommended that the St. Agnes Church and Rectory (SN-RCC-006) and St. Agnes Cemetery (SN-RCC-007) are potentially eligible for the NRHP as contributing to the St. Agnes Church Historic District under Criterion A. Although situated outside the TH 23 APE, the properties were evaluated because they are at the edge of the historic Town of Roscoe and the St. Agnes church steeple is visible from TH 23 as approached from the east and west. The potential district properties, like most in Roscoe, are placed at a lower grade than the highway. At present there is a substantial amount of trees and shrubs

providing a buffer between the roadway and the church property. There are no other potentially eligible properties within the APE adjacent to the Town of Roscoe.

The preferred alternative will close an access road to TH 23 and shift the four-lane divided alignment to the south of Roscoe. The study found that there will be no effect on the setting of the property or views to the northeast, including those of the historic church steeple. Looking to the south and southwest, TH 23 cannot be directly seen from the church property (except a distant point to the east) so there will be no effect on views including those of the enlarged highway.

Cultural Resource Findings

The findings of the surveys identified no properties currently listed on the NRHP, and zero sites of archeological significant sites were identified in the APE. A phase II Architectural investigation was conducted to determine the potential eligibility of several properties for listing on NRHP. Through correspondence with MnDOT Cultural Resource Unit and the Army Corps of Engineers, measures were taken to avoid an adverse effect on these properties, under section 106 regulations, in the event that federal funds are received.

See ***Appendix G*** for communication from MnDOT Cultural Resources Unit. It has been determined that the proposed project has *"no potential to affect properties listed in the State or the National Registers of Historic Places or to affect known or suspected archaeological sites"*.

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 impacts.

While there will be minor visual impacts where roadways are realigned, the proposed project is adjacent to and consistent with the existing Highway 23 alignment, and minor impacts to the Viewshed are coherent with the existing highway corridor environment. No vapor plumes, glare, or major grade changes are proposed with the preferred alternative. No substantial impact to the visual resources of the natural, cultural, and project environments are anticipated. No substantial impact to the ability of the affected population to view visual resources is anticipated. Visual quality will, therefore, not be altered by the proposed project. The proposed project will have no substantial adverse impacts to visual quality nor will it create any opportunities to enhance visual quality in the project area.

There are no existing scenic overlooks or views of note within the project area. The project will not create any vapor plumes or intense lighting. Therefore, no mitigation is required.

Visual impacts associated with construction would include the introduction of heavy construction equipment and disruption of the landscape. These impacts would be noticeable to drivers traveling through the area. This may present an adverse visual impact, however it is temporary and after construction will be removed.

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 pollution, and any greenhouse gases. Discuss efforts to air quality including any sensitive receptors, human health or applicable regulatory criteria. Include a discussion of any methods used to 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 sources emissions.

The proposed project is a highway project and therefore, will not generate stationary source emissions in the project area.

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.

National Ambient Air Quality Standards (NAAQS) – Criteria Pollutants

Motorized vehicles affect air quality by emitting airborne pollutants. Changes in traffic volumes, travel patterns, and roadway locations affect air quality by changing the number of vehicles in an area and the congestion levels. The air quality impacts from the project are analyzed by addressing criteria pollutants, a group of common air pollutants regulated by the Environmental Protection Agency (EPA) on the basis of criteria (information on health and/or environmental effects of pollution). The criteria pollutants identified by the EPA are ozone, particulate matter, carbon monoxide, nitrogen dioxide, lead, and sulfur dioxide. Potential impacts resulting from these pollutants are assessed by comparing projected concentrations to National Ambient Air Quality Standards (NAAQS). In addition to the criteria air pollutants, the EPA also regulates air toxics. The Federal Highway Administration (FHWA) provides guidance for the assessment of Mobile Source Air Toxic (MSAT) effects for transportation projects in the National Environmental Policy Act (NEPA) process. A qualitative evaluation of MSATs has been performed for this project as documented below. The scope and methods of the analysis performed were developed in collaboration with MnDOT and the MPCA.

Ozone

Ground-level ozone is a primary constituent of smog and is a pollution problem in many areas of the United States. Exposures to ozone can cause people to be more susceptible to respiratory infection, resulting in lung inflammation, and aggravating respiratory diseases, such as asthma. Ozone is not emitted directly from vehicles but is formed when volatile organic compounds (VOCs) and nitrogen oxides (NOx) react in the presence of sunlight. Transportation sources emit NOx and VOCs and can, therefore, affect ozone concentrations. However, due to the phenomenon of atmospheric formation of ozone from chemical precursors, concentrations are not expected to be elevated near a particular roadway.

The MPCA, in cooperation with various other agencies, industries, and groups, has encouraged voluntary control measures for ozone concentrations and has begun developing a regional ozone modeling effort. Ozone concentrations in the lower atmosphere are influenced by a complex relationship of precursor concentrations, meteorological conditions, and regional influences on background concentrations. The MPCA states in the document, The Air We Breathe – The State of Minnesota's Air Quality 2017, that:

On October 1, 2015, the EPA strengthened the ozone standard to 70 parts per billion (ppb), down from the 2008 standard of 75 ppb. All areas of Minnesota currently meet the new standard – but some parts of the state are close. Measured ozone levels in some areas of the state are now within 85% or more of the level of the ozone standard, placing these areas at greater risk for violating the standard in the future. While emissions that help form ozone are decreasing, warmer summers and more frequent wildfires may cause both fine-particle levels and ozone levels to rise.

Ozone levels in the Twin Cities metropolitan area currently meet state and federal standards. Additionally, the State of Minnesota is classified by the EPA as an "ozone attainment area," which means that Minnesota has been identified as a geographic area that meets or exceeds the national standards for the reduction of ozone levels. Because of these factors, a quantitative ozone analysis was not conducted for this project.

Particulate Matter

Particulate matter (PM) is the term for particles and liquid droplets suspended in the air. Particles come in a wide variety of sizes and have been historically assessed based on size, typically measured by the diameter of the particle in micrometers. $PM_{2.5}$, or fine particulate matter, refers to particles that are 2.5 micrometers or less in diameter. PM_{10} refers to particulate matter that is 10 micrometers or less in diameter.

Motor vehicles (i.e., cars, trucks, and buses) emit direct PM from their tailpipes, as well as from normal brake and tire wear. Vehicle dust from paved and unpaved roads may be reentrained, or re-suspended, in the atmosphere. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds. $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract when inhaled. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- Increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing;
- Decreased lung function;
- Aggravated asthma;
- Development of chronic bronchitis;
- Irregular heartbeat;
- Nonfatal heart attacks; and,
- Premature death in people with heart or lung disease.

On December 14, 2012, the EPA issued a final rule revising the annual health NAAQS for fine particles ($PM_{2.5}$). The EPA website states:

With regard to primary (health-based) standards for fine particles (generally referring to particles less than or equal to 2.5 micrometers (mm) in diameter, $PM_{2.5}$), the EPA is strengthening the annual $PM_{2.5}$ standard by lowering the level to 12.0 micrograms per cubic meter (µg/m^3). The existing annual standard, 15.0µg/m^3, was set in 1997. The EPA is revising the annual $PM_{2.5}$ standard to 12.0µg/m^3 so as to provide increased protection against health effects associated with long- and short-term exposures (including premature mortality, increased hospital admissions and emergency department visits, and development of chronic respiratory disease), and to retain the 24-hour $PM_{2.5}$ standard at a

level of 35µg/m^3 (the EPA issued the 24-hour standard in 2006). The EPA is revising the Air Quality Index (AQI) for $PM_{2.5}$ to be consistent with the revised primary $PM_{2.5}$ standards.

The EPA also retained the existing standards for coarse particle pollution (PM_{10}). The NAAQS 24-hour standard for PM_{10} is 150 µg/m^3 which is not to be exceeded more than once per year on average over three years.

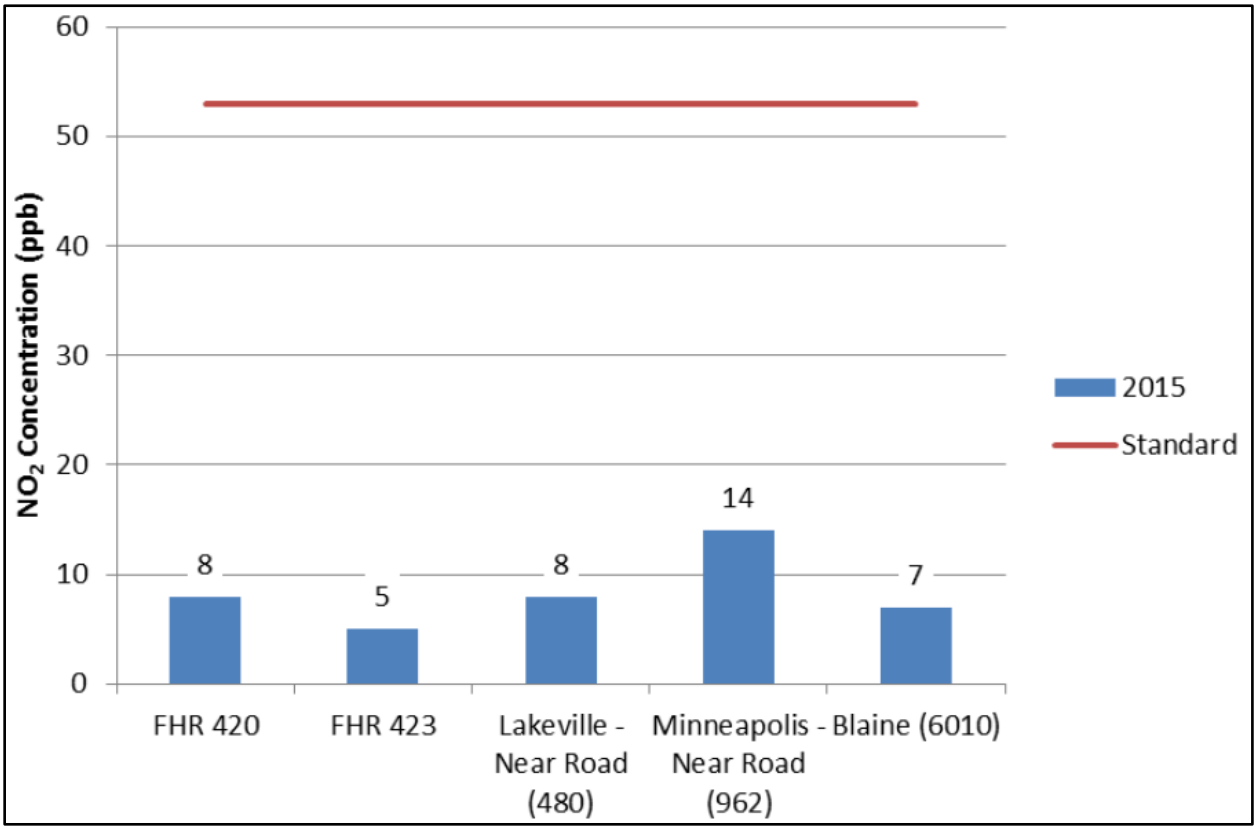
The Clean Air Act conformity requirements include the assessment of localized air quality impacts of federally-funded or federally-approved transportation projects that are located within $PM_{2.5}$ nonattainment and maintenance areas and deemed to be projects of air quality concern. The project is located in an area that has been designated as an unclassifiable/attainment area for PM. This means that the project area has been identified as a geographic area that meets the national health- based standards for PM levels, and therefore is exempt from performing PM analyses.

Nitrogen Dioxide (Nitrogen Oxides)

Nitrogen oxides, or NOx, are the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process. The primary sources of NOx are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels. Besides contributing to forming ozone and fine particles, NOx also have potential adverse health effects such as cardiovascular illnesses, respiratory illnesses and irritation (The Air We Breathe: The State of Minnesota's Air Quality, 2017).

Nitrogen dioxide (NO2), which is a form of nitrogen oxide (NOx), is regularly monitored. Minnesota currently meets federal nitrogen dioxide standards, according to the Annual Air Monitoring Network Plan for Minnesota, 2017 (August 2016). This document states: "A monitoring site meets the annual NAAQS for NO2 if the annual average is less than or equal to 53 ppb. Figure 21 [***Chart 1,*** see below] shows the 2015 average at Minnesota sites and compares them to the standard. Minnesota averages ranged from 5 ppb at Flint Hills Refinery 423 to 14 ppb at the Near Road I-35/I-94 site (962); therefore, Minnesota currently meets the annual NAAQS for NO2."

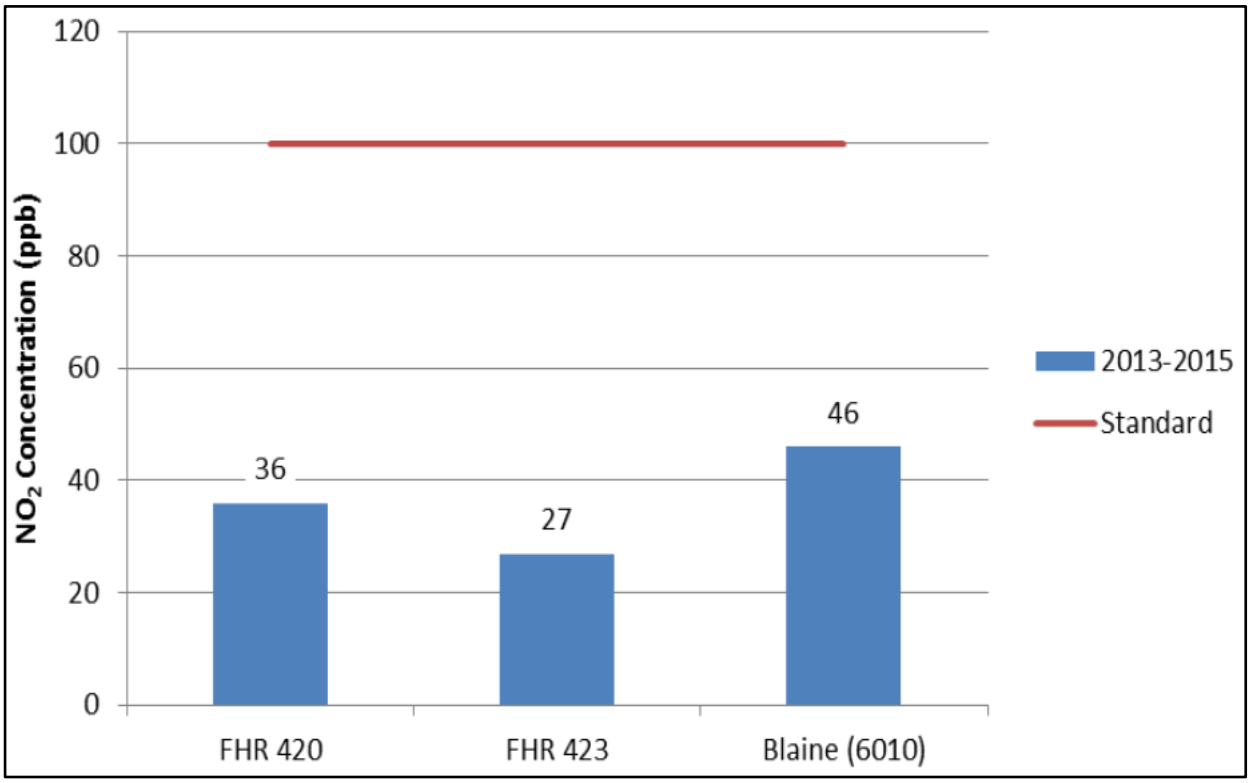
Chart 1 – Annual Average NO2



In the Annual Air Monitoring Network Plan for Minnesota, 2017, it states the following with regard to the 1-hr NO2 Standard:

> *On January 22, 2010 the EPA finalized revisions to the NO2 NAAQS. As part of the standard review process, the EPA retained the existing annual NO2 NAAQS, but also created a new 1-hour standard. This new 1-hour NAAQS will protect against adverse health effects associated with short term exposures to elevated NO2. To meet this standard, the three-year average of the annual 98th percentile daily maximum 1-hour NO2 concentration must not exceed 100 ppb. Figure 22 [**Chart 2** see below] shows the 2013-2015 average of the annual 98th percentile daily maximum 1-hour NO2 concentrations at Minnesota sites and compares them to the 1-hour standard. Minnesota averages ranged from 27 ppb at Flint Hills Refinery 423 to 46 ppb at Blaine (6010); therefore, all Minnesota sites currently meet the 1-hour NAAQS for NO2.*

Chart 2 – Hour NO2 Concentrations Compared to the NAAQs



The EPA's regulatory announcement, EPA420-F-99-051 (December 1999), describes the Tier 2 standards for tailpipe emissions, and states:

> *The new tailpipe standards are set at an average standard of 0.07 grams per mile for nitrogen oxides for all classes of passenger vehicles beginning in 2004. This includes all light-duty trucks, as well as the largest SUVs. Vehicles weighing less than 6000 pounds will be phased-in to this standard between 2004 and 2007. As newer, cleaner cars enter the national fleet, the new tailpipe standards will significantly reduce emissions of nitrogen oxides from vehicles by about 74 percent by 2030. The standards also will reduce emissions by more than 2 million tons per year by 2020 and nearly 3 million tons annually by 2030.*

Within the project area, it is unlikely that NO2 standards will be approached or exceeded based on the relatively low ambient concentrations of NO2 in Minnesota and on the long-term trend toward reduction of NOx emissions. Because of these factors, a specific analysis of NO2 was not conducted for this project.

Sulfur Dioxide

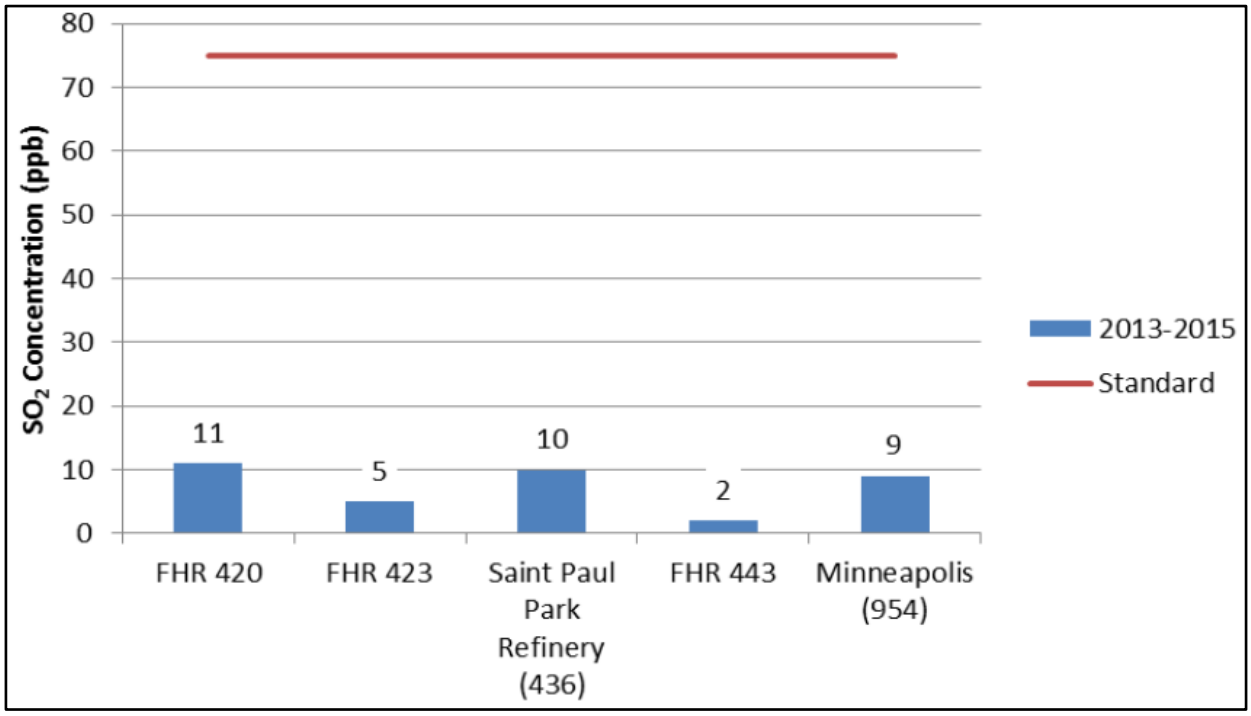
Sulfur dioxide (SO2) and other sulfur oxide gases (SOx) are formed when fuel containing sulfur is burned. Sulfur dioxide is a heavy, pungent, colorless gas. Elevated levels can impair breathing, lead to other respiratory symptoms, and at very high levels, can aggravate heart disease. People with asthma are most at risk when SO2 levels increase. Once emitted into the atmosphere, SO2 can be further oxidized into sulfuric acid, a component of acid rain. Emissions of sulfur oxides from transportation sources are a small component of overall emissions and continue to decline due to the desulphurization of fuels.

The MPCA monitors air quality across the state and compares those results to national standards. In 2015, monitoring shows ambient SO2 concentrations were at less than 20 percent of federal standards. (The Air We Breathe: The State of Minnesota's Air Quality, 2017). MPCA monitoring shows ambient SO2 concentrations ranging from 2 to 11 ppb for the 2013 to 2015 average 99th percentile daily maximum 1-hour SO2 concentrations well below state and federal standard of 75 ppb (Source: Annual Air Monitoring Network Plan for Minnesota, 2017). The MPCA has concluded that long-term trends in both ambient air concentrations and total SO2 emissions in Minnesota indicate steady improvement.

In the Annual Air Monitoring Network Plan for Minnesota, 2017, it states the following with regard to SO2:

> *On June 2, 2010, the EPA finalized revisions to the primary SO2 NAAQS. EPA established a new 1-hour standard which is met if the three-year average of the annual 99th percentile daily maximum 1-hour SO2 concentration is less than 75 ppb. In addition to creating the new 1-hour standard, the EPA revoked the existing 24-hour and annual standards. Figure 24 [**Chart 3**] below describes the 2013-2015 average 99th percentile 1-hour SO2 concentration and compares them to the 1-hour standard. Minnesota averages ranged from 2 ppb at Flint Hills Refinery 443 to 11 ppb at Flint Hills Refinery 420; therefore, all Minnesota sites currently meet the 1-hour NAAQS for SO2.*

Chart 3 – 1 Hour SO2 Concentration Compared to the NAAQS



Emissions of sulfur oxides from transportation sources are a small component of overall emissions and continue to decline due to the desulfurization of fuels. Additionally, the project area is classified by the EPA as a "sulfur dioxide attainment area," which means that the project area has been identified as a geographic area that meets the national health-based standards for sulfur dioxide levels. Because of these factors, a quantitative analysis for sulfur dioxide was not conducted for this project.

Lead

Due to the phase out of leaded gasoline, lead is no longer a pollutant associated with vehicular emissions.

Carbon Monoxide

This project is not located in an area where conformity requirements apply, and the scope of the project does not indicate that air quality impacts would be expected. Furthermore, the USEPA has approved a screening method to determine which intersections need a CO hotspot analysis. The results of the screening procedure demonstrate that traffic volumes are below the threshold of 79,400 ADT and do not require a detailed hotspot analysis. Therefore, no further air quality analysis is necessary.

Improvements in vehicle technology and in motor fuel regulations continue to result in reductions in vehicle emission rates. The EPA MOVES 2010b emissions model estimates that emission rates will continue to fall from existing rates through year 2030. Consequently, year 2030 vehicle-related CO concentrations in the study area are likely to be lower than existing concentrations even considering any increase in development-related and background traffic.

Mobile Source Air Toxics (MSAT)

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the U.S. Environmental Protection Agency (EPA) regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS).

In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA). These are acrolein, benzene, 1,3-butidiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules (Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, October 18, 2016).

Motor Vehicle Emissions Simulator (MOVES)

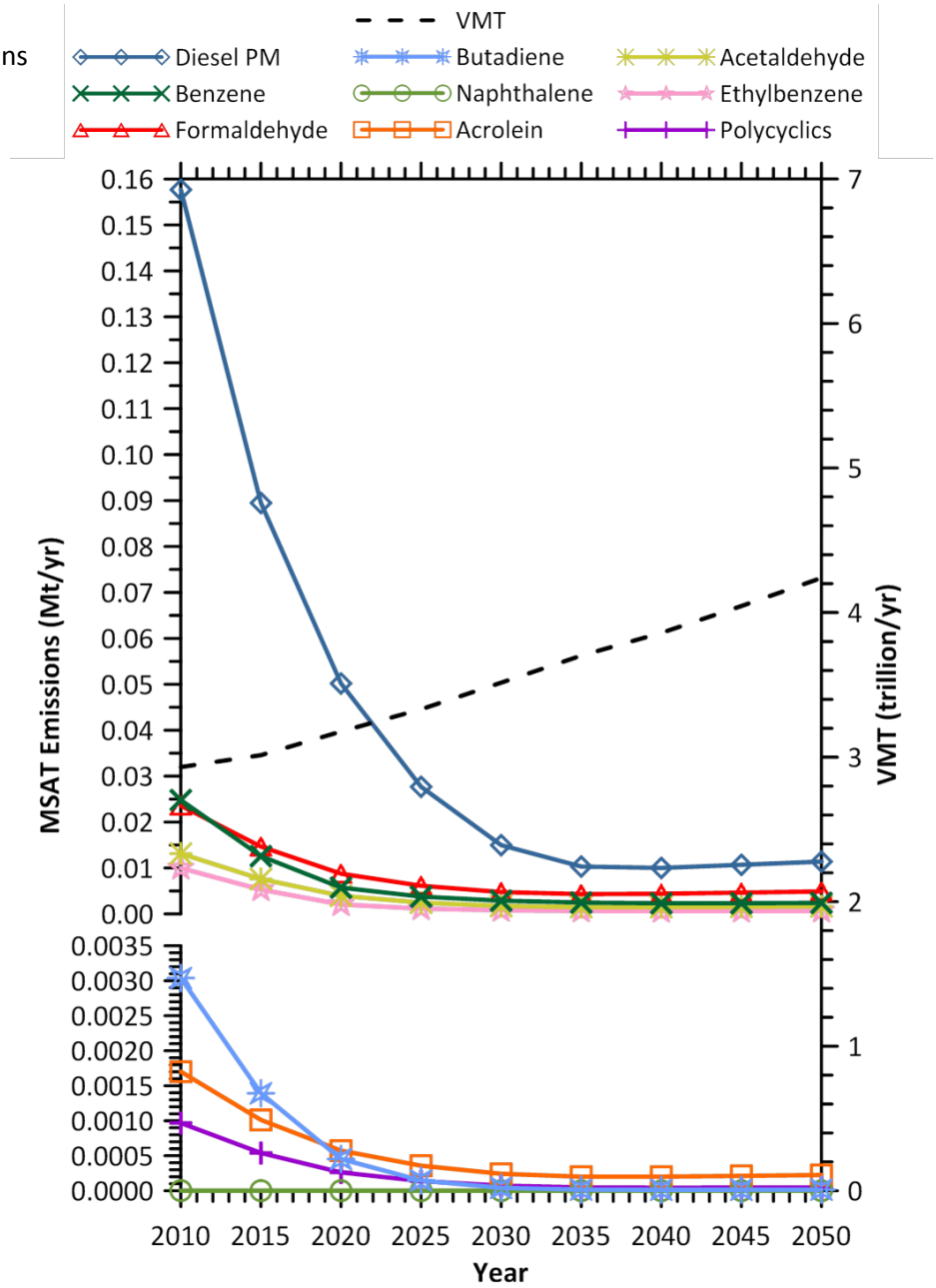
According to EPA, MOVES2014 is a major revision to MOVES2010 and improves upon it in many respects. MOVES2014 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2010. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES2014 also adds updated vehicle sales, population, age distribution, and vehicle miles travelled (VMT) data. MOVES2014 incorporates the effects of three new Federal emissions standard rules not included in MOVES2010. These new standards are all expected to impact MSAT emissions and include Tier 3 emissions and fuel standards starting in 2017 (79 FR 60344), heavy-duty greenhouse gas regulations that phase in during model years 2014-2018 (79 FR 60344), and the second phase of light duty greenhouse gas regulations that phase in during model years 2017-2025 (79 FR 60344). Since the release of MOVES2014, EPA has released MOVES2014a. In the November 2015 MOVES2014a Questions and Answers Guide, EPA states that for on-road emissions, MOVES2014a adds new options

requested by users for the input of local VMT, includes minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions. The change in brake wear emissions results in small decreases in PM emissions, while emissions for other criteria pollutants remain essentially the same as MOVES2014.

Based on an FHWA analysis using EPA's MOVES2014a model, as shown in ***Chart 4***, even if vehicle-miles travelled (VMT) increases by 45 percent as assumed from 2010 to 2050, a combined reduction of 91 percent in the total annual emissions for the priority MSAT is projected for the same time period (*Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents, October 18, 2016*).

Chart 4 – FHWA Projected National MSAT Emission Trends 2010-2050 for Vehicles Operating on Roadways Using EPA's MOVES2014a Model

Note: Trends for specific locations may be different, depending on locally derived information representing vehicle miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.



Diesel PM is the dominant component of MSAT emissions, making up 50 to 70 percent of all priority MSAT pollutants by mass, depending on calendar year. Users of MOVES2014a will notice some differences in emissions compared with MOVES2010b. MOVES2014a is based on updated data on some emissions and pollutant processes compared to MOVES2010b, and also reflects the latest Federal emissions standards in place at the time of its release. In addition, MOVES2014a emissions forecasts are based on lower VMT projections than MOVES2010b, consistent with recent trends suggesting reduced nationwide VMT growth compared to historical trends

MSAT Research

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Nonetheless, air toxics concerns continue to be raised on highway projects during the NEPA process. Even as the science emerges, we are duly expected by the public and other agencies to address MSAT impacts in our environmental documents. The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this field.

NEPA Context

The NEPA requires, to the fullest extent possible, that the policies, regulations, and laws of the Federal Government be interpreted and administered in accordance with its environmental protection goals. The NEPA also requires Federal agencies to use an interdisciplinary approach in planning and decision-making for any action that adversely impacts the environment. The NEPA requires, and FHWA is committed to, the examination and avoidance of potential impacts to the natural and human environment when considering approval of proposed transportation projects. In addition to evaluating the potential environmental effects, we must also take into account the need for safe and efficient transportation in reaching a decision that is in the best overall public interest. The FHWA policies and procedures for implementing NEPA are contained in regulation at 23 CFR Part 771.

Incomplete or Unavailable Information for Project Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, https://www.epa.gov/iris). Each report contains assessments of non-cancerous and cancerous effects for

individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures, with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). A number of HEI studies are summarized in Appendix D of FHWA's Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are; cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literatureexposure-and-health-effects) or in the future as vehicle emissions decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects).

As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. EPA states that with respect to diesel engine exhaust, “[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk" (EPA IRIS database, Diesel Engine Exhaust, Section II.C. https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0642.htm#quainhal).

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries.

The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million;

in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable (https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf).

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

Qualitative MSAT Analysis

For any future scenario, the amount of mobile source air toxics (MSAT) emitted would be proportional to the average daily traffic (ADT) assuming that other variables such as fleet mix are the same for each alternative. The ADT is not expected to differ significantly between the no build scenario and the preferred build alternative. Small differences in emissions resulting from differences in ADT are offset somewhat by lower MSAT emission rates due to increased speeds and improved mobility under the build alternative. According to EPA's MOVES2014a model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emissions decreases will offset ADT-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models.

Regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of the EPA's national control programs that are projected to reduce annual MSAT emissions by over 90 percent from 2010 to 2050 (*Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*, Federal Highway Administration, October 12, 2016). Local conditions may differ from these national projections in terms of fleet mix and turnover, ADT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for ADT growth) that MSAT emissions in the study area are likely to be lower in the future in virtually all locations.

Under the preferred alternative there may be localized areas where ADT would increase, and other areas where ADT would decrease. Therefore, it is possible that localized increases and decreases in MSAT emissions may occur. The localized increases in MSAT emissions would likely be most pronounced along Highway 36 as this route is expected to attract additional traffic if safety and mobility conditions are improved. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations.

In summary, under the preferred alternative in the design year it is expected there would be reduced MSAT emissions in the immediate area of the project, relative to the no build scenario, due to the reduced ADT associated with more direct routing, and due to EPA's MSAT reduction programs.

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.

Dust generated during construction will be minimized through standard dust control measures such as applying water to exposed soils and limiting the extent and duration of exposed soil conditions. Construction contractors will be required to control dust and other airborne particulates in accordance with MnDOT specification in place at the time of project construction. After construction is complete, dust levels are anticipated to be minimal because all soil surfaces exposed during construction would be in permanent cover (i.e., paved or re-vegetated areas).

17. Noise

A summary of the completed traffic noise analysis report is included below.

a. 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.

Noise During Construction

The construction activities associated with implementation of the proposed project will result in increased noise levels relative to existing conditions. These impacts will primarily be associated with construction equipment and pile driving. The duration of the project is anticipated to last up to two full construction seasons with work occurring during daylight hours. No nighttime construction is anticipated at this time.

Table 7 shows peak noise levels monitored at 50 feet from various types of construction equipment. This equipment is primarily associated with site grading/site preparation, which is generally the roadway construction phase associated with the greatest noise levels.

Table 7: Typical Construction Equipment Noise Levels at 50 feet

Equipment Type	Manufacturers Sampled	Total Number of Models in Sample	Peak Noise Level Range (dBA)	Peak Noise Level Average (dBA)
Backhoes	5	6	74-92	83
Front Loaders	5	30	75-96	85
Dozers	8	41	65-95	85
Graders	3	15	72-92	84
Scrapers	2	27	76-98	87
Pile Drivers	N/A	N/A	95-105	101

Source: United States Environmental Protection Agency and Federal Highway Administration

Any associated high-impact equipment noise, such as pavement sawing, or jack hammering, will be unavoidable with construction of the proposed project. High-impact noise construction activities will be limited in duration to the greatest extent possible.

Traffic Noise Analysis Requirement

Considering the fact that FHWA is not a participant in this project, neither in a financial or regulatory way, the requirement for noise analysis is based only on Minnesota State rules. While the FHWA regulations and criteria are not in effect for this construction project, they are included in their entirety for reference purposes. The following is a summary of the *Traffic Noise Analysis Report* for the proposed project. The report includes background information on noise, information regarding traffic noise regulations (i.e., federal and Minnesota traffic noise regulations and standards), a discussion of the traffic noise analysis methodology, documentation of the potential traffic noise impacts associated with the proposed project, and an evaluation of noise abatement measures. See ***Appendix H*** for the full *Traffic Noise Analysis Report*.

Federal and State Noise Regulations

The study was conducted in accordance with the 2015 Minnesota Noise Policy, which is an implementation of the FHWA Noise Regulation found at 23 CFR 772. The regulation requires the identification of highway traffic noise impacts and the evaluation of noise abatement measures, along with other considerations, in conjunction with the planning and design of a federal-aid highway project.

Daytime and nighttime noise standards have been established by the State of Minnesota. The Minnesota Pollution Control Agency (MPCA) defines daytime as 7:00 a.m. to 10:00 p.m. and nighttime as 10:00 p.m. to 7:00 a.m. State noise standards are for a one-hour period and apply to outdoor areas (i.e. exterior noise levels). The standards are set in terms of the L10 and L50 noise descriptors. The L10 is the sound level exceeded ten percent of the time, or six minutes out of an hour. The L50 is the sound level exceeded 50 percent of the time, or 30 minutes out of an hour.

Federal Noise Abatement Criteria apply to all Type I projects requiring FHWA approval, regardless of funding source, or Type I projects requiring Federal-aid highway funds. This project includes construction of a highway on new location, qualifying it as a Type I project. Under federal rules, traffic noise impacts are determined based on land use activities and predicted worst hourly (L_{10}) noise levels under future conditions. For example, for residential land uses (Activity Category B), the Federal Noise Abatement Criterion is 70 dBA (L_{10}). Receptor locations where noise levels are "approaching" or exceeding the criterion level must be evaluated for noise abatement feasibility and reasonableness. See ***Table 8*** below for federal noise abatement criteria details. In Minnesota, "approaching" is defined as 1 dBA or less below the Federal Noise Abatement Criteria. A noise impact is also defined as a "substantial increase" in the future modeled noise levels over the existing modeled noise levels. In Minnesota, a "substantial increase" is defined as an increase of 5 dBA or greater from existing to future conditions.

In Minnesota, traffic noise impacts are evaluated by measuring and/or modeling the traffic noise levels that are exceeded ten percent and 50 percent of the time during the hour of the day and/or night that has the loudest traffic noise. These noise levels are identified as the L_{10} and L_{50} levels. See ***Table 9*** below for Minnesota state noise standards. Minnesota state noise standards apply to the outdoor environment (i.e., exterior noise levels). Because state noise standards apply to trunk highway facilities, they apply to this project.

Table 8: Federal Noise Abatement Criteria

Activity Category	Activity Criteria [1][2] L_{eq} (dBA)	L_{10} (dBA)	Evaluation Location	Activity Description
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve and important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B[3]	67	70	Exterior	Residential
C(3)	67	70	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E(3)	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F
F	--	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources water treatment, electrical), and warehousing
G	--	--	--	Undeveloped lands that are not permitted

(1) In Minnesota, traffic noise impacts are determined using the hourly L10 value. In Wisconsin, traffic noise impacts are determined using the hourly L_{eq} value.
(2) The L_{eq}(h) and L_{10}(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
(3) Includes undeveloped lands permitted for this activity category.

Table 9: Minnesota Noise Standards

Land Use	Code	Daytime (7 a.m. – 10 p.m.) dBA		Nighttime (10 p.m. – 7:00 a.m.) dBA	
Residential	NAC-1[1]	L10 of 65	L50 of 60	L10 of 55	L50 of 50
Commercial	NAC-2[2]	L10 of 70	L50 of 65	L10 of 70	L50 of 65
Industrial	NAC-3[3]	L10 of 80	L50 of 75	L10 of 80	L50 of 75

(1) NAC-1 includes household units, transient lodging and hotels, educational, religious, cultural entertainment, camping, and picnicking land uses
(2) NAC-2 includes retail and restaurants, transportation terminals, professional offices, parks, recreational, and amusement land uses.
(3) NAC-3 includes industrial manufacturing, transportation facilities (except terminals), and utilities land uses.

Traffic Noise Analysis Methodology

Traffic noise impacts are evaluated by modeling the traffic noise levels during the hours of the day and/or night that have the loudest traffic scenario. Traffic noise modeling uses existing and forecast traffic volumes, as well as characteristics of the roadway and surrounding environment, to predict traffic noise levels at representative receptor locations. Modeled traffic noise levels at receptor locations along a project corridor are then compared to state daytime and nighttime standards. If modeled traffic noise

levels are projected to exceed state daytime and/or nighttime standards with the future Build Alternative, then an impact is identified and noise abatement measures (e.g., noise barriers) are considered.

Traffic noise impacts were assessed by modeling noise levels at noise sensitive receptor locations likely to be affected by the construction of the proposed project. Traffic noise levels were modeled at a total of 118 representative receptor locations throughout the project area. The Existing and No Build modeling includes the entire 118 receptors that exist today. The Build condition removes 14 receptors through right-of-way acquisitions and relocates 23 existing trail receptor along the new proposed trail alignment near Richmond; therefore the Build Condition has a total of 104 receptors.

Based on the FHWA and MnDOT Noise Policy guidance, noise receptors were assigned and modeled within approximately 500 feet of the existing and proposed highway mainline. The majority of the receptors, a total of 79, represent residential receptors of which some are located in clusters and others are scattered throughout the project corridor. On the eastern side of the project, near Richmond, the Rocori Trail has a total of 35 receptors within the project area.

The locations of the existing modeled receptor sites and of the build modeled receptor sites are illustrated in figures contained in ***Appendix H***.

Traffic Noise Analysis Results

Results of the noise modeling analysis have been tabulated and are shown in ***Appendix H*** (see Tables 5 and 6 of the Noise Report). The following describes the results of the traffic noise analysis for existing (2016), future (2040) No Build condition, and future (2040) Build condition. Noise levels along the TH 23 corridor exceed Federal and both State daytime and nighttime noise standards for the majority of the project area under existing (2016) conditions. In general, the construction of the TH 23 North Gap Project will result in increases in traffic noise levels compared to the existing conditions. Modeled build (2040) condition noise levels (daytime and nighttime) vary from -4.5 dBA to 5.9 dBA from existing (2016) conditions.

Noise Abatement Analysis and Conclusions

When noise impacts are identified, a noise barrier evaluation analysis must be performed. Noise barrier construction decisions are determined based on the evaluation of the feasibility and reasonableness of the noise barriers.

Feasibility of the noise barrier is determined by physical and/or engineering constraints (i.e., whether a noise barrier could feasibly be constructed on the site) and by acoustic feasibility (at least one receptor per proposed barrier must receive the minimum reduction of 5 dBA).

Reasonableness is based on a three factors that must be met for a noise abatement measure to be considered reasonable. The factors are as follows:

- A noise reduction goal of at least 7 dBA must be achieved at a minimum of one benefitted receptor for each proposed noise abatement measure to be considered reasonable.
- A cost effective (CE) threshold of $43,500 per individual benefitted receptor has been established, based on an estimated construction cost of $20 per square foot for noise barriers. Additional costs of some items such as guard rail, rub rail, purchased right-of-way and other extra costs shall be added to the baseline unit costs cited above for the purposes of the cost estimation.

- The viewpoints of the property owners and residents of all benefitted receptors shall be solicited and considered in reaching a decision on the abatement measure to be provided. See Section 5.3.3 of the MnDOT Noise Policy (effective date: June 15, 2015) for a detailed explanation of the voting system.

Assessing the cost effectiveness of noise barriers includes several steps. First, the impacted noise areas are assessed to determine the probable location for an effective noise barrier. Second, the noise barriers are modeled to assess their acoustical effectiveness. For the TH 23 noise analysis, three heights of potential noise barriers were analyzed: 20, 15 and 10 feet. If a 20 foot (MnDOT's maximum height) high noise barrier is feasible and meets the reasonableness criteria, it would be proposed for construction. If the 20 foot high barrier does not meet the criteria, a 15 foot barrier would be evaluated. Likewise, if a 15 foot high barrier does not meet the criteria a 10 foot barrier would be evaluated. Based on the number of benefitted receptors at each of the above barrier heights, varying barriers heights were back-calculated to assess if an intermediate height would be more beneficial.

Acoustic reasonableness and cost effectiveness were calculated for each noise barrier evaluated (25 noise barriers). No noise barrier was found to be both reasonable and feasible. As a result of this analysis, no noise barrier will be proposed as part of the TH 23 North Gap Project.

18. Transportation

The *Highway 23 North Gap – Crash History* (July 28, 2015) and *Highway 23 North Gap – Daily Traffic Forecasts (July 6, 2015)* memos contain detailed information on traffic and transportation considerations. Selected information from these memos is included below.

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 estimates, and 5) availability of transit and/or alternative transportation modes.

Not applicable. Traffic is not generated by the proposed project. Rather, this project is proposed to accommodate future increases in traffic forecast for the area roadways.

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.

Existing and Future Traffic Volumes

See ***Table 10*** below for existing (2013) and future traffic volumes throughout the TH 23 project corridor.

Table 10: Existing (2013) and Forecasted (2020, 2040) AADTs

Description	2012 AADT	2020 AADT	2040 AADT
TH 23 from the Paynesville Bypass to CR 12/CR 43	7,600	8,800	12,200
TH 23 between CR 12/ CR 43 to CR 9	8,700	10,100	14,000

Notes: * = Within two-lane to four-lane expansion area

Within the 2-lane project limits, TH 23 has an approximate growth rate of 2.2% to 2.3% per year. The TH 23 project forecast AADT demands are approximately 12,200 and 14,000 vehicles per day, which is well below the capacity of the proposed 4-lane roadway. Growth on the county road system ranges from 0.9% to 3.1% per year. The highest forecast demand on the county roads connecting to TH 23 within the project limits is approximately 2,700 vehicles per day; therefore all of the connecting roadways are well below the capacity of a typical 2-lane facility.

Crash History

The project area's crash history was also analyzed to identify any existing safety issues along the corridor. A 10-year crash analysis was conducted for crashes occurring from January 1st, 2005 through December 31st, 2014.

Within the 10-year crash analysis, six intersections that had more than 4 crashes; three intersections had more than 8 crashes (see ***Table 11***). A total of 35 crashes occurred at these three intersections. Of the 61 total intersection crashes, 43% of the crashes were vehicles leaving the roadway, 59% of the crashes occurred during daylight conditions and only 54% occurred on dry pavement.

All intersections along this segment of TH 23 are minor street stop controlled. The table below represents the 10-year crash history for all intersections that had at least two crashes. Three intersections along TH 23, at 263rd Avenue, 210th Street and CSAH 43, are at or above the statewide average crash and severity rates for a rural through/stop intersection. The intersection of TH 23 and CR 43 is above the critical severity rate; however all other intersections along TH 23 are below the calculated critical rates.

Table 11: Intersection Crash History (2005-2014)

TH 23 @	Fatal	A	B	C	N	Total	Crash Rate	Severity Rate	Critical Crash Rate	Critical Severity Rate
TH 23 at 263rd Avenue	0	0	0	6	6	12	0.44	0.66	0.55	0.81
TH 23 at County Road 123	0	0	1	2	0	3	0.11	0.26	0.55	0.81
TH 23 at 253rd Avenue	0	0	0	3	1	4	0.15	0.26	0.55	0.81
TH 23 at 205th Street	0	0	2	0	1	3	0.11	0.26	0.55	0.82
TH 23 at 210th Street	0	0	2	1	5	8	0.28	0.46	0.55	0.81
TH 23 at 190th Street	0	1	0	2	1	4	0.15	0.34	0.56	0.82
TH 23 at County Road 114	0	0	0	1	3	4	0.15	0.18	0.55	0.81
TH 23 at County Road 123	0	0	0	1	1	2	0.07	0.11	0.55	0.81
TH 23 at County Road 43	0	1	3	4	7	15	0.43	0.81	0.52	0.77
TH 23 at West Becker Lake Circle	0	0	1	2	0	3	0.09	0.21	0.52	0.77

TH 23 @	Fatal	A	B	C	N	Total	Crash Rate	Severity Rate	Critical Crash Rate	Critical Severity Rate
TH 23 at East Becker Lake Circle	0	0	1	0	2	3	0.09	0.15	0.52	0.77
							Above Statewide Average Rate		Above Critical Rate	

The roadway was divided into 4 segments surrounding the three highest crash intersections (see ***Table 12*** for segment crash history). The entire 2-lane section of TH 23 is at or above the statewide average crash and severity rate for a rural 2-lane roadway. The short segment between the existing 4-lane section and 263rd Avenue is above the critical severity rates; all other segments are below the calculated critical rates.

Table 12: Segment Crash History (2005-2014)

From	To	Length (Miles)	Segment ADT	Fatal	A	B	C	N	Total	Crash Rate	Severity Rate	Critical Crash Rate	Critical Severity Rate
Ref. 177+00.057	263rd Avenue	0.45	7,300	0	0	2	1	4	7	0.58	1.00	0.66	**0.94**
263rd Avenue	210th Street	2.42	7,300	0	0	6	8	11	25	0.39	0.70	0.47	0.71
210th Street	CSAH 43	4.35	7,300	0	3	3	13	22	41	0.35	0.59	0.43	0.67
CSAH 43	Ref. 185+00.780	1.49	9,200	0	1	3	6	10	20	0.40	0.70	0.50	0.71
										Above Statewide Average Rate		Above Critical Rate	

The high percentage of rear end and run-off-road crashes along the corridor could be attributed to the high number of access points onto TH 23 and lack of separate turning lanes for vehicles. All turning traffic along the corridor must turn from the TH 23 through-lane which is posted at 60 mph.

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

Not applicable.

19. Cumulative Potential Effects

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.

Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency or persons undertakes such actions." The planning efforts and potential projects discussed within this section are consistent with the Minnesota State Supreme Court ruling regarding cumulative potential effects inquiry under state statute, i.e., the projects: 1) are either existing, actually planned for, or for which a basis of expectation has been laid; 2) are located in the surrounding area; and 3) might reasonably be expected to affect the same natural resource.

The geographic areas considered are those that are directly adjacent to TH 23 and near the project corridor, and within the timeframe of the next few years. The project impacts described herein for the TH 23 impacts include impacts to increased impervious surfaces and therefore increased storm water runoff, potential effects to wetlands, and increased traffic noise.

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.

Planning documents utilized to identify applicable projects include Minnesota's pending approval 2018-2021 STIP, existing city and county comprehensive plans, direct communications with Stearns County Public Works, and capital improvement plans.

Stearns County has no immediate future public works projects that would interact with the environmental effects of the proposed project area.

TH 23 South Gap 2 to 4 Lane Expansion

MnDOT does plan to expand the remaining 2-lane gap of TH 23. In 2014, Highway 23 received funds through the Corridors of Commerce program to complete the environmental review and layout for expanding the segment of TH 23 between the existing four-lane highway section located near New London to the south end of the Paynesville bypass from two-lanes to four-lanes. The environmental review and preliminary layout for the TH 23 South Gap Project has been completed. The next phase in the project development process, including right-of-way acquisition and detail design, will begin when funds become available. Currently, there is no funding available for the construction at this time.

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.

The projects described in Question 19.b above are not anticipated to contribute to cumulative effects on stormwater, wetlands, traffic noise, or other environmental considerations.

The potential impacts to resources identified can be avoided or minimized through existing regulatory controls such as permits and land use ordinances. During the development of this EAW, no potentially significant cumulative impacts to the resources affected by this project have been identified.

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 how the environment will be affected, and identify measures that will be taken to minimize and mitigate these effects.

MnDOT Bicycle Pedestrian Section

The MnDOT Bicycle and Pedestrian Section was contacted to provide review and comments. The Statewide Bicycle System outreach map was also reviewed. The map from spring 2014 shows multiple comments and routes marked by users within the project area. Bicycle and pedestrian travel will be impacted during construction. If bicyclists will only be able to ride on the trail, information on the alternate route and/or detour for users will be needed before and during construction.

RGU Certification

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

I hereby certify that:

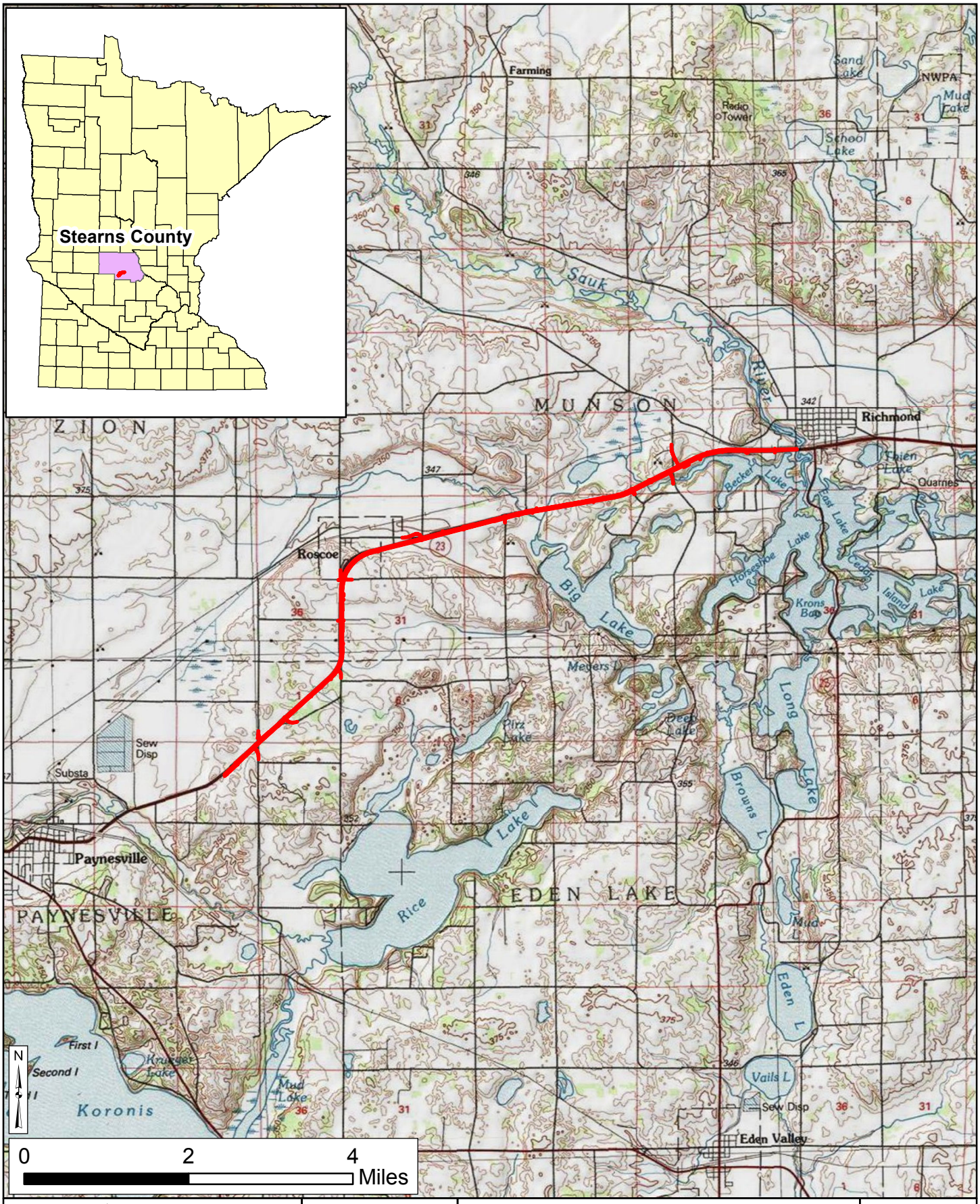
- The information contained in this document is accurate and complete to the best of my knowledge.
- The EAW describes the complete project; there are no other projects, stages or components other than those described in this document, which are related to the project as connected actions or phased actions, 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.

Name and Title of Signer: Lynn P. Clarkowski, P.E.
MnDOT Chief Environmental Officer

Date: September 29, 2017

Environmental Assessment Worksheet was prepared by the staff of the Environmental Quality Board at Minnesota Planning. For additional information, worksheets or for EAW Guidelines, contact: Environmental Quality Board, 658 Cedar St., St. Paul, MN 55155, 651-296-8253, or **www.mnplan.state.mn.us**.

Appendix A - Figure 1: Project Overview



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Project: MNT08 132980
Print Date: 1/4/2017

Map by: bpt
Projection: Stearns Co. Coords.
Source: MnDNR, SEHInc
Background: ESRI Base Map

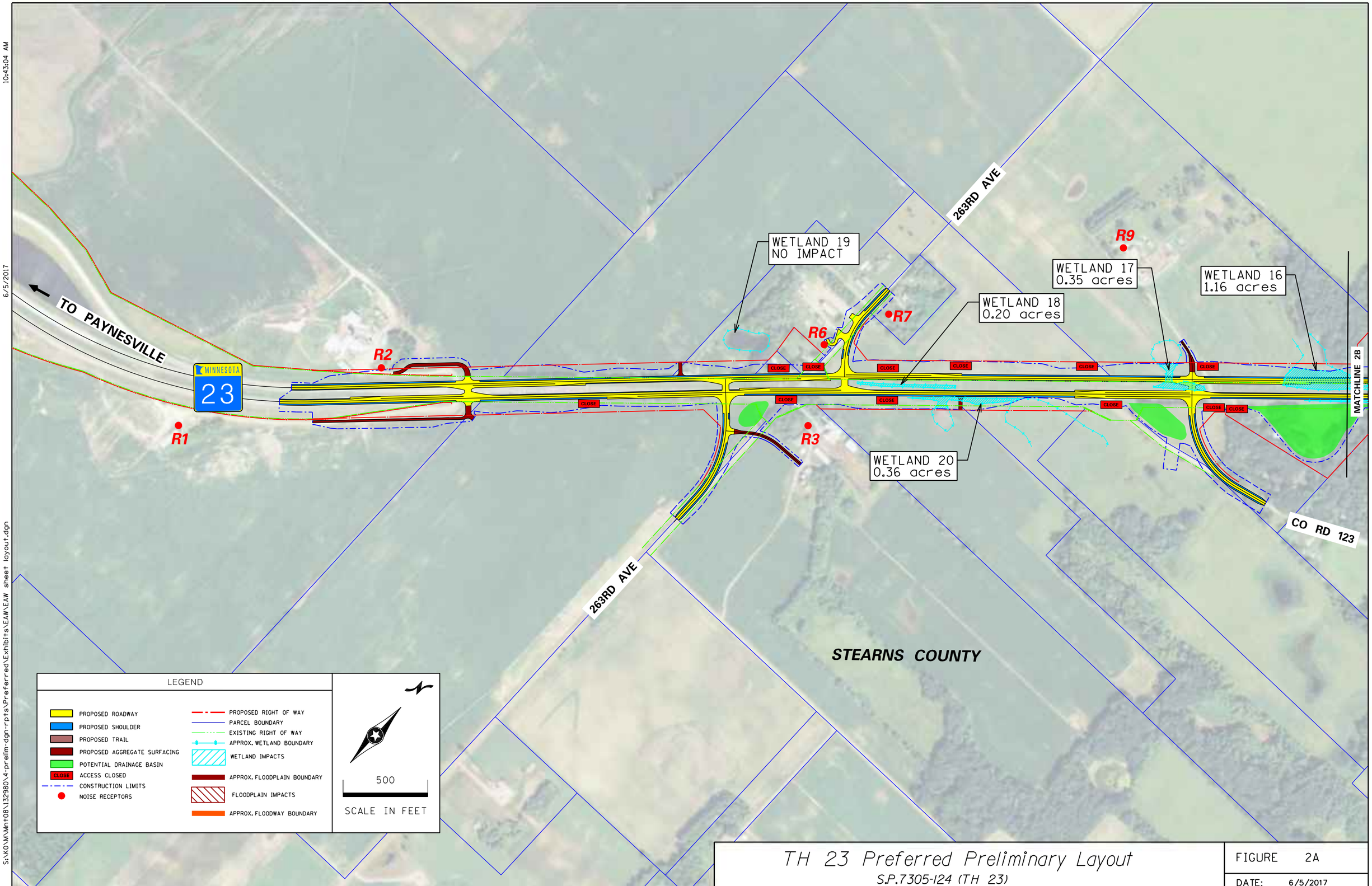
Project Overview Map

TH 23 North Gap Project
Stearns County, Minnesota

Figure 1

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.

Appendix B – Preferred Preliminary Layout: Figures 2A – 2F



TH 23 Preferred Preliminary Layout

S.P.7305-124 (TH 23)

FIGURE 2A

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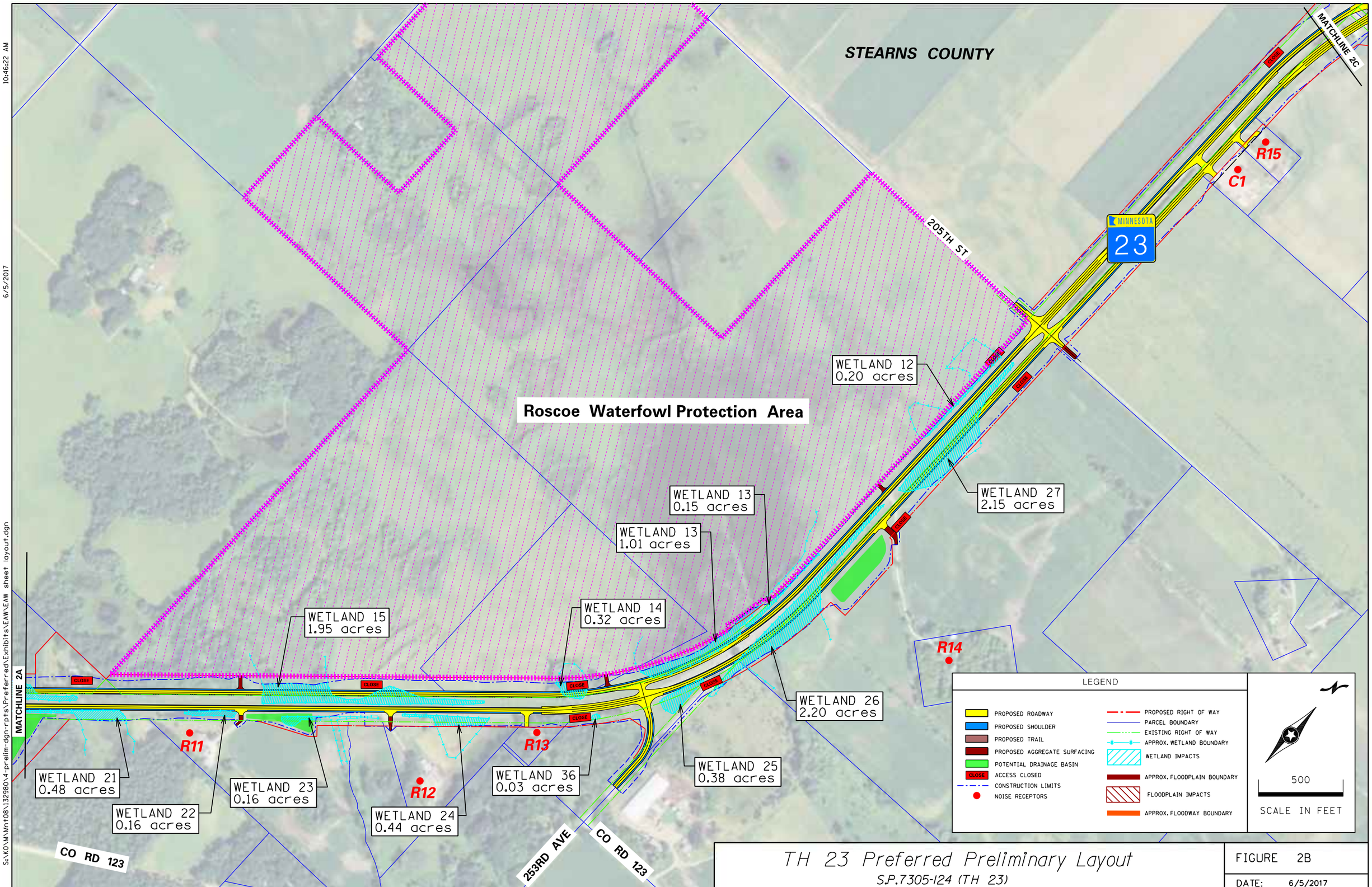

TH 23 Preferred Preliminary Layout

S.P.7305-124 (TH 23)

FIGURE 2B

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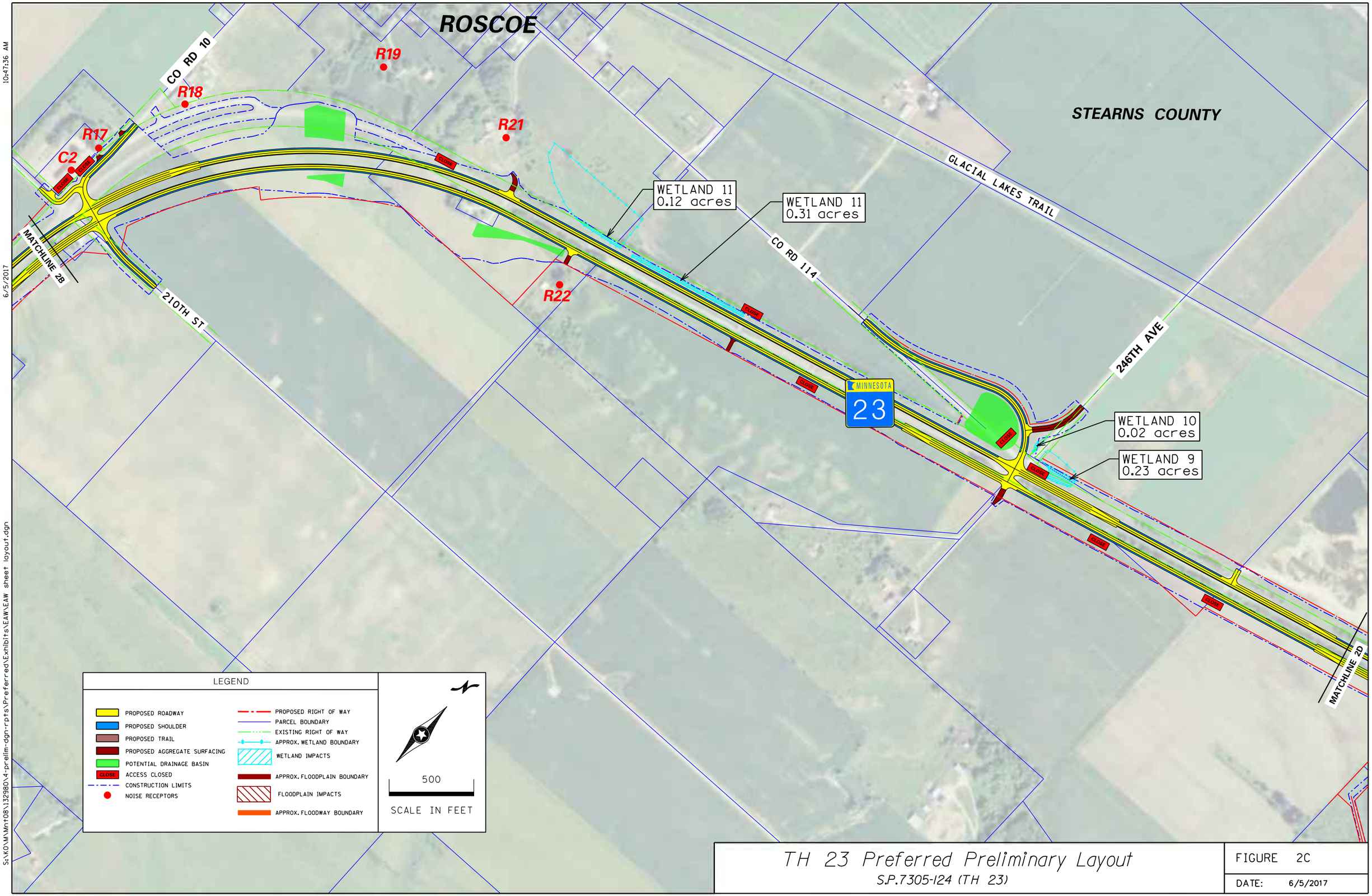

TH 23 Preferred Preliminary Layout

S.P.7305-124 (TH 23)

FIGURE 2C

DATE: 6/5/2017

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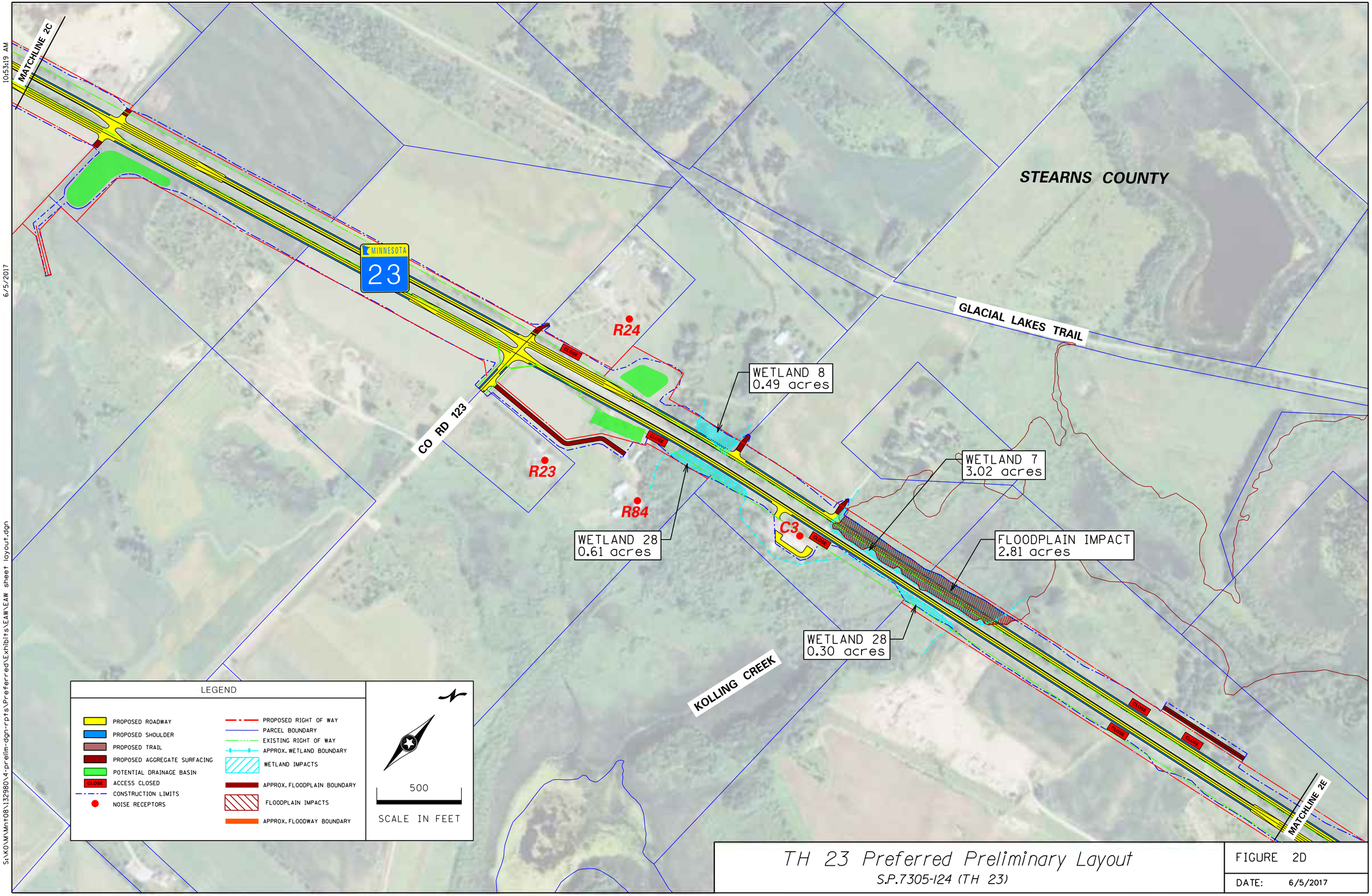

TH 23 Preferred Preliminary Layout

S.P.7305-124 (TH 23)

FIGURE 2D

DATE: 6/5/2017

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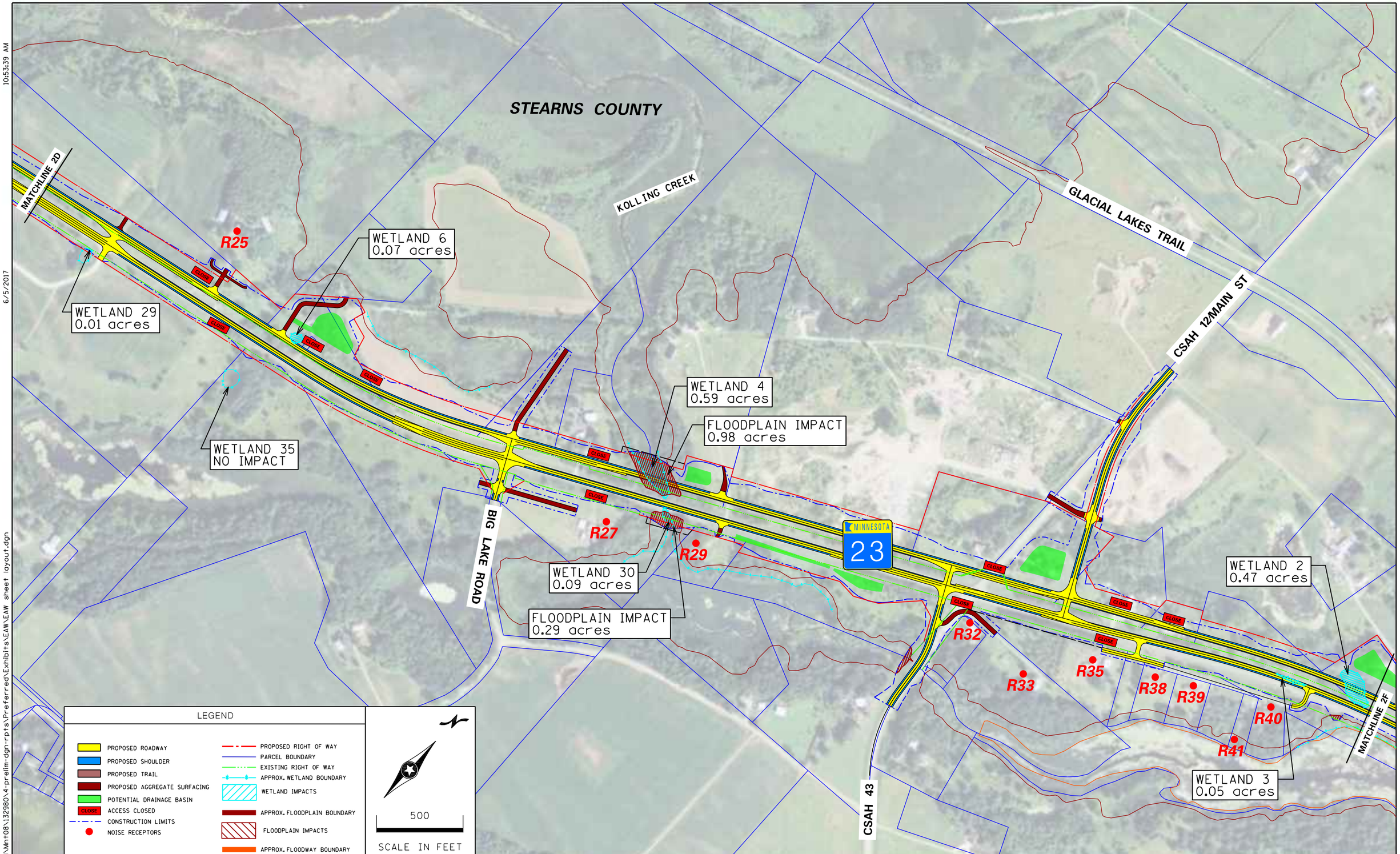

TH 23 Preferred Preliminary Layout

S.P.7305-124 (TH 23)

FIGURE 2E

DATE: 6/5/2017

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6/5/2017

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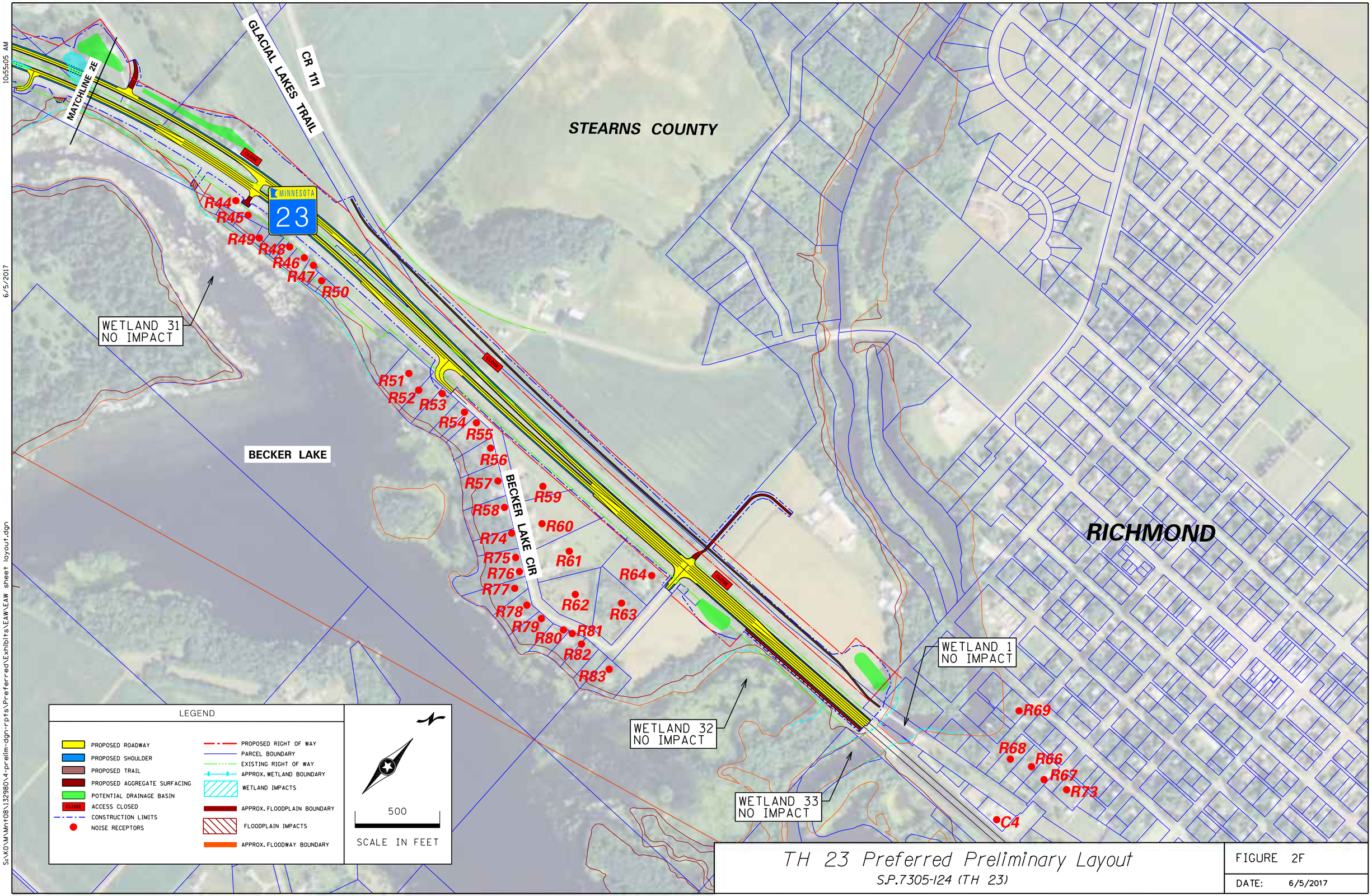
MATCHLINE 2E
GLACIAL LAKES TRAIL
CR 111
STEARNS COUNTY
MINNESOTA
23
CLOSE
R44
R45
R49
R48
R46
R47
R50
WETLAND 31
NO IMPACT
R51
R52
R53
R54
R55
R56
R57
R58
R59
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R82
R83
BECKER LAKE
BECKER LAKE CIR
RICHMOND
WETLAND 1
NO IMPACT
WETLAND 32
NO IMPACT
WETLAND 33
NO IMPACT
R69
R68
R66
R67
R73
C4
LEGEND
PROPOSED ROADWAY
PROPOSED SHOULDER
PROPOSED TRAIL
PROPOSED AGGREGATE SURFACING
POTENTIAL DRAINAGE BASIN
CLOSE ACCESS CLOSED
CONSTRUCTION LIMITS
NOISE RECEPTORS
PROPOSED RIGHT OF WAY
PARCEL BOUNDARY
EXISTING RIGHT OF WAY
APPROX. WETLAND BOUNDARY
WETLAND IMPACTS
APPROX. FLOODPLAIN BOUNDARY
FLOODPLAIN IMPACTS
APPROX. FLOODWAY BOUNDARY
500
SCALE IN FEET
TH 23 Preferred Preliminary Layout
S.P.7305-124 (TH 23)
FIGURE 2F
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6/5/2017
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Appendix C - Glacial Lakes Trail Impact: Alternatives Analysis

SEH
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MEMORANDUM

TO: Craig Johnson, MnDOT; Lance Kalthoff, MnDOT; Ryan Barney, MNDOT

FROM: Lisa Elliott and Mark Benson

DATE: April 11, 2017

RE: S.P. 7305-124 -TH 23 North Gap–Alternatives Analysis-Glacial Lakes Trail

The purpose of this memo is to document the alternative design options that were considered with respect to the current location of the Glacial Lakes Trail at the east end of the proposed TH 23 expansion project. The Glacial Lakes Trail is immediately adjacent to TH 23 for approximately ½ mile starting at the bridge over the Sauk River and extending to the west. A Phase I and II Architectural History Evaluation (completed 2016) recommended Glacial Lakes Trail/ St. Cloud, Mankato, Austin Railroad to be eligible for listing on the National Register of Historic Places. This memo summarizes the comparison of an avoidance option and the preferred alternative, which has been identified as a potential adverse impact to the Glacial Lakes Trail/ St. Cloud, Mankato, Austin Railroad (SN-MUN-041).

The process involved consideration of alternatives to avoid impacting this section of trail. Screening criteria used to evaluate the alternatives included social, environmental, and economic considerations.

No Build Alternative

The No-Build Alternative for this project would be limited to normal pavement maintenance along this segment of TH 23. The No-Build Alternate is used as a basis of comparison, or benchmark for the Build Alternates, and is not a viable option for this project as it does not meet the purpose and need.

Widen on South Side of TH 23

Widening to the south side of existing TH 23 would avoid impacting the Glacial Lakes Trail. However, TH 23 in this area is constrained along the north side by Becker Lake and numerous homes along its shoreline. The proximity of the lake along with its highly erodible steep slopes would not be suitable for construction of the expanded TH corridor. Furthermore numerous wetlands and floodway and floodplain areas would have to be filled in order to accomplish the widening.

Widen on the North Side of TH 23

Widening on the north side of TH 23 will require the realignment of approximately ½ mile of the Glacial Lakes Trail. This would require the acquisition of farmland but would result in restoring the trail and DNR right-of-way to the same width as currently exists.

Evaluation Results

An evaluation matrix was developed to provide a side-by-side comparison of the alternatives (see Attachment 1). The North alignment is considered the preferred alternative due to less acres of wetland impacts, fewer impacted parcels, fewer relocations, less impact to highly erodible soils, no floodplain encroachment, and a lower estimated cost (See Attachment 2).

Attachments: Attachment 1- Evaluation Matrix- Eastern Corridor
Attachment 2- Social and Environmentally Sensitive Areas -Glacial Lakes Trail

TH 23 Paynesville to Richmond 4-lane Gap

Glacial Lakes Trail Impact - Alternatives Analysis

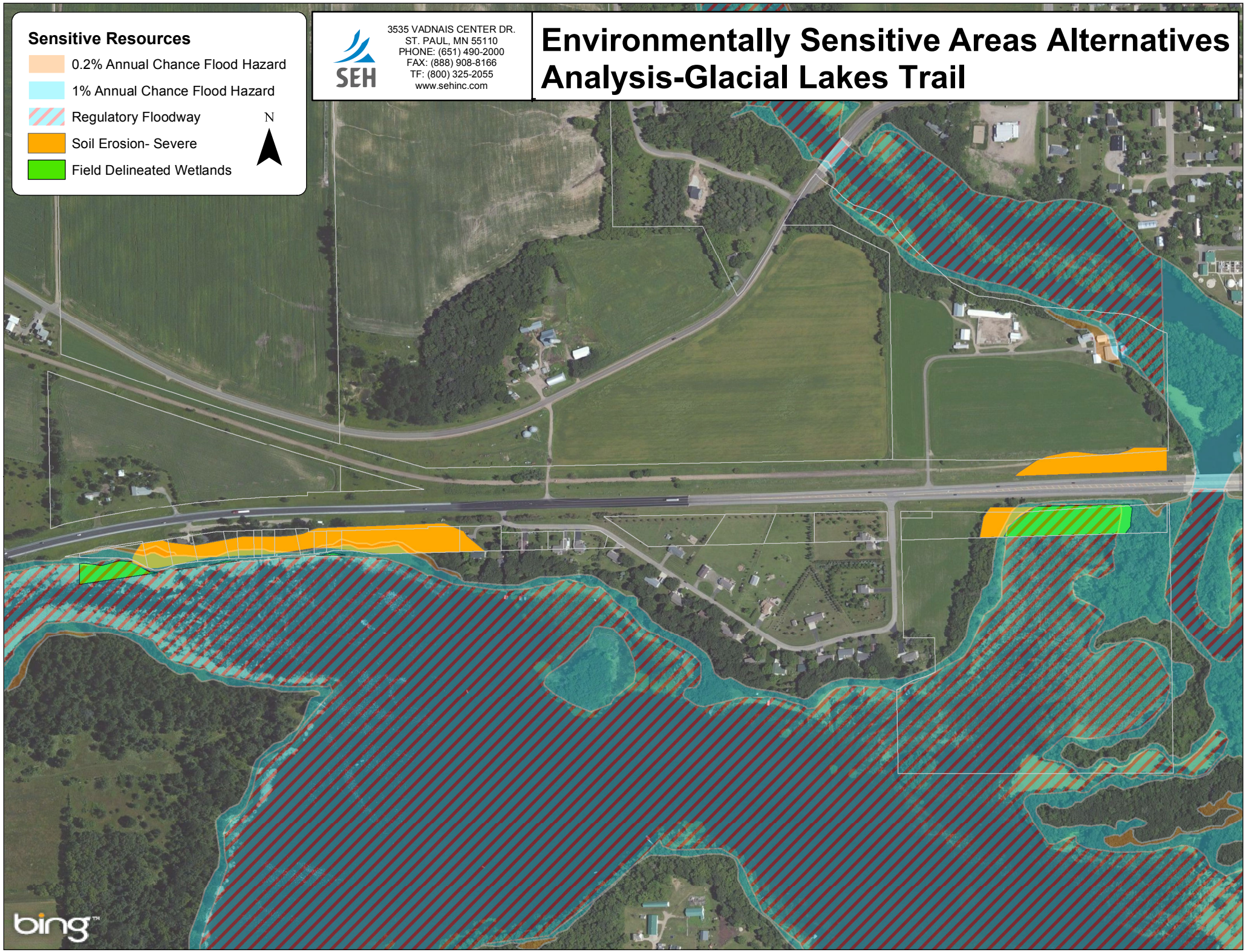
Differentiating Evaluation Criteria - Sauk River bridge to approximate 1/2 mile to the west

Draft: 4/11/2017

EVALUATION CRITERIA	Widen on South Side	Widen on North Side
Social, Environmental and Economic Impacts		
Field Delineated Wetlands (acres)	**9.2**	**0**
Highly Erodible Soils (acres)	**4.5**	**1.6**
Floodway and Floodplain Encroachment	**Yes**	**No**
Right of Way		
# of Parcels Impacted	**26**	**4**
# of Relocations	**13**	**0**
Land Uses impacted	**Residential**	**Farmland**
Cost Considerations		
Relocation ($300,000 Per Home)	**$3,900,000**	**$0**
Wetland Mitigation ($25,000 per acre)	**$460,000**	**$0**
Additional Cost	$4,360,000	$0

Environmentally Sensitive Areas Alternatives Analysis-Glacial Lakes Trail

SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (888) 908-8166
TF: (800) 325-2055
www.sehinc.com



Appendix D - Flood Hazard Maps

Path: S:\KOMM\mt08\132980\Water resources\GIS\Environmentally Sensitive Areas.mxd

SEH

3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (888) 908-8166
TF: (800) 325-2055
www.sehinc.com

Project: MNT08 131699
Print Date: 3/16/2016

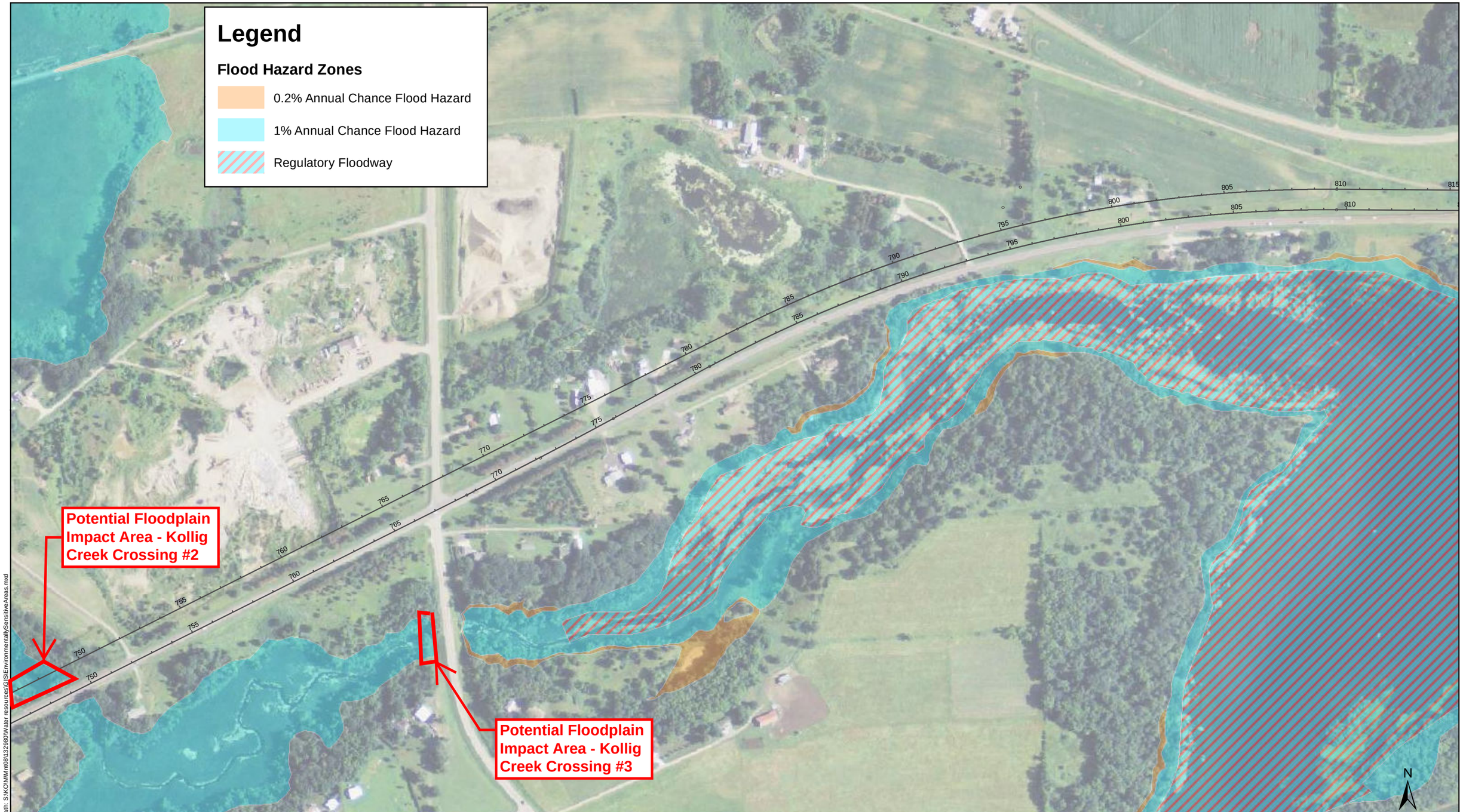
Map by: rsn
Projection:
Source:

FEMA Flood Hazard Zones

TH 23 North Gap Pre-Design and EAW

Paynesville to Richmond, Stearns County, Minnesota

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.



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3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
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Project: MNT08 131699
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TH 23 North Gap Pre-Design and EAW

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Appendix E - USDA NRCS Soils Reports

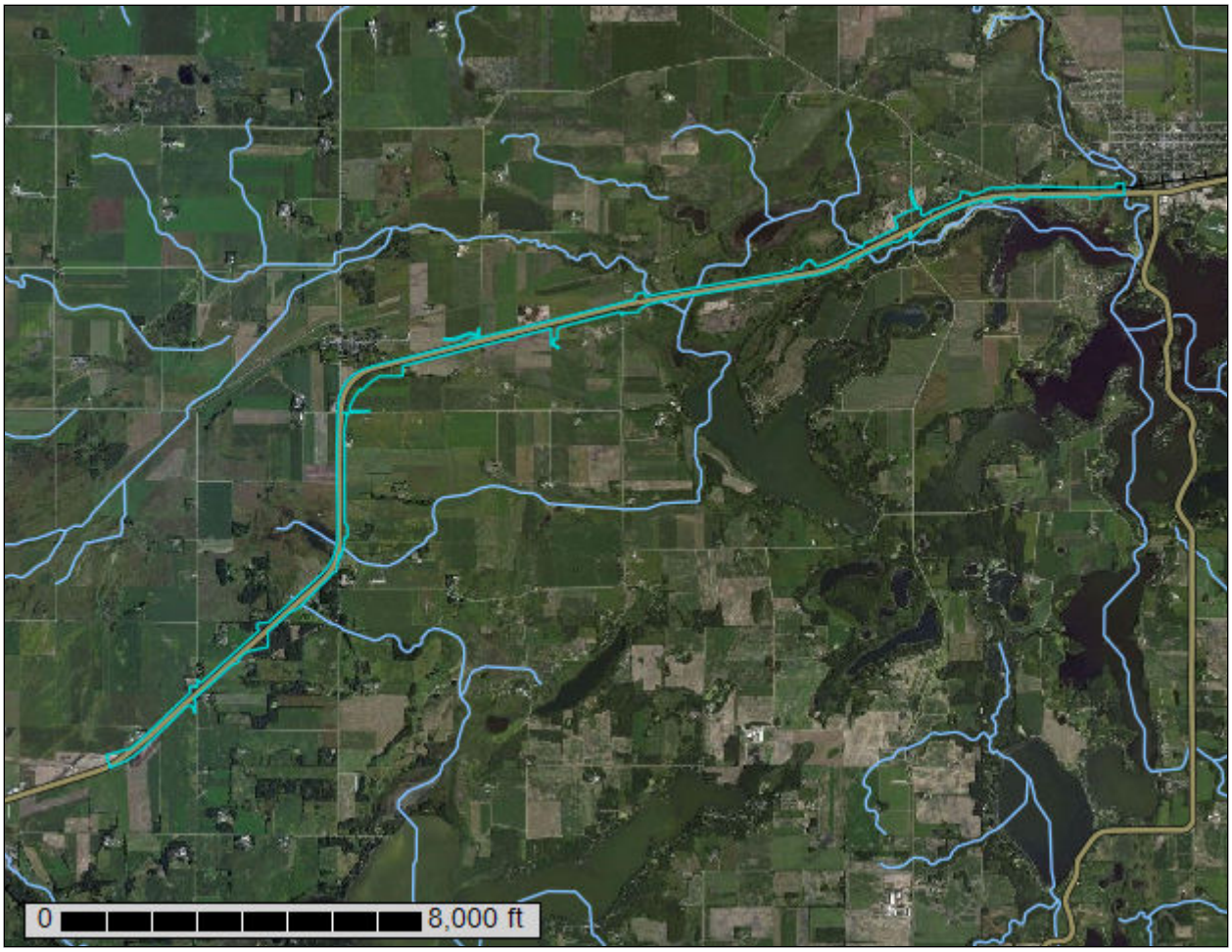
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Stearns County, Minnesota

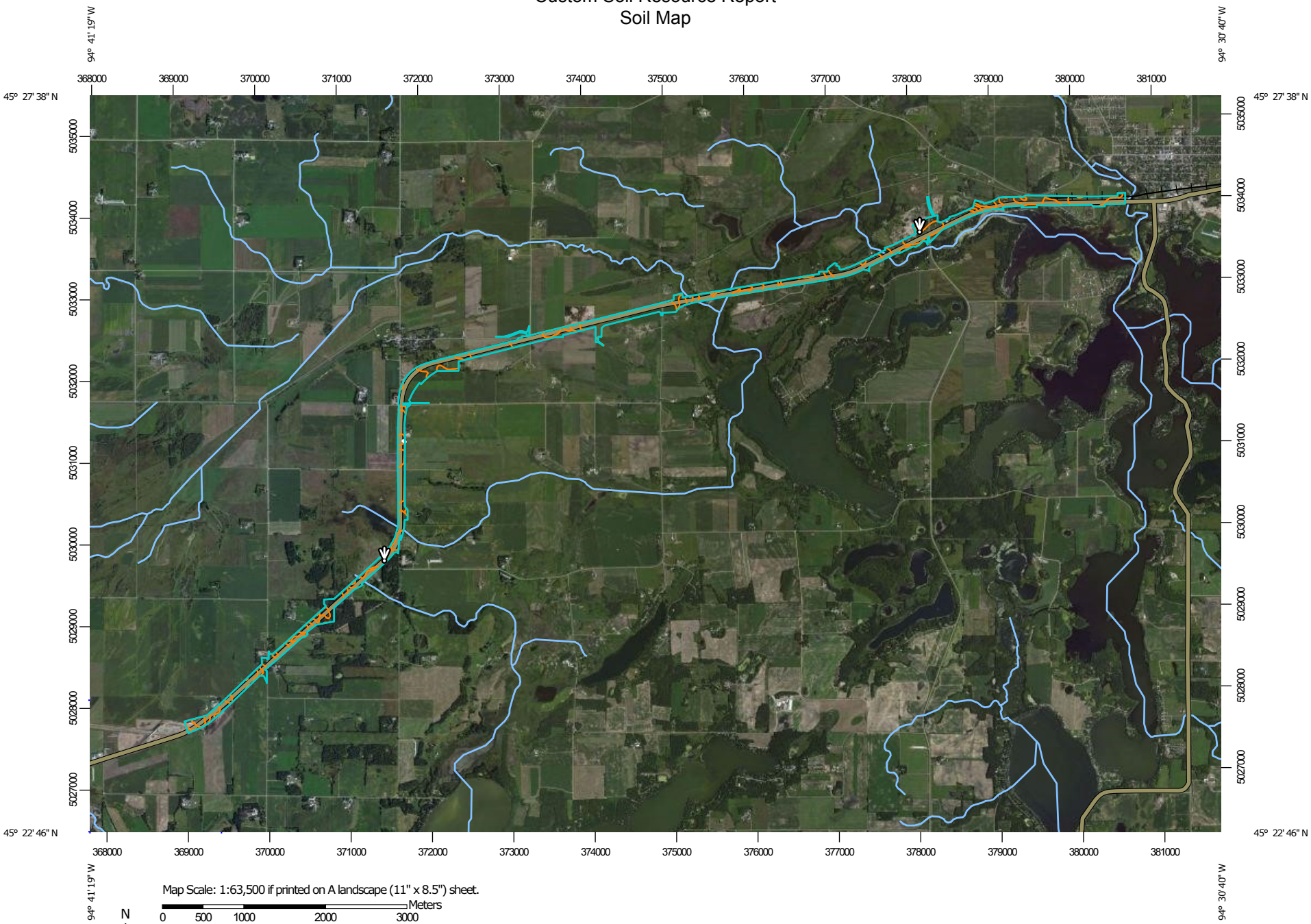


April 12, 2017

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:63,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 500 1000 2000 3000

Feet: 0 3000 6000 12000 18000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

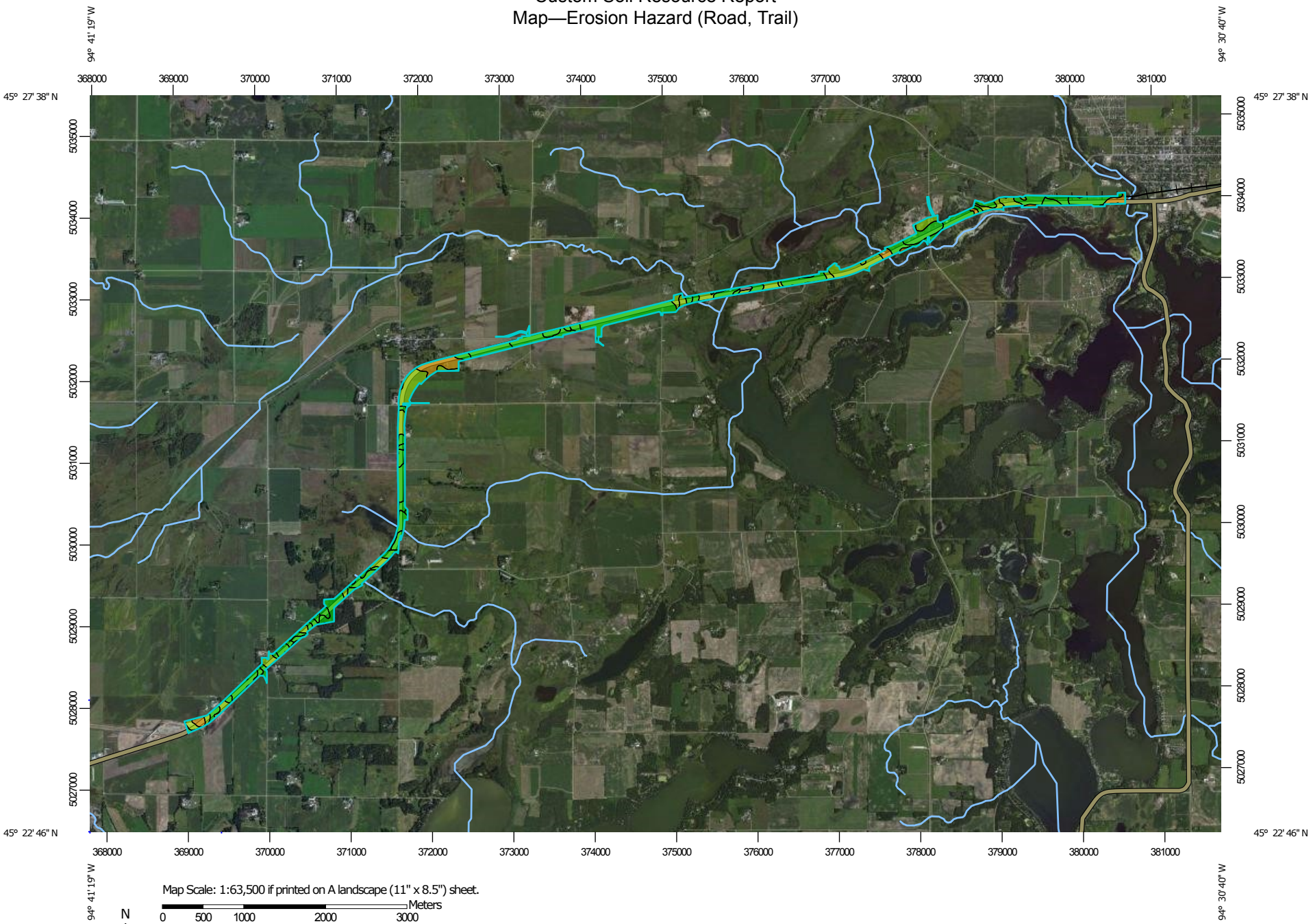
Soil Survey Area: Stearns County, Minnesota
Survey Area Data: Version 14, Sep 19, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 18, 2011—Sep 7, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map—Erosion Hazard (Road, Trail)



Map Scale: 1:63,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 500 1000 2000 3000

Feet: 0 3000 6000 12000 18000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Very severe

Severe

Moderate

Slight

Not rated or not available

Soil Rating Lines

Very severe

Severe

Moderate

Slight

Not rated or not available

Soil Rating Points

Very severe

Severe

Moderate

Slight

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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Date(s) aerial images were photographed: May 18, 2011—Sep 7, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Tables—Erosion Hazard (Road, Trail)

Erosion Hazard (Road, Trail)— Summary by Map Unit — Stearns County, Minnesota (MN145)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
7A	Hubbard loamy sand, 0 to 2 percent slopes	Slight	Hubbard (90%)		0.8	0.2%
41B	Estherville sandy loam, 2 to 6 percent slopes	Slight	Estherville (85%)		6.6	1.7%
			Dickinson (8%)			
			Biscay (1%)			
156A	Fairhaven loam, 0 to 2 percent slopes	Slight	Fairhaven (90%)		1.4	0.4%
156B	Fairhaven loam, 2 to 6 percent slopes	Moderate	Fairhaven (90%)	Slope/erodibility (0.50)	0.1	0.0%
255	Marysland loam, 0 to 2 percent slopes	Slight	Marysland (75%)		1.7	0.4%
			Malachy (10%)			
			Vallers, sandy substratum (8%)			
			Arveson (5%)			
			Marysland, occasionally ponded (2%)			
281	Darfur coarse sandy loam	Slight	Darfur (90%)		2.9	0.7%
327A	Sverdrup sandy loam, Sandy Outwash, 0 to 2 percent slopes	Slight	Sverdrup (70%)		5.2	1.3%
			Hubbard (10%)			
			Duelm (10%)			
			Sandberg (5%)			
			Fordville (3%)			
			Forada (2%)			
327B	Sverdrup sandy loam, Sandy Outwash, 2 to 6 percent slopes	Slight	Sverdrup (70%)		8.6	2.2%
			Duelm (10%)			
			Hubbard (10%)			
			Sandberg (5%)			
			Fordville (3%)			
			Forada (2%)			
392	Biscay loam	Slight	Biscay (90%)		9.3	2.4%
413	Osakis loam	Slight	Osakis (90%)		3.7	0.9%
459	Corunna loam	Slight	Corunna (95%)		4.2	1.1%
540	Seelyeville-Seelyeville,	Slight	Seelyeville (55%)		5.1	1.3%

Erosion Hazard (Road, Trail)— Summary by Map Unit — Stearns County, Minnesota (MN145)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
	ponded, complex, 0 to 1 percent slopes		Seelyeville, ponded (45%)			
543	Markey muck, occasionally ponded, 0 to 1 percent slopes	Slight	Markey, occasionally ponded (85%)		1.4	0.4%
			Markey, frequently ponded (10%)			
			Seelyeville (5%)			
544	Cathro muck, occasionally ponded, 0 to 1 percent slopes	Slight	Cathro, occasionally ponded (85%)		6.9	1.7%
			Cathro, frequently ponded (10%)			
			Seelyeville (5%)			
566	Regal loam	Slight	Regal (90%)		14.5	3.7%
572	Lowlein sandy loam	Slight	Lowlein (90%)		2.3	0.6%
611C	Hawick loamy sand, 6 to 12 percent slopes	Moderate	Hawick (90%)	Slope/erodibility (0.50)	22.2	5.7%
611D	Hawick loamy sand, 12 to 40 percent slopes	Severe	Hawick (95%)	Slope/erodibility (0.95)	12.0	3.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	Moderate	Estherville (55%)	Slope/erodibility (0.50)	32.3	8.2%
1016	Udorthents, loamy	Not rated	Udorthents, loamy (100%)		1.5	0.4%
1018	Udifluvents, frequently flooded	Slight	Udifluvents, frequently flooded (90%)		0.1	0.0%
D105A	Arvilla sandy loam, 0 to 2 percent slopes	Slight	Arvilla (85%)		83.1	21.2%
			Sandberg (5%)			
			Fordville (5%)			
			Osakis (3%)			
			Forada (2%)			
D105B	Arvilla sandy loam, 2 to 6 percent slopes	Slight	Arvilla (85%)		38.4	9.8%
			Fordville (5%)			
			Sandberg (5%)			
			Osakis (3%)			
			Forada (2%)			

Erosion Hazard (Road, Trail)— Summary by Map Unit — Stearns County, Minnesota (MN145)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
L307B	Koronis loam, 2 to 6 percent slopes	Moderate	Koronis (80%)	Slope/erodibility (0.50)	49.0	12.5%
			Sunburg (5%)	Slope/erodibility (0.50)		
L307C2	Koronis loam, 6 to 12 percent slopes, moderately eroded	Severe	Koronis, moderately eroded (75%)	Slope/erodibility (0.95)	0.1	0.0%
			Sunburg (10%)	Slope/erodibility (0.95)		
L317A	Barry loam, 0 to 2 percent slopes	Slight	Barry (85%)		20.2	5.1%
			Marcellon (10%)			
			Lundlake (5%)			
L321A	Swedegrove loam, 0 to 2 percent slopes	Slight	Swedegrove (85%)		0.5	0.1%
			Lundlake (5%)			
			Crowriver (5%)			
			Seaforth, lundlake catena (5%)			
L324A	Forestcity, overwash-Forestcity complex, 1 to 4 percent slopes	Slight	Forestcity, overwash (45%)		1.2	0.3%
			Forestcity (40%)			
			Lundlake (10%)			
			Marcellon (5%)			
L326B	Rohrbeck-Koronis complex, 1 to 6 percent slopes	Slight	Rohrbeck (55%)		8.8	2.2%
			Barry (8%)			
			Lundlake (2%)			
L330A	Muskego, Blue Earth and Houghton soils, lundlake catena, 0 to 1 percent slopes, ponded	Slight	Houghton, ponded (30%)		2.7	0.7%
			Muskego, ponded (30%)			
			Blue Earth, ponded (30%)			
			Klossner, lundlake catena, ponded (10%)			
L335A	Klossner soils, lundlake catena, 0 to 1 percent slopes	Slight	Klossner, surface drained, lundlake catena (65%)		0.3	0.1%
			Klossner, drained, lundlake catena (20%)			

Erosion Hazard (Road, Trail)— Summary by Map Unit — Stearns County, Minnesota (MN145)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Lundlake (15%)			
L350A	Marcellon loam, 0 to 3 percent slopes	Slight	Marcellon (85%)		26.4	6.7%
			Barry (8%)			
			Lundlake (2%)			
L356D2	Sunburg-Wadenill complex, 12 to 18 percent slopes, moderately eroded	Severe	Sunburg, moderately eroded (70%)	Slope/erodibility (0.95)	15.6	4.0%
			Wadenill, moderately eroded (20%)	Slope/erodibility (0.95)		
			Ridgeton (5%)	Slope/erodibility (0.95)		
L357D2	Koronis-Sunburg complex, 12 to 18 percent slopes, moderately eroded	Severe	Koronis, moderately eroded (65%)	Slope/erodibility (0.95)	3.6	0.9%
			Sunburg, moderately eroded (20%)	Slope/erodibility (0.95)		
			Ridgeton (10%)	Slope/erodibility (0.95)		
W	Water	Not rated	Water (100%)		0.4	0.1%
Totals for Area of Interest					**393.0**	**100.0%**

Erosion Hazard (Road, Trail)— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Slight	256.1	65.2%
Moderate	103.6	26.4%
Severe	31.3	8.0%
Null or Not Rated	1.9	0.5%
Totals for Area of Interest	**393.0**	**100.0%**

Rating Options—Erosion Hazard (Road, Trail)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix F – Early Notification Memo: MNDNR Response

FW: DNR comments on MnDOT Early Notification Memo, proposed TH23 2-lane to 4-lane proejct Richmond to Waseca, Stearns Co (SP7305-124)
Kalthoff, Lance (DOT)
to:
Lisa Elliott
04/12/2017 02:19 PM
Cc:
Mark Benson, Bob Rogers
Hide Details
From: "Kalthoff, Lance (DOT)" <lance.kalthoff@state.mn.us>
To: Lisa Elliott <lelliott@sehinc.com>
Cc: Mark Benson <mbenson@sehinc.com>, Bob Rogers <brogers@sehinc.com>
History: This message has been replied to.

5 Attachments

ENM_SP_7305-124_TH_23_North_Gap_Complete_COMPR.PDF DNRbasemap(April2017).pdf
DNR GP2004-0001copy.pdf Fish Passage & Work Exclusion dates (from Chapter 2).pdf AES.pdf

Hi Lisa,

Peter has just completed his review for the ENM for the TH 23 North Gap. His ENM response is attached.

Thanks,
Lance

From: Leete, Peter (DOT)
Sent: Wednesday, April 12, 2017 2:13 PM
To: Kalthoff, Lance (DOT) <lance.kalthoff@state.mn.us>; Wilts, Brent (DOT) <brent.wilts@state.mn.us>
Cc: Hanson, Trygve J (DNR) <trygve.hanson@state.mn.us>; Stangler, Michael (DOT) <mike.stangler@state.mn.us>; Pederson, Nathan A (DOT) <nathan.pederson@state.mn.us>; Straumanis, Sarma (DOT) <sarma.straumanis@state.mn.us>; Smith, Christopher E (DOT) <christopher.e.smith@state.mn.us>; Joyal, Lisa (DNR) <lisa.joyal@state.mn.us>; Orne, Benjamin G MVP <Benjamin.G.Orne@usace.army.mil>; Horton, Becky (DNR) <becky.horton@state.mn.us>; Stewig, Joe (DNR) <joe.stewig@state.mn.us>; Edgeton, Tim (DNR) <tim.edgeton@state.mn.us>; Blake-Bradley, Nicola (DNR) <nicola.blake-bradley@state.mn.us>; Bengtson, Fred (DNR) <fred.bengtson@state.mn.us>; Hoaglund, Erica (DNR) <erica.hoaglund@state.mn.us>
Subject: DNR comments on MnDOT Early Notification Memo, proposed TH23 2-lane to 4-lane proejct Richmond to Waseca, Stearns Co (SP7305-124)

Hi,
This email is the DNR response for your project records. I have not sent this Early Notification Memo (ENM) out for full DNR review. The following comments are based on information provided in the submitted documents regarding the proposed expansion of TH23 from a 2-lane road to a 4-lane road between Richmond and Paynesville. The project is currently at the very early stages of environmental documentation, with an unknown construction date. Be aware that details provided here are mainly for environmental documentation and that DNR requirements for final design may change by the time the projects final designs and special provisions are drafted. Though please incorporate the following comments into project documentation as they are developed:

1. For MnDOT planning purposes, attached to this email is a map of the project area (DNRbasemap.pdf) showing nearby locations of DNR areas concern (if they exist), such as Public Waters (in blue), waterbodies designated as infested with aquatic invasive species (AIS), snowmobile Trails (in pink), and various green shaded polygons for Sites of Biodiversity Significance. This map may be shared or included in project documentation, as all information is from publically available data layers. Most of this information is also available on the MnDOT georilla website (http://georilla/metrogis/#) in the natural resources catalog (DNR ENM). The Natural Heritage Information System (NHIS) database has been reviewed, though in order to prevent the inadvertent release of a rare features location, those details are not shown on the map. Comments on potential impacts to rare features listed in the NHIS comments are below. If you have questions regarding proposed work near any of the data shown, please give me a call.

2. TH23 has three crossings of Kolling Creek. All three crossings will require modification or replacement. As such a DNR Public Waters Work Permit will be required. Authorization for the project under the DNR General Permit (GP2004-0001) will require final review at a later date. At that time, enter the project into the DNR online permitting system (MPARS): www.dnr.state.mn.us/mpars. A copy of GP2004-0001 is attached, please review all the conditions of this permit and integrate their requirements into project design. Please contact me if you have questions on any of its requirements. Specific items to incorporate into design and construction are:

   a. As the project moves forward, design of the crossing should meet the conditions listed in GP 2004-0001: http://files.dnr.state.mn.us/waters/watermgmt_section/pwpermits/General_Permit_2004-0001.pdf. Additional information, including options on how to meet the conditions of the GP are presented in the collection of ' Best Practices for Meeting GP 2004-0001', at http://www.dnr.state.mn.us/waters/watermgmt_section/pwpermits/gp_2004_0001_manual.html

   b. We typically limit work in the water (Work Exclusion dates) to allow for undisturbed fish migration and spawning. These dates are March 15 through June 15. While we may revise these dates for a particular project, there may still be limitations on the types of work during this time.

   c. Be aware that the design for replacement of Public Waters crossings will need to meet design criteria for fish passage (see attached info sheet).

   d. Please be aware that the MPCA NPDES general permit for authorization to discharge stormwater associated with construction activities (permit MN R10001) recognizes the DNR "work in water restrictions" during specified fish migration and spawning time frames for areas adjacent to water. During the restriction period, all exposed soil areas that are within 200 feet of the water's edge and drain to these waters, must have erosion prevention stabilization activities initiated immediately after soil disturbing activity has ceased (and be completed within 24 hours).

   e. Construction and demolition methods shall be submitted for review and approval at a later date. See the GP2004-0001 condition 'TEMPORARY IMPACTS DURING CONSTRUCTION' and items 'A' though 'L' for subjected conditions. This is normal procedure for bridge or culvert projects as we recognize that construction methods are not finalized until a contractor is chosen. Construction contractors shall be made aware of this condition as they may be held responsible for compliance.

   f. Revegetation of disturbed soils should include native mixes in areas that are not proposed for mowed turf grass. Please utilize the native recommendations developed by BWSR (http://www.bwsr.state.mn.us/native_vegetation/) or MnDOT' in the 'Vegetation Establishment Recommendations' – dated November 13, 2015 (http://www.dot.state.mn.us/environment/erosion/seedmixes.html). In addition, for meeting DNR

concerns, revegetation may include woody vegetation (trees and shrubs) in addition to grasses and/or forbs. Please contact your Districts representatives for the Erosion Control & Stormwater Management Unit, Roadside Vegetation Management Unit, and the Districts Maintenance staff to help determine appropriate permanent revegetation plans. Additionally, any use of Category 3 or 4 erosion control blanket shall be limited to 'bio-netting' or 'naturalnetting' types (category 3N or 4N), and specifically not allow plastic mesh netting.

g. There is one more Public Waters adjacent to TH23 in the project area: Becker Lake #73015600. Fill into this lake should be avoided. Should plans include work other work within the Ordinary High Water (OHW) elevation, such as stormwater outfalls, the items above would apply to this location as well.

3. The Minnesota Natural Heritage Information System (NHIS) has been queried to determine if any rare plant or animal species, native plant communities, or other significant natural features are known to occur within an approximate one-mile radius of the project area. There were over a dozen rare features identified in this query. In order to prevent the inadvertent release of the location of specific listed or rare species contained in the NHIS, I have not identified the species or their location on the attached 'DNRbasemap.pdf'. If these details are needed for documentation, please contact me. Please note that the following rare features were identified in the query and *may* be impacted by the proposed project. Suggested avoidance and/or protection measures are also identified:

a. Two of the crossings of Kolling Creek are identified as also being a Site of Biodiversity significance, also ranked 'high', for its composition. These are located at approximately RP182.5 – 183.0 and RP183.7-183.9. 'High' sites contain very good quality occurrences of the rarest species, high-quality examples of rare native plant communities, and/or important functional landscapes. These areas should be identified as an 'Area of Environmental Sensitivity' on plans. See the attached AES best practices guidance. The concern along this segment is that soil disturbance, incidental herbicide exposure, hydrologic alterations, tree disturbance, competition from non-native, sod-forming grasses, introduction of weed seeds, or shading by encroaching shrubs can all lead to degradation of these sites.

Revegetation of disturbed soils should include native mixes suitable to the local habitat in areas that are not proposed for mowed turf grass. Please utilize the native recommendations developed by BWSR (http://www.bwsr.state.mn.us/native_vegetation/) or MnDOT' in the 'Vegetation Establishment Recommendations' – dated November 13, 2015 (http://www.dot.state.mn.us/environment/erosion/seedmixes.html). In addition, for meeting DNR concerns, revegetation may include woody vegetation (trees and shrubs) in addition to grasses and/or forbs. Please contact your Districts representatives for the Erosion Control & Stormwater Management Unit, Roadside Vegetation Management Unit, and the Districts Maintenance staff to help determine appropriate permanent revegetation plans Additionally, any use of Category 3 or 4 erosion control blanket shall be limited to 'bio-netting' or 'naturalnetting' types (category 3N or 4N), and specifically not allow plastic mesh netting.

The Natural Heritage Information System (NHIS) is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. If information becomes available indicating additional listed species or other rare features, further review may be necessary.

4. The northern long-eared bat (*Myotis septentrionalis*), federally listed as threatened and state-listed as special concern, can be found throughout Minnesota. During the winter this species hibernates in caves and mines, and during the active season (approximately April-October) it roosts underneath bark, in

cavities, or in crevices of both live and dead trees. Pup rearing is during June and July. Activities that may impact this species include, but are not limited to, any disturbance to hibernacula and destruction/degradation of habitat (including tree removal).

The U.S. Fish and Wildlife Service (USFWS) has published a final 4(d) rule that identifies prohibited take. To determine whether you need to contact the USFWS, please refer to the USFWS Key to the Northern Long-Eared Bat 4(d) Rule (see links below). Please note that the NHIS does not contain any known occurrences of northern long-eared bat roosts or hibernacula within an approximate one-mile radius of the proposed project.

Links: USFWS Key to the Northern Long-Eared Bat 4(d) Rule for Non-Federal Activities
http://www.fws.gov/midwest/endangered/mammals/nleb/KeyFinal4dNLEB.html
USFWS Key to the Northern Long-Eared Bat 4(d) Rule for Federal Actions

http://www.fws.gov/midwest/endangered/mammals/nleb/KeyFinal4dNLEBFedProjects.html
USFWS Northern Long-eared Bat Website
http://www.fws.gov/midwest/endangered/mammals/nleb/index.html
USFWS Northern Long-eared Bat Fact Sheet
http://www.fws.gov/midwest/endangered/mammals/nleb/nlebFactSheet.html

5. A component of this project is to re-align the Glacial Lakes State Trail. Information on the trail may be found here: http://www.dnr.state.mn.us/state_trails/glacial_lakes/index.html. MnDOT coordination has been ongoing with the DNR Parks and Trails Acquisition and Development Specialist (Trygve Hanson). Please continue to work with Trygve as the project develops.

This ENM has not been circulated to DNR field staff for comment. I will let you know if any additional comments on design requirements are returned to me due to this email.

DNR folks, if I've missed anything, or have any suggestions for MnDOT to consider, please respond ASAP to Lance, and myself.

Contact me if you have questions

Peter Leete
Transportation Hydrologist (DNR-MnDOT Liaison) | Division of Ecological & Water Resources

Minnesota Department of Natural Resources
Office location: MnDOT Office of Environmental Stewardship
395 John Ireland Blvd., MS 620
St. Paul, MN 55155
Phone: 651-366-3634
Email: peter.leete@state.mn.us

Unnamed Stream
Kolling Creek
Willow - Dogwood Shrub Swamp
Spirit Prairie WMA
Mesic Prairie (Southern)
Wet Prairie (Southern)
Willow - Dogwood Shrub Swamp
Willow - Dogwood Shrub Swamp
Cattail Marsh (Northern)
Roscoe Prairie
Mesic Prairie (Southern)
Willow - Dogwood Shrub Swamp
Partners WMA
Roscoe
STEARNS COUNTY WATERFOWL PRODUCTION AREA
180
181
182
183
184
185
186
179
178
177
176
MN23
Raush Marsh (73044900)W
Rich Fen (Prairie Seepage)
Mesic Prairie (Southern)
Sedge Meadow
Mesic Prairie (Southern)
Mesic Prairie (Southern)
Glacial Lakes State Trail
Sedge Meadow
Roschien (73015500)W
Wet Prairie (Southern)
Sedge Meadow
Kolling Creek
Unnamed (73044800)W
Unnamed (73045000)W
Sauk River
Sauk River
Sauk River
Richmond
Becker (73015600)P
Schroeder (73015800)W
Becker (73015600)P
Cedar Island (East Lk) (73013304)P
Cedar Island (East Lk) (73013304)P
Cedar Island (East Lk) (73013304)P
Unnamed (73044700)W
Cedar Island (Koetter Lk) (73013303)P
Cedar Island (Main Bay) (73013301)P
Horseshoe (73015700)P
Cedar Island (Main Bay) (73013301)P
Unnamed Stream
Dry Sand - Gravel Prairie (Southern)
Dry Sand - Gravel Prairie (Southern)
Big (73015900)P
Calcareous Fen (Southeastern)
Dry Sand - Gravel Prairie (Southern)
Dry Sand - Gravel Prairie (Southern)
Dry Sand - Gravel Prairie (Southern)
Dry Sand - Gravel Prairie (Southern)
Dry Sand - Gravel Prairie (Southern)
Voss Slough (73014500)W
Voss Slough (73014500)W
Unnamed (73037300)W
Pirz (73014400)P
Unnamed (73014600)W
Pirz (73014400)P
Meyers (73014300)W
Not Designated

0 0.25 0.5 1 Miles

N

West project limits

see page 2

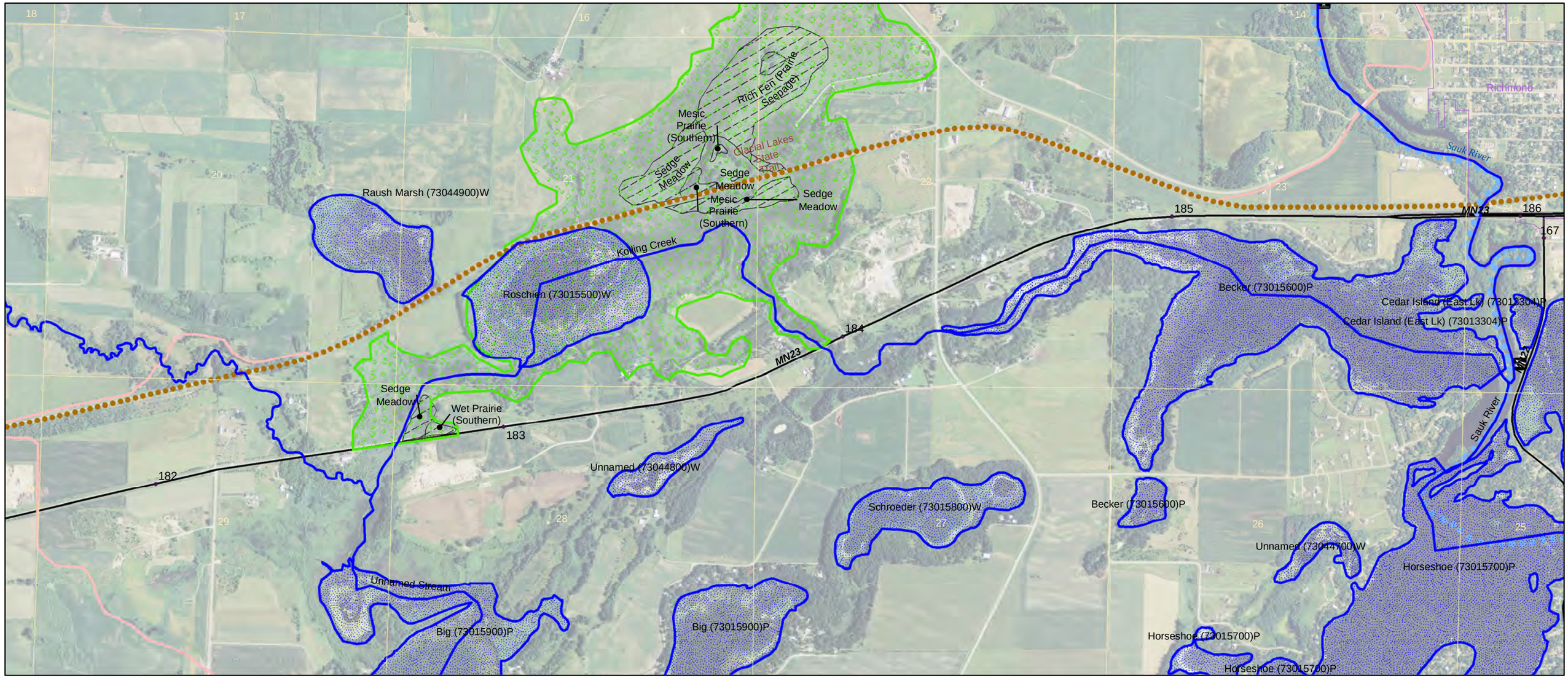
East Project limits

TH23 2-lane to 4-lane (North Gap) (SP7305-124)

- USFWS Waterfowl Production Areas (Current)
- Public Water Watercourse
- Public Ditch/Altered Natural Watercourse
- Public Waters Basins
- Public Access - Carry-In
- Public Access - Trailer Launch
- Scientific and Natural Area - SNA
- Wildlife Management Area - WMA
- Minnesota Water Trails
- Minnesota State Trails
- Local Snowmobile Trails
- Site of Biodiversity Significance - High
- Site of Biodiversity Significance - Moderate
- DNR Native Plant Communities (w/description)

Peter Leete, Transportation Hydrologist
(MnDNR-MnDOT Liaison)

Date: 4/12/2017



0 0.25 0.5 1 Miles

N

TH23 2-lane to 4-lane (North Gap) (SP7305-124)

- Public Water Watercourse
- Public Waters Basins
- Public Access - Carry-In
- Public Access - Trailer Launch
- Minnesota Water Trails
- Minnesota State Trails
- Local Snowmobile Trails
- Site of Biodiversity Significance - High
- DNR Native Plant Communities (w/description)

Peter Leete, Transportation Hydrologist
(MnDNR-MnDOT Liaison)

Date: 4/12/2017

Protection Measures for Areas of Environmental Sensitivity (AES)

An Area of Environmental Sensitivity (AES) is a generic term to be utilized on plans to identify an area as containing unique characteristics that needs specific protection during construction. These areas may be any area that is identified for added protection due to habitat, wildlife, cultural resources/properties, ecological significance, geological features, visual quality, or its sensitivity to disturbance.

Areas identified on plans as an AES shall not be disturbed during construction. Commonly the actual area to be protected is adjacent to the right of way corridor and the AES identifier is utilized as a buffer. The concern is that soil disturbance, incidental herbicide exposure, hydrologic alterations, tree disturbance, competition from non-native, sod-forming grasses, introduction of weed seeds, or shading by encroaching shrubs can all lead to degradation of these sites.

MnDOT projects must adhere to processes and application of measures consistent with, but limited to, the MnDOT Highway Project Development Process Handbook (HPDP), 2014 Standard Specifications For Construction; Section 2572 (Protection and Restoration of Vegetation), and Section 2101 (Clearing and Grubbing), of which key aspects are listed below:

Examples of an Area of Environmental Sensitivity:
Not all Areas of Environmental Sensitivity (AES) are equal. Many may have stringent levels of regulatory protection on their own, such as Threatened and Endangered Species. However, identifying a site as an AES is to be considered as a generic "stay out of this area" for construction purposes and does not have to reveal the reason for the designation. Typical examples are:

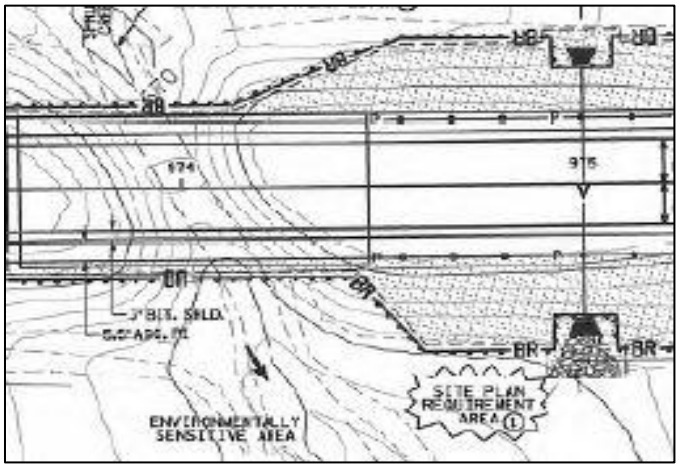
- Wetlands that are not permitted for construction activities.
- Open Water (such as DNR Public Waters, and other perennial streams and waterbodies)
- Trout Lakes and Streams along with their source springs.
- Calcareous Fens. These are identified in 'native plant communities' though due to their unique relationship with groundwater. Impacts to groundwater may also require separate analysis and protection.
- Impaired waters, Special Waters, and/or Outstanding Resource Value Waters (ORVW) as designated by the MPCA. http://pca-gis02.pca.state.mn.us/CSW/index.html.
- Wooded areas with Specimen Trees, or other permanent vegetation designated for preservation.
- Prairie remnants, including but not limited to areas adjacent to Railroad Rights-of-way Prairies.
- 'Sites of Biodiversity Significance' areas designated by the DNR Biological Survey. These sites contain varying levels of native biodiversity such as high quality 'Native Plant Communities', rare plants, rare animals, and/or animal aggregations. http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html.
- 'Native Plant Community' areas designated by the DNR Biological Survey. Native plant communities are classified and described by considering vegetation, hydrology, landforms, soils, and natural disturbance regimes. http://www.dnr.state.mn.us/npc/index.html.
- Federal or State listed species, and their habitat.
- Historical sites
- Any natural scenic elements, such as geological features not to be disturbed as designated by project planners, project managers, or project inspectors

Best Practices:
1. Design the project to avoid impacts to identified Area of Environmental Sensitivity.
2. Design and construction should incorporate protection and/or enhancement of adjacent AES features.
3. Label identified Areas of Environmental Sensitivity on all plans.
4. Drainage into Areas of Environmental Sensitivity may also have limitations on impacts.

In situations where work in or adjacent to an AES is authorized:
1. Prior to in-water work in an AES, check to see if a Mussel Survey is required.
2. Protect and preserve vegetation from damage in accordance with MnDOT Spec 2572.3
3. Prohibit vehicle and construction activities, including the location of field offices, storage of equipment and other supplies at least 25 feet outside the dripline of trees or other identified Area of Environmental Sensitivity to be preserved, also in accordance with MnDOT spec 2572.3
4. In areas where there are large or numerous separate of areas to protect, it may be preferred to identify those areas that are OK to be utilized, and have all other areas designated off limits for parking, staging, and/or stockpiling of materials.

5. Walk the perimeter of a sensitive area with the grading foreman so that all personnel understand and agree on the hard edge of the sensitive area.
6. Redundant sediment/erosion control Best Management Practices (BMP's) may be required for protection of areas of environmental sensitivity.
7. Revegetate disturbed soils with native species suitable to the local habitat. Revegetation plans may include woody vegetation (trees and shrubs) in addition to grasses and/or forbs.
8. Coordinate with MnDOT Office of Environmental Stewardship and/or the DNR if an Area of Environmental sensitivity is accidentally disturbed or damaged.
9. Relocate plants if harm is unavoidable (see Information on Transplanting Wildflowers and Other Plants).

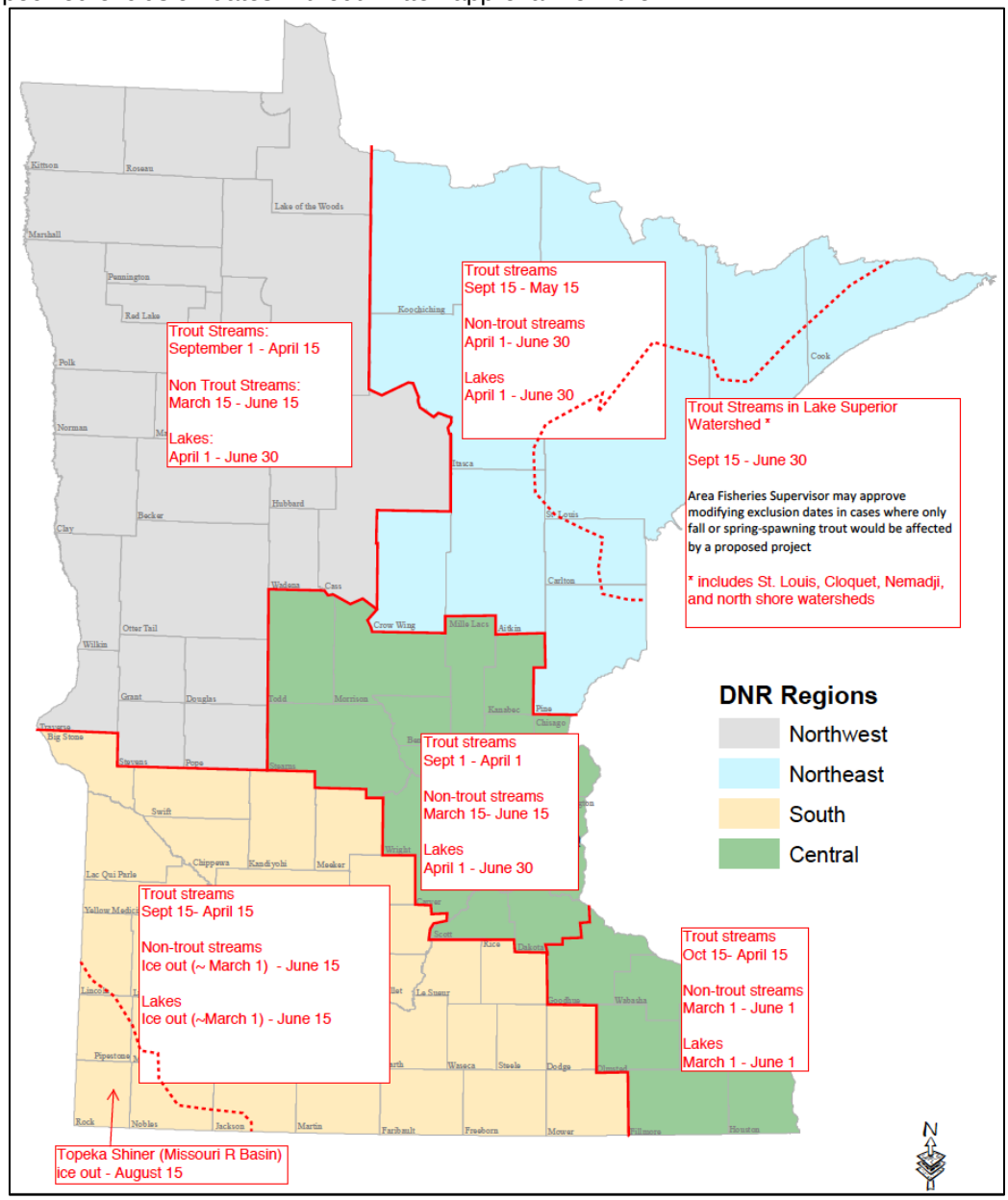
For more information:
MnDOT Highway Project Development Process (HPDP): http://www.dot.state.mn.us/planning/hpdp/environment.html
MnDOT 2014 Standard specifications: http://www.dot.state.mn.us/pre-letting/spec/
DNR Sites of Biodiversity Significance: http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html
DNR Rare Species Guide: http://www.dnr.state.mn.us/rsg/index.html



WORK EXCLUSION DATES
TO ALLOW FOR FISH SPAWNING AND MIGRATION

To allow for fish migration or spawning, no in-water work is allowed in Public Waters during these dates*.

The Work Exclusion Dates below shall be incorporated into project scheduling and staging to protect fish spawning and migration. Work may be conducted elsewhere on a project during these dates; however no work shall occur within Public Waters during the specified exclusion dates without written approval from the DNR.



* Where the **permittee** demonstrates that a project will minimize impacts to fish habitat or if work during this time is essential, work during this period may occur only upon written approval of the DNR Area Fisheries Manager. Contact information for Area Fisheries Managers:
http://files.dnr.state.mn.us/fisheries/management/dnr_fisheries_managers.pdf

Please be aware that the MPCA NPDES general permit for authorization to discharge stormwater associated with construction activities (Permit MN R10001) recognizes the DNR "work in water restrictions" during specified fish migration and spawning time frames. During the restriction period, all exposed soil areas that are within 200 feet of the water's edge and drain to these waters, must have erosion prevention stabilization activities initiated immediately after construction activity has ceased (and be completed within 24 hours).

Fish Passage

Culverts have a variety of factors associated with the ability for fish to pass through them, including perched outlets, high in-pipe velocity and/or turbulence, inadequate water depth, and excessive pipe length without fish resting space. Any of these can cause difficulties for fish movement and thus adversely affect their habitat, natural range, and ability to spawn. On Minnesota's Public Waters, culverts shall provide for fish movement unless the structure is intended to impede rough fish movement or the stream has negligible fisheries value. The current GP2004-0001 has the following requirement for fish passage:

> Bridges, culverts and other crossings shall provide for fish movement unless the structure is intended to impede rough fish movement or the stream has negligible fisheries value as determined by the Transportation Hydrologist or Area Hydrologist in consultation with the Area Fisheries Manager. The accepted practices for achieving these conditions include:
>
> A. Where possible a single culvert or bridge shall span the natural bankfull width adequate to allow for debris and sediment transport rates to closely resemble those of upstream and downstream conditions. A single culvert shall be recessed in order to pass bedload and sediment load. Additional culvert inverts should be set at a higher elevation. All culverts should match the alignment and slope of the natural stream channel, and extend through the toe of the road side slope. "Where possible" means that other conditions may exist and could take precedence, such as unsuitable substrate, natural slope and background velocities, bedrock, flood control, 100yr flood elevations, wetland/lake level control elevations, local ditch elevations, and other adjacent features.
>
> B. Rock Rapids or other structures may be used to retrofit crossings to mimic natural conditions.

Traditionally, culvert design was based on hydrologic and hydraulic models that predict peak runoff from a watershed, with the culvert sized accordingly to pass a specified design storm. Fish passage was not always addressed with these designs. Several alternative design methods have been developed that focus on matching the natural characteristics, and consider sediment transport and fish passage requirements. These recent improvements to hydraulic design practices may also reduce the frequency of scour at pipe outlets in many areas. Other potential benefits include lower maintenance costs, longer life span, and better sediment and erosion control. Alternative designs or simulation techniques inherently take fish passage into account by addressing issues of low flow, hydraulic variability and sediment transport. A variety of design techniques are being implemented in Minnesota where fish passage is a concern.

Culvert Design Approaches

Open bottom span: Open bottom structures are not considered as restricting flow or impinging upon the channel cross sectional area. These structures are generally not considered an impediment to fish movement in Minnesota.

Conventional Hydraulic Design: Culverts sized to pass a specified design storm event (e.g., 10 years peak flow) with no consideration given to fish passage needs.

Hydraulic Design for Fish Passage: Techniques that create water depths and velocities to meet the swimming abilities of target fish populations. This approach considers the flow requirements (eg: maximum velocity, sustained velocity, flow depth, etc) needed by specific species. The goal is to keep the velocity below a set of thresholds corresponding to a fish's maximum swim speed, sustained swim speed, and related measures. This is the method for meeting the frequent DNR requirement of: 'Velocities of the 2-year 24-hour event shall not exceed 2 feet per second".

FHWA has the publication 'HEC-26' that utilizes the hydraulic design approach to select culvert size and bedload material. HEC-26 presents a mathematical design procedure, methods, and best practices for designing roadway culverts to facilitate aquatic organism passage (AOP).
http://www.fhwa.dot.gov/engineering/hydraulics/pubs/11008/hif11008.pdf.

Hydraulic Simulation: Hydraulic design approaches that simulate natural hydraulics of streams by adding rock or roughness elements to simulate natural hydraulic variation within or adjacent to the culvert. Typically these include placement of rock on the floor of the culvert or placement of rock rapids below the outlet to create pools and riffles, etc.

Stream Simulation (Geomorphic Design): Design approaches that recreate or allow natural channel morphology and sediment transport. In Minnesota, two differing methods are being utilized.

(http://www.dnr.state.mn.us/waters/watermgmt_section/pwpermits/gp_2004_0001_manual.html)

1. '**MESBOAC**' was developed in the northern forested region of Minnesota and is based on principles of fluvial geomorphology rather than individual fish swimming ability. **MESBOAC** aims to match the culvert width with natural stream dimensions, while maintaining sediment balance (sediment in = sediment out). In addition to burying the culvert bottom below the streambed to provide for a natural substrate in the culvert, it also provides a low-flow channel that is important for late season migrations which occur from August to November. MESBOAC assumes that since the natural flow characteristics are maintained, fish passage will occur. See Appendix A for more information on MESBOAC methods.

MESBOAC stands for:

Match culvert width to bankfull stream width.
Extend culvert length through the side slope toe of the road.
Set culvert slope the same as stream slope
Bury the culvert
Offset multiple culverts.
Align the culvert with the stream channel.
Consider headcuts and cutoffs.

2. The Aquatic Organism Passage (AOP) program is a broader ecosystem-based design approach developed by the USDA Forest Service for designing and constructing a channel through the road-stream crossing structure based on physical and ecological continuity along the stream corridor. The premise of stream simulation (AOP) is that the culvert be large enough for a channel to be constructed within the crossing that simulates the dimensions and characteristics of the adjacent natural channel. Therefor, fish and other aquatic organisms should experience no greater difficulty moving through the structure than if there were no road crossing. Identifying a 'reference reach' is a key concept and component of stream simulation as it provides the natural template for designing a channel through the crossing and determining the size and embedment depth of the replacement structure. The manual '**Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings'** is located here: http://www.stream.fs.fed.us/fishxing/aop_pdfs.html.
A copy of the published report on a summary of this program is in Appendix A (Stream Simulation for Aquatic Organism Passage at Road-Stream Crossings, by Cenderelli, Clarken, Gubernick and Weinhold).

Note: The link to the FishXing program that is embedded in the AOP website is a culvert assessment tool for aquatic organism passage. The program models various organisms capabilities against culvert hydraulics across a range of expected stream discharges. AOP methodology does not require a check on velocities since it uses reference conditions in the stream to emulate a crossing that has the proper context with its surrounding profiles.

MESBOAC and AOP are similar in the use of bankfull width determination, though differ in determination of slope and invert elevations for a culvert.

MESBOAC utilizes a line connecting the thalweg riffle elevations from upstream and downstream of the crossing to set culvert slope and elevation.

In addition to utilizing riffle elevations, the AOP program methodology incorporates pool depths, stable control points, and other vertical control points in the steam (bedrock, pool-tailcrests, and large woody debris) to determine a streambeds potential upper and lower vertical adjustment profile (VAP) to which the culvert invert and slope are determined.

Summaries of both methods are located in Appendix A

Floodplain Connectivity: In addition to the above, there is growing attention in the concept of 'floodplain culverts'. These culverts are set in the floodplain, away from the main channel and are dry, except in flood conditions. It is gaining interest for use within floodplains, and in areas with woody debris or ice issues. An initial study by the DNR is located here: http://files.dnr.state.mn.us/eco/streamhab/geomorphology/reducing-rior.pdf

Please contact the DNR Area Hydrologist for design information at the earliest stages of project development. Determining the appropriate design method is influenced by project objectives. Consideration for fish passage, other aquatic organisms, rare species, invasive species, habitat protection/restoration, wildlife passage, traffic (road safety), funding limits, adjacent property and right-of-way limits, floodplain ordinances and other regulatory requirements (e.g., wetland protection) are to be considered.

(http://www.dnr.state.mn.us/waters/watermgmt_section/pwpermits/gp_2004_0001_manual.html)

Appendix G - CRU Determination

DEPARTMENT OF TRANSPORTATION

Office of Environmental Stewardship
Mail Stop 620
395 John Ireland Boulevard
St. Paul, MN 55155-1899

Office Tel: (651) 366-3614
craig.johnson@state.mn.us

July 3, 2017

Ryan Barney
MnDOT District 8
2505 Transportation Road
Willmar, MN 56201

Re: S.P. 7305-124. Two to four lane conversion of TH 23 (North Gap), Stearns County

Dear Mr. Barney:

Your request for review of the above-referenced project indicates that no FHWA funds will be used, but will require a U.S. Army Corps of Engineers permit. The project will use state funds; therefore, a review per Minnesota statutes 138.661-138.669 (Minnesota Historic Sites Acts) and 138.31-138.42 (Minnesota Field Archaeology Act) is required. These statutes require Mn/DOT to consult with the Minnesota Historical Society (MHS) when its undertakings have the potential to affect historic properties listed in the State or National Registers of Historic Places, or to consult with MHS and the Office of the State Archaeologist (OSA) when its undertakings have the potential to affect known or suspected archaeological sites.

The project involves the conversion of TH 23 from a two lane to a four lane roadway from CSAH 9 in Richmond to the north/east end of the Paynesville Bypass. An architectural history survey and evaluation of the area of potential effect (APE) by Landscape Research concluded that there are no listed properties present. Archaeological surveys and evaluations by Deco Cultural Services and Florin Cultural Resource Services did not identify any eligible archaeological sites.

It is the determination of this office that the proposed undertaking has **no potential to affect properties listed in the State or the National Registers of Historic Places or to affect known or suspected archaeological sites.** Therefore, no consultation with the MHS or the OSA is required and the historical/archaeological review should be considered completed. If the project does receive FHWA funds or the project scope changes, the Cultural Resources Unit should be notified to determine if additional review is required. Since this project requires a Corps permit, the Corps will conduct a Section 106 review, pursuant to their responsibilities for compliance with Section 106 of the National Historic Preservation Act, as amended (36 CFR 800).

Sincerely,

Craig Johnson
Archaeologist
Cultural Resources Unit (CRU)

cc: MnDOT CRU Project File
Linda Pate, USACOE
Mark Benson, SEH
Lance Kalthoff, MnDOT D. 8
Joe Hiller, MnDNR

Appendix H - Noise Analysis

Traffic Noise Analysis Report

TH 23 North Gap Project

S.P. 7305-124
SEH No. MNT08 132980

February 21, 2017

SEH

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Traffic Noise Analysis Report

TH 23 North Gap Project

Prepared for the Minnesota Department of Transportation (MnDOT).

1.0 Project Description

The purpose of this analysis is to evaluate and document the effect of the proposed TH 23 North Gap Project on traffic noise levels in the project area.

The Highway 23 Corridor extends across the state of Minnesota from Interstate 90 to Interstate 35 and beyond. It connects many cities including Pipestone, Marshall, Granite Falls, Willmar and St. Cloud. The segment of Highway 23 between Willmar and Interstate 94 is a distance of approximately 53 miles. Of those 53 miles, all but 15 miles have been constructed as a four lane roadway. TH 23 between Paynesville and Richmond is one of two remaining segments of two-lane roadway from Willmar to Saint Cloud, and part of the long-standing effort to construct four-lane facilities for the length of the corridor.

The project will expand approximately 8.75 miles of the existing 2-lane highway, posted at 60 mph, to a 4-lane divided highway posted at 65 mph. The corridor will be designed to full standards, with some alignment changes to improve safety and operations.

1.1 Project Limits

The noise modeling includes the following roadway limits:

- TH 23 from CR 85 (near Paynesville) to TH 22 (near Richmond); approximately 8.75 miles.
- Approach roadways connecting to TH 23 include the following:
  - 263rd Avenue, CR 123 (South), 253rd Avenue, 205th Street, 210th Street, 190th Street, 246th Street, CR 123 (North), Big Lake Court, CR 12/CR 43, Becker Lake Circle (East and West)

1.2 Project Assessment

This study was conducted in accordance with the 2015 Minnesota Noise Policy, which is an implementation of the FHWA Noise Regulation found at 23 CFR 772.

The analysis utilized MnDOT's MINNOISEV31 software model; which is a modified version of the Federal Highway Administration's (FHWA) STAMINA 2.0 software model. The analysis includes modeling of existing conditions (2016) and future (2040) no build and build conditions.

2.0 Noise Description

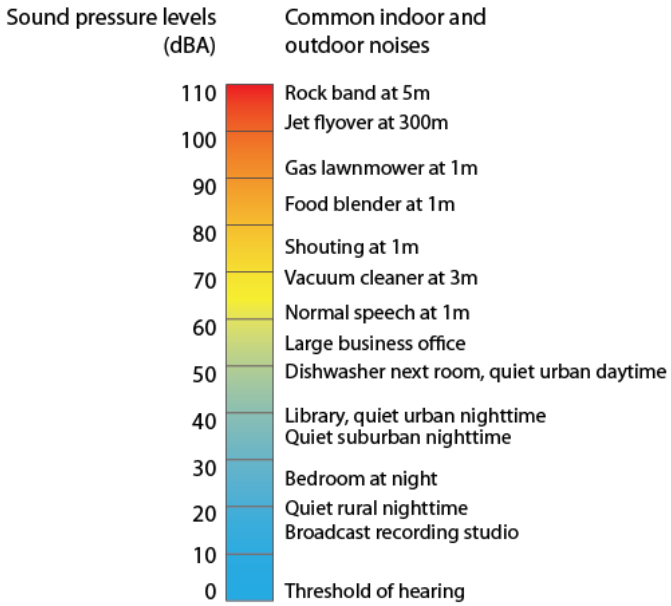
Noise is defined as any unwanted sound. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels. A-weighted decibels (dBA) represent the logarithmic increase (decrease) in sound energy relative to a reference energy level. A sound increase of three dBA is barely perceptible to the human ear, a five dBA increase is clearly noticeable, and a ten dBA increase is heard as twice as loud. For example, if the sound energy is doubled (e.g., the amount of traffic doubles), there is a three dBA increase in noise, which is just barely noticeable to most people. On the other hand, if the traffic volumes increase by a factor of ten the sound energy level increases by ten dBA, which is heard as a doubling of the loudness.

For highway traffic noise, an adjustment, or weighting, of the high- and low-pitched sounds, is made to approximate the way that an average person hears sounds. The adjusted sound levels are stated in units of "A-weighted decibels" (dBA).

In Minnesota, traffic noise impacts are evaluated by measuring and/or modeling the traffic noise levels that are exceeded ten percent and 50 percent of the time during the hour of the day and/or night that has the loudest traffic noise. These numbers are identified as the L_{10} and L_{50} levels. The L_{10} value is compared to FHWA noise abatement criteria.

The following figure provides a rough comparison of the noise levels of some common noise sources.

Figure 1 – Decibel Levels of Common Noise Sources



Source: "A Guide to Noise Control in Minnesota" (November 2015)
Minnesota Pollution Control Agency, http://www.pca.state.mn.us

Along with traffic volumes, vehicle speeds, roadway grades, and topography, the distance of a receptor from a sound's source is also a significant factor that contributes to the level of traffic noise. Sound level decreases as the distance from the source increases. A general rule regarding sound level decrease due to increase distance is: outside of approximately 50 feet, every time the distance between a line source, such as a roadway, and a receptor is doubled, the sound level decreases by either 3 dBA over hard surfaces or 4.5 dBA over soft surfaces.

2.1 Minnesota Regulations

Daytime and nighttime noise standards have been established by for the State of Minnesota. State noise standards are for a one-hour period and apply to outdoor areas (i.e. exterior noise levels). The standards are set in terms of the L_{10} and L_{50} noise descriptors. The L_{10} is the sound level exceeded ten percent of the time, or six minutes out of an hour. The L_{50} is the sound level exceeded 50 percent of the time, or 30 minutes out of an hour.

The Minnesota Pollution Control Agency (MPCA) defines daytime as 7:00 a.m. to 10:00 p.m. and nighttime as 10:00 p.m. to 7:00 a.m.

The Minnesota State Noise Standards are depicted in Table 1. State noise standards apply to all Interstate and Truck Highways in Minnesota.

Table 1
State of Minnesota Noise Standards

Noise Area Classification (NAC)	**General Land Use Type**	**Exterior Hourly Noise Level Limit (dBA)**			
		Day (7:00 am to 10:00 pm)		**Night (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

NOTES:
NAC-1 includes household units, transient lodging and hotels, educational, religious, cultural entertainment, camping and picnicking land uses.
NAC 2 includes retail and restaurants, transportation terminals, professional offices, parks, recreational and amusement land uses.
NAC-3 includes industrial, manufacturing, transportation facilities (except terminals), and utilities land uses

2.2 Federal Regulations

Considering the fact that FHWA is not a participant in this project, nether in a financial or regulatory way, the requirement for noise analysis is based only on Minnesota State rules. While the FHWA regulations and criteria are not in effect for this construction project, they are included in their entirety for reference purposes.

The Federal Noise Abatement Criteria (23 CFR 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise) established the noise criteria for various land uses. The criteria are in terms of the L_{eq} or L_{10} descriptor. In Minnesota, the L_{10} descriptor is used to identify impacts and has been used to identify impacts in this analysis. L_{eq} is an equivalent steady-state sound level which contains the same acoustic energy as the time-varying sound level during the same time period.

Federal Noise Abatement Criteria apply to all Type I projects requiring FHWA approval, regardless of funding source, or Type I projects requiring Federal-aid highway funds.

This project includes construction of a highway on a new location and adding additional through lanes, qualifying it as a Type I project. For the full definition of Type I projects see the definitions at link:

http://www.dot.state.mn.us/environment/noise/pdf/mndot-2015-noise-policy.pdf.

In the Federal Noise Abatement criteria, a noise impact is defined as occurring when the predicted traffic noise levels:

- Approach or exceed the noise abatement criteria (see Table 2)
- Substantially exceed the existing noise levels (5 dBA increase, L_{10})

The State of Minnesota has defined “approach or exceed” as being within one dBA or less of the activity category of the NAC, and “substantially exceed” as an increase of five dBA or more over existing noise levels.

Table 2
FHWA Noise Abatement Criteria

Activity Category	Activity Criteria (1,2) L_{10} (h)	Description of Activity Category
A	60 dBA (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B(3)	70 dBA (exterior)	Residential
C(3)	70 dBA (exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilitates, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	55 dBA (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E(3)	75 dBA (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D of F
F	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical) and warehousing
G	--	Undeveloped lands that are not permitted

(1) L_{10}(h) shall be used for impact assessment
(2) L_{10}(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
(3) Includes undeveloped lands permitted for this activity category.

3.0 Methodology

3.1 Affected Environment

The purpose of this noise analysis is to determine the impacts the proposed project has on traffic noise levels in the immediate vicinity of the project at noise sensitive receptors (residences, business, etc). It is important to note that this analysis only includes traffic generated noise. There are other noise sources in the project area that have some effect on the ambient noise levels.

The project will expand approximately 8.75 miles of the existing 2-lane highway to a 4-lane divided highway. The noise area limits extended beyond the construction limits to the next full access intersection on the existing 4-lane sections of TH 23. The west TH 23 limit is at CR 85/Business 23 interchange, approximately 1,500 feet beyond construction, and the east TH 23 limit is at TH 22, approximately 1,000 beyond construction.

The project will retain the majority of the existing 2-lane roadway as portion of the 4-lane design. The design switches multiple times along the existing alignment where the existing 2-lane roadway would be converted to a one-way section and a new, opposite direction, one-way roadway would be constructed parallel to the existing roadway. The approximate ½ mile curve adjacent to Roscoe will be constructed on a new alignment to increase the radius.

3.2 Field Monitoring

Noise level monitoring is commonly performed during a noise study to document existing noise levels and assist in validating the noise prediction model. Monitored noise levels can also be used as a baseline of the possible ambient noise levels that can occur with a new roadway alignment.

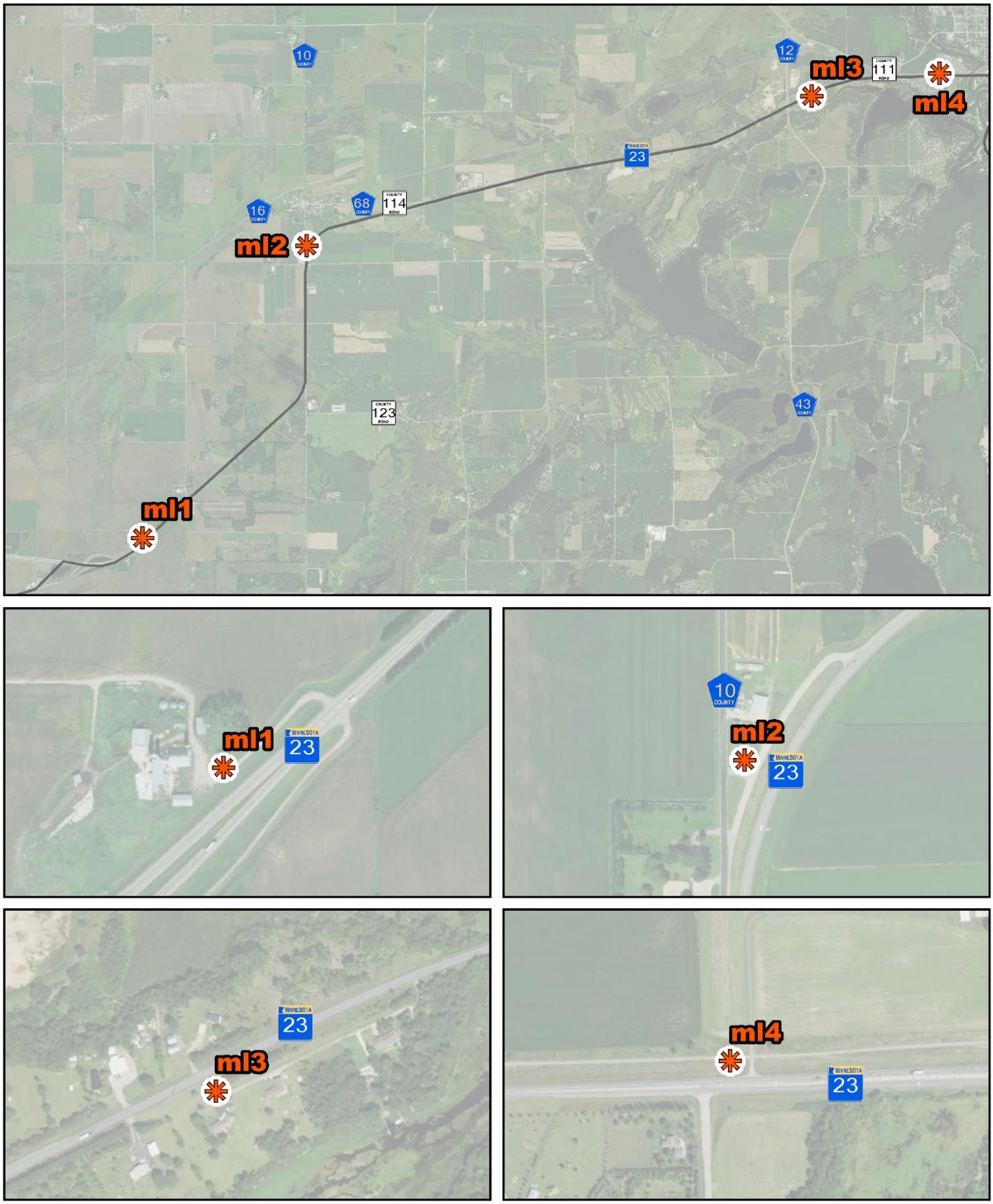
The existing noise levels along the TH 23 corridor were monitored in August 2016. A total of 4 sites were monitored in 2016; noise level monitoring results ranged from 66.1 dBA (L_{10}) to 71.7 dBA (L_{10}). Both the AM and PM monitoring time periods had good weather (no precipitation with winds less than 12 mph), and dry pavement; the sound level meter utilized was a Larson Davis model 831 that was laboratory calibrated in August of 2016.

The monitoring location sites and noise model limits are illustrated in Figure 2, Existing Conditions. The monitoring results are provided in Table 3 which shows the results of the validation modeling to be at or within the 3 dBA limits and therefore the model is considered to be validated.

Table 3 Noise Monitoring Locations/Results

Site ID	Location Description	Measurement Date/Time			Measured Levels, dBA	Modeled Levels, dBA	Difference, dBA
		Date	Begin	End	L_{10}	L_{10}	L_{10}
ML 1	Residential (Vacant)- 26855 State Highway 23; Paynesville, MN	8/18/2016	8:23 AM	8:53 AM	69.1	68.0	-1.1
		8/23/2016	1:08 PM	1:38 PM	67.5	67.8	0.3
ML 2	Commercial Lot - Parcel Between 190th St NE and Main St; Roscoe, MN	8/18/2016	9:10 AM	9:40 AM	66.5	65.3	-1.2
		8/23/2016	1:48 PM	2:18 PM	66.1	65.9	-0.2
ML 3	Residential - Near 21593 Finley Circle; Richmond, MN	8/18/2016	9:55 AM	10:25 AM	71.7	70.8	-0.9
		8/23/2016	2:31 PM	3:01 PM	71.1	71.3	0.2
ML 4	Commercial - Rocori Trail near Becker Lake Circle; Richmond, MN	8/18/2016	10:36 AM	11:06 AM	71.7	69.7	-2.0
		8/23/2016	3:12 PM	3:42 PM	71.2	69.9	-1.3

Figure 2 – Existing Condition - Monitoring Locations



4.0 Noise Analysis

4.1 Noise Modeling

Traffic noise impacts were assessed by modeling noise levels at noise sensitive receptor locations likely to be affected by the construction of the proposed project. Traffic noise levels were modeled at a total of 118 representative receptor locations throughout the project area. The Existing and No Build modeling includes the entire 118 receptors that exist today. The Build condition removes 14 receptors through right-of-way acquisitions and relocates 23 existing trail receptor along the new proposed trail alignment near Richmond; therefore the Build Condition has a total of 104 receptors.

Based on the FHWA and MnDOT Noise Policy guidance, noise receptors were assigned and modeled within approximately 500 feet of the existing and proposed highway mainline. The majority of the receptors, a total of 79, represent residential receptors of which some are located in clusters and others are scattered throughout the project corridor. On the eastern side of the project, near Richmond, the Rocori Trail has a total of 35 receptors within the project area.

The locations of the existing modeled receptor sites are illustrated in Appendix A Figures 1 through 9; Existing/No Build Conditions. The locations of the build modeled receptor sites are illustrated in Appendix C Figures 1 through 9; Build Conditions.

The attached Tables 5 and 6 include the receptor site ID's and land use for each receptor.

The noise modeling was done using the noise prediction program MINNOISEV31, which is a modified version of the Federal Highway Administration's (FHWA) STAMINA. The model uses the roadway alignment (horizontal and vertical), traffic volumes, traffic speeds, vehicle classification, and the distances from the roadway center-of-lanes to the receptors as well as relative elevation differences.

In general, higher traffic volumes, vehicle speeds, and numbers of heavy trucks increases the loudness of highway traffic noise. The loudest hourly traffic noise impact typically occurs when traffic is flowing more freely and when heavy truck volumes are greatest. For determining the worst-case daytime (7:00 a.m. to 10:00 p.m) traffic noise hour, traffic noise levels for four time periods were modeled at four representative receptor locations along the project corridor under existing conditions, taking into account the appropriate vehicle mix (i.e. cars, medium trucks, heavy trucks), seasonal traffic variations where appropriate, and directional split in traffic volumes (i.e. northbound versus southbound). For determining the worst-case nighttime (10:00 p.m. to 7:00 a.m) traffic noise hour, 24-hour traffic distribution was utilized to determine hour.

The following assumptions were used in modeling the noise levels for this project:

- Traffic data input into the noise model included existing (year 2016) and future (year 2040) No Build and Build forecast traffic volumes. Year 2040 was identified as the design year for the proposed project.
- Vehicular fleet composition was collected from a 48-hour vehicle classification Site #7251 in the project area obtained from MnDOT in August 2011.
- The 6:00 a.m. to 7:00 a.m. hour, just prior to the start of the morning rush hour, was identified as the loudest hour of the nighttime period.

- The existing 48-hour vehicle classification count along Highway 23 was used to determine that the 6:00 a.m. to 7:00 a.m. has more than double the traffic than the next highest peak traffic demand during the 10:00 p.m. to 7:00 a.m. "nighttime" period.

- The 4:00 p.m. to 5:00 p.m. hour was identified as the loudest hour of the daytime period.
  - Based on existing count data and the vehicle classification count, the hours starting at 9 a.m., 11 a.m., 2 p.m., and 4 p.m. had the highest vehicle demand, vehicle speeds and proportions of trucks. Table 4 includes the summary of the four daytime periods. Based on this analysis, it was determined that the time period from 4:00 p.m. to 5:00 p.m. represents the loudest traffic noise hour.

Table 4
Worst Daytime Hourly Traffic Noise Summary

Site ID		Modeled Level (dBA) by Time Period							
		Daytime (7:00 a.m. to 10:00 p.m.) Analysis							
		9:00-10:00 AM		1:00-2:00 PM		3:00-4:00 PM		4:00-5:00 PM	
		L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}	L_{10}	L_{50}
ML1	Residential	**67.9**	59.9	**68.0**	**60.1**	**67.8**	**60.3**	**68.0**	**60.9**
ML2	Commercial	65.4	57.8	65.6	58.1	65.9	58.7	66.0	59.1
ML3	Residential	**71.0**	**62.5**	**70.4**	**61.7**	**71.2**	**62.6**	**71.8**	**63.8**
ML4	Commercial	69.9	61.1	69.3	60.4	69.7	61.2	**70.4**	62.3

Bold/Shaded numbers are above State daytime standards. **Bold/Shaded and underlined** are above both State daytime standards and Federal standards.

4.2 Noise Model Results

Results of the noise modeling analysis are tabulated in Table 5 (daytime) and Table 6 (nighttime). The following describes the results of the traffic noise analysis for existing (2016), future (2040) No Build condition, and future (2040) Build condition.

Existing (2016) daytime modeled noise levels at the modeled receptor locations range from 53.6 dBA (L_{10}) to 72.6 dBA (L_{10}); nighttime noise levels range from 51.8 dBA (L_{10}) to 70.5 dBA (L_{10}). Modeled noise receptors exceeded State daytime standards (L_{10}) at 33 of 118 modeled receptor locations under existing (2016) conditions. Modeled noise receptors exceeded State nighttime standards (L_{10}) at 69 of 118 modeled receptor locations under existing (2016) conditions. Modeled noise receptors exceeded FHWA criteria (L_{10}) at 17 of 118 modeled receptor locations under existing (2016) conditions

Existing (2016) daytime modeled noise levels at the modeled receptor locations range from 49.6 dBA (L_{50}) to 64.4 dBA (L_{50}); nighttime noise levels range from 46.7 dBA (L_{50}) to 61.0 dBA (L_{50}). Modeled noise receptors exceeded State daytime standards (L_{50}) at 12 of 118 modeled receptor locations under existing (2016) conditions. Modeled noise receptors exceeded State nighttime standards (L_{50}) at 68 of 118 modeled receptor locations under existing (2016) conditions.

Future (2040) No Build daytime modeled noise levels at the modeled receptor locations range from 55.2 dBA (L_{10}) to 74.6 dBA (L_{10}); nighttime noise levels range from 53.5 dBA (L_{10}) to 72.7 dBA (L_{10}). Modeled noise receptors exceeded State daytime standards (L_{10}) at 61 of 118 modeled receptor locations under No Build (2040) conditions. Modeled noise receptors exceeded State nighttime standards (L_{10}) at 94 of 118 modeled receptor locations under No

Build (2040) conditions. Modeled noise receptors exceeded FHWA criteria (L_{10}) at 15 of 118 modeled receptor locations under existing (2040) conditions

Future (2040) No Build daytime modeled noise levels at the modeled receptor locations range from 51.9 dBA (L_{50}) to 67.2 dBA (L_{50}); nighttime noise levels range from 49.2 dBA (L_{50}) to 64.0 dBA (L_{50}). Modeled noise receptors exceeded State daytime standards (L_{50}) at 41 of 118 modeled receptor locations under No Build (2040) conditions. Modeled noise receptors exceeded State nighttime standards (L_{50}) at 78 of 118 modeled receptor locations under No Build (2040) conditions.

Future (2040) Build daytime modeled noise levels at the modeled receptor locations range from 56.4 dBA (L_{10}) to 72.2 dBA (L_{10}); nighttime noise levels range from 54.4 dBA (L_{10}) to 71.5 dBA (L_{10}). Modeled noise receptors exceeded State daytime standards (L_{10}) at 31 of 104 modeled receptor locations under Build (2040) conditions. Modeled noise receptors exceeded State nighttime standards (L_{10}) at 66 of 104 modeled receptor locations under Build (2040) conditions. Modeled noise receptors exceeded FHWA criteria (L_{10}) at 9 of 104 modeled receptor locations under existing (2040) conditions

Future (2040) Build daytime modeled noise levels at the modeled receptor locations range from 52.7 dBA (L_{50}) to 64.6 dBA (L_{50}); nighttime noise levels range from 50.1 dBA (L_{50}) to 62.9 dBA (L_{50}). Modeled noise receptors exceeded State daytime standards (L_{50}) at 29 of 104 modeled receptor locations under Build (2040) conditions. Modeled noise receptors exceeded State nighttime standards (L_{50}) at 65 of 104 modeled receptor locations under Build (2040) conditions.

Modeled noise level fluctuations (daytime and nighttime) range from -4.5 dBA to 5.9 dBA for existing receptor locations when comparing the Build (2040) to the existing (2016) conditions.

5.0 Noise Abatement Analysis

Because State noise standards are exceeded and Federal noise standards are both approached and exceeded at modeled receptor locations throughout the project area, noise abatement must be considered.

Noise mitigation measures have been considered, as listed in 23 CFR 772.13(c) and are addressed below:

- **Traffic management measures**: The primary purpose of the facility is to move people and goods. Restrictions of certain vehicles or speeds would be inconsistent with the purpose of the project.
- **Alteration of horizontal and vertical alignments**: The project was aligned for practical reasons based on grade and safety within the available right of way. Redesigning the horizontal and vertical alignments to minimize noise impacts would be impractical for this project.
- **Acquisition of real property or interests therein (predominantly unimproved property) to serve as a buffer zone to preempt development that would be adversely impacted by traffic noise**: Exclusive land use designations or acquisition of property to serve as a buffer zone between the roadway and adjacent lands would not be feasible because land has already been developed along the project corridor.
- **Noise insulation of public use or nonprofit institutional structures**: Noise insulation does not address the outside environment. Therefore, noise insulation is not proposed as a part of the project. Under MnDOT and FHWA guidelines, only public buildings such as schools and hospitals should be considered for acoustical insulation.
- **Construction of Noise Barriers**: including acquisition of property rights, either within or outside the highway right of way.

Noise barriers have been chosen as the most cost-effective noise mitigation measure available for this project.

The use of quieter pavements is not an acceptable noise abatement measure for Federal-aid projects. Planting of vegetation or landscaping is not an acceptable Federal-aid noise abatement measure because only dense stands of evergreen vegetation at least 100 feet deep will reduce noise levels by a noticeable amount.

5.1 Noise Barrier Evaluation

When noise impacts are identified, a noise barrier evaluation analysis must be performed. Noise barrier construction decisions are determined based on the evaluation of the feasibility and reasonableness of the noise barriers.

Feasibility of the noise barrier is determined by physical and/or engineering constraints (i.e., whether a noise barrier could feasibly be constructed on the site) and by acoustic feasibility (at least one receptor per proposed barrier must receive the minimum reduction of 5 dBA). The feasibility of noise barrier construction is sometimes dependent on design details that are not known until the final design of the project. The following analysis assumes that noise barriers could be feasibly constructed throughout the project area, up to 20 feet high along the corridor.

Reasonableness is based on a three factors that must be met for a noise abatement measure to be considered reasonable. The factors are as follows:

- A noise reduction goal of at least 7 dBA must be achieved at a minimum of one benefitted receptor for each proposed noise abatement measure to be considered reasonable.
- A cost effective (CE) threshold of $43,500 per individual benefitted receptor has been established, based on an estimated construction cost of $20 per square foot for noise barriers. Additional costs of some items such as guard rail, rub rail, purchased right-of-way and other extra costs shall be added to the baseline unit costs cited above for the purposes of the cost estimation.
- The viewpoints of the property owners and residents of all benefitted receptors shall be solicited and considered in reaching a decision on the abatement measure to be provided. See Section 5.3.3 of the MnDOT Noise Policy (effective date: June 15, 2015) for a detailed explanation of the voting system.

Assessing the cost effectiveness of noise barriers includes several steps. First, the impacted noise areas are assessed to determine the probable location for an effective noise barrier. Second, the noise barriers are modeled to assess their acoustical effectiveness. For this study, three heights of potential noise barriers were analyzed: 20, 15 and 10 feet. If a 20 foot (MnDOT's maximum height) high noise barrier is feasible and meets the reasonableness criteria, it would be proposed for construction. If the 20 foot high barrier does not meet the criteria, a 15 foot barrier would be evaluated. Likewise, if a 15 foot high barrier does not meet the criteria a 10 foot barrier would be evaluated. Based on the number of benefitted receptors at each of the above barrier heights, varying barriers heights were back-calculated to assess if an intermediate height would be more beneficial.

All barriers evaluated must meet MnDOT's 7 dBA noise reduction design goal for at least one receptor for each noise abatement measure evaluated. If a barrier is unable to achieve the design goal, further evaluation will not be completed.

State noise standards are currently predicted to be exceeded throughout portions of the study area. Noise barriers were evaluated at 25 barrier locations within the project's 20 noise areas. Appendix C Figures 1 through 9 illustrates the analysis summary of noise barriers that were considered.

Noise barrier cost-effectiveness results are tabulated in Appendix B. The discussion of the noise barrier modeling results presented here includes only the daytime L_{10} results; unless otherwise noted. For reference, nighttime L_{10} noise barrier cost-effectiveness results are also tabulated and presented with the daytime L_{10} noise barrier cost-effectiveness results.

5.2 Noise Barrier Results

The project receptors were divided up into 20 separate noise areas based on proximity of adjacent receptors and highway access locations. These access roadways provide a natural break between noise barrier locations.

5.2.1 Noise Area 1 – South side of TH 23 between CR 85 and 263rd

Land uses south of TH 23 between CR 85 and 263rd Avenue consist of a single residential building.

The proposed Highway 23 alignment in this noise area does not change the noise environment for the existing receptor as the receptor is near the existing 4-lane roadway section.

Noise levels were modeled at 1 receptor locations in Area 1. Modeled noise levels exceed State daytime standards at 1 of the 1 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 1 of 1 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 1 receptor locations with future (2040) Build conditions.

5.2.1.1 Barrier EB 1

An approximately 827 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 near the CR 85 interchange to mitigate impacts to receptor “r1”. The barrier provides a reduction of 7.9 dBA. The cost effectiveness of the 20 foot high barrier is $312,800 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 827 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 near the CR 85 interchange to mitigate impacts to receptor “r1”. The barrier provides a reduction of 5.5 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.2 Noise Area 2 – South side of TH 23 between 263rd and CR 123

Land uses south of TH 23 between 263rd Avenue and CR 123 consist of a single residential building.

The proposed Highway 23 alignment in this noise area pushes the mainline further from the existing receptor. It expands the mainline away from this noise area, putting more traffic farther from this noise area.

Noise levels were modeled at 1 receptor locations in Area 2. Modeled noise levels exceed State daytime standards at 1 of the 1 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 1 of 1 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 1 receptor locations with future (2040) Build conditions.

5.2.2.1 Barrier EB 2

An approximately 973 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 near 263rd Avenue to mitigate impacts to receptor “r3”. The barrier provides a reduction of 6.6 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.3 Noise Area 3 – South side of TH 23 between CR 123 and 253rd

Land uses south of TH 23 between CR 123 and 253rd Street consist of three residential buildings.

The proposed Highway 23 alignment in this noise area pushes the mainline further from the existing receptor. It expands the mainline away from this noise area, putting more traffic farther from this noise area. The proposed roadway design removes receptors “r8” from the Build conditions.

Noise levels were modeled at 3 receptor locations in Area 3. Modeled noise levels exceed State daytime standards at 2 of the 3 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 3 of 3 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 3 receptor locations with future (2040) Build conditions.

5.2.3.1 Barrier EB 3

An approximately 529 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r11”. The barrier provides a reduction of 7.1 dBA. The cost effectiveness of the 20 foot high barrier is $193,600 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 529 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r11”. The barrier provides a reduction of 4.4 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.3.2 Barrier EB 4

An approximately 2,085 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r12” and “r13”. There are two gaps in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 2.2 dBA to 4.7 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.4 Noise Area 4 – South side of TH 23 between 253rd and 205th

Land uses south of TH 23 between 253rd Street and 115th Street consist of a single residential building.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptor. It expands the mainline towards this noise area, putting more traffic closer to this noise area.

Noise levels were modeled at 1 receptor locations in Area 4. Modeled noise levels exceed State daytime standards at 0 of the 1 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 1 of 1 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 1 receptor locations with future (2040) Build conditions.

5.2.4.1 Barrier EB 5

An approximately 2,057 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r14”. There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction of 2.0 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.5 Noise Area 5 – South side of TH 23 between 205th and 210th

Land uses south of TH 23 between 205th Street and 210th Street consist of a single commercial receptor and single residential receptor buildings.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards this noise area, putting more traffic closer to this noise area. The proposed roadway design removes receptors “r16” from the Build conditions.

Noise levels were modeled at 2 receptor locations in Area 5. Modeled noise levels exceed State daytime standards at 1 of the 2 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 1 of 2 receptor locations with future (2040)

Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 2 receptor locations with future (2040) Build conditions.

5.2.5.1 Barrier EB 6

An approximately 652 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r15”. There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 5.0 dBA to 5.9 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.6 Noise Area 6 – South side of TH 23 between 210th and CR 123

Land uses south of TH 23 between 210th Street and CR 123 consist of a single residential building.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards this noise area, putting more traffic closer to this noise area. The proposed roadway design removes receptors “r20” from the Build conditions.

Noise levels were modeled at 1 receptor locations in Area 6. Modeled noise levels exceed State daytime standards at 1 of the 1 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 1 of 1 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 1 receptor locations with future (2040) Build conditions.

5.2.6.1 Barrier EB 7

An approximately 1,382 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r22”. There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction of 1.9 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.7 Noise Area 7 – South side of TH 23 between CR 123 and Big Lake Court

Land uses south of TH 23 between CR 123 and Big Lake Court consist two residential receptors and a single commercial receptor.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards the western end of this noise area, putting more traffic closer to this noise area.

Noise levels were modeled at 3 receptor locations in Area 7. Modeled noise levels exceed State daytime standards at 1 of the 3 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 2 of 3 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 3 receptor locations with future (2040) Build conditions.

5.2.7.1 Barrier EB 8

An approximately 1,718 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r23” and “r84”. There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 3.2 dBA to 3.6 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.7.2 Barrier EB 9

An approximately 481 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “c3”. The barrier provides a reduction of 9.2 dBA. The cost effectiveness of the 20 foot high barrier is $174,400 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 481 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “c3”. The barrier provides a reduction of 5.7 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.8 Noise Area 8 – South side of TH 23 between Big Lake Court and CR 43

Land uses south of TH 23 between Big Lake Court and CR 43 consist of two residential buildings.

The proposed Highway 23 alignment in this noise area pushes the mainline further from the existing receptor. It expands the mainline away from this noise area, putting more traffic farther from this noise area. The proposed roadway design removes receptors “r8” from the Build conditions.

Noise levels were modeled at 2 receptor locations in Area 8. Modeled noise levels exceed State daytime standards at 2 of the 2 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 2 of 2 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 2 receptor locations with future (2040) Build conditions.

5.2.8.1 Barrier EB 10

An approximately 1,467 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r27” and “r29”. There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 1.2 dBA to 5.9 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.9 Noise Area 9 – South side of TH 23 between CR 43 and West Becker Lake Circle

Land uses north of TH 23 between CR 2 and 240th Avenue consist of two pockets of residential buildings.

The proposed Highway 23 alignment in this noise area pushes the mainline further from the existing receptor. It expands the mainline away from this noise area, putting more traffic farther from this noise area.

Noise levels were modeled at 19 receptor locations in Area 9. Modeled noise levels exceed State daytime standards at 16 of the 19 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 19 of 19 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 19 receptor locations with future (2040) Build conditions.

5.2.9.1 Barrier EB 11

An approximately 1,021 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r32”, “r33”, and ”r35”. The barrier provides a reduction that varies from 4.4 dBA to 7.7 dBA. The cost effectiveness of the 20 foot high

barrier is $195,200 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 1,021 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors "r32", "r33", and "r35". The barrier provides a reduction that varies from 3.8 dBA to 6.2 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.9.2 Barrier EB 12

An approximately 932 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors "r38" through "r41". The barrier provides a reduction that varies from 2.1 dBA to 8.9 dBA. The cost effectiveness of the 20 foot high barrier is $118,267 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 932 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors "r38" through "r41". The barrier provides a reduction that varies from 1.9 dBA to 6.7 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.9.3 Barrier EB 13

An approximately 1,746 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors "r44" through "r52". There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 3.1 dBA to 11.5 dBA. The cost effectiveness of the 20 foot high barrier is $132,480 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

Based on the number of benefitted receptors with a 20 foot high noise barrier (5 receptors), an approximate noise barrier height of less than 7 feet would be required to meet the cost effectiveness calculations for this barrier. Therefore, a shortened and optimized noise barrier was evaluated for receptors "r44" through "r50".

5.2.9.3.1 *Barrier EB 13a*

An optimum noise barrier, approximately 1,312 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors "r44" through "r50". There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 0.3 dBA to 11.1 dBA. The cost effectiveness of the 20 foot high barrier is $101,360 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

Based on the number of benefitted receptors with a 20 foot high noise barrier (5 receptors), an approximate noise barrier height of less than 10 feet would be required to meet the cost effectiveness calculations for this barrier. Therefore, an optimized noise barrier height of 10 foot high was evaluated.

An optimum noise barrier, approximately 1,312 foot long, 10 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors "r44" through "r50". There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 0.0 dBA to 6.7 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.10 Noise Area 10 – South side of TH 23 between West Becker Lake Circle and East Becker Lake Circle

Land uses south of TH 23 between West Becker Lake Circle and East Becker Lake Circle consist of a grouping of residential buildings.

The proposed Highway 23 alignment in this noise area pushes the mainline further from the existing receptor. It expands the mainline away from this noise area, putting more traffic farther from this noise area.

Noise levels were modeled at 19 receptor locations in Area 10. Modeled noise levels exceed State daytime standards at 3 of the 19 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 19 of 19 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 19 receptor locations with future (2040) Build conditions.

5.2.10.1 Barrier EB 14

An approximately 1,791 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r53” through “r64” and “r74” through “r83”. Due to highway access to TH 23, the noise barrier length is limited. The barrier provides a reduction that varies from 1.7 dBA to 9.0 dBA. The cost effectiveness of the 20 foot high barrier is $69,840 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 1,791 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r53” through “r64” and “r74” through “r83”. Due to highway access to TH 23, the noise barrier length is limited. The barrier provides a reduction that varies from 1.2 dBA to 6.1 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.11 Noise Area 11 – South side of TH 23 between East Becker Lake Circle and TH 22

Land uses north of TH 23 between East Becker Lake Circle and TH 22 consist of a single residential receptor.

The proposed Highway 23 alignment in this noise area does not change the noise environment for the existing receptor as the receptor is near the existing 4-lane roadway section.

Noise levels were modeled at 1 receptor location in Area 11. Modeled noise levels exceed State daytime standards at 0 of the 1 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 1 of 1 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 1 receptor locations with future (2040) Build conditions.

5.2.11.1 Barrier EB 15

An approximately 594 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r65”. The barrier provides a reduction of 3.8 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.12 Noise Area 12 – North side of TH 23 between TH 22 and East Becker Lake Circle

Land uses north of TH 23 between TH 22 and East Becker Lake Circle consist of a spread out mix of both commercial and residential buildings and a section of the Rocori Trail.

The proposed Highway 23 alignment in this noise area does not significantly change the noise environment for the existing receptors as the receptors are near the existing 4-lane roadway section.

Noise levels were modeled at 18 receptor locations in Area 12. Modeled noise levels exceed State daytime standards at 1 of the 18 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 5 of 18 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 18 receptor locations with future (2040) Build conditions.

5.2.12.1 Barrier WB 1

An approximately 511 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “r66” through “r69” and “c4”. There is a gap in the noise barrier to allow TH 23 commercial driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 1.5 dBA to 6.3 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.12.2 Barrier WB 2

An approximately 471 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “trail29”. The barrier provides a reduction that varies from 0.3 dBA to 7.0 dBA. The cost effectiveness of the 20 foot high barrier is $170,400 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 471 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “trail29”. The barrier provides a reduction that varies from 0.2 dBA to 5.1 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.13 Noise Area 13 – North side of TH 23 between East Becker Lake Circle and West Becker Lake Circle

Land uses north of TH 23 between East Becker Lake Circle and West Becker Lake Circle consist of a section of the Rocori Trail.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards the western end of this noise area, putting more traffic closer to this noise area.

Noise levels were modeled at 10 receptor locations in Area 13. Modeled noise levels exceed State daytime standards at 0 of the 10 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 0 of 10 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 3 of 10 receptor locations with future (2040) Build conditions.

5.2.13.1 Barrier WB 3

An approximately 998 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “Trail16” through “trail18”. The barrier provides a

reduction that varies from 0.4 dBA to 10.3 dBA. The cost effectiveness of the 20 foot high barrier is $76,240 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 998 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "Trail16" through "trail18". The barrier provides a reduction that varies from 0.3 dBA to 7.5 dBA. The cost effectiveness of the 15 foot high barrier is $58,040 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 998 foot long, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "Trail16" through "trail18". The barrier provides a reduction that varies from 0.2 dBA to 4.4 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.14 Noise Area 14 – North side of TH 23 between West Becker Lake Circle and CR 12

Land uses north of TH 23 between West Becker Lake Circle and CR 12 consist of a section of the Rocori Trail.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards the western end of this noise area, putting more traffic closer to this noise area. The proposed roadway design removes receptors "r36", "r37", "r42", and "r43" from the Build conditions.

Noise levels were modeled at 12 receptor locations in Area 12. Modeled noise levels exceed State daytime standards at 0 of the 12 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 0 of 12 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 3 of 12 receptor locations with future (2040) Build conditions.

5.2.14.1 Barrier WB 4

An approximately 1,568 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "Trail6" through "trail8". The barrier provides a reduction that varies from 1.1 dBA to 9.1 dBA. The cost effectiveness of the 20 foot high barrier is $101,533 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 1,568 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "Trail6" through "trail8". The barrier provides a reduction that varies from 0.9 dBA to 6.1 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.15 Noise Area 15 – North side of TH 23 between CR 12 and Big Lake Court

Land uses north of TH 23 between CR 12 and Big Lake Court consist of spread out residential buildings.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards the western end of this noise area, putting more traffic closer to this noise area. The proposed roadway design removes receptors "r28", "r30", and "r34" from the Build conditions.

Therefore, there are no impacted receptors in Noise Area 15 for the Build Condition.

5.2.16 Noise Area 16 – North side of TH 23 between Big Lake Court and CR 114

Land uses north of TH 23 between Big Lake Court and CR 114/246th Avenue consist of a spread out residential buildings.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards the western end of this noise area, putting more traffic closer to this noise area. The proposed roadway design removes receptor "r26" from the Build conditions.

Noise levels were modeled at 2 receptor locations in Area 16. Modeled noise levels exceed State daytime standards at 0 of the 2 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 2 of 2 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 2 receptor locations with future (2040) Build conditions.

5.2.16.1 Barrier WB 5

An approximately 1,902 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "r25". There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies of 1.6 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.16.2 Barrier WB 6

An approximately 1,652 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "r24". There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies of 3.7 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.17 Noise Area 17 – North side of TH 23 between CR 114 and 205th

Land uses north of TH 23 between CR 114 and 205th Street consist of a spread out mix of residential buildings and a single commercial receptor.

The proposed Highway 23 alignment in this noise area pushes the mainline further from the existing receptor. It expands the mainline away from this noise area, putting more traffic farther from this noise area.

Noise levels were modeled at 5 receptor locations in Area 17. Modeled noise levels exceed State daytime standards at 0 of the 5 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 4 of 5 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 5 receptor locations with future (2040) Build conditions.

5.2.17.1 Barrier WB 7

An approximately 2,875 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "r17" through "r21". There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 0.8 dBA to 7.6 dBA. The cost effectiveness of the 20 foot high barrier is $566,000 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

Based on the number of benefitted receptors with a 20 foot high noise barrier (2 receptors), an approximate noise barrier height of less than 5 feet would be required to meet the cost

effectiveness calculations for this barrier. Therefore, a shortened and optimized noise barrier was evaluated for receptors “r18” and “r19”.

5.2.17.1.1 *Barrier WB 7a*

An optimum noise barrier, approximately 2,421 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r18” and “r19”. The barrier provides a reduction that varies from 0.3 dBA to 7.2 dBA. The cost effectiveness of the 20 foot high barrier is $475,200 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An optimum noise barrier, approximately 2,421 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r18” and “r19”. The barrier provides a reduction that varies from 0.3 dBA to 5.6 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.18 Noise Area 18 – North side of TH 23 between 205th and CR 123

Land uses north of TH 23 between 205th Street and CR 123 consist of a single residential building.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards the western end of this noise area, putting more traffic closer to this noise area. The proposed roadway design removes receptor “r10” from the Build conditions.

Therefore, there are no impacted receptors in Noise Area 18 for the Build Condition.

5.2.19 Noise Area 19 – North side of TH 23 between CR 123 and 263rd

Land uses north of TH 23 between CR 123 and 263rd Avenue consist of a two spread residential buildings.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards the western end of this noise area, putting more traffic closer to this noise area.

Noise levels were modeled at 2 receptor locations in Area 19. Modeled noise levels exceed State daytime standards at 0 of the 2 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 2 of 2 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 2 receptor locations with future (2040) Build conditions.

5.2.19.1 Barrier WB 8

An approximately 2,408 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “r7” and “r9”. There is a gap in the noise barrier to allow TH 23 driveway access which does not allow a continuous barrier. The barrier provides a reduction that varies from 1.9 dBA to 3.1 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.20 Noise Area 20 – North side of TH 23 between 263rd and CR 85

Land uses north of TH 23 between 263rd Avenue and the CR 85 interchange consist of a spread out residential buildings.

The proposed Highway 23 alignment in this noise area brings the mainline closer to the existing receptors. It expands the mainline towards the western end of this noise area,

putting more traffic closer to this noise area. The proposed roadway design removes receptors “r4” and “r5” from the Build conditions.

Noise levels were modeled at 2 receptor locations in Area 20. Modeled noise levels exceed State daytime standards at 2 of the 2 receptor locations with future (2040) Daytime Build conditions and State nighttime standards at 2 of 2 receptor locations with future (2040) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 2 receptor locations with future (2040) Build conditions.

5.2.20.1 Barrier WB 9

An approximately 579 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “r6”. The barrier provides a reduction that varies 4.0 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.20.2 Barrier WB 10

An approximately 409 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “r2”. The barrier provides a reduction of 9.2 dBA. The cost effectiveness of the 20 foot high barrier is $145,600 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 409 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “r2”. The barrier provides a reduction of 7.4 dBA. The cost effectiveness of the 15 foot high barrier is $113,500 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 409 foot long, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor “r2”. The barrier provides a reduction of 4.2 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

6.0 Construction Noise

The construction activities associated with implementation of the proposed project will result in increased noise levels relative to existing conditions. These impacts will primarily be associated with construction equipment and pile driving.

The following table (Table 7) shows peak noise levels monitored at 50 feet from various types of construction equipment. This equipment is primarily associated with site grading/site preparation, which is generally the roadway construction phase associated with the greatest noise levels.

Table 7
Typical Construction Equipment Noise Levels at 50 feet

Equipment Type	Manufacturers Sampled	Total Number of Models in Sample	Peak Noise Level (dBA)	
			Range	Average
Backhoes	5	6	74-92	83
Front Loaders	5	30	75-96	85
Dozers	8	41	65-95	85
Graders	3	15	72-92	84
Scrapers	2	27	76-98	87
Pile Drivers	N/A	N/A	95-105	101

Source: United States Environmental Protection Agency and Federal Highway Administration

Elevated noise levels are, to a degree, unavoidable for this type of project. MnDOT will require that construction equipment be properly muffled and in proper working order. While MnDOT and its contractor(s) are exempt from local noise ordinances, it is the practice to require contractor(s) to comply with applicable local noise restrictions and ordinances to the extent that is reasonable. Advanced notice will be provided to affected communities of any planned abnormally loud construction activities.

It is anticipated that night construction may be required to minimize traffic impacts and to improve safety. However, construction will be limited to daytime hours as much as possible. This project is expected to be under construction for up to 24 months. If necessary, a detailed nighttime construction mitigation plan will be developed during the project final design stage.

Any associated high-impact equipment noise, such as pile driving, pavement sawing, or jack hammering, will be unavoidable with construction of the proposed project. Pile-driving noise is associated with any bridge construction and sheet piling necessary for retaining wall construction. High-impact noise construction activities will be limited in duration to the greatest extent possible. While pile-driving equipment results in the highest peak noise level, as shown in Table 7, it is limited in duration to the activities noted above (e.g., bridge construction). The use of pile drivers, jack hammers, and pavement sawing equipment will be prohibited during nighttime hours.

7.0 Conclusion

Noise levels along the TH 23 corridor exceed Federal and both State daytime and nighttime noise standards for the majority of the project area under existing (2016) conditions.

In general, the construction of the TH 23 North Gap Project will result in increases in traffic noise levels compared to the existing conditions. Modeled build (2040) condition noise levels (daytime and nighttime) vary from -4.5 dBA to 5.9 dBA from existing (2016) conditions.

Acoustic reasonableness and cost effectiveness were calculated for each noise barrier evaluated (25 noise barriers). No noise barrier was found to be both reasonable and feasible. As a result of this analysis, no noise barrier will be proposed as part of the TH 23 North Gap Project.

If there are any significant changes to the final design of the TH 23 North Gap Project, the environmental document may need to be re-evaluated.

List of Tables

Table 5 – Daytime Noise Analysis Summary
Table 6 – Nighttime Noise Analysis Summary

Table 5
Daytime Noise Analysis Summary
Existing and Future Scenarios

Noise Level Comparison to Standards	
XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards
N/A	Receptor does not exist in Scenario

Receiver		MN State Standards (dBA)			FHWA Standards (dBA)		Existing 2016 Conditions		2040							
									Future No Build Conditions		Difference - Existing and No Build		Future Build Conditions		Difference - Existing and Build	
Receptor ID	Land Use	Noise Area Classification	L10	L50	Activity Category	L10	L10	L50	L10	L50	L10	L50	L10	L50	L10	L50
Noise Area 1 - South side of TH 23 between CR 85/Business 23 and 263rd Avenue																
r1	Residential	NAC-1	65	60	B	70	63.9	57.4	**65.7**	**60.1**	1.8	2.7	**65.7**	**60.1**	1.8	2.7
Noise Area 2 - South side of TH 23 between south leg of 263rd Avenue and County Road 123																
r3	Residential	NAC-1	65	60	B	70	**65.5**	59.3	**67.3**	**61.9**	1.8	2.6	**66.9**	**61.3**	1.4	2.0
Noise Area 3 - South side of TH 23 between County Road 123 and 253rd Avenue																
r8	Residential	NAC-1	65	60	B	70	**65.0**	58.6	**66.8**	**61.3**	1.8	2.7	N/A	N/A		
r11	Residential	NAC-1	65	60	B	70	**67.1**	**60.2**	**69.1**	**63.0**	2.0	2.8	**68.7**	**62.4**	1.6	2.2
r12	Residential	NAC-1	65	60	B	70	59.7	54.6	61.5	57.2	1.8	2.6	61.7	57.4	2.0	2.8
r13	Residential	NAC-1	65	60	B	70	**68.1**	**61.0**	**70.1**	**63.7**	2.0	2.7	**69.4**	**62.9**	1.3	1.9
Noise Area 4 - South side of TH 23 between 253rd Avenue and 205th Street																
r14	Residential	NAC-1	65	60	B	70	53.6	49.6	55.2	52.0	1.6	2.4	56.4	53.0	2.8	3.4
Noise Area 5 - South side of TH 23 between 205th Street and 210th Street																
c1	Commercial	NAC-2	70	65	E	75	64.1	58.0	65.9	60.6	1.8	2.6	68.5	62.2	4.4	4.2
r15	Residential	NAC-1	65	60	B	70	63.7	57.7	**65.5**	**60.3**	1.8	2.6	**68.2**	**62.1**	4.5	4.4
r16	Residential	NAC-1	65	60	B	70	**70.3**	**62.6**	**72.3**	**65.4**	2.0	2.8	N/A	N/A		
Noise Area 6 - South side of TH 23 between 210th Street and County Road 123																
r20	Residential	NAC-1	65	60	B	70	**67.4**	**60.0**	**69.4**	**62.8**	2.0	2.8	N/A	N/A		
r22	Residential	NAC-1	65	60	B	70	61.3	55.4	63.1	58.0	1.8	2.6	**65.8**	**60.2**	4.5	4.8
Noise Area 7 - South side of TH 23 between County Road 123 and Big Lake Court																
C3	Commercial	NAC-2	70	65	E	75	69.7	61.8	**71.8**	64.7	2.1	2.9	**71.2**	63.6	1.5	1.8
r23	Residential	NAC-1	65	60	B	70	57.6	52.7	59.3	55.1	1.7	2.4	60.5	56.2	2.9	3.5
r84	Residential	NAC-1	65	60	B	70	59.0	53.8	60.8	56.3	1.8	2.5	61.4	56.8	2.4	3.0
Noise Area 8 - South side of TH 23 between Big Lake Court and County Road 43																
r27	Residential	NAC-1	65	60	B	70	64.4	57.7	**66.4**	**60.4**	2.0	2.7	**66.2**	**60.2**	1.8	2.5
r29	Residential	NAC-1	65	60	B	70	**65.9**	59.0	**67.8**	**61.7**	1.9	2.7	**67.4**	**61.0**	1.5	2.0
Noise Area 9 - South side of TH 23 between County Road 43 and West Becker Lake Circle																
r32	Residential	NAC-1	65	60	B	70	**66.8**	58.9	**68.8**	**61.8**	2.0	2.9	**67.4**	**61.4**	0.6	2.5
r33	Residential	NAC-1	65	60	B	70	60.7	55.4	62.4	57.9	1.7	2.5	62.4	57.9	1.7	2.5
r35	Residential	NAC-1	65	60	B	70	**65.2**	58.5	**67.1**	**61.2**	1.9	2.7	**66.6**	**60.7**	1.4	2.2
r38	Residential	NAC-1	65	60	B	70	64.8	57.7	**66.7**	**60.4**	1.9	2.7	**66.1**	**60.2**	1.3	2.5
r39	Residential	NAC-1	65	60	B	70	**65.7**	58.6	**67.6**	**61.4**	1.9	2.8	**66.9**	**61.1**	1.2	2.5
r40	Residential	NAC-1	65	60	B	70	**66.1**	59.0	**68.0**	**61.7**	1.9	2.7	**67.3**	**61.4**	1.2	2.4
r41	Residential	NAC-1	65	60	B	70	56.9	52.0	58.6	54.5	1.7	2.5	58.5	54.5	1.6	2.5
r44	Residential	NAC-1	65	60	B	70	**69.1**	**60.4**	**71.2**	**63.3**	2.1	2.9	**69.6**	**62.7**	0.5	2.3
r45	Residential	NAC-1	65	60	B	70	**66.5**	58.8	**68.5**	**61.5**	2.0	2.7	**67.3**	**61.2**	0.8	2.4
r46	Residential	NAC-1	65	60	B	70	**68.4**	59.9	**70.5**	**62.8**	2.1	2.9	**68.2**	**61.5**	-0.2	1.6
r47	Residential	NAC-1	65	60	B	70	**68.3**	59.9	**70.4**	**62.7**	2.1	2.8	**67.8**	**61.3**	-0.5	1.4
r48	Residential	NAC-1	65	60	B	70	**66.8**	58.5	**68.8**	**61.4**	2.0	2.9	**66.7**	**60.5**	-0.1	2.0
r49	Residential	NAC-1	65	60	B	70	62.9	55.9	64.9	58.6	2.0	2.7	63.5	57.7	0.6	1.8
r50	Residential	NAC-1	65	60	B	70	**66.7**	59.0	**68.7**	**61.7**	2.0	2.7	**66.7**	**60.4**	0.0	1.4
r51	Residential	NAC-1	65	60	B	70	64.9	58.7	**66.7**	**61.3**	1.8	2.6	**66.2**	**60.9**	1.3	2.2
r52	Residential	NAC-1	65	60	B	70	63.8	57.8	**65.6**	**60.4**	1.8	2.6	**65.4**	**60.2**	1.6	2.4
r53	Residential	NAC-1	65	60	B	70	**66.6**	59.9	**68.4**	**62.6**	1.8	2.7	**68.0**	**62.1**	1.4	2.2
r54	Residential	NAC-1	65	60	B	70	**66.8**	**60.1**	**68.7**	**62.8**	1.9	2.7	**68.4**	**62.5**	1.6	2.4
r55	Residential	NAC-1	65	60	B	70	**66.7**	**60.0**	**68.6**	**62.7**	1.9	2.7	**68.4**	**62.5**	1.7	2.5
Noise Area 10 - South side of TH 23 between West Becker Lake Circle & East Becker Lake Circle																
r56	Residential	NAC-1	65	60	B	70	64.5	58.3	**66.3**	**61.0**	1.8	2.7	**66.5**	**61.1**	2.0	2.8
r57	Residential	NAC-1	65	60	B	70	61.5	56.0	63.2	58.6	1.7	2.6	63.6	59.0	2.1	3.0
r58	Residential	NAC-1	65	60	B	70	59.7	54.7	61.4	57.1	1.7	2.4	62.0	57.6	2.3	2.9
r59	Residential	NAC-1	65	60	B	70	**65.5**	59.1	**67.3**	**61.7**	1.8	2.6	**67.7**	**62.1**	2.2	3.0
r60	Residential	NAC-1	65	60	B	70	61.0	55.7	62.7	58.2	1.7	2.5	63.3	58.7	2.3	3.0
r61	Residential	NAC-1	65	60	B	70	60.6	55.3	62.3	57.8	1.7	2.5	62.9	58.4	2.3	3.1
r62	Residential	NAC-1	65	60	B	70	57.7	53.0	59.4	55.4	1.7	2.4	60.0	55.9	2.3	2.9
r63	Residential	NAC-1	65	60	B	70	59.8	54.6	61.5	57.1	1.7	2.5	62.0	57.5	2.2	2.9

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Existing and Future Scenarios

Noise Level Comparison to Standards	
XX	**Bold**; Exceeds MN State Standards
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N/A	Receptor does not exist in Scenario

Receiver		MN State Standards (dBA)			FHWA Standards (dBA)		Existing 2016 Conditions		2040							
									Future No Build Conditions		Difference - Existing and No Build		Future Build Conditions		Difference - Existing and Build	
Receptor ID	Land Use	Noise Area Classification	L10	L50	Activity Category	L10	L10	L50	L10	L50	L10	L50	L10	L50	L10	L50
r64	Residential	NAC-1	65	60	B	70	**66.3**	59.5	**68.2**	**62.2**	1.9	2.7	**68.7**	**62.6**	2.4	3.1
r74	Residential	NAC-1	65	60	B	70	58.2	53.4	59.8	55.9	1.6	2.5	60.5	56.4	2.3	3.0
r75	Residential	NAC-1	65	60	B	70	57.1	52.5	58.7	54.9	1.6	2.4	59.3	55.5	2.2	3.0
r76	Residential	NAC-1	65	60	B	70	56.4	52.0	58.1	54.4	1.7	2.4	58.7	54.9	2.3	2.9
r77	Residential	NAC-1	65	60	B	70	55.4	51.1	57.0	53.5	1.6	2.4	57.6	54.0	2.2	2.9
r78	Residential	NAC-1	65	60	B	70	55.0	50.8	56.7	53.2	1.7	2.4	57.3	53.7	2.3	2.9
r79	Residential	NAC-1	65	60	B	70	54.9	50.7	56.6	53.1	1.7	2.4	57.2	53.6	2.3	2.9
r80	Residential	NAC-1	65	60	B	70	55.3	51.0	56.9	53.4	1.6	2.4	57.5	53.8	2.2	2.8
r81	Residential	NAC-1	65	60	B	70	55.5	51.2	57.2	53.6	1.7	2.4	57.7	54.0	2.2	2.8
r82	Residential	NAC-1	65	60	B	70	55.3	51.0	56.9	53.3	1.6	2.3	57.4	53.8	2.1	2.8
r83	Residential	NAC-1	65	60	B	70	55.1	50.8	56.8	53.2	1.7	2.4	57.2	53.5	2.1	2.7
Noise Area 11 - South side of TH 23 between East Becker Lake Circle and TH 22																
r65	Residential	NAC-1	65	60	B	70	61.8	54.8	63.7	57.5	1.9	2.7	63.9	57.7	2.1	2.9
Noise Area 12 - North side of TH 23 between TH 22 to East Becker Lake Cicle																
c4	Commercial	NAC-2	70	65	E	75	**70.6**	62.1	**72.7**	64.9	2.1	2.8	**72.2**	64.6	1.6	2.5
r66	Residential	NAC-1	65	60	B	70	57.8	51.8	59.6	54.4	1.8	2.6	59.5	54.4	1.7	2.6
r67	Residential	NAC-1	65	60	B	70	57.6	51.4	59.4	54.0	1.8	2.6	59.4	54.0	1.8	2.6
r68	Residential	NAC-1	65	60	B	70	59.1	53.2	60.9	55.8	1.8	2.6	60.8	55.7	1.7	2.5
r69	Residential	NAC-1	65	60	B	70	55.5	50.3	57.2	52.8	1.7	2.5	57.1	52.7	1.6	2.4
trail23	Trail	NAC-2	70	65	C	70	69.4	61.6	**71.4**	64.4	2.0	2.8	68.3	62.3	-1.1	0.7
trail24	Trail	NAC-2	70	65	C	70	69.2	61.4	**71.2**	64.2	2.0	2.8	68.0	61.9	-1.2	0.5
trail25	Trail	NAC-2	70	65	C	70	69.1	61.3	**71.1**	64.1	2.0	2.8	67.9	61.9	-1.2	0.6
trail26	Trail	NAC-2	70	65	C	70	68.5	60.9	**70.5**	63.6	2.0	2.7	67.9	61.8	-0.6	0.9
trail27	Trail	NAC-2	70	65	C	70	68.2	60.6	**70.2**	63.3	2.0	2.7	67.9	61.8	-0.3	1.2
trail28	Trail	NAC-2	70	65	C	70	67.8	60.3	69.8	63.1	2.0	2.8	67.9	61.7	0.1	1.4
trail29	Trail	NAC-2	70	65	C	70	67.6	60.2	69.6	62.9	2.0	2.7	69.3	62.6	1.7	2.4
trail30	Trail	NAC-2	70	65	C	70	65.9	58.1	68.0	60.9	2.1	2.8	65.4	58.7	-0.5	0.6
trail31	Trail	NAC-2	70	65	C	70	65.1	57.6	67.1	60.3	2.0	2.7	65.8	58.7	0.7	1.1
trail32	Trail	NAC-2	70	65	C	70	65.3	58.4	67.2	61.1	1.9	2.7	67.0	61.0	1.7	2.6
trail33	Trail	NAC-2	70	65	C	70	64.2	57.5	66.1	60.2	1.9	2.7	65.9	60.1	1.7	2.6
trail34	Trail	NAC-2	70	65	C	70	63.0	56.2	64.9	58.9	1.9	2.7	64.8	58.8	1.8	2.6
trail35	Trail	NAC-2	70	65	C	70	62.5	55.6	64.4	58.3	1.9	2.7	64.3	58.3	1.8	2.7
Noise Area 13 - North side of TH 23 between East Becker Lake Circle and West Becker Lake Circle																
trail13	Trail	NAC-2	70	65	C	70	69.5	62.1	**71.5**	64.9	2.0	2.8	68.6	62.4	-0.9	0.3
trail14	Trail	NAC-2	70	65	C	70	69.2	61.9	**71.1**	64.7	1.9	2.8	68.8	62.9	-0.4	1.0
trail15	Trail	NAC-2	70	65	C	70	69.1	61.9	**71.1**	64.6	2.0	2.7	68.9	63.0	-0.2	1.1
trail16	Trail	NAC-2	70	65	C	70	69.3	62.0	**71.3**	64.8	2.0	2.8	69.0	63.1	-0.3	1.1
trail17	Trail	NAC-2	70	65	C	70	69.3	62.0	**71.3**	64.7	2.0	2.7	69.1	63.2	-0.2	1.2
trail18	Trail	NAC-2	70	65	C	70	69.3	62.0	**71.3**	64.8	2.0	2.8	69.1	63.2	-0.2	1.2
trail19	Trail	NAC-2	70	65	C	70	69.5	62.1	**71.4**	64.8	1.9	2.7	68.8	62.7	-0.7	0.6
trail20	Trail	NAC-2	70	65	C	70	69.6	62.2	**71.6**	64.9	2.0	2.7	68.4	62.1	-1.2	-0.1
trail21	Trail	NAC-2	70	65	C	70	69.6	62.1	**71.5**	64.8	1.9	2.7	68.4	62.1	-1.2	0.0
trail22	Trail	NAC-2	70	65	C	70	69.6	61.9	**71.5**	64.7	1.9	2.8	68.5	62.2	-1.1	0.3
Noise Area 14 - North side of TH 23 between West Becker Lake Circle and County Road 43																
r36	Residential	NAC-1	65	60	B	70	**68.0**	**60.4**	**70.0**	**63.2**	2.0	2.8	N/A	N/A		
r37	Residential	NAC-1	65	60	B	70	**67.1**	59.7	**69.1**	**62.4**	2.0	2.7	N/A	N/A		
r42	Residential	NAC-1	65	60	B	70	62.5	56.8	64.2	59.4	1.7	2.6	N/A	N/A		
r43	Residential	NAC-1	65	60	B	70	**66.5**	58.8	**68.5**	**61.6**	2.0	2.8	N/A	N/A		
trail1	Trail	NAC-2	70	65	C	70	53.8	49.6	55.4	51.9	1.6	2.3	57.3	53.8	3.5	4.2
trail2	Trail	NAC-2	70	65	C	70	54.7	50.3	56.4	52.7	1.7	2.4	58.4	54.6	3.7	4.3
trail3	Trail	NAC-2	70	65	C	70	55.6	51.0	57.3	53.4	1.7	2.4	59.6	55.6	4.0	4.6
trail4	Trail	NAC-2	70	65	C	70	56.7	51.7	58.4	54.2	1.7	2.5	60.9	56.6	4.2	4.9
trail5	Trail	NAC-2	70	65	C	70	58.0	52.7	59.7	55.2	1.7	2.5	62.6	58.0	4.6	5.3
trail6	Trail	NAC-2	70	65	C	70	59.4	54.0	61.2	56.5	1.8	2.5	64.3	59.4	4.9	5.4

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Receiver		MN State Standards (dBA)			FHWA Standards (dBA)		Existing 2016 Conditions		2040							
									Future No Build Conditions		Difference - Existing and No Build		Future Build Conditions		Difference - Existing and Build	
Receptor ID	Land Use	Noise Area Classification	L10	L50	Activity Category	L10	L10	L50	L10	L50	L10	L50	L10	L50	L10	L50
trail7	Trail	NAC-2	70	65	C	70	61.2	55.6	63.0	58.1	1.8	2.5	67.0	61.4	5.8	5.8
trail8	Trail	NAC-2	70	65	C	70	63.3	57.4	65.1	60.0	1.8	2.6	68.3	62.4	5.0	5.0
trail9	Trail	NAC-2	70	65	C	70	65.4	59.1	67.2	61.7	1.8	2.6	68.5	62.6	3.1	3.5
trail10	Trail	NAC-2	70	65	C	70	67.4	60.6	69.3	63.3	1.9	2.7	68.7	62.7	1.3	2.1
trail11	Trail	NAC-2	70	65	C	70	68.7	61.6	**70.6**	64.3	1.9	2.7	68.5	62.4	-0.2	0.8
trail12	Trail	NAC-2	70	65	C	70	69.3	62.0	**71.3**	64.8	2.0	2.8	68.5	62.4	-0.8	0.4
Noise Area 15 - North side of TH 23 between County Road 43 and Big Lake Court																
r28	Residential	NAC-1	65	60	B	70	**68.2**	**60.7**	**70.2**	**63.5**	2.0	2.8	N/A	N/A		
r30	Residential	NAC-1	65	60	B	70	64.0	57.4	**65.9**	**60.1**	1.9	2.7	N/A	N/A		
r34	Residential	NAC-1	65	60	B	70	63.8	57.6	**65.7**	**60.2**	1.9	2.6	N/A	N/A		
Noise Area 16 - North side of TH 23 between Big Lake Court and CR 114/246th Avenue																
r24	Residential	NAC-1	65	60	B	70	58.8	53.6	60.5	56.1	1.7	2.5	61.3	56.9	2.5	3.3
r25	Residential	NAC-1	65	60	B	70	58.5	53.4	60.2	55.9	1.7	2.5	61.9	57.3	3.4	3.9
r26	Residential	NAC-1	65	60	B	70	63.0	56.8	64.9	59.5	1.9	2.7	N/A	N/A		
Noise Area 17 - North side of TH 23 between CR 114/246th Avenue and 205th Street																
c2	Commercial	NAC-2	70	65	E	75	66.8	59.7	68.8	62.4	2.0	2.7	65.6	60.1	-1.2	0.4
r17	Residential	NAC-1	65	60	B	70	**66.2**	59.2	**68.1**	**61.9**	1.9	2.7	64.6	57.8	-1.6	-1.4
r18	Residential	NAC-1	65	60	B	70	**66.4**	59.4	**68.3**	**62.1**	1.9	2.7	61.9	57.2	-4.5	-2.2
r19	Residential	NAC-1	65	60	B	70	59.6	54.0	61.4	56.5	1.8	2.5	58.9	54.6	-0.7	0.6
r21	Residential	NAC-1	65	60	B	70	61.6	55.7	63.4	58.3	1.8	2.6	62.9	58.0	1.3	2.3
Noise Area 18 - North side of TH 23 between 205th Street and County Road 123																
r10	Residential	NAC-1	65	60	B	70	**66.3**	59.6	**68.2**	**62.4**	1.9	2.8	N/A	N/A		
Noise Area 19 - North side of TH 23 between County Road 123 and 263rd Avenue																
r7	Residential	NAC-1	65	60	B	70	59.2	54.4	60.8	56.8	1.6	2.4	62.5	58.0	3.3	3.6
r9	Residential	NAC-1	65	60	B	70	54.2	50.3	55.9	52.6	1.7	2.3	57.2	53.8	3.0	3.5
Noise Area 20 - North side of TH 23 between 263rd Avenue and CR 85/Business 23																
r2	Residential	NAC-1	65	60	B	70	**68.8**	**61.4**	**70.8**	**64.1**	2.0	2.7	**71.3**	**64.2**	2.5	2.8
r4	Residential	NAC-1	65	60	B	70	**72.6**	**64.4**	**74.6**	**67.2**	2.0	2.8	N/A	N/A		
r5	Residential	NAC-1	65	60	B	70	**67.0**	**60.3**	**68.8**	**63.0**	1.8	2.7	N/A	N/A		
r6	Residential	NAC-1	65	60	B	70	63.1	57.4	**65.1**	59.5	2.0	2.1	**67.0**	**61.4**	3.9	4.0

Table 6
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Noise Level Comparison to Standards	
XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards
N/A	Receptor does not exist in Scenario

Receiver		MN State Standards (dBA)			FHWA Standards (dBA)		Existing 2016 Conditions		2040							
									Future No Build Conditions		Difference - Existing and No Build		Future Build Conditions		Difference - Existing and Build	
Receptor ID	Land Use	Noise Area Classification	L10	L50	Activity Category	L10	L10	L50	L10	L50	L10	L50	L10	L50	L10	L50
Noise Area 1 - South side of TH 23 between CR 85/Business 23 and 263rd Avenue																
r1	Residential	NAC-1	55	50	B	70	**61.4**	**54.2**	**63.3**	**57.0**	1.9	2.8	**63.3**	**57.0**	1.9	2.8
Noise Area 2 - South side of TH 23 between south leg of 263rd Avenue and County Road 123																
r3	Residential	NAC-1	55	50	B	70	**63.4**	**56.0**	**65.4**	**58.8**	2.0	2.8	**64.4**	**58.0**	1.0	2.0
Noise Area 3 - South side of TH 23 between County Road 123 and 253rd Avenue																
r8	Residential	NAC-1	55	50	B	70	**62.9**	**55.4**	**64.8**	**58.2**	1.9	2.8	N/A	N/A		
r11	Residential	NAC-1	55	50	B	70	**65.0**	**57.0**	**67.0**	**59.8**	2.0	2.8	**65.8**	**58.9**	0.8	1.9
r12	Residential	NAC-1	55	50	B	70	**57.9**	**51.6**	**59.7**	**54.3**	1.8	2.7	**59.5**	**54.3**	1.6	2.7
r13	Residential	NAC-1	55	50	B	70	**65.9**	**57.6**	**67.9**	**60.5**	2.0	2.9	**66.5**	**59.3**	0.6	1.7
Noise Area 4 - South side of TH 23 between 253rd Avenue and 205th Street																
r14	Residential	NAC-1	55	50	B	70	51.8	46.7	53.5	49.2	1.7	2.5	**54.4**	**50.1**	2.6	3.4
Noise Area 5 - South side of TH 23 between 205th Street and 210th Street																
c1	Commercial	NAC-2	70	65	E	75	61.9	54.5	63.8	57.3	1.9	2.8	65.6	58.6	3.7	4.1
r15	Residential	NAC-1	55	50	B	70	**61.5**	**54.3**	**63.5**	**57.1**	2.0	2.8	**65.4**	**58.5**	3.9	4.2
r16	Residential	NAC-1	55	50	B	70	**67.8**	**59.0**	**70.0**	**61.9**	2.2	2.9	N/A	N/A		
Noise Area 6 - South side of TH 23 between 210th Street and County Road 123																
r20	Residential	NAC-1	55	50	B	70	**65.7**	**57.5**	**67.8**	**60.3**	2.1	2.8	N/A	N/A		
r22	Residential	NAC-1	55	50	B	70	**59.8**	**53.0**	**61.7**	**55.8**	1.9	2.8	**63.6**	**57.5**	3.8	4.5
Noise Area 7 - South side of TH 23 between County Road 123 and Big Lake Court																
C3	Commercial	NAC-2	70	65	E	75	68.3	59.8	**70.4**	62.6	2.1	2.8	69.1	61.3	0.8	1.5
r23	Residential	NAC-1	55	50	B	70	**56.5**	**50.7**	**58.3**	**53.3**	1.8	2.6	**59.1**	**54.2**	2.6	3.5
r84	Residential	NAC-1	55	50	B	70	**57.9**	**51.9**	**59.7**	**54.5**	1.8	2.6	**60.0**	**54.9**	2.1	3.0
Noise Area 8 - South side of TH 23 between Big Lake Court and County Road 43																
r27	Residential	NAC-1	55	50	B	70	**63.2**	**55.7**	**65.2**	**58.5**	2.0	2.8	**64.4**	**58.0**	1.2	2.3
r29	Residential	NAC-1	55	50	B	70	**64.5**	**56.9**	**66.5**	**59.7**	2.0	2.8	**65.5**	**58.8**	1.0	1.9
Noise Area 9 - South side of TH 23 between County Road 43 and West Becker Lake Circle																
r32	Residential	NAC-1	55	50	B	70	**65.5**	**57.2**	**67.6**	**60.1**	2.1	2.9	**65.9**	**59.5**	0.4	2.3
r33	Residential	NAC-1	55	50	B	70	**59.7**	**53.7**	**61.5**	**56.3**	1.8	2.6	**61.2**	**56.3**	1.5	2.6
r35	Residential	NAC-1	55	50	B	70	**64.2**	**56.8**	**66.1**	**59.6**	1.9	2.8	**65.2**	**59.0**	1.0	2.2
r38	Residential	NAC-1	55	50	B	70	**63.8**	**56.1**	**65.8**	**58.9**	2.0	2.8	**64.7**	**58.6**	0.9	2.5
r39	Residential	NAC-1	55	50	B	70	**64.7**	**57.0**	**66.7**	**59.8**	2.0	2.8	**65.5**	**59.4**	0.8	2.4
r40	Residential	NAC-1	55	50	B	70	**65.2**	**57.3**	**67.2**	**60.1**	2.0	2.8	**65.9**	**59.7**	0.7	2.4
r41	Residential	NAC-1	55	50	B	70	**56.3**	**50.7**	**58.0**	**53.2**	1.7	2.5	**57.4**	**53.0**	1.1	2.3
r44	Residential	NAC-1	55	50	B	70	**68.1**	**59.0**	**70.3**	**61.8**	2.2	2.8	**68.1**	**61.1**	0.0	2.1
r45	Residential	NAC-1	55	50	B	70	**65.7**	**57.3**	**67.7**	**60.1**	2.0	2.8	**66.0**	**59.6**	0.3	2.3
r46	Residential	NAC-1	55	50	B	70	**67.4**	**58.5**	**69.5**	**61.3**	2.1	2.8	**66.8**	**59.8**	-0.6	1.3
r47	Residential	NAC-1	55	50	B	70	**67.4**	**58.4**	**69.5**	**61.3**	2.1	2.9	**66.4**	**59.6**	-1.0	1.2
r48	Residential	NAC-1	55	50	B	70	**65.9**	**57.2**	**68.0**	**60.1**	2.1	2.9	**65.4**	**58.9**	-0.5	1.7
r49	Residential	NAC-1	55	50	B	70	**62.2**	**54.6**	**64.1**	**57.3**	1.9	2.7	**62.1**	**56.1**	-0.1	1.5
r50	Residential	NAC-1	55	50	B	70	**65.7**	**57.5**	**67.8**	**60.3**	2.1	2.8	**65.3**	**58.8**	-0.4	1.3
r51	Residential	NAC-1	55	50	B	70	**63.8**	**56.9**	**65.7**	**59.6**	1.9	2.7	**65.0**	**59.2**	1.2	2.3
r52	Residential	NAC-1	55	50	B	70	**62.8**	**56.1**	**64.6**	**58.8**	1.8	2.7	**64.2**	**58.6**	1.4	2.5
r53	Residential	NAC-1	55	50	B	70	**65.4**	**58.1**	**67.3**	**60.9**	1.9	2.8	**66.7**	**60.5**	1.3	2.4
r54	Residential	NAC-1	55	50	B	70	**65.7**	**58.3**	**67.6**	**61.0**	1.9	2.7	**67.1**	**60.8**	1.4	2.5
r55	Residential	NAC-1	55	50	B	70	**65.5**	**58.2**	**67.5**	**61.0**	2.0	2.8	**67.1**	**60.8**	1.6	2.6
Noise Area 10 - South side of TH 23 between West Becker Lake Circle & East Becker Lake Circle																
r56	Residential	NAC-1	55	50	B	70	**63.4**	**56.6**	**65.3**	**59.3**	1.9	2.7	**65.3**	**59.4**	1.9	2.8
r57	Residential	NAC-1	55	50	B	70	**60.4**	**54.3**	**62.2**	**56.9**	1.8	2.6	**62.6**	**57.3**	2.2	3.0
r58	Residential	NAC-1	55	50	B	70	**58.7**	**53.0**	**60.5**	**55.6**	1.8	2.6	**60.9**	**56.0**	2.2	3.0
r59	Residential	NAC-1	55	50	B	70	**64.3**	**57.3**	**66.2**	**60.0**	1.9	2.7	**66.5**	**60.3**	2.2	3.0
r60	Residential	NAC-1	55	50	B	70	**60.0**	**54.0**	**61.8**	**56.6**	1.8	2.6	**62.2**	**57.0**	2.2	3.0
r61	Residential	NAC-1	55	50	B	70	**59.6**	**53.7**	**61.4**	**56.3**	1.8	2.6	**61.9**	**56.7**	2.3	3.0
r62	Residential	NAC-1	55	50	B	70	**56.8**	**51.4**	**58.5**	**53.9**	1.7	2.5	**59.0**	**54.4**	2.2	3.0
r63	Residential	NAC-1	55	50	B	70	**58.8**	**53.0**	**60.6**	**55.5**	1.8	2.5	**61.0**	**55.9**	2.2	2.9

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XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards
N/A	Receptor does not exist in Scenario

Receiver		MN State Standards (dBA)			FHWA Standards (dBA)		Existing 2016 Conditions		2040							
									Future No Build Conditions		Difference - Existing and No Build		Future Build Conditions		Difference - Existing and Build	
Receptor ID	Land Use	Noise Area Classification	L10	L50	Activity Category	L10	L10	L50	L10	L50	L10	L50	L10	L50	L10	L50
r64	Residential	NAC-1	55	50	B	70	**65.1**	**57.8**	**67.0**	**60.5**	1.9	2.7	**67.4**	**60.8**	2.3	3.0
r74	Residential	NAC-1	55	50	B	70	**57.2**	**51.8**	**59.0**	**54.3**	1.8	2.5	**59.5**	**54.8**	2.3	3.0
r75	Residential	NAC-1	55	50	B	70	**56.1**	**51.0**	**57.9**	**53.4**	1.8	2.4	**58.4**	**53.9**	2.3	2.9
r76	Residential	NAC-1	55	50	B	70	**55.5**	**50.4**	**57.2**	**52.9**	1.7	2.5	**57.8**	**53.4**	2.3	3.0
r77	Residential	NAC-1	55	50	B	70	54.5	49.6	**56.2**	**52.0**	1.7	2.4	**56.7**	**52.5**	2.2	2.9
r78	Residential	NAC-1	55	50	B	70	54.1	49.3	**55.8**	**51.7**	1.7	2.4	**56.4**	**52.2**	2.3	2.9
r79	Residential	NAC-1	55	50	B	70	54.0	49.2	**55.7**	**51.6**	1.7	2.4	**56.2**	**52.1**	2.2	2.9
r80	Residential	NAC-1	55	50	B	70	54.4	49.5	**56.1**	**51.9**	1.7	2.4	**56.6**	**52.3**	2.2	2.8
r81	Residential	NAC-1	55	50	B	70	54.7	49.7	**56.3**	**52.1**	1.6	2.4	**56.8**	**52.5**	2.1	2.8
r82	Residential	NAC-1	55	50	B	70	54.4	49.5	**56.1**	**51.9**	1.7	2.4	**56.5**	**52.3**	2.1	2.8
r83	Residential	NAC-1	55	50	B	70	54.3	49.3	**56.0**	**51.7**	1.7	2.4	**56.3**	**52.1**	2.0	2.8
Noise Area 11 - South side of TH 23 between East Becker Lake Circle and TH 22																
r65	Residential	NAC-1	55	50	B	70	**60.7**	**53.3**	**62.7**	**56.0**	2.0	2.7	**62.8**	**56.1**	2.1	2.8
Noise Area 12 - North side of TH 23 between TH 22 to East Becker Lake Cicle																
c4	Commercial	NAC-2	70	65	E	75	69.8	60.4	**72.0**	63.3	2.2	2.9	**71.5**	62.9	1.7	2.5
r66	Residential	NAC-1	55	50	B	70	**57.0**	**50.3**	**58.8**	**52.9**	1.8	2.6	**58.7**	**52.9**	1.7	2.6
r67	Residential	NAC-1	55	50	B	70	**56.8**	49.9	**58.7**	**52.6**	1.9	2.7	**58.6**	**52.5**	1.8	2.6
r68	Residential	NAC-1	55	50	B	70	**58.3**	**51.6**	**60.2**	**54.3**	1.9	2.7	**60.1**	**54.2**	1.8	2.6
r69	Residential	NAC-1	55	50	B	70	54.8	48.8	**56.5**	**51.4**	1.7	2.6	**56.4**	**51.3**	1.6	2.5
trail23	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.5**	62.6	2.0	2.8	67.5	60.6	-1.0	0.8
trail24	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.5	2.1	2.8	67.2	60.3	-1.1	0.6
trail25	Trail	NAC-2	70	65	C	70	68.2	59.5	**70.3**	62.3	2.1	2.8	67.2	60.2	-1.0	0.7
trail26	Trail	NAC-2	70	65	C	70	67.7	59.1	69.7	61.9	2.0	2.8	67.2	60.2	-0.5	1.1
trail27	Trail	NAC-2	70	65	C	70	67.4	58.9	69.4	61.7	2.0	2.8	67.2	60.1	-0.2	1.2
trail28	Trail	NAC-2	70	65	C	70	67.0	58.6	69.0	61.4	2.0	2.8	67.2	60.1	0.2	1.5
trail29	Trail	NAC-2	70	65	C	70	66.8	58.5	68.9	61.3	2.1	2.8	68.5	61.0	1.7	2.5
trail30	Trail	NAC-2	70	65	C	70	65.5	56.9	67.5	59.7	2.0	2.8	65.1	57.7	-0.4	0.8
trail31	Trail	NAC-2	70	65	C	70	64.6	56.3	66.6	59.1	2.0	2.8	65.5	57.7	0.9	1.4
trail32	Trail	NAC-2	70	65	C	70	64.4	56.7	66.4	59.5	2.0	2.8	66.2	59.4	1.8	2.7
trail33	Trail	NAC-2	70	65	C	70	63.4	55.9	65.4	58.6	2.0	2.7	65.2	58.5	1.8	2.6
trail34	Trail	NAC-2	70	65	C	70	62.3	54.7	64.3	57.4	2.0	2.7	64.1	57.3	1.8	2.6
trail35	Trail	NAC-2	70	65	C	70	61.8	54.1	63.7	56.8	1.9	2.7	63.6	56.8	1.8	2.7
Noise Area 13 - North side of TH 23 between East Becker Lake Circle and West Becker Lake Circle																
trail13	Trail	NAC-2	70	65	C	70	68.4	60.2	**70.4**	63.0	2.0	2.8	67.8	60.7	-0.6	0.5
trail14	Trail	NAC-2	70	65	C	70	68.1	60.0	**70.1**	62.8	2.0	2.8	68.0	61.0	-0.1	1.0
trail15	Trail	NAC-2	70	65	C	70	68.0	59.9	**70.0**	62.7	2.0	2.8	68.0	61.1	0.0	1.2
trail16	Trail	NAC-2	70	65	C	70	68.2	60.1	**70.3**	62.9	2.1	2.8	68.1	61.2	-0.1	1.1
trail17	Trail	NAC-2	70	65	C	70	68.2	60.0	**70.2**	62.8	2.0	2.8	68.2	61.3	0.0	1.3
trail18	Trail	NAC-2	70	65	C	70	68.2	60.1	**70.3**	62.9	2.1	2.8	68.2	61.3	0.0	1.2
trail19	Trail	NAC-2	70	65	C	70	68.4	60.1	**70.4**	62.9	2.0	2.8	68.0	60.9	-0.4	0.8
trail20	Trail	NAC-2	70	65	C	70	68.5	60.2	**70.6**	63.0	2.1	2.8	67.6	60.4	-0.9	0.2
trail21	Trail	NAC-2	70	65	C	70	68.5	60.1	**70.6**	62.9	2.1	2.8	67.6	60.4	-0.9	0.3
trail22	Trail	NAC-2	70	65	C	70	68.5	60.0	**70.6**	62.8	2.1	2.8	67.7	60.6	-0.8	0.6
Noise Area 14 - North side of TH 23 between West Becker Lake Circle and County Road 43																
r36	Residential	NAC-1	55	50	B	70	**67.1**	**58.7**	**69.1**	**61.5**	2.0	2.8	N/A	N/A		
r37	Residential	NAC-1	55	50	B	70	**66.2**	**58.0**	**68.2**	**60.8**	2.0	2.8	N/A	N/A		
r42	Residential	NAC-1	55	50	B	70	**61.5**	**55.0**	**63.3**	**57.7**	1.8	2.7	N/A	N/A		
r43	Residential	NAC-1	55	50	B	70	**65.7**	**57.3**	**67.7**	**60.1**	2.0	2.8	N/A	N/A		
trail1	Trail	NAC-2	70	65	C	70	53.0	48.1	54.7	50.5	1.7	2.4	56.6	52.3	3.6	4.2
trail2	Trail	NAC-2	70	65	C	70	53.9	48.8	55.6	51.3	1.7	2.5	57.7	53.2	3.8	4.4
trail3	Trail	NAC-2	70	65	C	70	54.9	49.5	56.6	52.0	1.7	2.5	58.9	54.1	4.0	4.6
trail4	Trail	NAC-2	70	65	C	70	55.9	50.3	57.7	52.8	1.8	2.5	60.3	55.1	4.4	4.8
trail5	Trail	NAC-2	70	65	C	70	57.2	51.2	59.0	53.8	1.8	2.6	62.0	56.5	4.8	5.3
trail6	Trail	NAC-2	70	65	C	70	58.6	52.4	60.4	55.0	1.8	2.6	63.6	57.7	5.0	5.3

Table 6
Nighttime Noise Analysis Summary
Existing and Future Scenarios

Noise Level Comparison to Standards	
XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards
N/A	Receptor does not exist in Scenario

Receiver		MN State Standards (dBA)			FHWA Standards (dBA)		Existing 2016 Conditions		2040							
									Future No Build Conditions		Difference - Existing and No Build		Future Build Conditions		Difference - Existing and Build	
Receptor ID	Land Use	Noise Area Classification	L10	L50	Activity Category	L10	L10	L50	L10	L50	L10	L50	L10	L50	L10	L50
trail7	Trail	NAC-2	70	65	C	70	60.3	53.9	62.2	56.6	1.9	2.7	66.2	59.6	5.9	5.7
trail8	Trail	NAC-2	70	65	C	70	62.3	55.6	64.2	58.3	1.9	2.7	67.5	60.5	5.2	4.9
trail9	Trail	NAC-2	70	65	C	70	64.4	57.2	66.3	59.9	1.9	2.7	67.7	60.7	3.3	3.5
trail10	Trail	NAC-2	70	65	C	70	66.3	58.7	68.3	61.5	2.0	2.8	67.8	60.8	1.5	2.1
trail11	Trail	NAC-2	70	65	C	70	67.6	59.6	69.6	62.4	2.0	2.8	67.8	60.7	0.2	1.1
trail12	Trail	NAC-2	70	65	C	70	68.2	60.1	**70.3**	62.9	2.1	2.8	67.8	60.7	-0.4	0.6
Noise Area 15 - North side of TH 23 between County Road 43 and Big Lake Court																
r28	Residential	NAC-1	55	50	B	70	**66.9**	**58.6**	**69.0**	**61.4**	2.1	2.8	N/A	N/A		
r30	Residential	NAC-1	55	50	B	70	**63.0**	**55.7**	**65.0**	**58.5**	2.0	2.8	N/A	N/A		
r34	Residential	NAC-1	55	50	B	70	**62.9**	**55.9**	**64.8**	**58.6**	1.9	2.7	N/A	N/A		
Noise Area 16 - North side of TH 23 between Big Lake Court and CR 114/246th Avenue																
r24	Residential	NAC-1	55	50	B	70	**57.7**	**51.6**	**59.5**	**54.2**	1.8	2.6	**60.6**	**55.0**	2.9	3.4
r25	Residential	NAC-1	55	50	B	70	**57.5**	**51.6**	**59.3**	**54.2**	1.8	2.6	**61.2**	**55.6**	3.7	4.0
r26	Residential	NAC-1	55	50	B	70	**61.9**	**54.9**	**63.9**	**57.6**	2.0	2.7	N/A	N/A		
Noise Area 17 - North side of TH 23 between CR 114/246th Avenue and 205th Street																
c2	Commercial	NAC-2	70	65	E	75	65.1	56.8	67.2	59.7	2.1	2.9	64.2	57.4	-0.9	0.6
r17	Residential	NAC-1	55	50	B	70	**64.5**	**56.5**	**66.6**	**59.3**	2.1	2.8	**62.9**	**55.7**	-1.6	-0.8
r18	Residential	NAC-1	55	50	B	70	**64.8**	**56.7**	**66.9**	**59.6**	2.1	2.9	**60.9**	**55.0**	-3.9	-1.7
r19	Residential	NAC-1	55	50	B	70	**58.3**	**51.6**	**60.2**	**54.4**	1.9	2.8	**58.0**	**52.6**	-0.3	1.0
r21	Residential	NAC-1	55	50	B	70	**60.2**	**53.3**	**62.2**	**56.0**	2.0	2.7	**62.0**	**55.9**	1.8	2.6
Noise Area 18 - North side of TH 23 between 205th Street and County Road 123																
r10	Residential	NAC-1	55	50	B	70	**64.3**	**56.4**	**66.3**	**59.2**	2.0	2.8	N/A	N/A		
Noise Area 19 - North side of TH 23 between County Road 123 and 263rd Avenue																
r7	Residential	NAC-1	55	50	B	70	**57.4**	**51.4**	**59.2**	**54.0**	1.8	2.6	**61.1**	**55.3**	3.7	3.9
r9	Residential	NAC-1	55	50	B	70	52.6	47.5	**54.3**	**50.0**	1.7	2.5	**55.7**	**51.2**	3.1	3.7
Noise Area 20 - North side of TH 23 between 263rd Avenue and CR 85/Business 23																
r2	Residential	NAC-1	55	50	B	70	**67.2**	**58.4**	**69.4**	**61.3**	2.2	2.9	**70.1**	**61.7**	2.9	3.3
r4	Residential	NAC-1	55	50	B	70	**70.5**	**61.0**	**72.7**	**64.0**	2.2	3.0	N/A	N/A		
r5	Residential	NAC-1	55	50	B	70	**64.9**	**57.1**	**67.0**	**59.9**	2.1	2.8	N/A	N/A		
r6	Residential	NAC-1	55	50	B	70	**61.2**	**54.3**	**63.1**	**57.0**	1.9	2.7	**65.6**	**58.5**	4.4	4.2

Appendix A

Existing/No Build Noise Figures (1-9)

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SEH

Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors

- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap

Paynesville to Richmond, MN

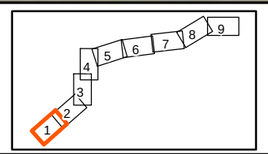
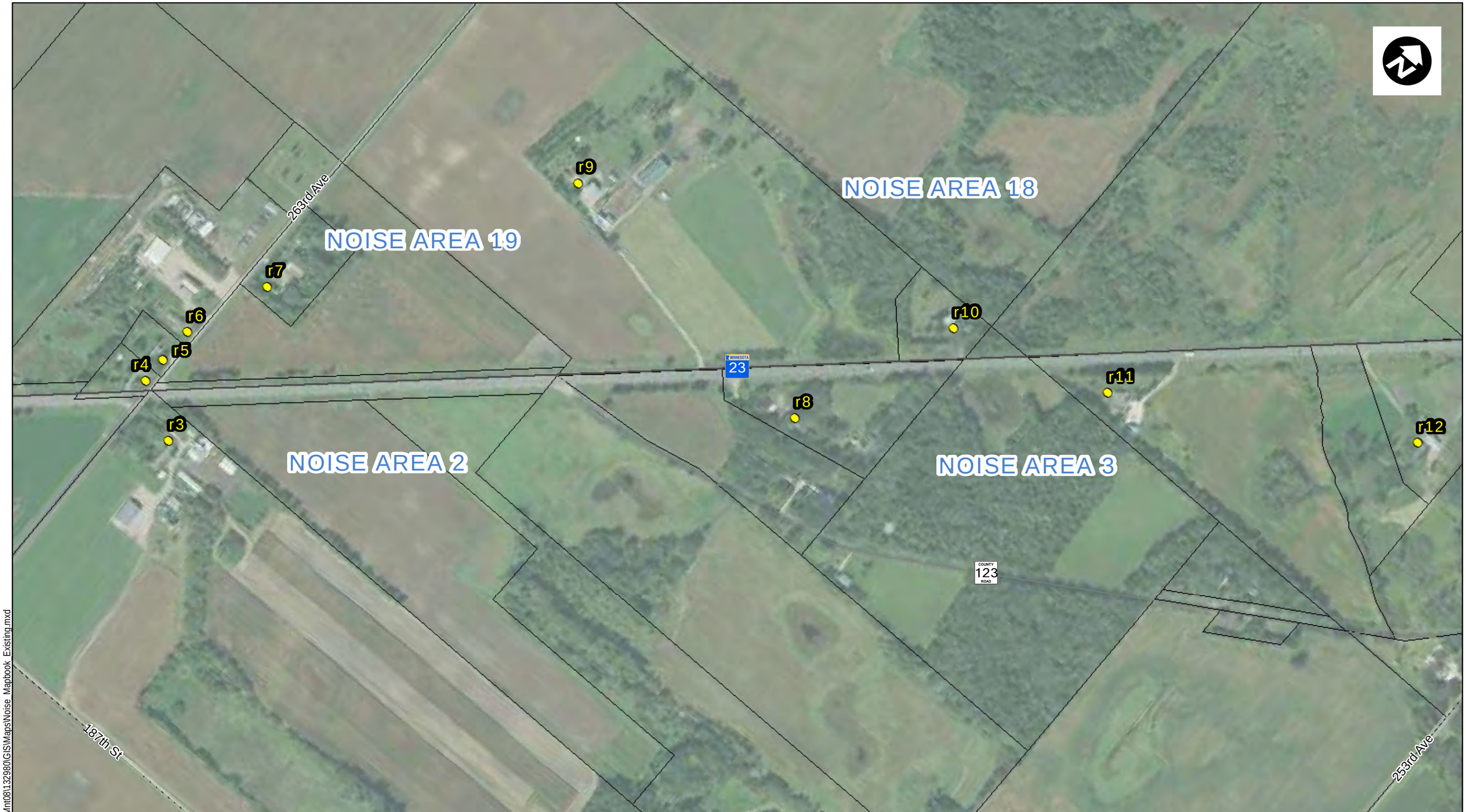


Figure
1 of 9



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SEH

Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors

- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap

Paynesville to Richmond, MN

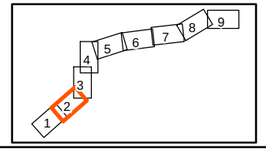

Figure
2 of 9

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SEH

Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap
Paynesville to Richmond, MN

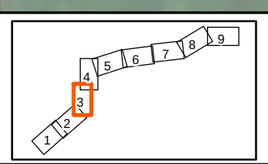
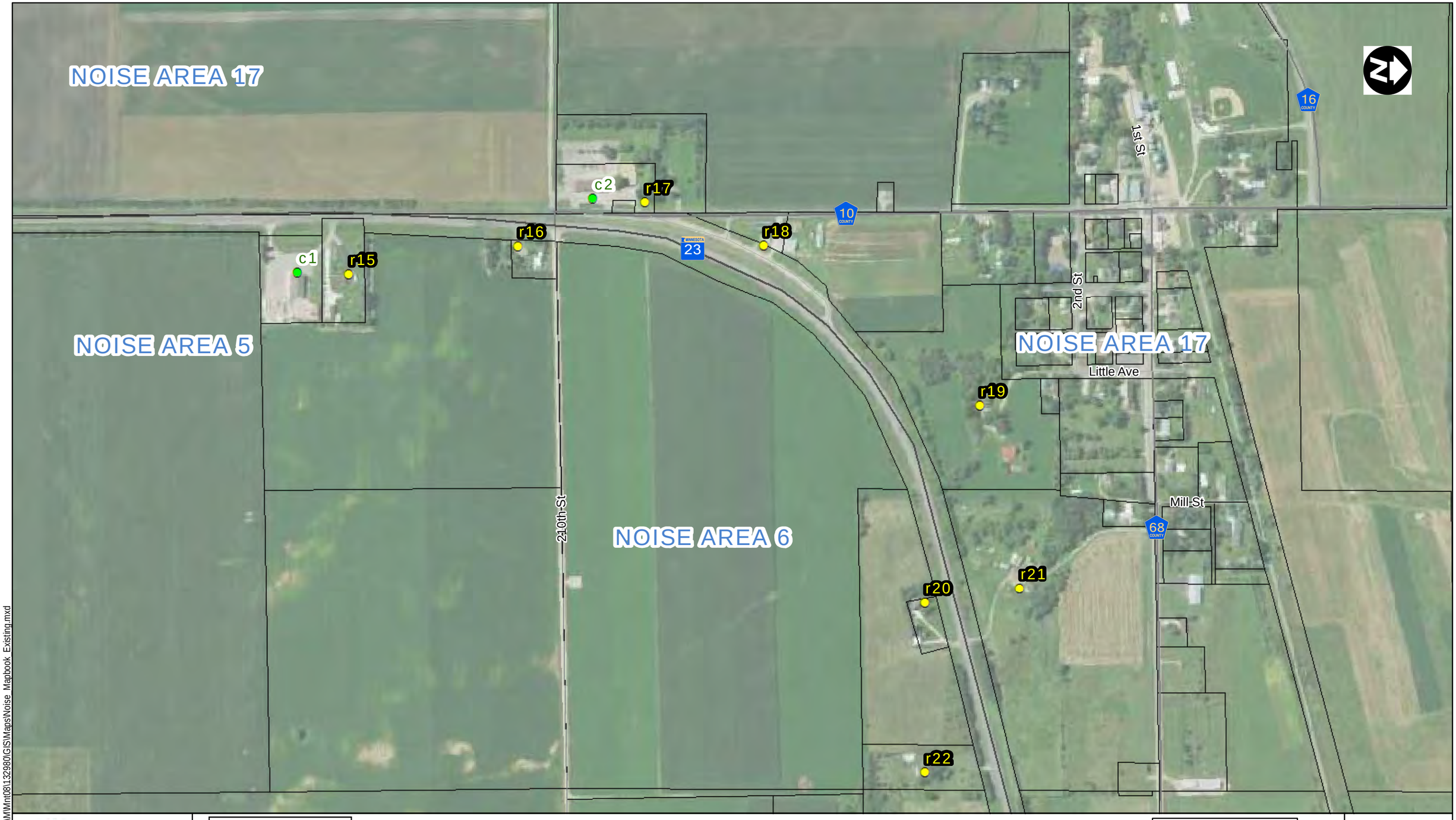


Figure
3 of 9



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SEH

Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors

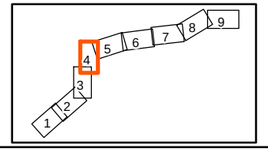
- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap

Paynesville to Richmond, MN



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4 of 9

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Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors

- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap

Paynesville to Richmond, MN

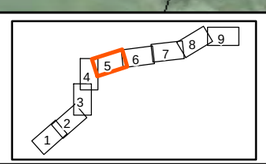

Figure
5 of 9

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Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors

- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap

Paynesville to Richmond, MN

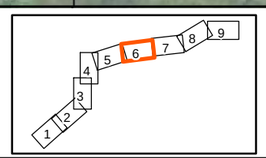
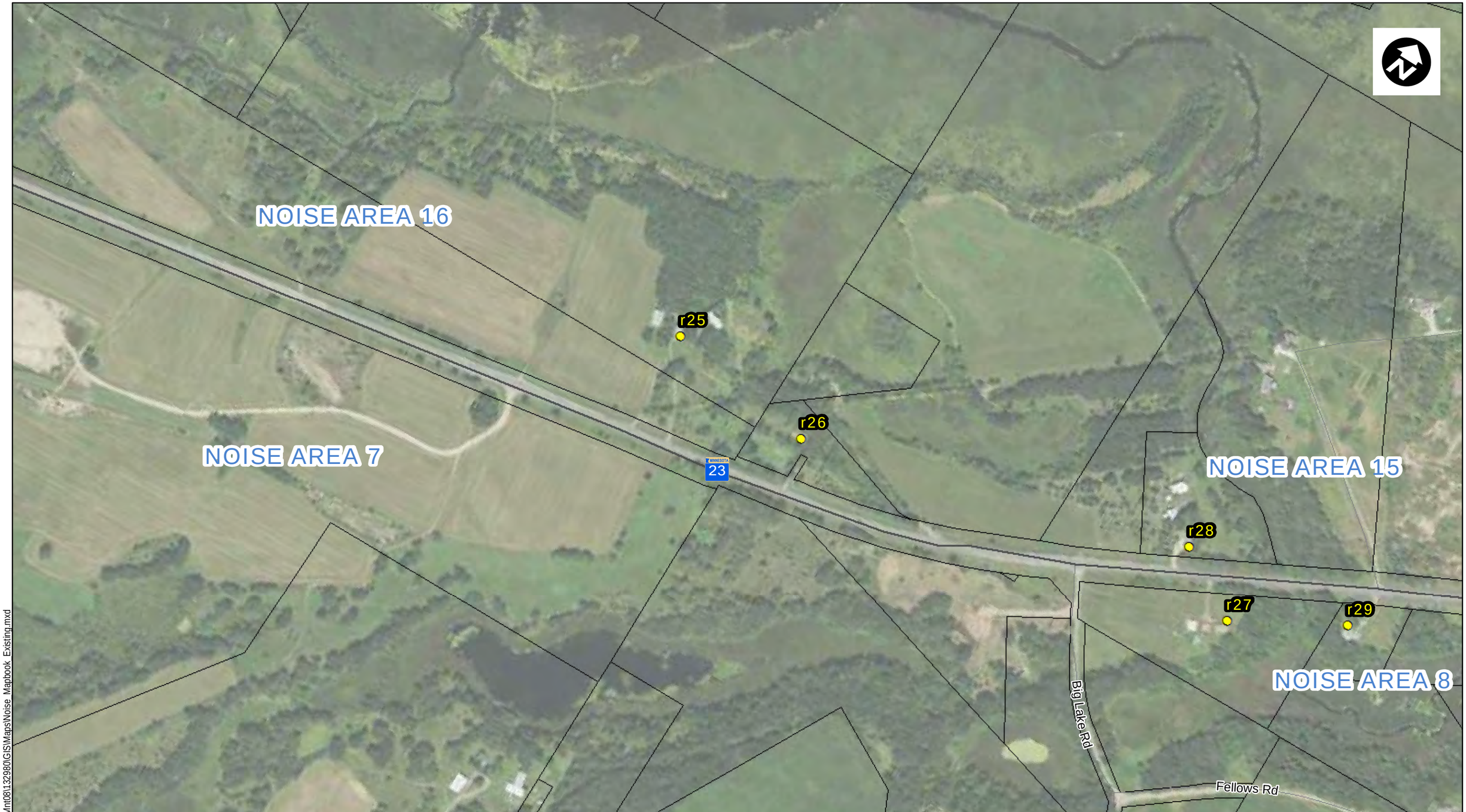


Figure
6 of 9



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Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors

- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap

Paynesville to Richmond, MN

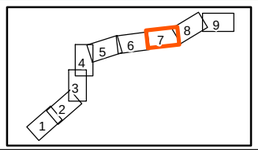

Figure 7 of 9

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SEH

Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors

- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap

Paynesville to Richmond, MN

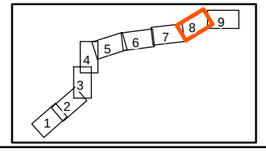
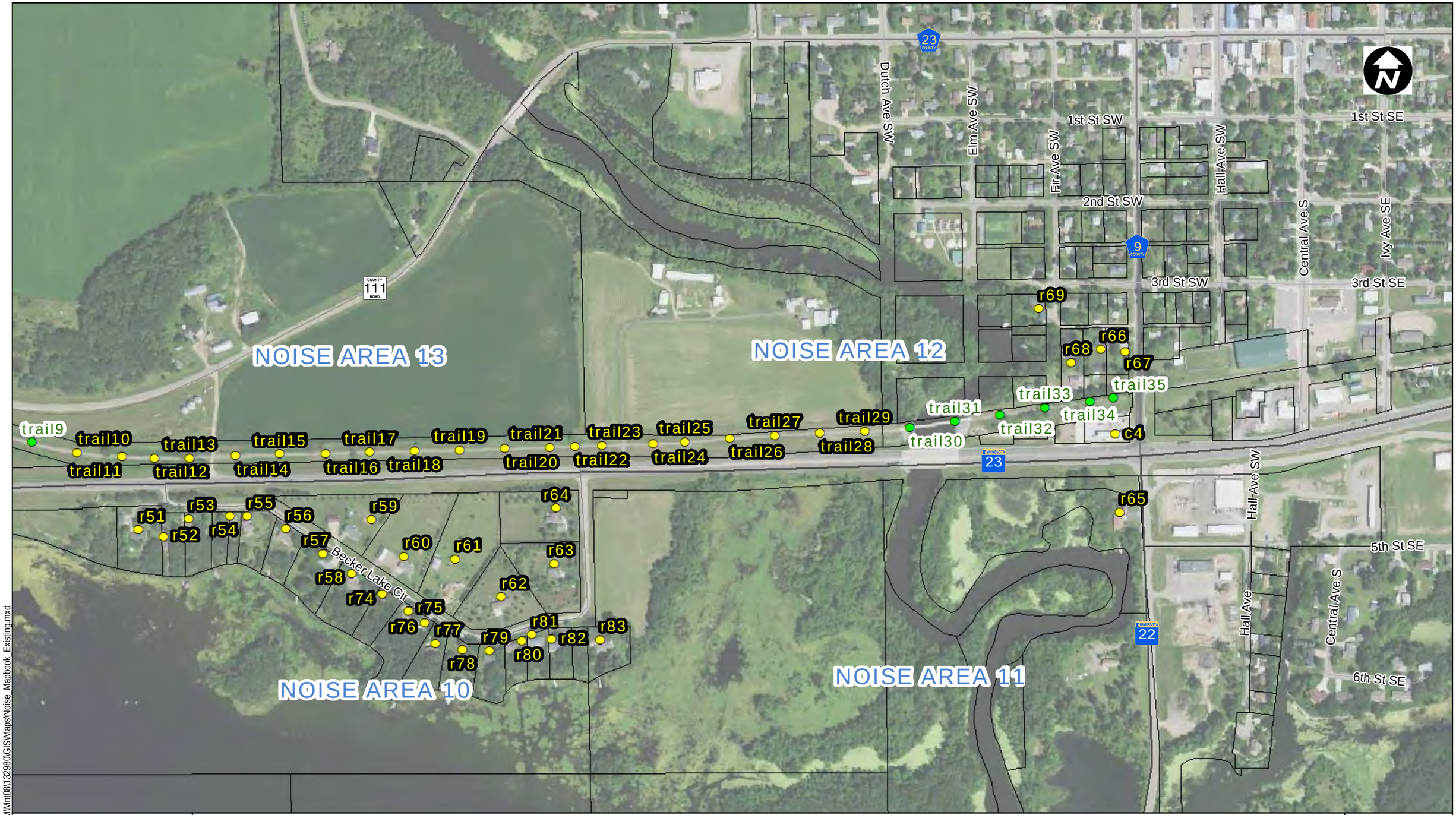


Figure 8 of 9



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SEH

Project: MNT08 132980
Print Date: 1/12/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

Noise Receptors

- Impacted
- Not Impacted

0 200 400 Feet

Existing / No Build Conditions - Noise Analysis

TH 23 - North Gap

Paynesville to Richmond, MN

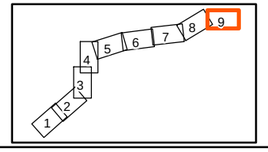


Figure
9 of 9

Appendix B

Noise Barrier Tables

Table B1
Build Noise Barrier Cost Effectiveness (Areas 1, 2, 3, 4, 5, 6 & 7)
Noise Barriers - EB1, EB2, EB3, EB4, EB5, EB6, EB7, EB8

				Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					
Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	NOISE WALL RESULTS
EB1	r1	Residential	Day	65	70	**65.7**	57.8	**-7.9**	1	1	**1**	**YES**	**YES**	827	20	15,640	$312,800	$312,800	NOT COST EFFECTIVE
	r1	Residential	Night	55	70	**63.3**	**55.7**	**-7.6**	1	1	**1**	**YES**	**YES**	827	20	15,640	$312,800	$312,800	NOT COST EFFECTIVE
EB1	r1	Residential	Day	65	70	**65.7**	60.2	**-5.5**	1	1	**1**	**YES**	NO	827	15	11,945	$238,900	$238,900	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r1	Residential	Night	55	70	**63.3**	**58.1**	**-5.2**	1	1	**1**	**YES**	NO	827	15	11,945	$238,900	$238,900	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
EB2	r3	Residential	Day	65	70	**66.9**	60.3	**-6.6**	1	1	**1**	**YES**	NO	973	20	18,560	$371,200	$371,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r3	Residential	Night	55	70	**64.4**	**58.6**	**-5.8**	1	1	**1**	**YES**	NO	973	20	18,560	$371,200	$371,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
EB3	r11	Residential	Day	65	70	**68.7**	61.6	**-7.1**	1	1	**1**	**YES**	**YES**	529	20	9,680	$193,600	$193,600	NOT COST EFFECTIVE
	r11	Residential	Night	55	70	**65.8**	**59.5**	**-6.3**	1	1	**1**	**YES**	NO	529	20	9,680	$193,600	$193,600	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
EB3	r11	Residential	Day	65	70	**68.7**	64.3	-4.4	1	0	**0**	NO	NO	529	15	7,475	$149,500	N/A	NOT ACOUSTICALLY EFFECTIVE
	r11	Residential	Night	55	70	**65.8**	**62.1**	-3.7	1	0	**0**	NO	NO	529	15	7,475	$149,500	N/A	NOT ACOUSTICALLY EFFECTIVE
EB4	r12	Residential	Day	65	70	61.7	59.5	-2.2	1	0	**0**	NO	NO	2,085	20	38,100	$762,000	N/A	NOT ACOUSTICALLY EFFECTIVE
	r13	Residential	Day	65	70	**69.4**	64.7	-4.7	1	0									
	r12	Residential	Night	55	70	**59.5**	**58.0**	-1.5	1	0	**0**	NO	NO	2,085	20	38,100	$762,000	N/A	NOT ACOUSTICALLY EFFECTIVE
	r13	Residential	Night	55	70	**66.5**	**62.1**	-4.4	1	0									
EB5	r14	Residential	Day	65	70	56.4	54.4	-2.0	1	0	**0**	NO	NO	2,057	20	39,340	$786,800	N/A	NOT ACOUSTICALLY EFFECTIVE
	r14	Residential	Night	55	70	54.4	52.9	-1.5	1	0	**0**	NO	NO	2,057	20	39,340	$786,800	N/A	NOT ACOUSTICALLY EFFECTIVE
EB6	c1	Commercial	Day	70	75	68.5	63.5	**-5.0**	1	1	**2**	**YES**	NO	652	20	9,440	$188,800	$94,400	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r15	Residential	Day	65	70	**68.2**	62.3	**-5.9**	1	1									
	c1	Commercial	Night	70	75	65.6	60.8	-4.8	1	0	**1**	**YES**	NO	652	20	9,440	$188,800	$188,800	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r15	Residential	Night	55	70	**65.4**	**59.6**	**-5.8**	1	1									
EB7	r22	Residential	Day	65	70	**65.8**	63.9	-1.9	1	0	**0**	NO	NO	1,382	20	25,840	$516,800	N/A	NOT ACOUSTICALLY EFFECTIVE
	r22	Residential	Night	55	70	**63.6**	**62.2**	-1.4	1	0	**0**	NO	NO	1,382	20	25,840	$516,800	N/A	NOT ACOUSTICALLY EFFECTIVE
EB8	r23	Residential	Day	65	70	60.5	56.9	-3.6	1	0	**0**	NO	NO	1,718	20	32,560	$651,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	r84	Residential	Day	65	70	61.4	58.2	-3.2	1	0									
	r23	Residential	Night	55	70	**59.1**	**55.9**	-3.2	1	0	**0**	NO	NO	1,718	20	32,560	$651,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	r84	Residential	Night	55	70	**60.0**	**57.0**	-3.0	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B2
Build Noise Barrier Cost Effectiveness (Areas 7, 8 & 9)
Noise Barriers - EB 9, EB10, EB11, EB12

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
EB9	c3	Commercial	Day	70	75	**71.2**	62.0	**-9.2**	1	1	**1**	**YES**	**YES**	481	20	8,720	$174,400	$174,400	NOT COST EFFECTIVE
	c3	Commercial	Night	70	75	69.1	60.3	**-8.8**	1	1	**1**	**YES**	**YES**	481	20	8,720	$174,400	$174,400	NOT COST EFFECTIVE
EB9	c3	Commercial	Day	70	75	**71.2**	65.5	**-5.7**	1	1	**1**	**YES**	NO	481	15	6,755	$135,100	$135,100	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	c3	Commercial	Night	70	75	69.1	63.8	**-5.3**	1	1	**1**	**YES**	NO	481	15	6,755	$135,100	$135,100	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
EB10	r27	Residential	Day	65	70	**66.2**	60.3	**-5.9**	1	1	**1**	**YES**	NO	1,467	20	27,540	$550,800	$550,800	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r29	Residential	Day	65	70	**67.4**	**66.2**	-1.2	1	0									
	r27	Residential	Night	55	70	**64.4**	**59.1**	**-5.3**	1	1	**1**	**YES**	NO	1,467	20	27,540	$550,800	$550,800	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r29	Residential	Night	55	70	**65.5**	**64.4**	-1.1	1	0									
EB11	r32	Residential	Day	65	70	**67.4**	63.0	-4.4	1	0	**2**	**YES**	**YES**	1,021	20	19,520	$390,400	$195,200	NOT COST EFFECTIVE
	r33	Residential	Day	65	70	62.4	56.7	**-5.7**	1	1									
	r35	Residential	Day	65	70	**66.6**	58.9	**-7.7**	1	1									
	r32	Residential	Night	55	70	**65.9**	**61.5**	-4.4	1	0	**2**	**YES**	**YES**	1,021	20	19,520	$390,400	$195,200	NOT COST EFFECTIVE
	r33	Residential	Night	55	70	**61.2**	**55.8**	**-5.4**	1	1									
	r35	Residential	Night	55	70	**65.2**	**57.7**	**-7.5**	1	1									
EB11	r32	Residential	Day	65	70	**67.4**	63.6	-3.8	1	0	**1**	**YES**	NO	1,021	15	14,855	$297,100	$297,100	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r33	Residential	Day	65	70	62.4	58.3	-4.1	1	0									
	r35	Residential	Day	65	70	**66.6**	60.4	**-6.2**	1	1									
	r32	Residential	Night	55	70	**65.9**	**62.3**	-3.6	1	0	**1**	**YES**	NO	1,021	15	14,855	$297,100	$297,100	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r33	Residential	Night	55	70	**61.2**	**57.5**	-3.7	1	0									
	r35	Residential	Night	55	70	**65.2**	**59.3**	**-5.9**	1	1									
EB12	r38	Residential	Day	65	70	**66.1**	59.8	**-6.3**	1	1	**3**	**YES**	**YES**	932	20	17,740	$354,800	$118,267	NOT COST EFFECTIVE
	r39	Residential	Day	65	70	**66.9**	58.0	**-8.9**	1	1									
	r40	Residential	Day	65	70	**67.3**	59.9	**-7.4**	1	1									
	r41	Residential	Day	65	70	58.5	56.4	-2.1	1	0									
	r38	Residential	Night	55	70	**64.7**	**58.5**	**-6.2**	1	1	**3**	**YES**	**YES**	932	20	17,740	$354,800	$118,267	NOT COST EFFECTIVE
	r39	Residential	Night	55	70	**65.5**	**57.0**	**-8.5**	1	1									
	r40	Residential	Night	55	70	**65.9**	**58.8**	**-7.1**	1	1									
	r41	Residential	Night	55	70	**57.4**	**55.3**	-2.1	1	0									
EB12	r38	Residential	Day	65	70	**66.1**	60.7	**-5.4**	1	1	**3**	**YES**	NO	932	15	13,520	$270,400	$90,133	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r39	Residential	Day	65	70	**66.9**	60.2	**-6.7**	1	1									
	r40	Residential	Day	65	70	**67.3**	61.2	**-6.1**	1	1									
	r41	Residential	Day	65	70	58.5	56.6	-1.9	1	0									
	r38	Residential	Night	55	70	**64.7**	**59.4**	**-5.3**	1	1	**3**	**YES**	NO	932	15	13,520	$270,400	$90,133	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r39	Residential	Night	55	70	**65.5**	**59.3**	**-6.2**	1	1									
	r40	Residential	Night	55	70	**65.9**	**60.2**	**-5.7**	1	1									
	r41	Residential	Night	55	70	**57.4**	**55.5**	-1.9	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B3
Build Noise Barrier Cost Effectiveness (Areas 9 & 10)
Noise Barriers - EB13, EB 13a

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
EB13	r44	Residential	Day	65	70	**69.6**	**66.0**	-3.6	1	0	**5**	**YES**	**YES**	1,746	20	33,120	$662,400	$132,480	NOT COST EFFECTIVE
	r45	Residential	Day	65	70	**67.3**	64.2	-3.1	1	0									
	r46	Residential	Day	65	70	**68.2**	56.9	**-11.3**	1	1									
	r47	Residential	Day	65	70	**67.8**	56.3	**-11.5**	1	1									
	r48	Residential	Day	65	70	**66.7**	56.7	**-10.0**	1	1									
	r49	Residential	Day	65	70	63.5	57.9	**-5.6**	1	1									
	r50	Residential	Day	65	70	**66.7**	55.9	**-10.8**	1	1									
	r51	Residential	Day	65	70	**66.2**	62.3	-3.9	1	0									
	r52	Residential	Day	65	70	**65.4**	62.3	-3.1	1	0									
	r44	Residential	Night	55	70	**68.1**	**64.6**	-3.5	1	0	**5**	**YES**	**YES**	1,746	20	33,120	$662,400	$132,480	NOT COST EFFECTIVE
	r45	Residential	Night	55	70	**66.0**	**62.8**	-3.2	1	0									
	r46	Residential	Night	55	70	**66.8**	**55.7**	**-11.1**	1	1									
	r47	Residential	Night	55	70	**66.4**	**55.1**	**-11.3**	1	1									
	r48	Residential	Night	55	70	**65.4**	**55.4**	**-10.0**	1	1									
	r49	Residential	Night	55	70	**62.1**	**56.6**	**-5.5**	1	1									
	r50	Residential	Night	55	70	**65.3**	54.7	**-10.6**	1	1									
	r51	Residential	Night	55	70	**65.0**	**61.1**	-3.9	1	0									
	r52	Residential	Night	55	70	**64.2**	**61.2**	-3.0	1	0									
EB13a	r44	Residential	Day	65	70	**69.6**	**66.0**	-3.6	1	0	**5**	**YES**	**YES**	1,312	20	25,340	$506,800	$101,360	NOT COST EFFECTIVE
	r45	Residential	Day	65	70	**67.3**	64.2	-3.1	1	0									
	r46	Residential	Day	65	70	**68.2**	57.1	**-11.1**	1	1									
	r47	Residential	Day	65	70	**67.8**	56.7	**-11.1**	1	1									
	r48	Residential	Day	65	70	**66.7**	56.8	**-9.9**	1	1									
	r49	Residential	Day	65	70	63.5	58.1	**-5.4**	1	1									
	r50	Residential	Day	65	70	**66.7**	56.9	**-9.8**	1	1									
	r51	Residential	Day	65	70	**66.2**	**65.9**	-0.3	1	0									
	r52	Residential	Day	65	70	**65.4**	64.5	-0.9	1	0									
	r44	Residential	Night	55	70	**68.1**	**64.6**	-3.5	1	0	**5**	**YES**	**YES**	1,312	20	25,340	$506,800	$101,360	NOT COST EFFECTIVE
	r45	Residential	Night	55	70	**66.0**	**62.8**	-3.2	1	0									
	r46	Residential	Night	55	70	**66.8**	**55.9**	**-10.9**	1	1									
	r47	Residential	Night	55	70	**66.4**	**55.4**	**-11.0**	1	1									
	r48	Residential	Night	55	70	**65.4**	**55.6**	**-9.8**	1	1									
	r49	Residential	Night	55	70	**62.1**	**56.8**	**-5.3**	1	1									
	r50	Residential	Night	55	70	**65.3**	**55.7**	**-9.6**	1	1									
	r51	Residential	Night	55	70	**65.0**	**64.7**	-0.3	1	0									
	r52	Residential	Night	55	70	**64.2**	**63.3**	-0.9	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B4
Build Noise Barrier Cost Effectiveness (Areas 9 & 10)
Noise Barriers - EB13a

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
EB13a	r44	Residential	Day	65	70	**69.6**	**69.1**	-0.5	1	0	**4**	**YES**	NO	1,312	10	13,024	$260,480	$65,120	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r45	Residential	Day	65	70	**67.3**	**65.7**	-1.6	1	0									
	r46	Residential	Day	65	70	**68.2**	62.0	**-6.2**	1	1									
	r47	Residential	Day	65	70	**67.8**	61.1	**-6.7**	1	1									
	r48	Residential	Day	65	70	**66.7**	60.5	**-6.2**	1	1									
	r49	Residential	Day	65	70	63.5	59.9	-3.6	1	0									
	r50	Residential	Day	65	70	**66.7**	60.7	**-6.0**	1	1									
	r51	Residential	Day	65	70	**66.2**	**66.2**	0.0	1	0									
	r52	Residential	Day	65	70	**65.4**	**65.4**	0.0	1	0									
	r44	Residential	Night	55	70	**68.1**	**67.6**	-0.5	1	0	**4**	**YES**	NO	1,312	10	13,024	$260,480	$65,120	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r45	Residential	Night	55	70	**66.0**	**64.3**	-1.7	1	0									
	r46	Residential	Night	55	70	**66.8**	**60.7**	**-6.1**	1	1									
	r47	Residential	Night	55	70	**66.4**	**59.7**	**-6.7**	1	1									
	r48	Residential	Night	55	70	**65.4**	**59.2**	**-6.2**	1	1									
	r49	Residential	Night	55	70	**62.1**	**58.6**	-3.5	1	0									
	r50	Residential	Night	55	70	**65.3**	**59.4**	**-5.9**	1	1									
	r51	Residential	Night	55	70	**65.0**	**65.0**	0.0	1	0									
	r52	Residential	Night	55	70	**64.2**	**64.2**	0.0	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B5
Build Noise Barrier Cost Effectiveness (Area 10)
Noise Barriers - EB14

				Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					
Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	NOISE WALL RESULTS
EB14	r53	Residential	Day	65	70	**68.0**	63.6	-4.4	1	0	**10**	**YES**	**YES**	1,791	20	34,920	$698,400	$69,840	NOT COST EFFECTIVE
	r54	Residential	Day	65	70	**68.4**	59.7	**-8.7**	1	1									
	r55	Residential	Day	65	70	**68.4**	59.4	**-9.0**	1	1									
	r56	Residential	Day	65	70	**66.5**	58.8	**-7.7**	1	1									
	r57	Residential	Day	65	70	63.6	56.7	**-6.9**	1	1									
	r58	Residential	Day	65	70	62.0	56.3	**-5.7**	1	1									
	r59	Residential	Day	65	70	**67.7**	59.0	**-8.7**	1	1									
	r60	Residential	Day	65	70	63.3	57.0	**-6.3**	1	1									
	r61	Residential	Day	65	70	62.9	56.8	**-6.1**	1	1									
	r62	Residential	Day	65	70	60.0	55.8	-4.2	1	0									
	r63	Residential	Day	65	70	62.0	58.6	-3.4	1	0									
	r64	Residential	Day	65	70	**68.7**	61.4	**-7.3**	1	1									
	r74	Residential	Day	65	70	60.5	55.3	**-5.2**	1	1									
	r75	Residential	Day	65	70	59.3	54.8	-4.5	1	0									
	r76	Residential	Day	65	70	58.7	54.2	-4.5	1	0									
	r77	Residential	Day	65	70	57.6	53.7	-3.9	1	0									
	r78	Residential	Day	65	70	57.3	53.7	-3.6	1	0									
	r79	Residential	Day	65	70	57.2	53.9	-3.3	1	0									
	r80	Residential	Day	65	70	57.5	54.5	-3.0	1	0									
	r81	Residential	Day	65	70	57.7	54.9	-2.8	1	0									
	r82	Residential	Day	65	70	57.4	55.0	-2.4	1	0									
	r83	Residential	Day	65	70	57.2	55.5	-1.7	1	0									
	r53	Residential	Night	55	70	**66.7**	**62.3**	-4.4	1	0	**9**	**YES**	**YES**	1,791	20	34,920	$698,400	$77,600	NOT COST EFFECTIVE
	r54	Residential	Night	55	70	**67.1**	**58.7**	**-8.4**	1	1									
	r55	Residential	Night	55	70	**67.1**	**58.4**	**-8.7**	1	1									
	r56	Residential	Night	55	70	**65.3**	**58.1**	**-7.2**	1	1									
	r57	Residential	Night	55	70	**62.6**	**56.1**	**-6.5**	1	1									
	r58	Residential	Night	55	70	**60.9**	**55.7**	**-5.2**	1	1									
	r59	Residential	Night	55	70	**66.5**	**58.2**	**-8.3**	1	1									
	r60	Residential	Night	55	70	**62.2**	**56.4**	**-5.8**	1	1									
	r61	Residential	Night	55	70	**61.9**	**56.1**	**-5.8**	1	1									
	r62	Residential	Night	55	70	**59.0**	**55.2**	-3.8	1	0									
	r63	Residential	Night	55	70	**61.0**	**57.8**	-3.2	1	0									
	r64	Residential	Night	55	70	**67.4**	**60.4**	**-7.0**	1	1									
	r74	Residential	Night	55	70	**59.5**	54.7	-4.8	1	0									
	r75	Residential	Night	55	70	**58.4**	54.2	-4.2	1	0									
	r76	Residential	Night	55	70	**57.8**	53.6	-4.2	1	0									
	r77	Residential	Night	55	70	**56.7**	53.1	-3.6	1	0									
	r78	Residential	Night	55	70	**56.4**	53.2	-3.2	1	0									
	r79	Residential	Night	55	70	**56.2**	53.3	-2.9	1	0									
	r80	Residential	Night	55	70	**56.6**	53.9	-2.7	1	0									
	r81	Residential	Night	55	70	**56.8**	54.2	-2.6	1	0									
	r82	Residential	Night	55	70	**56.5**	54.3	-2.2	1	0									
	r83	Residential	Night	55	70	**56.3**	54.7	-1.6	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B6
Build Noise Barrier Cost Effectiveness (Areas 10 & 11)
Noise Barriers - EB14 & EB15

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
EB14	r53	Residential	Day	65	70	**68.0**	64.9	-3.1	1	0	**4**	**YES**	NO	1,791	15	26,405	$528,100	$132,025	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r54	Residential	Day	65	70	**68.4**	62.4	**-6.0**	1	1									
	r55	Residential	Day	65	70	**68.4**	62.3	**-6.1**	1	1									
	r56	Residential	Day	65	70	**66.5**	62.0	-4.5	1	0									
	r57	Residential	Day	65	70	63.6	59.7	-3.9	1	0									
	r58	Residential	Day	65	70	62.0	59.2	-2.8	1	0									
	r59	Residential	Day	65	70	**67.7**	62.5	**-5.2**	1	1									
	r60	Residential	Day	65	70	63.3	60.0	-3.3	1	0									
	r61	Residential	Day	65	70	62.9	59.4	-3.5	1	0									
	r62	Residential	Day	65	70	60.0	57.6	-2.4	1	0									
	r63	Residential	Day	65	70	62.0	59.6	-2.4	1	0									
	r64	Residential	Day	65	70	**68.7**	62.6	**-6.1**	1	1									
	r74	Residential	Day	65	70	60.5	58.0	-2.5	1	0									
	r75	Residential	Day	65	70	59.3	57.3	-2.0	1	0									
	r76	Residential	Day	65	70	58.7	56.5	-2.2	1	0									
	r77	Residential	Day	65	70	57.6	55.8	-1.8	1	0									
	r78	Residential	Day	65	70	57.3	55.6	-1.7	1	0									
	r79	Residential	Day	65	70	57.2	55.5	-1.7	1	0									
	r80	Residential	Day	65	70	57.5	55.9	-1.6	1	0									
	r81	Residential	Day	65	70	57.7	56.1	-1.6	1	0									
	r82	Residential	Day	65	70	57.4	56.0	-1.4	1	0									
	r83	Residential	Day	65	70	57.2	56.0	-1.2	1	0									
	r53	Residential	Night	55	70	**66.7**	**63.7**	-3.0	1	0	**3**	**YES**	NO	1,791	15	26,405	$528,100	$176,033	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r54	Residential	Night	55	70	**67.1**	**61.4**	**-5.7**	1	1									
	r55	Residential	Night	55	70	**67.1**	**61.3**	**-5.8**	1	1									
	r56	Residential	Night	55	70	**65.3**	**61.1**	-4.2	1	0									
	r57	Residential	Night	55	70	**62.6**	**58.9**	-3.7	1	0									
	r58	Residential	Night	55	70	**60.9**	**58.5**	-2.4	1	0									
	r59	Residential	Night	55	70	**66.5**	**61.6**	-4.9	1	0									
	r60	Residential	Night	55	70	**62.2**	**59.3**	-2.9	1	0									
	r61	Residential	Night	55	70	**61.9**	**58.7**	-3.2	1	0									
	r62	Residential	Night	55	70	**59.0**	**56.9**	-2.1	1	0									
	r63	Residential	Night	55	70	**61.0**	**58.8**	-2.2	1	0									
	r64	Residential	Night	55	70	**67.4**	**61.6**	**-5.8**	1	1									
	r74	Residential	Night	55	70	**59.5**	**57.4**	-2.1	1	0									
	r75	Residential	Night	55	70	**58.4**	**56.7**	-1.7	1	0									
	r76	Residential	Night	55	70	**57.8**	**55.9**	-1.9	1	0									
	r77	Residential	Night	55	70	**56.7**	**55.2**	-1.5	1	0									
	r78	Residential	Night	55	70	**56.4**	54.9	-1.5	1	0									
	r79	Residential	Night	55	70	**56.2**	54.8	-1.4	1	0									
	r80	Residential	Night	55	70	**56.6**	**55.2**	-1.4	1	0									
	r81	Residential	Night	55	70	**56.8**	**55.4**	-1.4	1	0									
	r82	Residential	Night	55	70	**56.5**	**55.3**	-1.2	1	0									
	r83	Residential	Night	55	70	**56.3**	**55.3**	-1.0	1	0									
EB15	r65	Residential	Day	65	70	63.9	60.1	-3.8	1	0	**0**	NO	NO	594	20	10,980	$219,600	N/A	NOT ACOUSTICALLY EFFECTIVE
	r65	Residential	Night	55	70	62.8	59.1	-3.7	1	0	**0**	NO	NO	594	20	10,980	$219,600	N/A	NOT ACOUSTICALLY EFFECTIVE
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B7
Build Noise Barrier Cost Effectiveness (Area 12)
Noise Barriers - WB1 & WB2

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
WB1	trail32	Trail	Day	70	70	67.0	62.7	-4.3	1	0	**1**	**YES**	NO	511	20	8,420	$168,400	$168,400	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	trail33	Trail	Day	70	70	65.9	63.1	-2.8	1	0									
	trail34	Trail	Day	70	70	64.8	63.0	-1.8	1	0									
	trail35	Trail	Day	70	70	64.3	62.5	-1.8	1	0									
	c4	Commercial	Day	70	75	**72.2**	65.9	**-6.3**	1	1									
	r66	Residential	Day	65	70	59.5	57.8	-1.7	1	0									
	r67	Residential	Day	65	70	59.4	57.9	-1.5	1	0									
	r68	Residential	Day	65	70	60.8	58.8	-2.0	1	0									
	r69	Residential	Day	65	70	57.1	55.1	-2.0	1	0									
	trail32	Trail	Night	70	70	66.2	62.0	-4.2	1	0	**1**	**YES**	NO	511	20	8,420	$168,400	$168,400	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	trail33	Trail	Night	70	70	65.2	62.3	-2.9	1	0									
	trail34	Trail	Night	70	70	64.1	62.2	-1.9	1	0									
	trail35	Trail	Night	70	70	63.6	61.7	-1.9	1	0									
	c4	Commercial	Night	70	75	**71.5**	65.1	**-6.4**	1	1									
	r66	Residential	Night	55	70	**58.7**	**57.0**	-1.7	1	0									
	r67	Residential	Night	55	70	**58.6**	**57.1**	-1.5	1	0									
	r68	Residential	Night	55	70	**60.1**	**58.0**	-2.1	1	0									
	r69	Residential	Night	55	70	**56.4**	54.4	-2.0	1	0									
WB2	trail27	Trail	Day	70	70	67.9	67.6	-0.3	1	0	**1**	**YES**	**YES**	471	20	8,520	$170,400	$170,400	NOT COST EFFECTIVE
	trail28	Trail	Day	70	70	67.9	64.6	-3.3	1	0									
	trail29	Trail	Day	70	70	69.3	62.3	**-7.0**	1	1									
	trail30	Trail	Day	70	70	65.4	63.4	-2.0	1	0									
	trail27	Trail	Night	70	70	67.2	66.8	-0.4	1	0	**1**	**YES**	NO	471	20	8,520	$170,400	$170,400	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	trail28	Trail	Night	70	70	67.2	63.8	-3.4	1	0									
	trail29	Trail	Night	70	70	68.5	61.7	**-6.8**	1	1									
	trail30	Trail	Night	70	70	65.1	63.1	-2.0	1	0									
WB2	trail27	Trail	Day	70	70	67.9	67.7	-0.2	1	0	**1**	**YES**	NO	471	15	6,605	$132,100	$132,100	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	trail28	Trail	Day	70	70	67.9	65.7	-2.2	1	0									
	trail29	Trail	Day	70	70	69.3	64.2	**-5.1**	1	1									
	trail30	Trail	Day	70	70	65.4	63.6	-1.8	1	0									
	trail27	Trail	Night	70	70	67.2	66.9	-0.3	1	0	**0**	NO	NO	471	15	6,605	$132,100	N/A	NOT ACOUSTICALLY EFFECTIVE
	trail28	Trail	Night	70	70	67.2	65.0	-2.2	1	0									
	trail29	Trail	Night	70	70	68.5	63.6	-4.9	1	0									
	trail30	Trail	Night	70	70	65.1	63.3	-1.8	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B8
Build Noise Barrier Cost Effectiveness (Area 13)
Noise Barriers - WB3

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
WB3	trail14	Trail	Day	70	70	68.8	68.6	-0.2	1	0	**5**	**YES**	**YES**	998	20	19,060	$381,200	$76,240	NOT COST EFFECTIVE
	trail15	Trail	Day	70	70	68.9	61.8	**-7.1**	1	1									
	trail16	Trail	Day	70	70	69.0	59.0	**-10.0**	1	1									
	trail17	Trail	Day	70	70	69.1	58.9	**-10.2**	1	1									
	trail18	Trail	Day	70	70	69.1	58.8	**-10.3**	1	1									
	trail19	Trail	Day	70	70	68.8	61.5	**-7.3**	1	1									
	trail20	Trail	Day	70	70	68.4	68.0	-0.4	1	0									
	trail14	Trail	Night	70	70	68.0	67.7	-0.3	1	0	**5**	**YES**	**YES**	998	20	19,060	$381,200	$76,240	NOT COST EFFECTIVE
	trail15	Trail	Night	70	70	68.0	61.1	**-6.9**	1	1									
	trail16	Trail	Night	70	70	68.1	58.4	**-9.7**	1	1									
	trail17	Trail	Night	70	70	68.2	58.3	**-9.9**	1	1									
	trail18	Trail	Night	70	70	68.2	58.2	**-10.0**	1	1									
	trail19	Trail	Night	70	70	68.0	60.8	**-7.2**	1	1									
	trail20	Trail	Night	70	70	67.6	67.2	-0.4	1	0									
WB3	trail14	Trail	Day	70	70	68.8	68.7	-0.1	1	0	**5**	**YES**	**YES**	998	15	14,510	$290,200	$58,040	NOT COST EFFECTIVE
	trail15	Trail	Day	70	70	68.9	63.3	**-5.6**	1	1									
	trail16	Trail	Day	70	70	69.0	62.0	**-7.0**	1	1									
	trail17	Trail	Day	70	70	69.1	62.1	**-7.0**	1	1									
	trail18	Trail	Day	70	70	69.1	61.6	**-7.5**	1	1									
	trail19	Trail	Day	70	70	68.8	62.5	**-6.3**	1	1									
	trail20	Trail	Day	70	70	68.4	68.1	-0.3	1	0									
	trail14	Trail	Night	70	70	68.0	67.8	-0.2	1	0	**5**	**YES**	**YES**	998	15	14,510	$290,200	$58,040	NOT COST EFFECTIVE
	trail15	Trail	Night	70	70	68.0	62.7	**-5.3**	1	1									
	trail16	Trail	Night	70	70	68.1	61.4	**-6.7**	1	1									
	trail17	Trail	Night	70	70	68.2	61.5	**-6.7**	1	1									
	trail18	Trail	Night	70	70	68.2	61.0	**-7.2**	1	1									
	trail19	Trail	Night	70	70	68.0	61.8	**-6.2**	1	1									
	trail20	Trail	Night	70	70	67.6	67.3	-0.3	1	0									
WB3	trail14	Trail	Day	70	70	68.8	68.8	0.0	1	0	**0**	NO	NO	998	10	9,884	$197,680	N/A	NOT ACOUSTICALLY EFFECTIVE
	trail15	Trail	Day	70	70	68.9	65.9	-3.0	1	0									
	trail16	Trail	Day	70	70	69.0	65.7	-3.3	1	0									
	trail17	Trail	Day	70	70	69.1	66.0	-3.1	1	0									
	trail18	Trail	Day	70	70	69.1	65.3	-3.8	1	0									
	trail19	Trail	Day	70	70	68.8	64.4	-4.4	1	0									
	trail20	Trail	Day	70	70	68.4	68.2	-0.2	1	0									
	trail14	Trail	Night	70	70	68.0	67.9	-0.1	1	0	**0**	NO	NO	998	10	9,884	$197,680	N/A	NOT ACOUSTICALLY EFFECTIVE
	trail15	Trail	Night	70	70	68.0	65.3	-2.7	1	0									
	trail16	Trail	Night	70	70	68.1	65.1	-3.0	1	0									
	trail17	Trail	Night	70	70	68.2	65.4	-2.8	1	0									
	trail18	Trail	Night	70	70	68.2	64.6	-3.6	1	0									
	trail19	Trail	Night	70	70	68.0	63.8	-4.2	1	0									
	trail20	Trail	Night	70	70	67.6	67.4	-0.2	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B9
Build Noise Barrier Cost Effectiveness (Area 14)
Noise Barriers - WB4

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
WB4	trail1	Trail	Day	70	70	57.3	56.2	-1.1	1	0	**6**	**YES**	**YES**	1,568	20	30,460	$609,200	$101,533	NOT COST EFFECTIVE
	trail2	Trail	Day	70	70	58.4	56.5	-1.9	1	0									
	trail3	Trail	Day	70	70	59.6	56.2	-3.4	1	0									
	trail4	Trail	Day	70	70	60.9	55.3	**-5.6**	1	1									
	trail5	Trail	Day	70	70	62.6	55.4	**-7.2**	1	1									
	trail6	Trail	Day	70	70	64.3	56.6	**-7.7**	1	1									
	trail7	Trail	Day	70	70	67.0	58.2	**-8.8**	1	1									
	trail8	Trail	Day	70	70	68.3	59.2	**-9.1**	1	1									
	trail9	Trail	Day	70	70	68.5	59.9	**-8.6**	1	1									
	trail10	Trail	Day	70	70	68.7	66.7	-2.0	1	0									
	trail1	Trail	Night	70	70	56.6	55.5	-1.1	1	0	**6**	**YES**	**YES**	1,568	20	30,460	$609,200	$101,533	NOT COST EFFECTIVE
	trail2	Trail	Night	70	70	57.7	55.8	-1.9	1	0									
	trail3	Trail	Night	70	70	58.9	55.4	-3.5	1	0									
	trail4	Trail	Night	70	70	60.3	54.6	**-5.7**	1	1									
	trail5	Trail	Night	70	70	62.0	54.7	**-7.3**	1	1									
	trail6	Trail	Night	70	70	63.6	55.9	**-7.7**	1	1									
	trail7	Trail	Night	70	70	66.2	57.5	**-8.7**	1	1									
	trail8	Trail	Night	70	70	67.5	58.6	**-8.9**	1	1									
	trail9	Trail	Night	70	70	67.7	59.4	**-8.3**	1	1									
	trail10	Trail	Night	70	70	67.8	65.8	-2.0	1	0									
WB4	trail1	Trail	Day	70	70	57.3	56.4	-0.9	1	0	**5**	**YES**	NO	1,568	15	23,060	$461,200	$92,240	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	trail2	Trail	Day	70	70	58.4	56.9	-1.5	1	0									
	trail3	Trail	Day	70	70	59.6	56.8	-2.8	1	0									
	trail4	Trail	Day	70	70	60.9	56.5	-4.4	1	0									
	trail5	Trail	Day	70	70	62.6	57.4	**-5.2**	1	1									
	trail6	Trail	Day	70	70	64.3	59.1	**-5.2**	1	1									
	trail7	Trail	Day	70	70	67.0	61.3	**-5.7**	1	1									
	trail8	Trail	Day	70	70	68.3	62.4	**-5.9**	1	1									
	trail9	Trail	Day	70	70	68.5	62.4	**-6.1**	1	1									
	trail10	Trail	Day	70	70	68.7	67.1	-1.6	1	0									
	trail1	Trail	Night	70	70	56.6	55.7	-0.9	1	0	**5**	**YES**	NO	1,568	15	23,060	$461,200	$92,240	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	trail2	Trail	Night	70	70	57.7	56.1	-1.6	1	0									
	trail3	Trail	Night	70	70	58.9	56.1	-2.8	1	0									
	trail4	Trail	Night	70	70	60.3	55.8	-4.5	1	0									
	trail5	Trail	Night	70	70	62.0	56.7	**-5.3**	1	1									
	trail6	Trail	Night	70	70	63.6	58.4	**-5.2**	1	1									
	trail7	Trail	Night	70	70	66.2	60.7	**-5.5**	1	1									
	trail8	Trail	Night	70	70	67.5	61.8	**-5.7**	1	1									
	trail9	Trail	Night	70	70	67.7	61.8	**-5.9**	1	1									
	trail10	Trail	Night	70	70	67.8	66.2	-1.6	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B10
Build Noise Barrier Cost Effectiveness (Areas 16 & 17)
Noise Barriers - WB5, WB6, WB7

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
WB5	r25	Residential	Day	65	70	61.9	60.3	-1.6	1	0	**0**	NO	NO	1,902	20	37,140	$742,800	N/A	NOT ACOUSTICALLY EFFECTIVE
	r25	Residential	Night	55	70	**61.2**	**59.6**	-1.6	1	0	**0**	NO	NO	1,902	20	37,140	$742,800	N/A	NOT ACOUSTICALLY EFFECTIVE
WB6	r24	Residential	Day	65	70	61.3	57.6	-3.7	1	0	**0**	NO	NO	1,652	20	32,140	$642,800	N/A	NOT ACOUSTICALLY EFFECTIVE
	r24	Residential	Night	55	70	**60.6**	**56.9**	-3.7	1	0	**0**	NO	NO	1,652	20	32,140	$642,800	N/A	NOT ACOUSTICALLY EFFECTIVE
WB7	r17	Residential	Day	65	70	64.6	61.7	-2.9	1	0	**2**	**YES**	**YES**	2,875	20	56,600	$1,132,000	$566,000	NOT COST EFFECTIVE
	r18	Residential	Day	65	70	61.9	54.3	**-7.6**	1	1									
	r19	Residential	Day	65	70	58.9	52.2	**-6.7**	1	1									
	r21	Residential	Day	65	70	62.9	58.9	-4.0	1	0									
	c2	Commercial	Day	70	75	65.6	64.8	-0.8	1	0									
	r17	Residential	Night	55	70	**62.9**	**59.2**	-3.7	1	0	**2**	**YES**	**YES**	2,875	20	56,600	$1,132,000	$566,000	NOT COST EFFECTIVE
	r18	Residential	Night	55	70	**60.9**	53.2	**-7.7**	1	1									
	r19	Residential	Night	55	70	**58.0**	51.4	**-6.6**	1	1									
	r21	Residential	Night	55	70	**62.0**	**58.1**	-3.9	1	0									
	c2	Commercial	Night	70	75	64.2	63.2	-1.0	1	0									
WB7	r17	Residential	Day	65	70	64.6	62.7	-1.9	1	0	**2**	**YES**	**YES**	2,421	20	47,520	$950,400	$475,200	NOT COST EFFECTIVE
	r18	Residential	Day	65	70	61.9	54.7	**-7.2**	1	1									
	r19	Residential	Day	65	70	58.9	52.3	**-6.6**	1	1									
	r21	Residential	Day	65	70	62.9	59.5	-3.4	1	0									
	c2	Commercial	Day	70	75	65.6	65.3	-0.3	1	0									
	r17	Residential	Night	55	70	**62.9**	**60.5**	-2.4	1	0	**2**	**YES**	**YES**	2,421	20	47,520	$950,400	$475,200	NOT COST EFFECTIVE
	r18	Residential	Night	55	70	**60.9**	53.6	**-7.3**	1	1									
	r19	Residential	Night	55	70	**58.0**	51.5	**-6.5**	1	1									
	r21	Residential	Night	55	70	**62.0**	**58.6**	-3.4	1	0									
	c2	Commercial	Night	70	75	64.2	63.8	-0.4	1	0									
WB7	r17	Residential	Day	65	70	64.6	63.0	-1.6	1	0	**1**	**YES**	NO	2,421	15	35,855	$717,100	$717,100	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r18	Residential	Day	65	70	61.9	56.3	**-5.6**	1	1									
	r19	Residential	Day	65	70	58.9	54.0	-4.9	1	0									
	r21	Residential	Day	65	70	62.9	60.6	-2.3	1	0									
	c2	Commercial	Day	70	75	65.6	65.3	-0.3	1	0									
	r17	Residential	Night	55	70	**62.9**	**61.0**	-1.9	1	0	**1**	**YES**	NO	2,421	15	35,855	$717,100	$717,100	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r18	Residential	Night	55	70	**60.9**	**55.3**	**-5.6**	1	1									
	r19	Residential	Night	55	70	**58.0**	53.2	-4.8	1	0									
	r21	Residential	Night	55	70	**62.0**	**59.9**	-2.1	1	0									
	c2	Commercial	Night	70	75	64.2	63.9	-0.3	1	0									
																		$43,500	MnDOT Threshold

NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Table B11
Build Noise Barrier Cost Effectiveness (Areas 19 & 20)
Noise Barriers - WB8, WB9, WB10

Noise Barrier	Receiver	Land Use	Timeframe (Day or Night)	Noise Standard (L_{10} dBA)		Noise Levels (L_{10} dBA)		Acoustic Effectiveness						Cost Effectiveness ($20/SF)					NOISE WALL RESULTS
				MnDOT	FHWA	Future Build (dBA)	Future Build with Barriers (dBA)	dBA Reduction	Number of Receptors	Benefitted Receptors (-5dBA)	**Total Benefitted Receptors**	**Acoustically Effective**	**Design Goal (-7dBA)**	Barrier Length (ft)	Barrier Height (ft)	Area of Barrier (SF)**	Total Cost	Cost per Benefited Receptor	
WB8	r7	Residential	Day	65	70	62.5	59.4	-3.1	1	0	**0**	NO	NO	2,408	20	47,260	$945,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	r9	Residential	Day	65	70	57.2	55.3	-1.9	1	0									
	r7	Residential	Night	55	70	**61.1**	**57.9**	-3.2	1	0	**0**	NO	NO	2,408	20	47,260	$945,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	r9	Residential	Night	55	70	**55.7**	53.7	-2.0	1	0									
WB9	r6	Residential	Day	65	70	**67.0**	63.0	-4.0	1	0	**0**	NO	NO	579	20	10,680	$213,600	N/A	NOT ACOUSTICALLY EFFECTIVE
	r6	Residential	Night	55	70	**65.6**	**61.5**	-4.1	1	0		NO	NO	579	20	10,680	$213,600	N/A	NOT ACOUSTICALLY EFFECTIVE
WB10	r2	Residential	Day	65	70	**71.3**	62.1	**-9.2**	1	1	**1**	**YES**	**YES**	409	20	7,280	$145,600	$145,600	NOT COST EFFECTIVE
	r2	Residential	Night	55	70	**70.1**	**61.3**	**-8.8**	1	1	**1**	**YES**	**YES**	409	20	7,280	$145,600	$145,600	NOT COST EFFECTIVE
WB10	r2	Residential	Day	65	70	**71.3**	63.9	**-7.4**	1	1	**1**	**YES**	**YES**	409	15	5,675	$113,500	$113,500	NOT COST EFFECTIVE
	r2	Residential	Night	55	70	**70.1**	**63.1**	**-7.0**	1	1	**1**	**YES**	**YES**	409	15	5,675	$113,500	$113,500	NOT COST EFFECTIVE
WB10	r2	Residential	Day	65	70	**71.3**	**67.1**	-4.2	1	0	**0**	NO	NO	409	10	3,994	$79,880	N/A	NOT ACOUSTICALLY EFFECTIVE
	r2	Residential	Night	55	70	**70.1**	**66.2**	-3.9	1	0	**0**	NO	NO	409	10	3,994	$79,880	N/A	NOT ACOUSTICALLY EFFECTIVE
																		$43,500	MnDOT Threshold

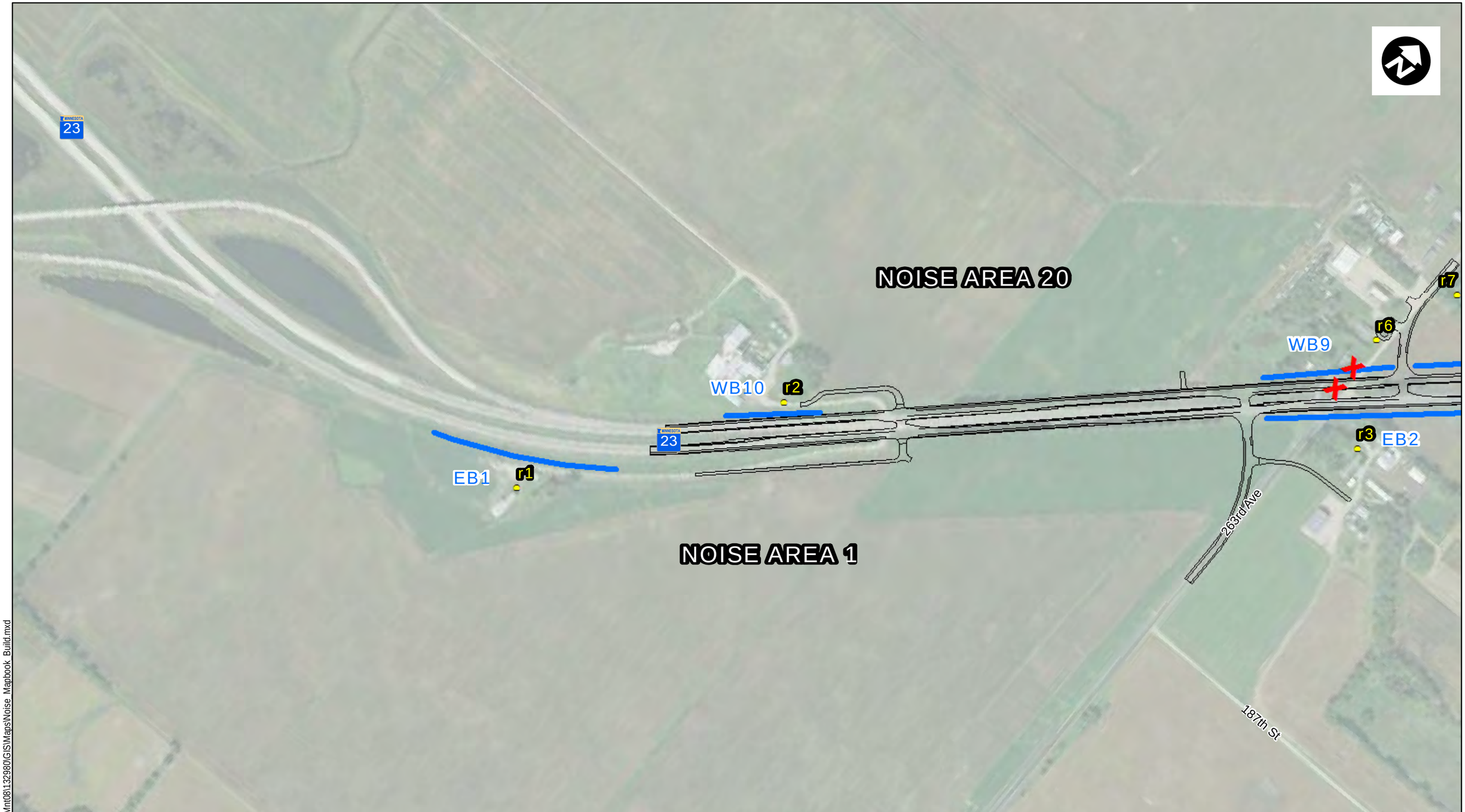
NOTES:

XX	**Bold**; Exceeds MN State Standards
XX	Underline; Approach or Exceeds FHWA Standards

**Noise barrier tapers were included on all evaluated barriers.

Appendix C

Build Noise Barrier Figures (1-9)



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SEH

Project: MNT08 132980
Print Date: 2/21/2017

Map by: MSS
Projection:Stearns County Coordinates
Source: MnGEO, MnDOT

NOISE RECEPTORS
- BENEFITED
- IMPACTED
- NOT IMPACTED

ACQUIRED BUILDING

BARRIERS-NOT PROPOSED

0 200 400 Feet
1 inch = 400 feet

Build Conditions - Noise Analysis

TH 23 - North Gap
Paynesville to Richmond, MN

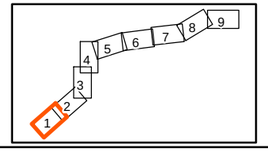
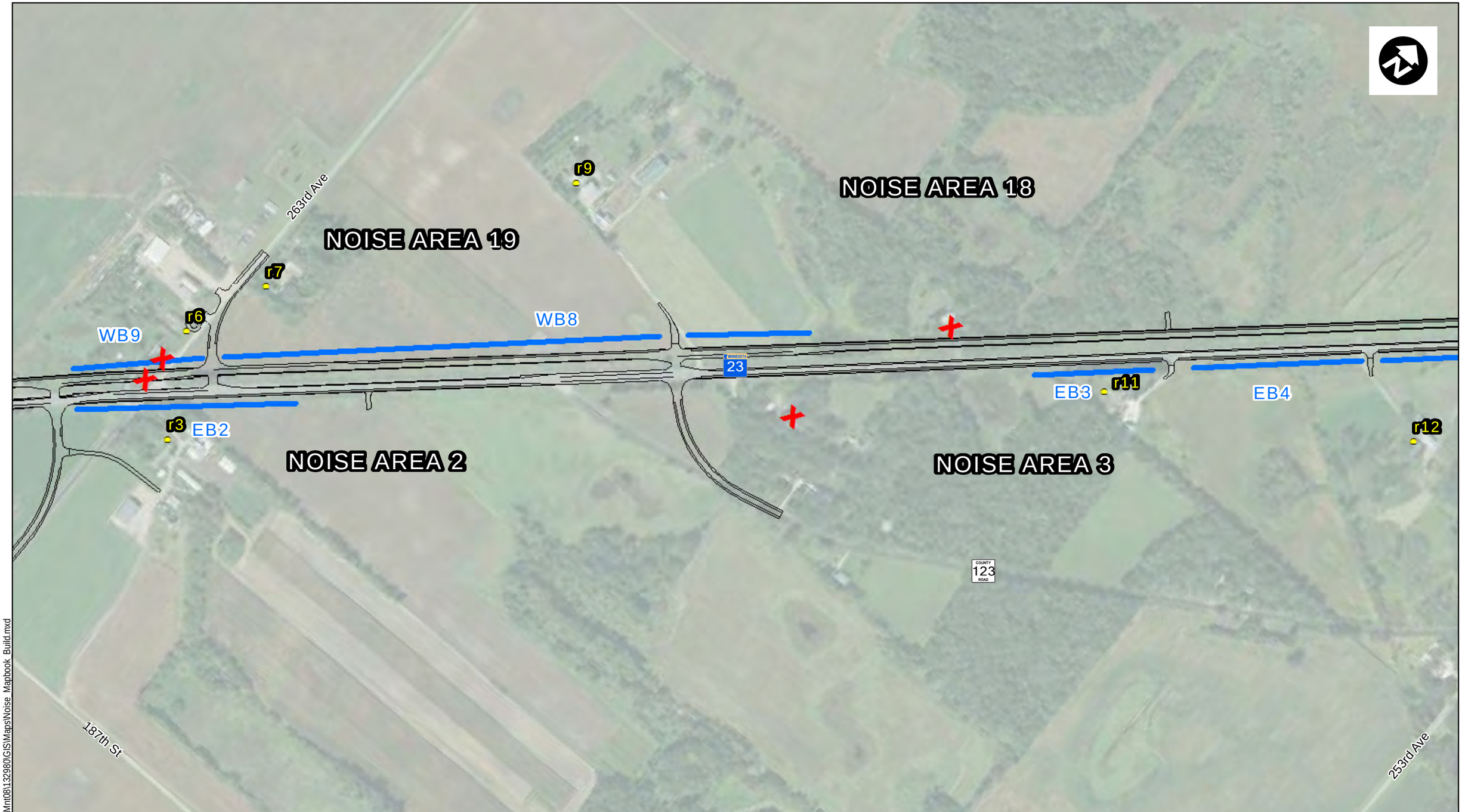


Figure
1 of 9



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Project: MNT08 132980
Print Date: 2/21/2017

Map by: MSS
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BARRIERS-NOT PROPOSED

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Build Conditions - Noise Analysis

TH 23 - North Gap
Paynesville to Richmond, MN

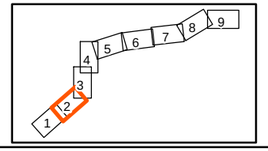

Figure
2 of 9

Document Path: S:\KO\M\Mnt08\132980\GIS\Maps\Noise_Mapbook_Build.mxd

SEH

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Build Conditions - Noise Analysis

TH 23 - North Gap
Paynesville to Richmond, MN

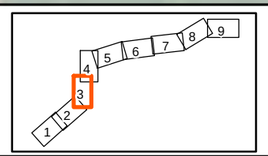

Figure
3 of 9

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Build Conditions - Noise Analysis

TH 23 - North Gap
Paynesville to Richmond, MN

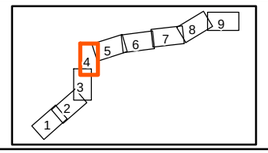
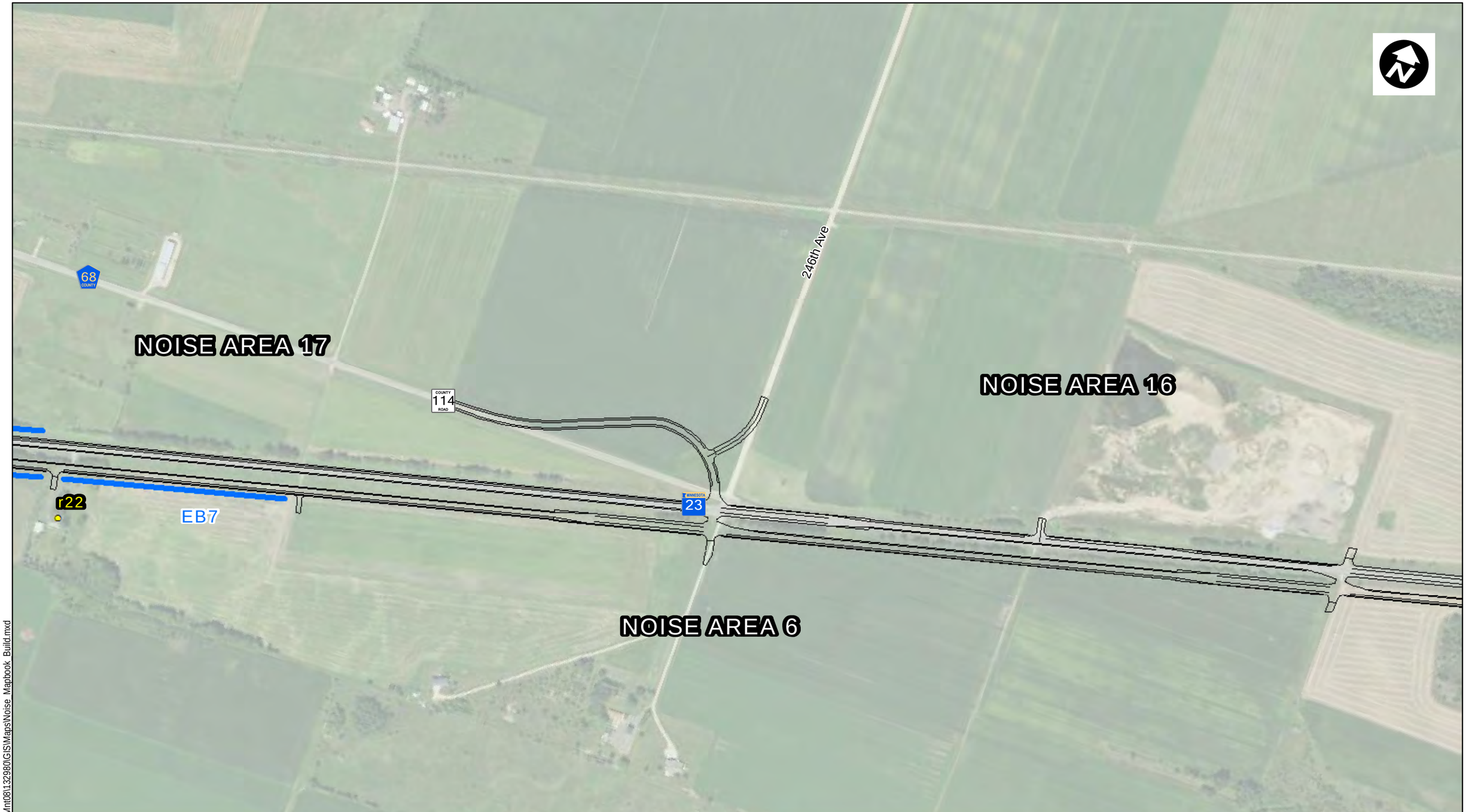


Figure
4 of 9



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Build Conditions - Noise Analysis

TH 23 - North Gap
Paynesville to Richmond, MN

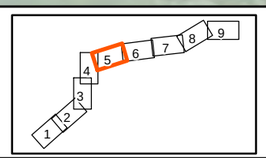
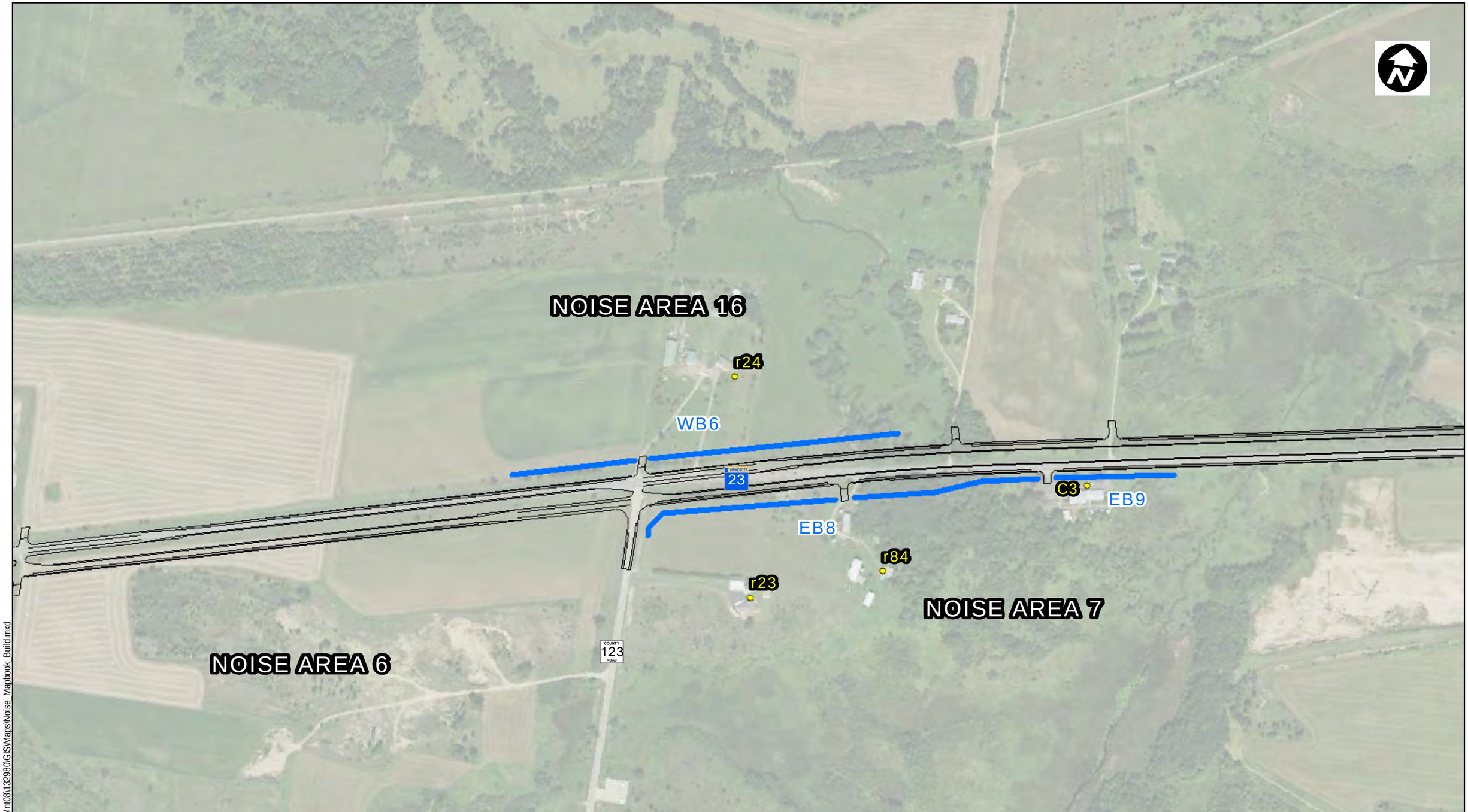


Figure
5 of 9



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Build Conditions - Noise Analysis

TH 23 - North Gap
Paynesville to Richmond, MN

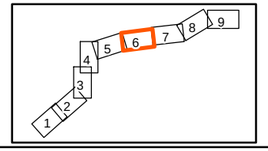

Figure
6 of 9

NOISE AREA 16

r25

WB5

NOISE AREA 7

23

NOISE AREA 15

r27

r29

EB10

NOISE AREA 8

Big Lake Rd

Fellows Rd

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Paynesville to Richmond, MN

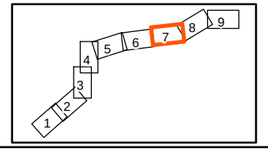
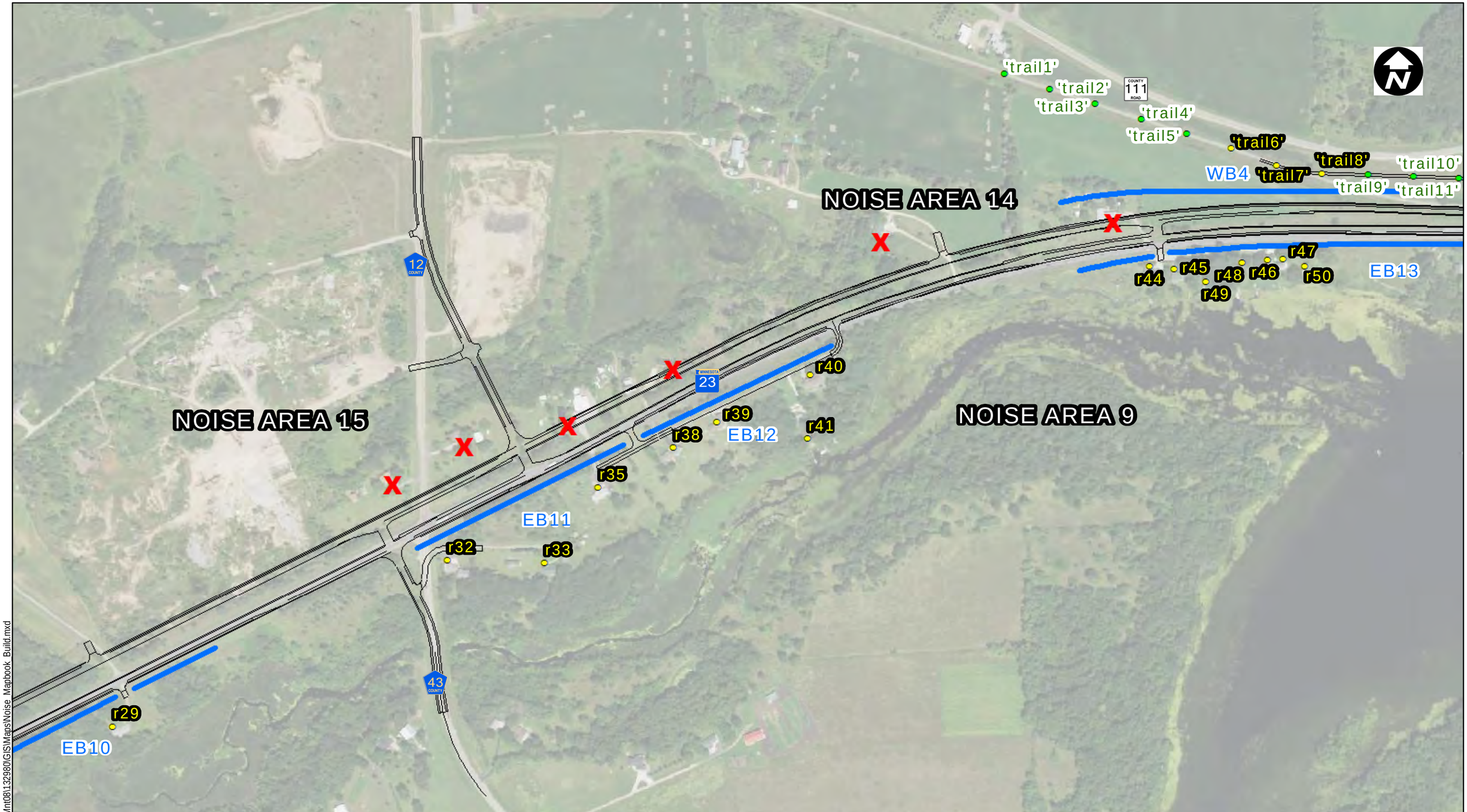


Figure 7 of 9



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TH 23 - North Gap
Paynesville to Richmond, MN

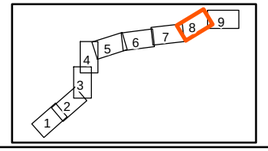

Figure
8 of 9

Document Path: S:\KO\M\Mnt08\132980\GIS\Maps\Noise_Mapbook_Build.mxd

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TH 23 - North Gap
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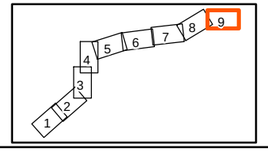

Figure
9 of 9