Minnesota Department of Transportation

TH 23 New London to Paynesville 2-Lane to 4-Lane Conversion Project

Environmental Assessment Worksheet

April 2016

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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: New London to Paynesville 2-Lane to 4-Lane Conversion Project

2. Proposer

Contact Person: Jon Huseby, PE
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3. RGU

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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: Kandiyohi
City/Township: Roseville Township, New London Township, Burbank Township, Irving Township
PLS Location (¼, ¼, Section, Township, Range): T121N, R34W, Section 1; T122N, R34W, Section 36; T122N, R33W, Sections 24-29 and 31
Watershed (81 major watershed scale): 18 (North Fork Crow River, Middle Fork Crow 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 and natural features are found in Appendix A-Figure 2.

Typical Sections for the project are found in Appendix B.

6. Project Description

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

This project will expand TH 23 from New London to Paynesville in Kandiyohi County from its current configuration as a two-lane roadway, to a four-lane facility. The project length is approximately 7.4 miles and is located within Kandiyohi 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.

The project will expand approximately 7.4 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 4-lane design. The western portion, approximately 4.5 miles, of existing 2-lane roadway will be converted to the westbound lanes and the new eastbound lanes will be constructed parallel to the existing roadway. The eastern most section, approximately 1.25 miles, of existing 2-lane roadway will be converted to the eastbound lanes and the new westbound lanes will be constructed parallel to the existing roadway. For the remaining middle segment, both lanes will be completely reconstructed to accommodate a new alignment along the corridor.

MnDOT began the environmental review and layout development for the New London to Paynesville segment in the summer of 2014. Currently there is no state or federal funding for the project; as such, there is no construction start date estimated at this time. When funding is secured, a concrete timeline will be developed for the timing and duration of construction activities.

Construction: Noise, Vibration, and Dust

Pile driving and other components of project construction will result in noise, vibration, and dust impacts, as would heavy equipment (dozers, front-end loaders, backhoes, and vibratory rollers) are used for these activities. Noise impacts related to the operation of construction equipment will vary in location and duration. Construction will be limited to daytime hours as much as possible. Air quality impacts may also result from emissions from construction equipment and from traffic stopped at intersecting roadways. These impacts are expected to be minimal and of short duration.

Construction: Erosion

This project will result in some potential for erosion as existing ground cover will be disturbed. A National Pollution Discharge Elimination System (NPDES) Construction Storm Water Permit will be required for this project. A Stormwater Pollution Prevention Plan (SWPPP) will be developed for the project. Erosion prevention and sediment control requirements will be followed in accordance with the NPDES permit, which includes both temporary and permanent erosion and sediment control plans as well as other Best Management Practices (BMPs) to protect the resource waters. BMPs contained in MnDOT's standard specifications, details, and special provisions will also be used.

Construction: DNR Coordination

Continued coordination with the MnDNR is expected to ensure adequate construction staging along the Glacial Lakes Trail. It is anticipated construction equipment will need to be temporarily placed on DNR right of way to construct one or more sections. Construction staging plans will be coordinated with the MnDNR prior to letting the project to minimize disruption.

c. Project magnitude:

Total Project Acreage*	309
Linear Project Length	7.4 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 Highway 23 Corridor extends southwest to northeast 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 New London and Paynesville is one of two remaining segments of two-lane roadway from Willmar to Saint Cloud, and part of the long-standing effort to construct a four-lane facility 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.

A crash analysis along the 7.4 miles section of TH 23 was completed based on a 10-year crash history. The analysis revealed a high percentage of rear end and run-off-road crashes along the corridor, which could be attributed to the high number of accesses onto TH 23 and lack of separate turning lanes for vehicles. Currently all turning traffic along the corridor must turn from the TH 23 thru-lane which is posted at 60 mph.

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 the 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.

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 the 60 mile corridor between Willmar and Saint Cloud. In addition to the proposed project, the segment between Paynesville and Richmond is the last remaining two-lane facility along the corridor. Preliminary engineering and environmental review began on the Paynesville to Richmond segment[3] starting in the spring of 2015. This project (SP 7305-124) is also being proposed by MnDOT District 8. A construction timeline has not been established and the project is not formally tied to the proposed New London to Paynesville segment project.

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. The TH 23 segment west of the proposed project between Spicer and New London expanded to a four-lane facility in 2005. In addition, a TH 23 four-lane bypass expansion around Paynesville was completed in 2012.

[2] Source: http://www.dot.state.mn.us/d8/projects/manufacturersperspectives
[3] See project website: http://www.dot.state.mn.us/d8/projects/hwy23gappaynesvillerichmond/index.html

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
Wetlands	5.3	0.9	4.4 loss
Cropland	56.7	42.2	14.5 loss
Grassland	189.6	151.1	38.5 loss
Red Oak	5.2	3.8	1.4 loss
Upland Shrub	0.8	0.8	-
Impervious	51.2	91.5	40.3 gain
Infiltration Basin	0.0	19.1	19.1 gain
Total	**309**	**309**	

The area of interest encompasses land within the proposed right of way. Source: MnDNR Data Deli, GAP Land Cover – Vector layer. GAP Land Cover layer only identifies grassland within project area. GAP Land Cover incorrectly identifies cropland within area of interest. This land is assumed Grassland within listed cover types. GAP Land Cover also does not identify existing roadway cover. As a result, the layer's existing grassland area is approximate only. Minnesota Land Cover Classification System (MLCCS) not available for project area.

** Acreage taken from project layout.

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 404 Permit – General Permit	U.S. Army Corps of Engineers	Approval
State		
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
Water Appropriation Permit	MnDNR	Permit (if required)
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 is rural in nature. Agricultural uses dominate the surrounding areas, with residential and commercial/industrial uses concentrated in several portions of the project area. These areas are described in further detail below.

The Long Lake watercourse crossing area near the intersection of TH 23 and 115th Street NE contains a concentration of residential land uses, particularly south of TH 23 adjacent to the Long Lake shoreline. A Duininck Concrete Central Ready Mix facility is located north of TH 23 at this intersection.

Additional residential land uses and related access points are located near the intersection of TH 23 and 130th Street NE. A Great River Energy facility is located north of TH 23 just east of this intersection.
A concentration of residential land uses exist in the community of Hawick near the intersection of TH 23 and 160th Street NE. A large Jennie-O turkey facility lies south of TH 23 near the eastern terminus of the project limits.

The project is not expected to cause significant 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 land use patterns within the project area and prevent developments inconsistent with existing land uses. In addition, the *Kandiyohi County Comprehensive Plan*[4] identifies an objective to carefully manage land uses along transportation corridors in part to preserve managed 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. These areas of statewide importance are disrupted by areas of "not prime farmland" at the project's western terminus, the Long Lake watercourse crossing, the Duininck gravel operation, and intermittent forested areas east of Long Lake. A NRCS Web Soil Survey map of farmland classifications is located within Appendix C.

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 130 acres of farmland to transportation right-of-way. This assessment is based on soil classification, and not whether land is tilled. According to Kandiyohi property records, ninety-five parcels will be effected by the conversion.

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 adverse impacts to agricultural land or operations. The project will not have a substantial effect upon agricultural production in Kandiyohi County.

Parks and Trails

The Glacial Lakes State Trail runs immediately north of TH 23 from approximately 1/3 mile north of 199th Avenue NE on the western end of the project area to 240th Avenue NE on its eastern end, a distance of about 4.7 miles. Approximately 100 feet of separation currently exists (centerline-to-centerline) between the trail and TH 23. As part of the project a new trailhead and parking facility is proposed, located east of Hawick.

A pedestrian tunnel is proposed on the east end of 212th Avenue NE. The trail connection will provide safe access to the Glacial Lakes Trail for users from the south, which include residential developments along Long Lake, a church camp facility, and private campground facility. Improvements to 212th Avenue NE are proposed as part of the TH 23 reconstruction, including a cul-de-sac located at the south end of the underpass. This design allows a low volume traffic area for users to access the trail, provides a vehicle turnaround, and parking near the trail access.

Figure 2 – Sheets 1 through 11, located in Appendix A, depicts the location and alignment of the Glacial Lakes Trail through the study area.

[4] Source: http://www.co.kandiyohi.mn.us/docs/EnvSvcs/PlanZoneForms/00_Kandiyohi_County_Comprehensive_Plan.pdf

The project has been reviewed for potential Section 6(f) involvement. The project will result in the conversion of land acquired or developed with funds from the Land and Water Conservation Fund (LAWCON). The purpose of the Land and Water Conservation Fund Act (LAWCON) is to help preserve, develop and provide accessibility to outdoor recreation resources. LAWCON stipulates that any land developed or improved with LAWCON funds cannot be converted to other than outdoor recreational use unless replacement land of at least equal fair market value and reasonably equivalent usefulness is provided. Any time a transportation project will cause such a conversion, replacement land must be provided. All conversions must be approved by the National Park Service. All conversion requests must first be approved by the MNDNR before they are sent to the National Park Service for final approval.

Section 6(f) Impacts

The Section 6(f) portion of the trail is approximately 4 miles along the corridor. The 6(f) portion of the trail effected by the project area starts approximately 1/3 mile north of 199th Avenue NE, and ends at the cemetery access road located east of the City of Hawick. See Appendix A- Figure 2, Sheets 1-9. The total projects impacts will result in a change of use for 6(f) property. Project impacts and change of use to the 6(f) portions of the trail were assessed in consultation with the MNDNR. An estimated 0.22 acre of the 6(f) property will be permanently converted from 6(f) trail property. This impact is mitigated through closures of private, public road, and field accesses along the 6(f) property; equaling approximately 0.36 acres of mitigation. This mitigation is considered adequate to meet the demand of replacement land of at least equal fair market value. Temporary impacts during construction as estimated to temporarily change the use of 2.26 acres of the trail. These areas of temporary impact will only result in a change of use during construction and will be returned to normal use after the construction of the highway is complete.

Table 3: 6(f) Property- Change of Use

Permanent Conversion	0 .22 acres
Mitigated DNR Right of Way	0.36 acres
Temporary Conversion	2.26 acres

DNR Impacts

The remaining sections of the Glacial Lakes trail that are effected by the TH 23 project are state property impacts and are not subject to Section 6(f) mitigation requirements. The non-6(f) portion of the trail starts immediately east of the cemetery access road, located west of the City of Hawick. An estimated 4.3 acres of Glacial Lakes Trail right of way will be acquired during the relocation of TH 23 during the four lane expansion.

Zoning

Zoning within the project area is varied. Zoning districts adjacent to the roadway include C1-Central Commercial, Restricted Agriculture, A-2 General Agriculture, Community Residence, Central Commercial, R-1 Platted, R-2 Platted, and R-1 Shoreland Management.[5]

The Long Lake watercourse crossing area is a complex area of different zoning districts, including R-2 Community Residence, C-1 Central Commercial, and R-1 Platted. Between 115th Street NE and 145th Street NE, the north side of TH 23 is zoned C-1 Central Commercial and the south side is predominantly zoned Community Residence. The area surrounding Hawick is zoned Restricted Agriculture on the north side of

[5] See the Kandiyohi County Comprehensive Plan (2001), Chapter 5 Pages 4, 24, 36, and 43. Available at http://www.co.kandiyohi.mn.us/docs/EnvSvcs/PlanZoneForms/00_Kandiyohi_County_Comprehensive_Plan.pdf

TH 23 and R-2 Platted and Restricted Agriculture on the south side. The only R-1 Shoreland Management zoning within the project area is located immediately east of Hawick. The eastern terminus is zoned exclusively A-2 General Agriculture.

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, Kandiyohi County maintains an R-1 Shoreland Residential Management District surrounding Natural Environment Lakes 68 and 69 within the Roseville Township zoning map.[6] These public waters are located between 160th Street NE and 240th Avenue NE on the eastern half of the project area. Shoreland district ordinance language primarily involves structure and development regulations. Zoning regulations have been considered throughout the project's design process. Per the Kandiyohi County zoning ordinance, roads placed within shore impact zones will be designed to minimize adverse impacts.[7]

Wild and Scenic Rivers and Nationwide Rivers Inventory

No State Wild and Scenic Rivers exist in the project area. No rivers exist within the project limits that are included within the National Wild and Scenic Rivers System or the Nationwide Rivers Inventory.

Flood Plain Assessment

According to panels 27067C0225D and 27067C025D of the relevant Flood Insurance Rate Map (FIRM), there are no special flood hazard areas within one mile of the project area. The entire project area is within an area of minimal flooding.

Substantial consideration was given to the roadway crossing of the Long Lake watercourse. Data from the DNR LakeFinder indicates minimal water level bounce between the ordinary high water level (OHW) to the highest recorded water level, 0.9 feet. Flood risk is naturally minimized, in part because of the small watershed to lake area ratio.

The roadway design at the Long Lake watercourse crossings includes two feet of freeboard between the highest recorded water level for Long Lake and the roadway to account for any flooding potential. No significant interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route is anticipated.

Kandiyohi County has shoreland district zoning and/or floodplain management ordinances that regulate floodplain development. This project is not anticipated to result in any incompatible floodplain development.

Additional information on floodplain and wetland assessments and minimization/mitigation strategies can be found in Section I.A 11 (Water Resources).

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[6] [6] See the Kandiyohi County Comprehensive Plan (2001), Chapter 5 Page 43.

[7] See Kandiyohi County Zoning Ordinance No. 9A, Page 66, April 25, 2014. Available at http://www.co.kandiyohi.mn.us/docs/Admin/Ordinances/09_ZoningOrdinance4_25_14.pdf

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. 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.

Not applicable. 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 area is located within the Minnesota River Prairie Subsections of the North Central Glaciated Plains Section. The entire project is located within the Prairie Parkland Province.[8] 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[9]. No geologic hazards that could result in groundwater impacts (e.g., sinkholes, shallow limestone formations or near-surface karst conditions) have been identified.

Mitigation

MnDOT's BMPs for chemical management and recovery during construction will be contained within the project Stormwater Pollution Prevention Plan (SWPPP), detail sheets, and/or special provisions of the construction plan; these management and recovery measures will prevent migration of potential chemical releases to surface water and groundwater during construction operations (e.g., surface milling, concrete sawing, equipment maintenance, washing, and refueling, chemical and equipment storage).

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 C. Table 4 below summarizes soil type information within the project area. According to the NRCS Soil Survey, the

[8] Source: MnDNR, Ecological Classification System, http://dnr.state.mn.us/ecs/index.html
[9] Source: MnDNR Ecological Classification System, http://www.dnr.state.mn.us/ecs/251Bb/index.html

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 4: Project Area USCS Soil Types

Symbol	Name	Texture	Representative Slope (%)
39	Wadena loam	Loam	2.0
392	Biscay loam	Loam	2.0
611D	Hawick gravelly loamy coarse sand	Loamy coarse sand	16.0
611F	Hawick gravelly loamy coarse sand	Loamy coarse sand	27.5
804B	Koronis-Hawick complex	Sandy loam	4.0
833C	Sunburg-Wadenill-Hawick complex	Loam	10.0
875B	Estherville-Hawick complex	Sandy loam	4.0
875C	Hawick-Estherville complex	Loamy coarse sand	9.0
1016	Udornthents	Loam	2.0
1029	Pits, gravel	N/A	10.0
1055	Aquollls and Histosols, ponded	Loam	0.5
D105A	Arvilla sandy loam, MLRA 91A	Sandy loam	1.0

Steep Slopes and Highly Erodible Soils

The EAW guidelines (Minnesota EQB, 2000) identify steep slopes of 12 percent or greater. Soils on the western side of Long Lake Crossing (Hawick gravelly loamy coarse sand) exhibit representative slopes of 16%. Land immediately north of the project area can exceed 27% in representative slope. The majority of the project area, however, exhibits representative slopes of less than 4%. Temporary stabilization measures such as mulch, erosion control blankets, etc. will be used on any impacted steep slopes to prevent erosion and sedimentation of ditches during construction. Vegetation establishment will be used to permanently stabilize side slopes, with proposed roadway ditches vegetated based on anticipated runoff velocities.

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 Long Lake (34-66 P) and Monongalia Lake (34-158 P), both public waters and impaired waters according to the MPCA 303d Impaired Waters List. These bodies of water and other surface waters located within one mile of the project area are summarized in Table 5.

Table 5: Project Area Surface Waters

No.	Name	PWI ID/Assessment Unit	Public Water	303d Impaired Water
1	Long	34-66 P	Yes	Yes
2	Monongalia	34-158 P	Yes	Yes
3	Unnamed	34-578 W	Yes	No
4	Unnamed	34-513 W	Yes	No
5	Shoemaker	34-61 W	Yes	No
6	Unnamed	34-150 W	Yes	No
7	Unnamed	34-151 P	Yes	No
8	Holstad	34-150 W	Yes	No
9	Mortenson	34-150 W	Yes	No
10	Unnamed	34-557 W	Yes	No
11	Unnamed	34-70 W	Yes	No
12	Unnamed	34-65 W	Yes	No
13	Unnamed	34-367 W	Yes	No
14	Unnamed	34-365 W	Yes	No
15	Unnamed	34-460 W	Yes	No
16	Unnamed	34-459 W	Yes	No
17	Hawick Creamery Slough	34-69 W	Yes	No
18	Raemer	34-68 W	Yes	No
19	Unnamed	34-458 W	Yes	No
20	Unnamed	34-520 W	Yes	No

As noted in Table 5 above, there are impaired waters as defined by the MPCA Final 2012 TMDL (303(d)) List within the project area. These bodies of water are Long Lake and Lake Monongalia. However, both impairments are for aquatic consumption due to mercury in fish tissue. Mercury is a non-construction related parameter which 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 October 21, 2015 through November 2, 2015. The results show the depth of groundwater ranging from 2.3 to 15.5 feet along the corridor.

MDH Wellhead Protection Area

MDH wellhead locations were investigated to determine if nearby wellhead protection areas would need to be taken into consideration for placement of infiltration BMPs. No wellhead protection areas were located in the project vicinity.

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.

No adverse effects are anticipated.

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.

No adverse effects are anticipated.

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 40.3 acres of new impervious area across the entire project. The portion of existing and new impervious areas is summarized in Table 6.

Table 6: Project Impervious Areas Summary (in acres)

Existing	Future	Net Increase
51.2	91.5	40.3

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 more detailed storm water runoff and treatment plan has been developed and will need to be updated during the final design stage.

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 and Long 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) and other pollutants. The soils in the corridor are Hydrologic Soil Group A which typically have high infiltration rates. The basin will treat both existing and new impervious areas to a level necessary to meet the MPCA NPDES Permit requirements. Storm water runoff from the project will discharge into waters classified as impaired (Long Lake is classified as impaired), therefore the level of treatment required is currently 1-inch of runoff over the new impervious surface area.

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 as possible, using special ditch grades and the natural slope of the roadway improvements. Figure 2 (Sheets 1 through 14), located in Appendix A, 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.

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.

At this time, it is uncertain whether temporary dewatering will 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 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.

Through the conversion of the two-lane to four-lane roadway, estimates show that around 4.39 acres of wetlands will be impacted. See Table 7 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.

See Figures in Appendix A for specific locations of wetland impacts.

Wetland Avoidance Alternatives & Potential Alignments

Early in the planning process several alignments and access configurations along the corridor were evaluated. The No-Build Alternative would not impact wetlands; however, it does not address the project purpose and need. The existing 2-lane road bed was retained to the greatest extent possible throughout the expansion to minimize the amount of new construction and impacts along the corridor. The location of additional lanes were evaluated through an alternatives evaluation process to determine potential impacts of the additional lanes, and determine the location of the additional lanes in the preferred

alternative. Several factors were weighed when evaluating alternative and selecting the preferred alternative, including wetland impacts.

Wetland Impacts

Fifteen wetland basins were identified, delineated, and classified in the *Wetland Delineation Report-November 2015*. 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 4.39 acres of wetland impacts. See Table 7 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 7: Wetland Impacts of Preferred Alternative

Wetland ID	Cowardin Type	C-39 Type	Field Wetland Type	Linear Wet Ditch	Natural Wetland	Public Water	Estimated impact (acres)
1	PEMC	3	Shallow Marsh/Lowland Hardwood Swamp	No	Yes	No	1.47
2	PEMC	3	Shallow Marsh	No	Yes	No	0.12
3	PEMC	3	Shallow Marsh	No	Yes	No	0.31
4	PEMG	4	Deep Marsh	No	Yes	Yes	0.31
5	PEMC	3	Shallow Marsh	No	Yes	Yes	0.01
6	PEMG	4	Deep Marsh	No	Yes	No	0.57
7	PEMC	3	Shallow Marsh	No	Yes	No	1.05
8	PEMB	4	Deep Marsh	No	Yes	No	0.23
9	PEMB	2	Fresh (wet) Meadow	No	Yes	No	0.34
						Total Wetland Impacts	**4.39**
						Wetland Impacts	4.07
						PWI Impacts	0.32

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. 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.

The project will impact up to 4.39 acres of wetland within Bank Service Area 7 and in North Fork Crow River (Watershed #18). 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. Up to 11 acres of 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. 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 regional, state, and federal levels including the USACE and the EPA at the federal level; the Minnesota Wetland Conservation Act (with oversite by the Board of Water and Soil Resources (BWSR)), the MNDNR, and the Minnesota Pollution Control Agency (MPCA) at the state level. MnDOT will act as the LGU responsible for the administration 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. Work below the established ordinary high water line of Wetlands 4, 10, and 14 will require a MNDNR Public Waters Work Permit. 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.

There is one location that will alter the surface water features of the channel of Long Lake. The current alignment of TH 23 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. The culvert structure crossing at Long Lake will be replaced to accommodate the expanded roadway.

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 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. Compliance with the MPCA NPDES Construction Stormwater Permit will provide 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.

The presence of potentially contaminated properties (defined as properties where soil and/or groundwater is impacted with pollutants, contaminants or hazardous wastes) is a concern in the development of highway projects because of potential liabilities associated with ownership of such properties, potential cleanup costs, and safety concerns associated with construction personnel encountering unsuspected wastes or contaminated soil or groundwater. Contaminated materials encountered during highway construction projects must be properly handled and treated in accordance with state and federal regulations. Improper handling of contaminated materials can worsen their impact on the environment. Contaminated materials also cause adverse impacts to highway projects by increasing construction costs and causing construction delays, which also can increase project costs.

MnDOT's Contaminated Materials Management Team (CMMT) reviewed the Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Agriculture (MDA) databases to check for known contaminated sites in the project area. Items searched for in the databases included: leaking underground storage tank facilities, landfills, salvage yards, voluntary investigation and cleanup (VIC) sites, Superfund sites and dump sites.

Based on the database review, there is one closed leaking underground storage tank site and one closed unpermitted dump site located just outside the boundary of the project area. Both the leaking underground storage tank, Monson Lumber Company, and the unpermitted dump, a former railroad demolition site, have been reviewed by MnDOT's Environmental Investigation Unit (EIU), and were cleared of any potential contamination issues in connection with the project area.

According to the CMMT, given the nature and location of the project area, and based on the Highway Project Development Process (HPDP) threshold criteria, this 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 contaminants that may have originated from an off-site source and migrated into the right-of-way.

The CMMT determined that, based upon their review of available databases, a complete Phase I ESA of the project area is not necessary. As the final design develops, excavation locations and depths will be shared with the CMMT to verify whether or not the project will be impacted by any documented contaminated sites. 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 will not be present at the construction site, with the exception of fuels and lubricants needed for construction equipment. Appropriate safety measures will be followed during construction to avoid spills. Leaks, spills, or other releases will 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 will 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 will be taken immediately in accordance with MPCA guidelines and regulations.

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 River Prairie Subsection of the Prairie Parkland Province of the MnDNR Ecological Classification System. The project area is immediately adjacent to the Hardwood Hills Subsection of the Eastern Broadleaf Forest Province. 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 Long Lake, including bluegill, largemouth bass, northern pike, walleye, and yellow perch.

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. The project area is adjacent to habitat corridors identified within the MnDNR *Prairie Conservation Plan*.

A non-native subspecies of phragmites (common reed) is known to exist within the project area. These perennial wetland grasses invade lake shores, wetlands, rivers, and roadsides and cause changes in ecosystem processes (hydrology, nutrient cycles) and negative impacts on native plants and wildlife.

There are no known threatened or endangered plant species in this corridor. The showy lady's slipper has been sighted near the Long Lake area. It is not a listed rare, threatened or endangered species; however, it is considered a state asset.

Correspondence with the MnDOT Roadside Vegetation Unit is located in Appendix E.

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.

Section 7 consultation with the US Fish and Wildlife Service will be required because of federal wetland permitting needs. Formal 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 D for correspondence related to rare features.

Fish and Wildlife

Per correspondence with MnDNR Ecological and Water Resources, the Minnesota Natural Heritage Information System (NHIS) has been queried (see Appendix D for additional information). Based on this query, rare features have been documented within the search area but have not been detailed in order to prevent the inadvertent release of the location specific listed or rare species contained in the NHIS.

However, given the nature and location of the proposed project, the project is not anticipated to adversely affect any known occurrences of rare features.

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.

Vegetation

According to GIS information obtained from the MnDNR Data Deli, several areas of Minnesota Biological Survey (MBS) Sites of High Biodiversity exist southwest of the Long Lake watercourse crossing north of and adjacent to the TH 23 corridor.

In addition, there is potential for native orchids to be located near Long Lake. However, there are currently no known sightings of rare orchids in the project area. The showy lady's slipper has been sighted near the Long Lake area. It is not a listed rare, threatened or endangered species, but it is considered a state asset and care should be taken to avoid or move them from the project area where possible. Native plant communities, including prairie and sedge meadow, may exist within MnDOT ROW.

A regional survey by MnDNR is scheduled to occur in the summer of 2016. This survey will help develop a more refined vegetation inventory and appropriate mitigation strategies will be developed as part of the ongoing project development process.

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 Long 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 Long Lake. As noted in Section I.A.13.a., A non-native subspecies of phragmites (common reed) is known to exist within the project area. Measures will be taken to appropriately address this plant during construction.

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 and sheds. The pup season, is from June 1 to July 31. They spend winter hibernating in caves and mines. Per the US Fish and Wildlife Service/ MNDNR there are no documented roost trees or hibernacula in the project area.

Given the location of the proposed project, the project is not anticipated to adversely affect any known occurrences of rare features.

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. Work Exclusion Dates established by MNDNR within the General Public Waters Work Permit (GP 2004-0001) will be followed. These exclusion dates will be through June 15 (dates subject to revision per MNDNR) and allow for undisturbed fish migration and spawning. Further, the MPCA NPDES General Storm Water Permit for Construction Activity (MNR10001) recognizes the aforementioned 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. Rolled erosion control products, such as erosion control blankets, should be limited to 'bio-netting', 'natural-netting' (category 3N or 4N) or woven type product, and specifically not allow welded plastic mesh netting in construction areas near Long Lake. Plastic mesh netting can result in the entanglement and death of a variety of small animals. The most vulnerable group of animals are the reptiles and amphibians.

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. 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 April 14, 2014 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.

Protocol will be developed as necessary if notable wildflowers are impacted, including the showy lady's slipper, within the right of way to transfer the plant(s) to other publicly owned property. Any transplanting would follow the protocol as prescribed by MnDOT's Roadside Vegetative Management Unit. Transplanting orchids will require written permission from the landowner or land agent. If the road project allows, MnDOT prefers to mark the plants ahead of time, then dig them in the fall after they've faded and are dormant.

Threatened and Endangered Species- Mitigation

As previously noted, the project is not anticipated to adversely affect any known occurrences of rare features (see Appendix D for additional information). No documented Northern Long Eared Bat roost trees or hibernacula in the project area as of June 6, 2015. The US Fish and Wildlife Service/MnDNR publication, *Townships Containing Northern Long-Eared Bat Roost Trees and/or Hibernacula (June, 2015)* is updated twice annually, on April 1 and October 1. Winter tree clearing from November 1 to March 31 will reduce any potential impact on the species. As the project progresses the document should be revisited to evaluate any changes in the hibernacula/root tree designations in Kandiyohi County. An incidental take that is not exempted by the 4(d) rule may result, and an incidental take permit may be necessary.

If a known roost tree or hibernacula is documented on or near the project area the incidental take of bats can be exempted by the 4(d) rule if the following conservation measures are followed:

- No activity is conducted within ¼ mile of a known, occupied hibernaculum;
- No known or occupied roost tree is cut between June 1 to July 31 (the pup season);
- No clearcut activity within ¼ mile of known, occupied roost trees from June1 to July 31.

If the above conservation measures are not feasible an incidental take permit may be necessary from the US Fish and Wildlife Service.

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 findings of the surveys identified no properties currently listed on the NRHP, and zero sites of archeological significant sites were identified. A phase II Architectural investigation was conducted on thirteen properties that merited further research to determine their potential eligibility for the NRHP. Six properties were found to be eligible. This could trigger a Section 106 Review if Federal Funds are received. Through correspondence with MnDOT Cultural Resource Unit and the Army Corps of Engineers, measures were taken to avoid an adverse effect on these properties in the event that federal funds are received.

See Appendix F for communication from MnDOT Cultural Resources Unit.

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.

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.

This project will not have stationary source air emissions concerns.

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 and the congestion levels in a given area. The air quality impacts from the project are analyzed by addressing criteria pollutants, a group of common air pollutants regulated by the U.S. 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 the Minnesota Department of Transportation (MnDOT) and Minnesota Pollution Control Agency (MPCA).

Ozone

Ground-level ozone is a primary constituent of smog and is a pollution problem throughout 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 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. MPCA states in *Air Quality in Minnesota: 2015 Report to the Legislature* that:

> *In 2008, EPA tightened the federal eight-hour ambient air standard for ozone to 75 parts per billion (ppb). EPA has proposed a revised ozone standard in November 2014 to strengthen the 8-hour standard from 75 ppb to a value between 70 ppb and 65 ppb. The EPA believes the scientific evidence on the health impacts of ozone shows that the current ambient standard is insufficient to protect public health. Based on 2013 ozone monitoring results, all areas of Minnesota will meet the revised ozone standard if it is set at 70 ppb. If the ozone standard is set at 66 ppb or lower, the Twin Cities metropolitan area will not meet the standard. EPA plans to use monitoring data from 2014-2016 to determine compliance. Depending on the final number selected, Minnesota may violate the ozone standard for the first time. The MPCA will closely monitor ozone levels over the summer of 2015 and 2016 to assess the likelihood of violating the revised ozone standard.*

The project is located in an area that has been designated as an unclassifiable/attainment area for ozone. This means that the project area has been identified as a geographic area that meets the national health-based standards for ozone levels, and therefore is exempt from performing further ozone analyses.

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[10]:

- Increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing;
- Decreased lung function;
- Aggravated asthma;
- Development of chronic bronchitis;
- Irregular heartbeat;
- 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:

[10] Source: https://www3.epa.gov/pm/health.html

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 ($\mu g/m^3$). The existing annual standard, 15.0$\mu g/m^3$, was set in 1997. The EPA is revising the annual $PM_{2.5}$ standard to 12.0$\mu g/m^3$ 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 35$\mu g/m^3$ (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 $\mu g/m^3$ 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 NO_x, 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 NO_x are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels.

Nitrogen dioxide (NO_2), which is a form of nitrogen oxide (NO_x), is regularly monitored. Minnesota currently meets federal nitrogen dioxide standards, according to the *2016 Annual Air Monitoring Network Plan* (October 2015). A monitoring site meets the annual NAAQS for NO_2 if the annual average is less than or equal to 53 parts per billion (ppb). The 2014 Minnesota NO_2 monitoring site averages ranged from 5 ppb to 16 ppb; therefore, Minnesota currently meets the annual NAAQS for NO_2." Exhibit 1 shows the 2014 averages at Minnesota sites and compares them to the standard. Exhibit 2 shows the 2012-2014 average of the annual 98th percentile daily maximum 1-hour concentrations at Minnesota monitoring site, and compares them to the 1-hour standard.

Exhibit 1: Annual Average NO_2 Concentrations Compared to the NAAQs

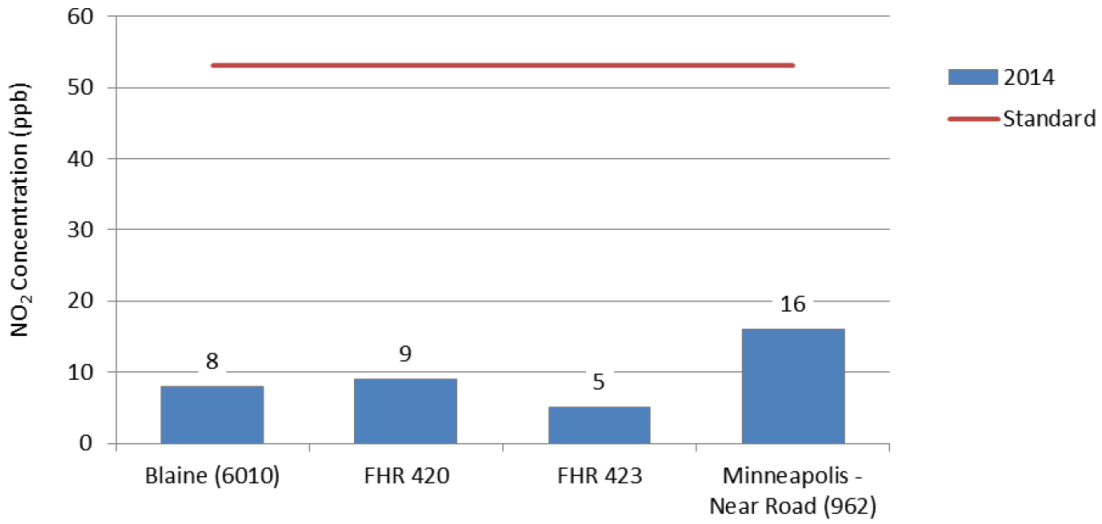
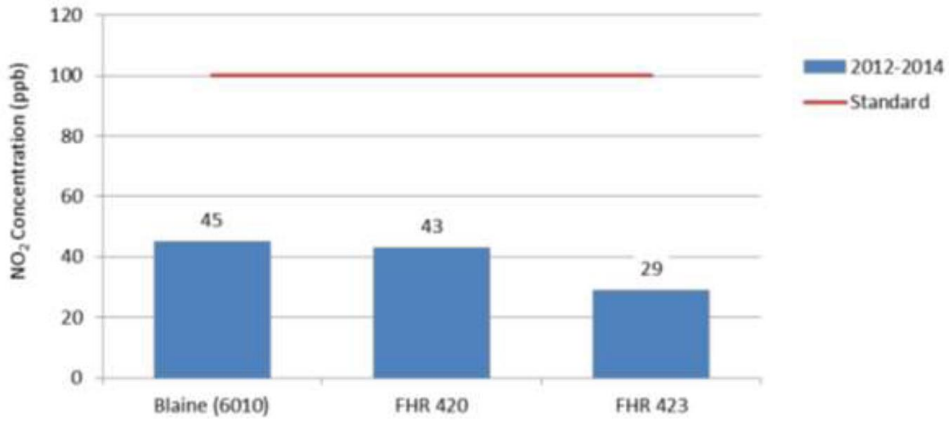


Exhibit 2: 1 Hour NO_2 Concentrations Compared to the NAAQs



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 NO_2 standards will be approached or exceeded based on the relatively low ambient concentrations of NO_2 in Minnesota and on the long-term trend toward reduction of NO_x emissions. Because of these factors, a specific analysis of NO_2 was not conducted for this project.

Sulfur Dioxide

Sulfur dioxide (SO_2) and other sulfur oxide gases (SO_x) are formed when fuel containing sulfur, such as coal, oil, and diesel fuel 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 aggravate heart disease. People with asthma are most at risk when SO_2 levels increase. Once emitted into the atmosphere, SO_2 can be further oxidized to 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.

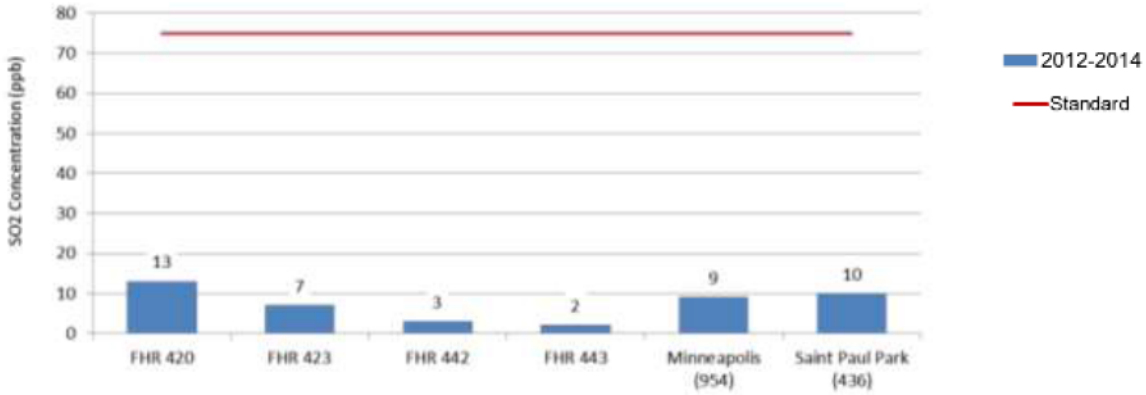
MPCA monitoring shows ambient SO_2 concentrations ranging from 2 ppb to 13 ppb for the 2012 to 2014 average 99th percentile daily maximum 1-hour SO_2 concentrations ; these findings are consistently below state and federal standard of 75 ppb (Source: *Annual Air Monitoring Network Plan for Minnesota, 2016*) The MPCA has concluded that long-term trends in both ambient air concentrations and total SO_2 emissions in Minnesota indicate steady improvement.

In the "*Annual Air Monitoring Network Plan for Minnesota, 2016*", it states the following with regard to SO_2:

> *On June 2, 2010, the EPA finalized revisions to the primary SO_2 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 SO_2 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. Exhibit 1 below describes the 2009-2011 average 99th percentile 1-hour SO_2 concentration and compares them to the 1-hour standard. Minnesota averages ranged from 2 ppb at FHR 442 to 13 ppb at FHR 420; therefore, all Minnesota sites currently meet the 1-hour NAAQS for SO_2.*

Because of these factors, an analysis for sulfur dioxide was not conducted for this project. Exhibit 3 describes the 2012-2014 average 99th percentile 1-hour sulfur dioxide concentration and compares them to the 1-hour standard.

Exhibit 3: One-Hour SO2 Concentrations Compared to the NAAQs



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. 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).

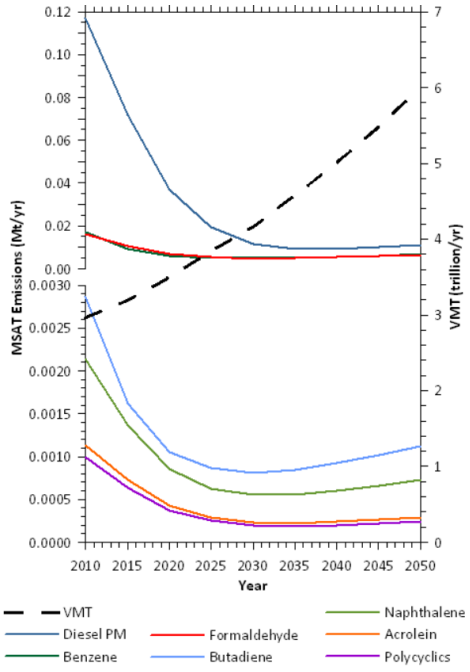
In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA). These are acrolein, benzene, 1,3-butidiene, diesel particulate matter plus diesel exhaust 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.

Motor Vehicle Emissions Simulator (MOVES)

According to EPA, MOVES improves upon the previous MOBILE model in several key aspects: MOVES is based on a vast amount of in-use vehicle data collected and analyzed since the latest release of MOBILE, including millions of emissions measurements from light-duty vehicles. Analysis of this data enhanced EPA's understanding of how mobile sources contribute to emissions inventories and the relative effectiveness of various control strategies. In addition, MOVES accounts for the significant effects that vehicle speed and temperature have on PM emissions estimates, whereas MOBILE did not. MOVES2010b includes all air toxic pollutants in NATA that are emitted by mobile sources. EPA has incorporated more recent data into MOVES2010b to update and enhance the quality of MSAT emission estimates. These data reflect advanced emission control technology and modern fuels, plus additional data for older technology vehicles.

Based on an FHWA analysis using EPA's MOVES2010b model, as shown in Exhibit 2 below, even if vehicle-miles travelled (VMT) increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same time period (Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA (December 2012)).

Exhibit 4: National MSAT Emissions Trends 1999-2050 for Vehicles Operating on Roadways Using EPA's MOVES2010b Model



The implications of MOVES on MSAT emissions estimates compared to MOBILE are: lower estimates of total MSAT emissions; significantly lower benzene emissions; significantly higher diesel PM emissions, especially for lower speeds. Consequently, diesel PM is projected to be the dominant component of the emissions total.

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.” 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). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance Update 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[11] or in the future as vehicle emissions substantially 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[12]. 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. The EPA[13] and the HEI have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

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.

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

[11] Source: http://pubs.healtheffects.org/view.php?id=282
[12] Source: http://pubs.healtheffects.org/view.php?id=282
[13] Source: http://www.epa.gov/risk/basicinformation.htm#g

traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

MSAT Analysis

Within the project limits, TH 23 has an approximate growth rate of 2.1% to 2.3% per year. The TH 23 project forecast AADT demands are approximately 9,400 and 10,200 vehicles per day, which is well below the capacity of the proposed four-lane roadway. See table 11 (Section 18. B.) for the forecasted AADT demands for the project corridor. As such, a qualitative MSAT analysis is sufficient per the Interim Guidance Update on Mobile Source Air Toxic Analysis in NEAP –Appendix B.

For the Preferred Alternative, the amount of MSAT emitted would be proportional to the average daily traffic, or ADT, assuming that other variables such as fleet mix are the same. The ADT estimated for the Preferred Alternative does not differ from that for the No Build Alternative, because the proposed project is intended to improve traffic flow on TH 23 during peak period traffic operation, and not influence regional travel patterns. Since no change in ADT is expected through the project corridor, or along parallel routes, no changes in MSAT emissions are expected compared to the No Build Alternative.

There is a potential for lower MSAT emission rates due to increased speeds and reduction in congestion/delays according to EPA's MOVES2010b model, emissions of all of the priority MSAT decrease as speed increases. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 80 percent between 2010 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA- projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

The roadway expansion will have the effect of moving some traffic closer to nearby residential development; therefore, under each alternative there may be localized areas where ambient concentrations of MSAT could be higher under the Preferred Alternative than the No Build Alternative. However, the magnitude and the duration of these potential increases compared to the No Build Alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. In sum, when a highway is expanded, the localized level of MSAT emissions for the Preferred Alternative could be higher relative to the No Build Alternative, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today. In summary, NAAQS for the criteria air pollutants are met, and this project will not adversely affect air quality with respect to MSATs.

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 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 construction 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.

Table 8 shows peak typical 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 8: 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, pile driving, 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 G 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 9 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 numbers are identified as the L_{10} and L_{50} levels. See Table 10 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 9: 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 10: Minnesota state 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 levels were modeled for existing (2014) conditions, the future (2035) No Build Alternative, and the future (2035) Build Alternative using the "MINNOISEV31" model, a version of the FHWA "STAMINA" model adapted by MnDOT. Traffic noise levels were modeled at a total of 251 representative receptor locations throughout the project area. The Existing and No Build models include only 250 receptors that exist today. The Build condition removes 11 receptors, through right-of-way acquisitions, and adds 1 additional trail receptor along the proposed trail underpass near212th Ave NE ; therefore the Build Condition has a total of 240 receptors.

The majority of the receptors, a total of 156, represent the Glacial Lakes State Trail, though there are both scattered and pockets of residential and commercial properties throughout 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 G.

Traffic Noise Analysis Results

Results of the noise modeling analysis are tabulated in Appendix G Table 5 (daytime) and Table 6 (nighttime). The following describes the results of the traffic noise analysis for existing (2014), future (2035) No Build condition, and future (2035) Build condition.

Existing (2014) daytime modeled noise levels at the modeled receptor locations range from 53.2 dBA (L10) to 71.5 dBA (L10); nighttime noise levels range from 51.8 dBA (L10) to 69.5 dBA (L10). Modeled noise receptors exceeded State daytime standards (L10) at 68 of 250 modeled receptor locations under existing (2014) conditions. Modeled noise receptors exceeded State nighttime standards (L10) at 75 of 250 modeled receptor locations under existing (2014) conditions. Modeled noise receptors exceeded FHWA criteria (L10) at 107 of 250 modeled receptor locations under existing (2014) conditions.

Existing (2014) daytime modeled noise levels at the modeled receptor locations range from 48.7 dBA (L50) to 63.0 dBA (L50); nighttime noise levels range from 46.1 dBA (L50) to 60.5 dBA (L50). Modeled noise receptors exceeded State daytime standards (L50) at 13 of 250 modeled receptor locations under existing (2014) conditions. Modeled noise receptors exceeded State nighttime standards (L50) at 72 of 250 modeled receptor locations under existing (2014) conditions.

Future (2035) No Build daytime modeled noise levels at the modeled receptor locations range from 54.7 dBA (L10) to 73.4 dBA (L10); nighttime noise levels range from 53.4 dBA (L10) to 71.6 dBA (L10). Modeled noise receptors exceeded State daytime standards (L10) at 139 of 250 modeled receptor locations under No Build (2035) conditions. Modeled noise receptors exceeded State nighttime standards (L10) at 169 of 250 modeled receptor locations under No Build (2035) conditions. Modeled noise receptors exceeded FHWA criteria (L10) at 125 of 250 modeled receptor locations under existing (2014) conditions.

Future (2035) No Build daytime modeled noise levels at the modeled receptor locations range from 49.9 dBA (L50) to 65.7 dBA (L50); nighttime noise levels range from 49.1 dBA (L50) to 63.3 dBA (L50). Modeled noise receptors exceeded State daytime standards (L50) at 61 of 250 modeled receptor locations under

No Build (2035) conditions. Modeled noise receptors exceeded State nighttime standards (L50) at 78 of 250 modeled receptor locations under No Build (2035) conditions.

Future (2035) Build daytime modeled noise levels at the modeled receptor locations range from 54.4 dBA (L10) to 71.7 dBA (L10); nighttime noise levels range from 53.2 dBA (L10) to 70.7 dBA (L10). Modeled noise receptors exceeded State daytime standards (L10) at 140 of 240 modeled receptor locations under Build (2035) conditions. Modeled noise receptors exceeded State nighttime standards (L10) at 160 of 240 modeled receptor locations under Build (2035) conditions. Modeled noise receptors exceeded FHWA criteria (L10) at 126 of 240 modeled receptor locations under existing (2014) conditions.

Future (2035) Build daytime modeled noise levels at the modeled receptor locations range from 49.4 dBA (L50) to 64.0 dBA (L50); nighttime noise levels range from 48.6 dBA (L50) to 62.3 dBA (L50). Modeled noise receptors exceeded State daytime standards (L50) at 18 of 240 modeled receptor locations under Build (2035) conditions. Modeled noise receptors exceeded State nighttime standards (L50) at 66 of 240 modeled receptor locations under Build (2035) conditions.

Modeled noise level fluctuations (daytime and nighttime) range from -2.8 dBA to 7.8 dBA for existing receptor locations when comparing the Build (2035) to the existing (2014) conditions.

Noise Abatement Measures

Noise abatement measures were evaluated along the proposed project corridor adjacent to receptor locations, where modeled traffic noise levels are projected to exceed state standards.

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 (2014) conditions. In general, due to the predicted increase in average daily traffic the TH 23 South Gap corridor will result in increases in traffic noise levels compared to the existing conditions under the no build conditions.

Modeled build (2035) condition noise levels (daytime and nighttime) vary from -2.8 dBA to 7.8 dBA from existing (2014) conditions.

Acoustic reasonableness and cost effectiveness were calculated for each noise barrier evaluated. The *Traffic Noise Analysis Report* found that 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 South Gap Project.

Based on public feedback and comments received at open houses, several changes were made to the layout after the noise analysis was complete. It is anticipated that these modifications would not change the findings of the *Traffic Noise Analysis Report*. If there are any significant changes to the final design of the TH 23 South Gap Project, the noise analysis may need to be re-evaluated.

18. Transportation

The *Highway 23 Gap – Crash History* and *Highway 23 Gap – Daily Traffic Forecasts* memos dated September 9, 2014 contains 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 11 below for existing (2012) and future traffic volumes throughout the TH 23 project corridor.

Table 11: Existing (2012) and Forecasted (2020, 2040) AADTs

Description	2012 AADT	2020 AADT	2040 AADT
TH 23 west of TH 9 (south of New London)	9,800	11,600	16,000
TH 23 between TH 9 and CR 2 (east of New London)*	6,200	7,300	10,200
TH 23 between CR 2 and CR 20 (west of Paynesville)*	5,900	6,900	9,400
TH 23 east of CR 20 (east of Paynesville	9,200	10,800	14,900

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

Within the project limits, TH 23 has an approximate growth rate of 2.1% to 2.3% per year. The 23 project forecast AADT demands are approximately 9,400 and 10,200 vehicles per day, which is well below the capacity of the proposed four-lane roadway. Growth on the county road system ranges from 0.5% to 2.8% per year. The highest forecast demand on the county roads connecting to TH 23 is approximately 1,070 vehicles per day, at CR 31. Therefore, all of the connecting roadways are well below the capacity of a typical two-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 1, 2004 through December 31, 2013.

During this 10-year period, a total of 39 intersection crashes occurred. See Table 12 below. Six intersections had 3 or more crashes and two intersections had more than three crashes. A total of 41% of the intersection crashes were run-off-road crashes. Thirty-one percent of intersection crashes were rear-end crashes. The TH 23 and CSAH 2/160th Street NE intersection is the only intersection with a crash and severity rate high than MnDOT District 8 average rates. No intersection is at or above critical crash or severity rates, and no key metrics identify sustained crash problems at unsafe intersections.

Table 12: Intersection Crash History (2004-2013)

TH 23 Intersection	Fatal	A	B	C	N	Total	Crash Rate	Severity Rate	Critical Crash Rate	Critical Severity Rate
CSAH 31 (199th St. NE)	0	0	2	0	0	2	0.08	0.25	0.92	1.22
115th St. NE (south side)	0	0	1	2	0	3	0.13	0.31	0.93	1.24
115th St. NE (north side)	0	0	1	0	2	3	0.13	0.22	0.93	1.24
212th Ave.	0	0	1	0	0	1	0.04	0.13	0.93	1.24
CR 135 (130th St. NE)	0	0	1	0	0	1	0.04	0.13	0.93	1.24
CR 106 (225th Ave./141st St.)	0	0	1	1	1	3	0.13	0.26	0.92	1.23
CSAH 2 (145th St. NE)	0	1	0	1	5	7	0.30	0.47	0.92	1.22
232nd Ave.	0	0	0	0	1	1	0.05	0.05	0.94	1.25
CSAH 2 (160th St. NE)	0	0	2	3	6	11	0.49	0.80	0.93	1.24
240th Ave. NE	0	0	1	1	1	3	0.14	0.28	0.94	1.25
175th St. NE	0	0	1	1	0	2	0.09	0.23	0.94	1.25
CSAH 6/CR 143 (190th St. NE)	0	0	0	0	2	2	0.09	0.09	0.93	1.24

Notes: **Bold** and italicized = Exceeds MnDOT District 8 average rates

The 10-year analysis identified 51 segment crashes within the project area. See Table 13 below. A total of 37% of the segment crashes were run-off-road crashes. 25% of segment crashes were rear-end crashes. All four project area segments have crash severity rates above the MnDOT District 8 average and two segments exceed the average crash rate for MnDOT District 8. Most importantly, the two most western project segments encompassing the existing four-lane to two-lane transition to CSAH 2/145th Street NE exceed the critical crash severity rates, suggesting the existence of a sustained crash area.

Table 13: Segment Crash History (2004-2013)

From	To	Fatal	A	B	C	N	Total	Crash Rate	Severity Rate	Critical Crash Rate	Critical Severity Rate
4 to 2 lane conversion	115th St. NE (north side)	0	0	4	8	3	15	***0.40***	***0.83***	0.54	***0.68***
115th St. NE (north side)	CSAH 2 (145th St.)	0	0	5	6	5	16	***0.32***	***0.64***	0.51	***0.64***
CSAH 2 (145th St.)	CSAH 2 (160th St.)	0	0	2	1	3	6	0.25	***0.46***	0.61	0.76
CSAH 2 (160th St.)	2 to 4 lane conversion	0	1	2	4	7	14	0.28	***0.50***	0.51	0.64

Notes: **Bold** and italicized = Exceeds MnDOT District 8 average rates

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 2016-2019 STIP, existing city and county comprehensive plans, direct communications with Kandiyohi County Public Works, and capital improvement plans.

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

TH 23 North 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 Paynesville and Richmond from two-lanes to four-lanes. Once the environmental review and layout are complete, right-of-way acquisition and detail design could begin if funds become available. Currently, there is no funding available for the construction at this time. The environmental review and layout development for the Paynesville to Richmond segment began in the summer of 2015.

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 Office of Aeronautics Review

Coordination of construction projects within an Airport Influence Area is essential to prevent height hazards in the path of approaching and departing aircraft. MnDOT guidance suggests that projects located within five miles of a public airport contact the MnDOT Office of Aeronautics. The MnDOT Office of Aeronautics was contacted and project materials were provided to staff for review and comment. It was determined that the proposed project will have no substantial effect to the operations at the Paynesville Municipal Airport.

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.)

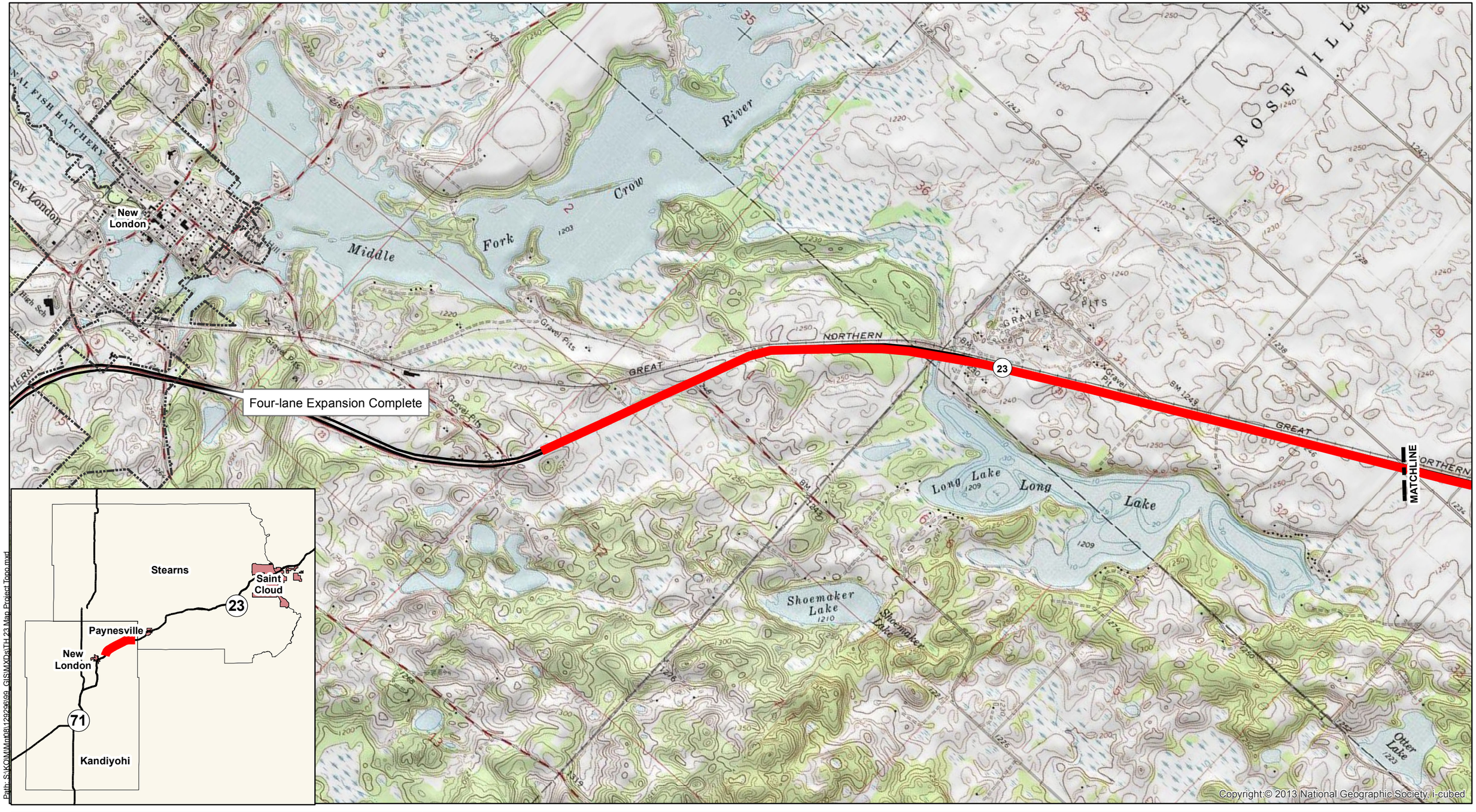
I hereby certify that:

- 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.

Signature: _____ Date: 4/20/2016

Title: Lynn P. Clarkowski, P.E.
Chief Environmental Officer
Director, Office of Environmental Stewardship
Minnesota Department of Transportation

Appendix A- Project Figures



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

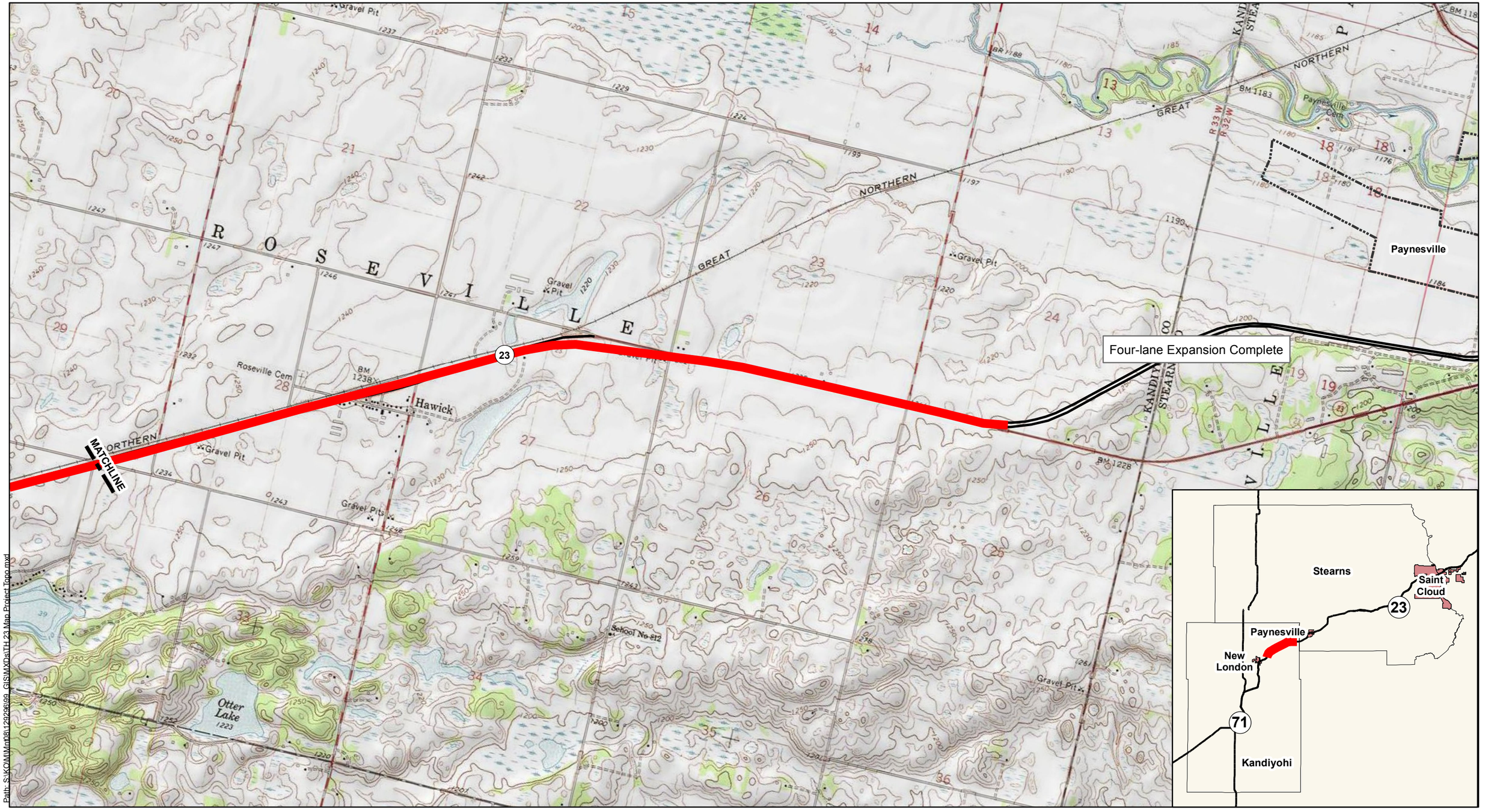
Project: MNT08 129296
Print Date: 10/15/2015

N

0 0.2 0.4 0.8 Miles

Figure 1. Location of Transportation Recommendations

TH 23
New London to Paynesville, MN



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N

0 0.2 0.4 0.8 Miles

Figure 1. Location of Transportation Recommendations

TH 23
New London to Paynesville, MN

LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

GLACIAL LAKES STATE TRAIL

scale 50 100 0 100 200 feet

STOCK PILE

RETENTION POND

RIP RAP

DESIGN SPECIAL STRUCTURE

ELECTRIC FENCE

CLOSE

2160 2165 2170 2175 2180 2185

INFILTRATION BASIN #1

WETLAND IMPACT #1
TYPE 3
1.47 ACRES

MATCHLINE - 2187+00

SEH PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	S.P. 3408-18	T.H. 23 SOUTH GAP NEW LONDON TO PAYNESVILLE ENVIRONMENTAL ASSESSMENT WORKSHEET	SHEET No. 1
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LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

100 0 100 200
scale 50 feet

GLACIAL LAKES STATE TRAIL

STOCK PILE

STOCKPILE

ELECTRIC FENCE

CONC.

GRAV.

CLOSE

INFILTRATION BASIN #3

INFILTRATION BASIN #2

LP TANK

PERM. ESMT

MATCHLINE - 2187+00

WETLAND IMPACT #2
TYPE 3
.12 ACRES

CO RD 31 - 199TH AVE NE

MATCHLINE - 2217+50

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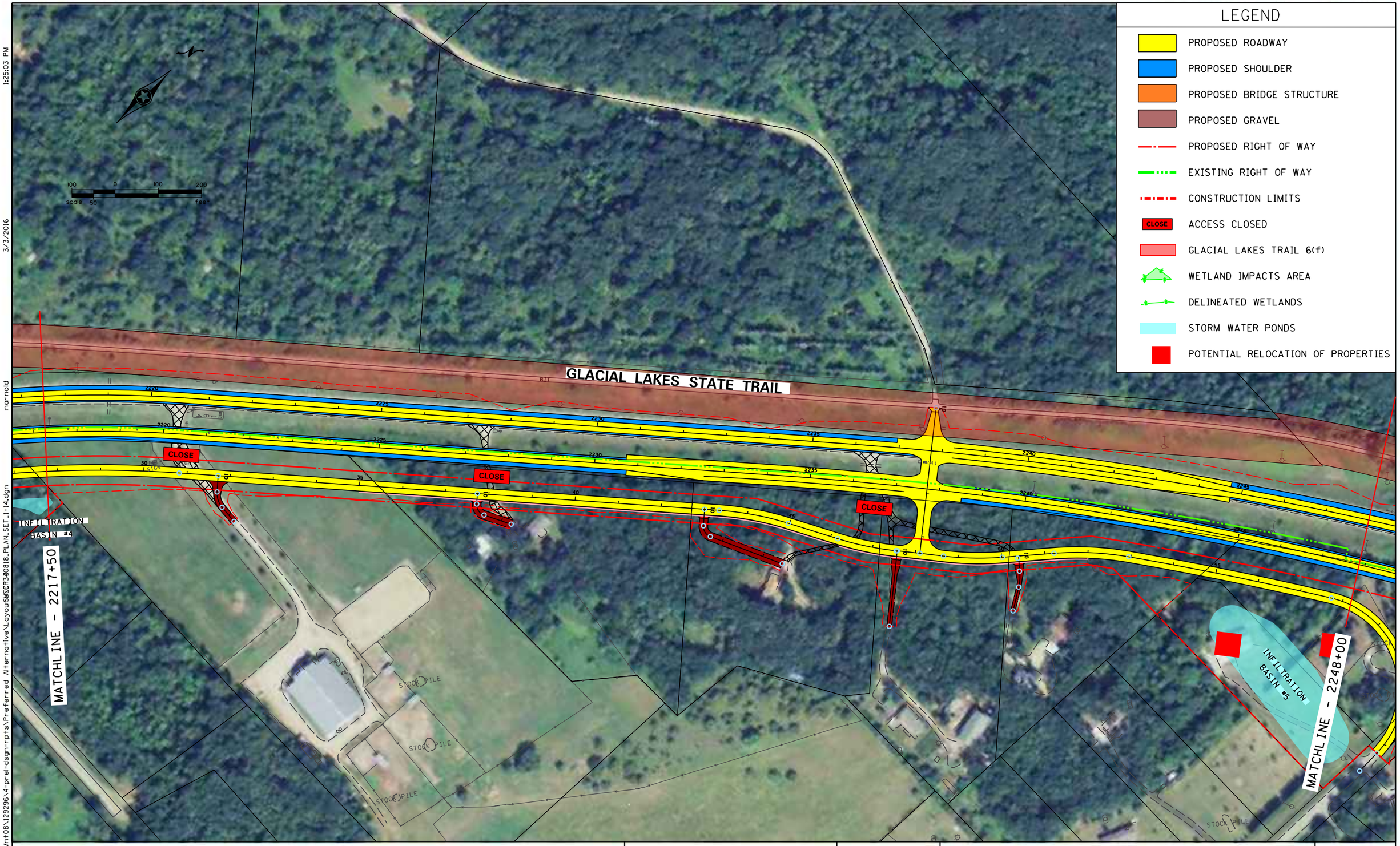

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WETLAND IMPACT #5
TYPE 3
.01 ACRES

115TH ST NE

DUININCK CONCRETE LLC

GLACIAL LAKES STATE TRAIL

CLOSE

OBLITERATE

212TH AVE NE

INFILTRATION BASIN #6

MATCHLINE - 2248+00

MATCHLINE - 2278+00

WETLAND IMPACT #4
TYPE 4
.31 ACRES

WETLAND IMPACT #3
TYPE 3
.31 ACRES

100 0 100 200
scale 50 feet

LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

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SHEET No. 4

LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

AREA UNDER CONSTRUCTION

100 0 100 200
scale 50 feet

GLACIAL LAKES STATE TRAIL

CLOSE CLOSE CLOSE CLOSE

INFILTRATION BASIN #7

MATCHLINE - 2278+00

MATCHLINE - 2308+00

212TH AVE NE

STOCKPILE STOCKPILE

	SEH PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	S.P. 3408-18 DATE: 3/3/2016	T.H. 23 SOUTH GAP NEW LONDON TO PAYNESVILLE ENVIRONMENTAL ASSESSMENT WORKSHEET	SHEET No. 5

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LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

CO RD 135 - 130TH ST NE

OBLITERATE

GREAT RIVER ENERGY

STOCK PILE

BIT

BILLBOARD SIGN

GLACIAL LAKES STATE TRAIL

CLOSE

CLOSE

CLOSE

BASIN #8

132ND ST NE

PROPOSED POND LOCATION

MATCHLINE - 2308+00

MATCHLINE - 2338+00

N

100 0 100 200
scale 50 feet

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LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

100 0 100 200
scale 50 feet

225TH AVE NE

GLACIAL LAKES STATE TRAIL

BILLBOARD SIGN

BILLBOARD SIGN

BILLBOARD SIGN

BIT

CLOSE

2340 2345 2350 2355 2360 2365

CLOSE

CLOSE

PERM. ESMT

CO RD 106 / 225TH AVE NE

141ST ST NE

MATCHLINE - 2338+00

MATCHLINE - 2368+00

SEH PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	S.P. 3408-18	T.H. 23 SOUTH GAP NEW LONDON TO PAYNESVILLE ENVIRONMENTAL ASSESSMENT WORKSHEET	SHEET No. 7
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LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

CO RD 2 - 145TH AVE NE

OBLITERATE

GLACIAL LAKES STATE TRAIL

BILLBOARD SIGN

CLOSE

INFILTRATION BASIN #9

OBLITERATE

CO RD 106 / 225TH AVE NE

MATCHLINE - 2368+00

MATCHLINE - 2398+00

N

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scale 50 feet

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LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

N

100 0 100 200
scale 50 feet

CEMETARY

232ND AVE NE

GLACIAL LAKES STATE TRAIL

CLOSE

MATCHLINE - 2398+00

MATCHLINE - 2428+00

CITY OF HAWICK

SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

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narnold

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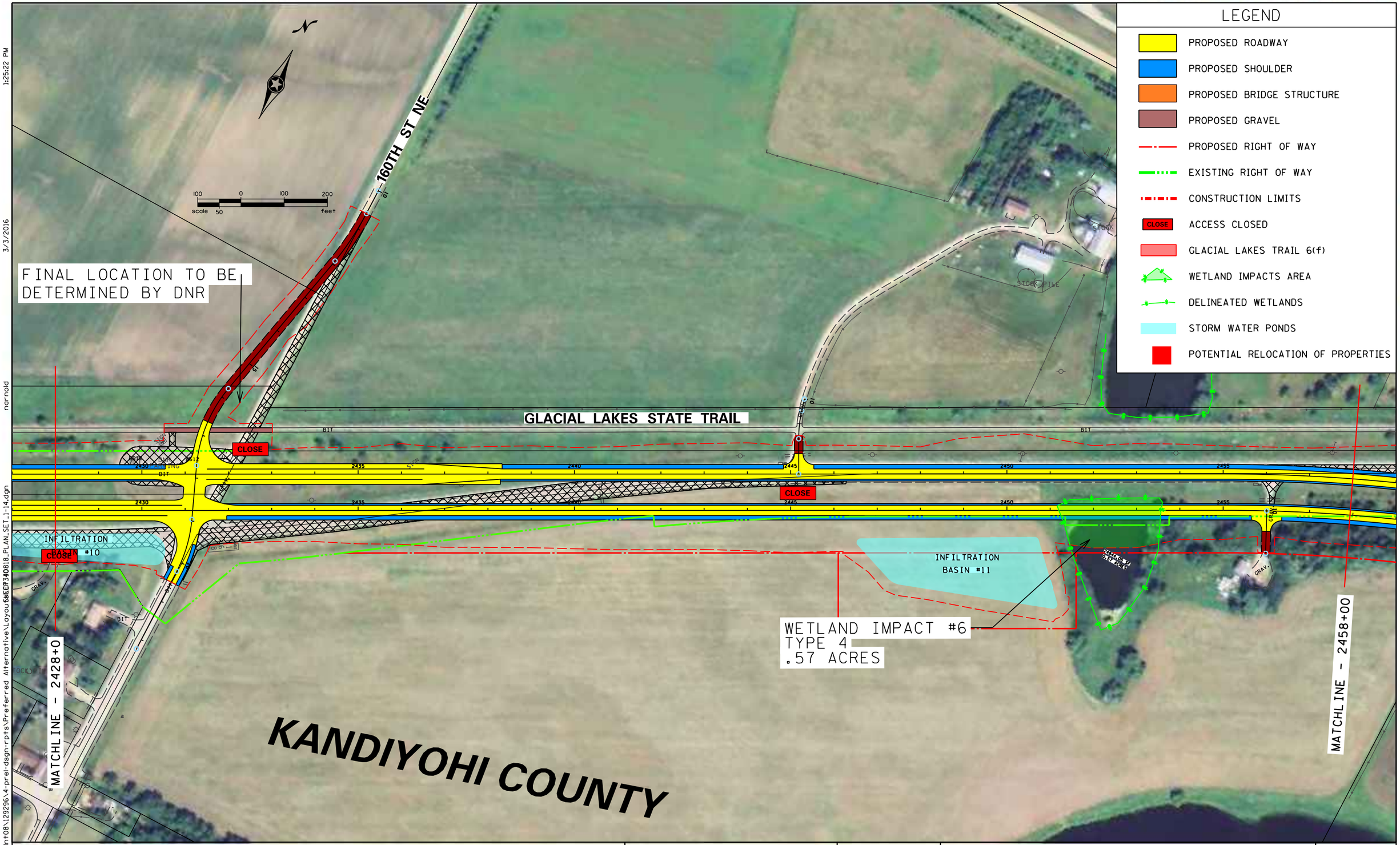


SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

S.P. 3408-18

DATE: 3/3/2016

T.H. 23 SOUTH GAP
NEW LONDON TO PAYNESVILLE
ENVIRONMENTAL ASSESSMENT WORKSHEET

SHEET No. 10

LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

GLACIAL LAKES STATE TRAIL

240TH AVE NE

INFILTRATION BASIN #12

CLOSE

WETLAND IMPACT #7
TYPE 3
1.05 ACRES

MATCHLINE - 2458+00

MATCHLINE - 2488+00

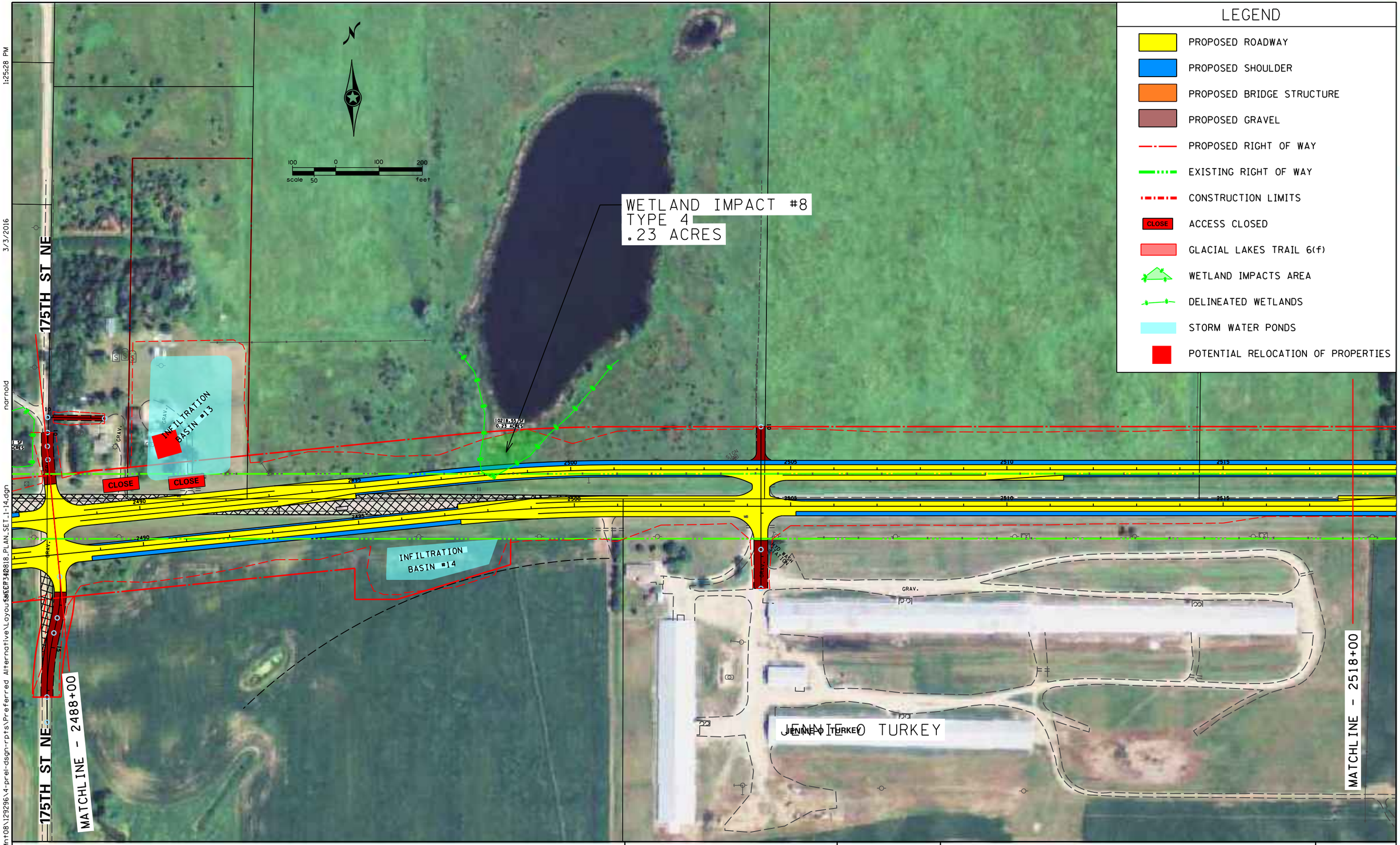
175TH ST NE

N

100 0 100 200
scale 50 feet

1:25:25 PM
3/3/2016
arnold
S:\K0\MN\Mn108\129296\4-prel-dsgn-rpts\Preferred Alternative\Layout\SHEET34D818_PLAN_SET_1-14.dgn

SEH PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	S.P. 3408-18 DATE: 3/3/2016	T.H. 23 SOUTH GAP NEW LONDON TO PAYNESVILLE ENVIRONMENTAL ASSESSMENT WORKSHEET	SHEET No. 11



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3/3/2016
arnold
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SEH
PHONE: (651)490-2000
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

S.P. 3408-18

DATE: 3/3/2016

T.H. 23 SOUTH GAP
NEW LONDON TO PAYNESVILLE
ENVIRONMENTAL ASSESSMENT WORKSHEET

SHEET No. 12

LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

N

100 0 100 200
scale 50 feet

CO RD 6 /190TH ST NE

CO RD 143 /190TH ST NE

INFILTRATION BASIN #16

INFILTRATION BASIN #15

CLOSE

MATCHLINE - 2518+00

MATCHLINE - 2548+00

1:25:31 PM
3/3/2016
narnold
S:\KO\MN\Mnt08\129296\4-prel-dsgn-rpts\Preferred Alternative\Layout\SEP3408-18_PLAN_SET_1-14.dgn

SEH PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	S.P. 3408-18	T.H. 23 SOUTH GAP NEW LONDON TO PAYNESVILLE ENVIRONMENTAL ASSESSMENT WORKSHEET	SHEET No. 13
	DATE: 3/3/2016		

LEGEND

- PROPOSED ROADWAY
- PROPOSED SHOULDER
- PROPOSED BRIDGE STRUCTURE
- PROPOSED GRAVEL
- PROPOSED RIGHT OF WAY
- EXISTING RIGHT OF WAY
- CONSTRUCTION LIMITS
- CLOSE — ACCESS CLOSED
- GLACIAL LAKES TRAIL 6(f)
- WETLAND IMPACTS AREA
- DELINEATED WETLANDS
- STORM WATER PONDS
- POTENTIAL RELOCATION OF PROPERTIES

WETLAND IMPACT #9
TYPE 2
.34 ACRES

14792.69 SF
0.34 ACRES

2550
2555
2560
2565

MATCHLINE - 2548+00

N

100 0 100 200
scale 50 feet

1:25:34 PM
3/3/2016
narnold
S:\K0\MN\08\129296\4-prel-dsgn-rpts\Preferred Alternative\Layout\SHEET 340818_PLAN_SET_1-14.dgn

SEH PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	S.P. 3408-18	T.H. 23 SOUTH GAP NEW LONDON TO PAYNESVILLE ENVIRONMENTAL ASSESSMENT WORKSHEET	SHEET No. 14
	DATE: 3/3/2016		

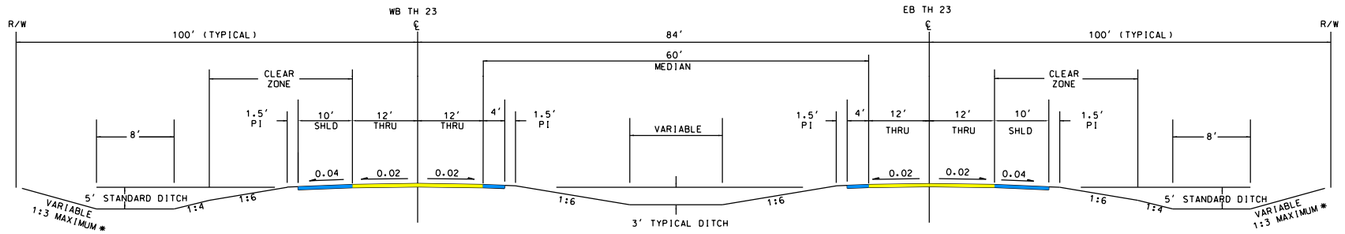
Appendix B- Typical Sections

11:20:10 AM

3/2/2016

TYPICAL SECTION A-A

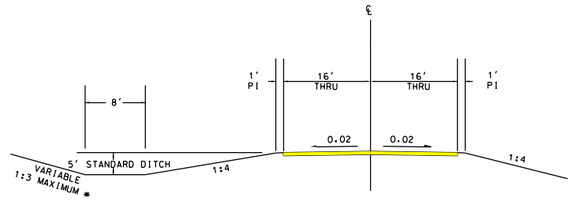
PROPOSED T.H. 23



* IN 1:3 BACKSLOPE AREAS A 10' DITCH WIDTH (MINIMUM) IS REQUIRED

TYPICAL SECTION B-B

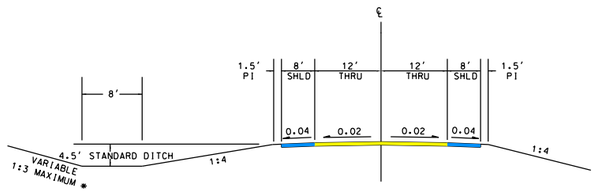
COMMERCIAL DRIVEWAYS



* IN 1:3 BACKSLOPE AREAS A 10' DITCH WIDTH (MINIMUM) IS REQUIRED

TYPICAL SECTION C-C

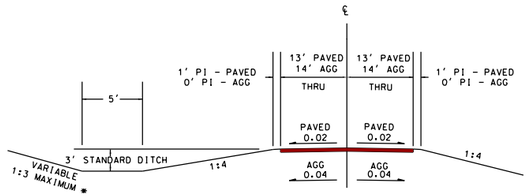
COUNTY ROADS (120' R/W)



* IN 1:3 BACKSLOPE AREAS A 10' DITCH WIDTH (MINIMUM) IS REQUIRED

TYPICAL SECTION D-D

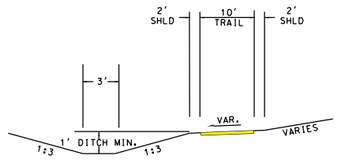
TOWNSHIP ROAD (66' R/W)



* IN 1:3 BACKSLOPE AREAS A 10' DITCH WIDTH (MINIMUM) IS REQUIRED

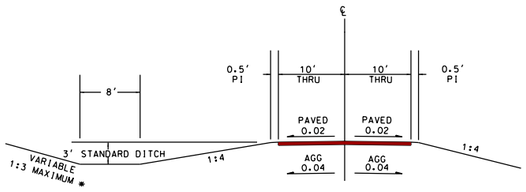
TYPICAL SECTION E-E

RECREATIONAL TRAIL
(100' R/W TYPICAL)



TYPICAL SECTION F-F

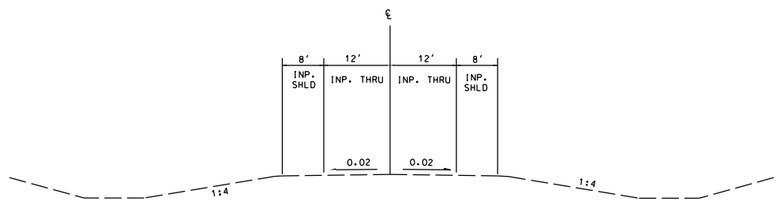
RESIDENTIAL/FARM ENTRANCE



* IN 1:3 BACKSLOPE AREAS A 10' DITCH WIDTH (MINIMUM) IS REQUIRED

INPLACE TYPICAL SECTION

EXISTING T.H. 23

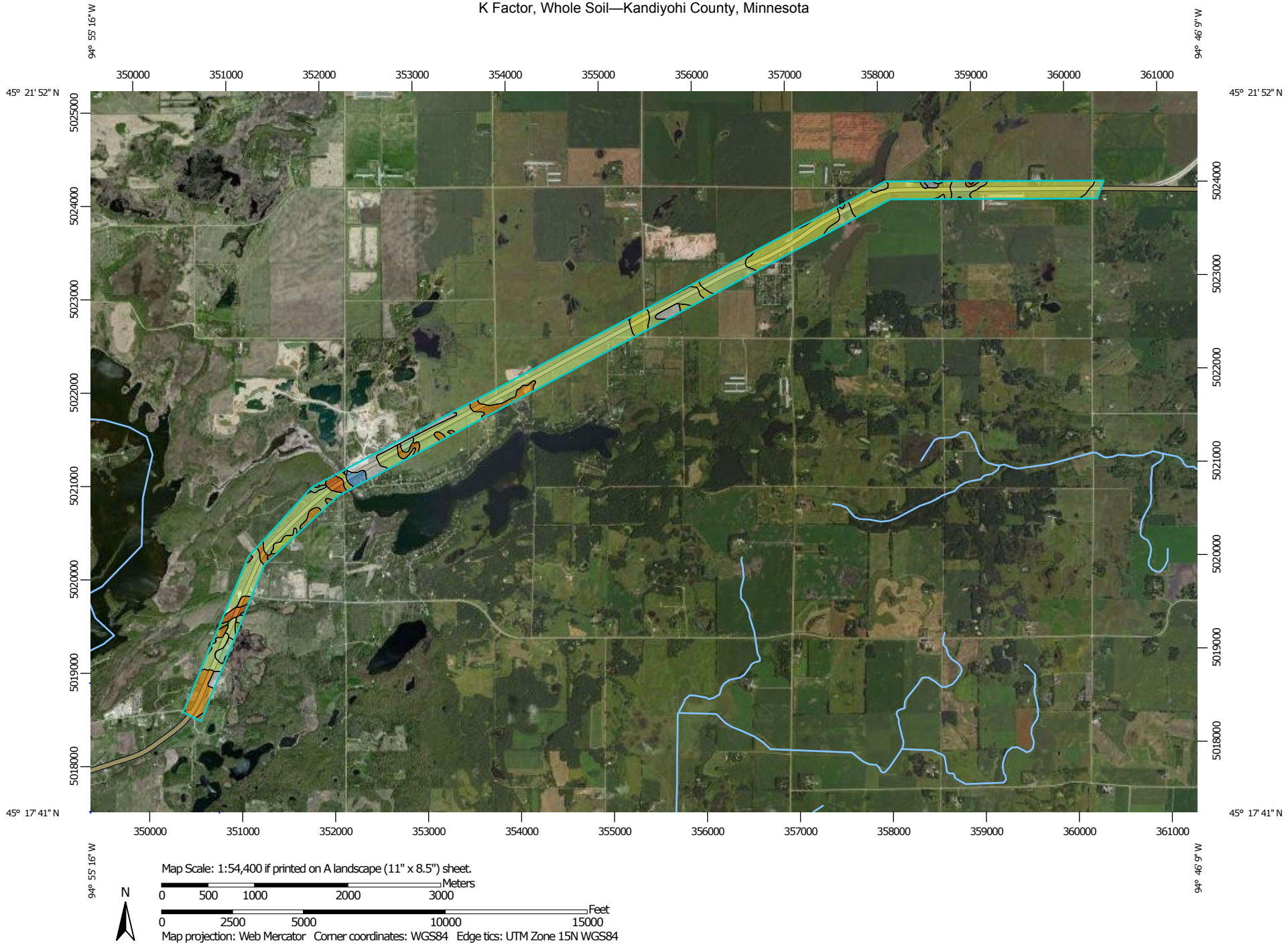


FILE NO. 129296	SEH	MINNESOTA DEPARTMENT OF TRANSPORTATION		TH 23 KANDIYOHI COUNTY, MINNESOTA		CONCEPT	FIGURE
DATE: 3/2/2016							

S:\KO\M\Mn108\129296\4-prel-dsgn-rpts\Preferred Alternative\Layouts\TYPICAL.dgn

Appendix C- Soil Classification Report

K Factor, Whole Soil—Kandiyohi County, Minnesota



Map Scale: 1:54,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2500 5000 10000 15000

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
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Soil Rating Lines
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- Not rated or not available

Soil Rating Points
- .02
- .05
- .10
- .15
- .17
- .20
- .24
- .28
- .32
- .37
- .43
- .49
- .55
- .64
- 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 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Kandiyohi County, Minnesota
Survey Area Data: Version 13, Sep 16, 2014

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.

K Factor, Whole Soil

K Factor, Whole Soil— Summary by Map Unit — Kandiyohi County, Minnesota (MN067)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
39	Wadena loam	.28	5.2	0.9%
392	Biscay loam	.28	6.3	1.0%
611D	Hawick gravelly loamy coarse sand, 12 to 20 percent slopes	.05	15.1	2.5%
611F	Hawick gravelly loamy coarse sand, 20 to 35 percent slopes	.05	0.0	0.0%
804B	Koronis-Hawick complex, 2 to 6 percent slopes	.24	4.4	0.7%
833C	Sunburg-Wadenill-Hawick complex, 6 to 12 percent slopes	.32	0.3	0.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	.24	288.6	47.5%
875C	Hawick-Estherville complex, 6 to 12 percent slopes	.10	63.2	10.4%
1016	Udorthents, loamy	.43	7.0	1.2%
1029	Pits, gravel		33.6	5.5%
1055	Aquolls and Histosols, ponded	.20	5.8	1.0%
D105A	Arvilla sandy loam, MLRA 91A, 0 to 2 percent slopes	.20	175.8	29.0%
W	Water		1.7	0.3%
Totals for Area of Interest			**607.2**	**100.0%**

Description

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Rating Options

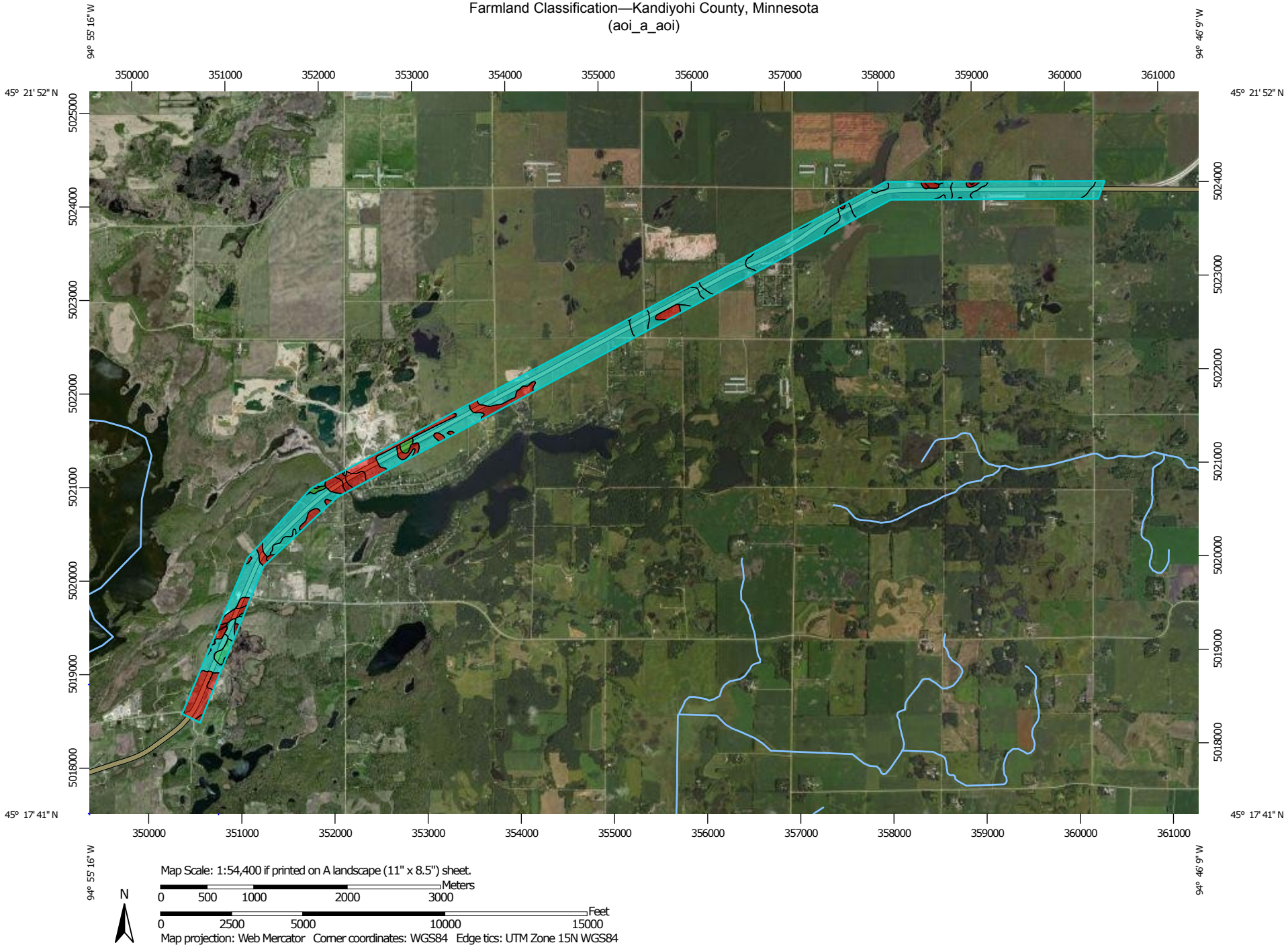
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Farmland Classification—Kandiyohi County, Minnesota
(aoi_a_aoi)



Map Scale: 1:54,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2500 5000 10000 15000

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

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

MAP INFORMATION

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Kandiyohi County, Minnesota
Survey Area Data: Version 13, Sep 16, 2014

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.

Farmland Classification

Farmland Classification— Summary by Map Unit — Kandiyohi County, Minnesota (MN067)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
39	Wadena loam	All areas are prime farmland	5.2	0.9%
392	Biscay loam	Prime farmland if drained	6.3	1.0%
611D	Hawick gravelly loamy coarse sand, 12 to 20 percent slopes	Not prime farmland	15.1	2.5%
611F	Hawick gravelly loamy coarse sand, 20 to 35 percent slopes	Not prime farmland	0.0	0.0%
804B	Koronis-Hawick complex, 2 to 6 percent slopes	Farmland of statewide importance	4.4	0.7%
833C	Sunburg-Wadenill-Hawick complex, 6 to 12 percent slopes	Farmland of statewide importance	0.3	0.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	Farmland of statewide importance	288.6	47.5%
875C	Hawick-Estherville complex, 6 to 12 percent slopes	Not prime farmland	63.2	10.4%
1016	Udorthents, loamy	Not prime farmland	7.0	1.2%
1029	Pits, gravel	Not prime farmland	33.6	5.5%
1055	Aquolls and Histosols, ponded	Not prime farmland	5.8	1.0%
D105A	Arvilla sandy loam, MLRA 91A, 0 to 2 percent slopes	Farmland of statewide importance	175.8	29.0%
W	Water	Not prime farmland	1.7	0.3%
Totals for Area of Interest			**607.2**	**100.0%**

Description

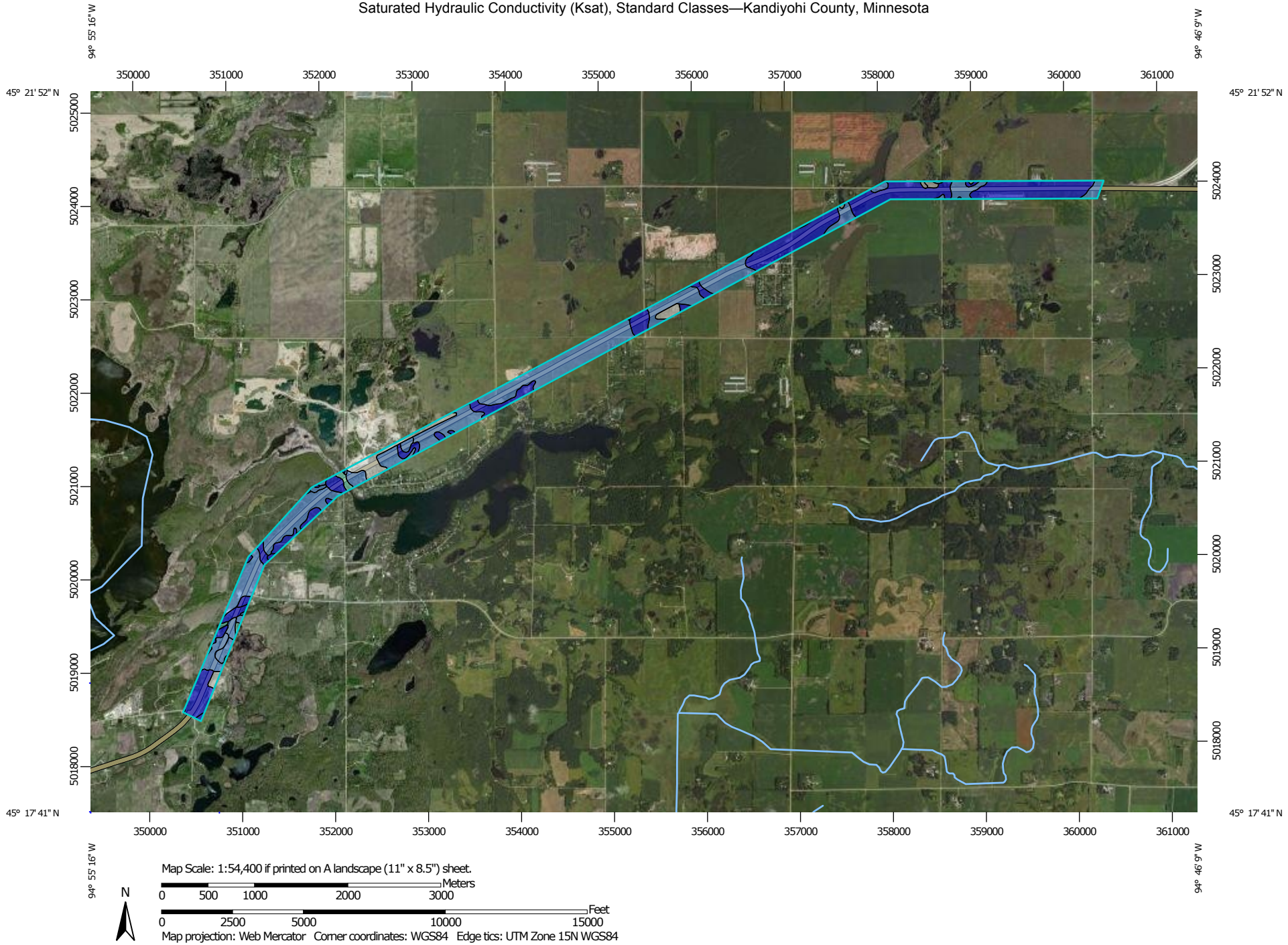
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Saturated Hydraulic Conductivity (Ksat), Standard Classes—Kandiyohi County, Minnesota



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Lines
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Soil Rating Points
- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- 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 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Kandiyohi County, Minnesota
Survey Area Data: Version 13, Sep 16, 2014

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.

Saturated Hydraulic Conductivity (Ksat), Standard Classes

Saturated Hydraulic Conductivity (Ksat), Standard Classes— Summary by Map Unit — Kandiyohi County, Minnesota (MN067)				
Map unit symbol	**Map unit name**	**Rating (micrometers per second)**	**Acres in AOI**	**Percent of AOI**
39	Wadena loam	54.8684	5.2	0.9%
392	Biscay loam	53.2303	6.3	1.0%
611D	Hawick gravelly loamy coarse sand, 12 to 20 percent slopes	179.6316	15.1	2.5%
611F	Hawick gravelly loamy coarse sand, 20 to 35 percent slopes	179.6316	0.0	0.0%
804B	Koronis-Hawick complex, 2 to 6 percent slopes	26.1579	4.4	0.7%
833C	Sunburg-Wadenill-Hawick complex, 6 to 12 percent slopes	25.7500	0.3	0.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	72.6316	288.6	47.5%
875C	Hawick-Estherville complex, 6 to 12 percent slopes	192.2632	63.2	10.4%
1016	Udorthents, loamy	23.0000	7.0	1.2%
1029	Pits, gravel		33.6	5.5%
1055	Aquolls and Histosols, ponded	8.5000	5.8	1.0%
D105A	Arvilla sandy loam, MLRA 91A, 0 to 2 percent slopes	113.3758	175.8	29.0%
W	Water		1.7	0.3%
Totals for Area of Interest			**607.2**	**100.0%**

Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Rating Options

Units of Measure: micrometers per second

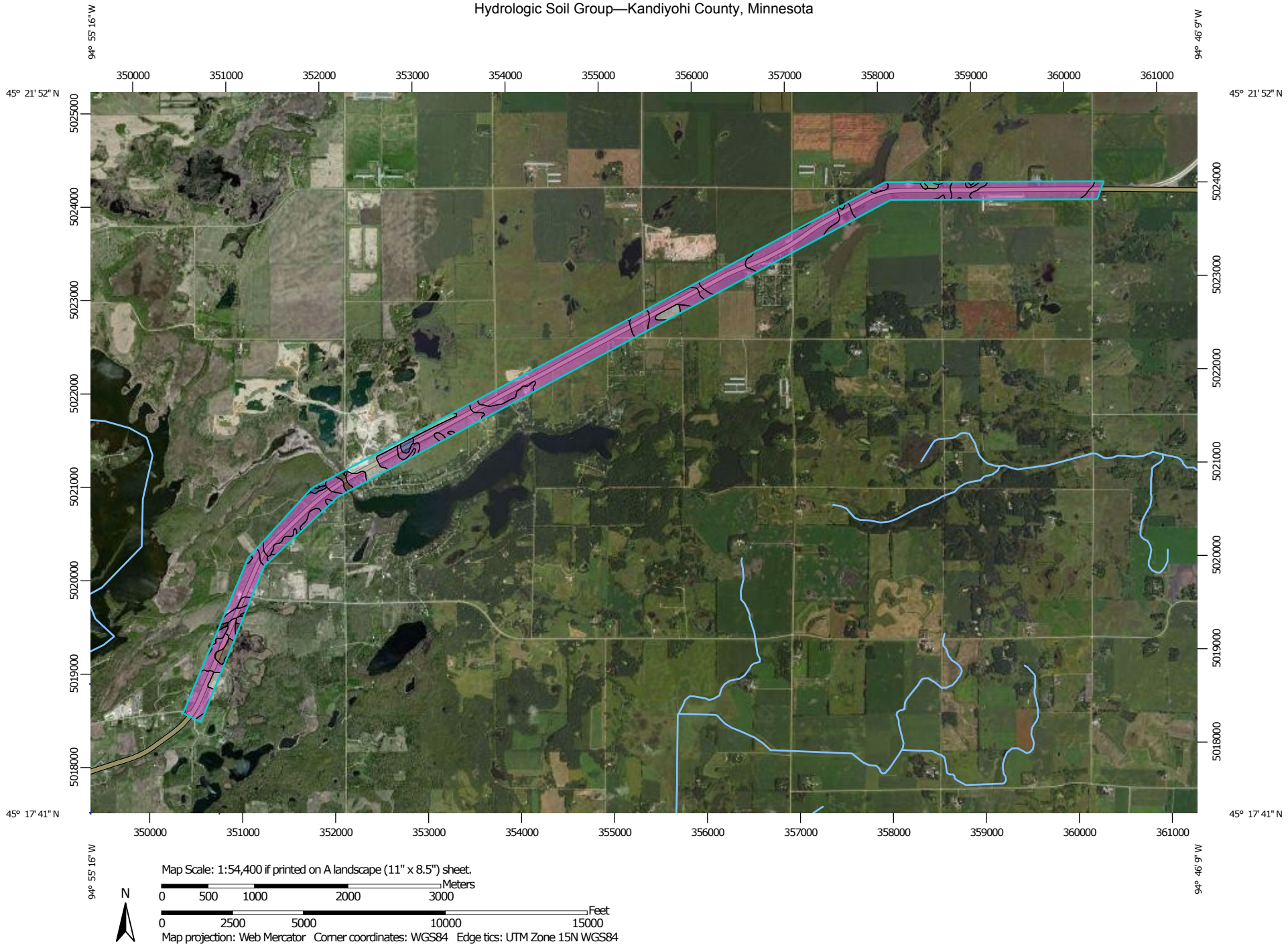
Aggregation Method: Dominant Component

Component Percent Cutoff: *None Specified*

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)


94° 55' 16" W
94° 46' 9" W
45° 21' 52" N
45° 17' 41" N
350000
351000
352000
353000
354000
355000
356000
357000
358000
359000
360000
361000
5025000
5024000
5023000
5022000
5021000
5020000
5019000
5018000
Map Scale: 1:54,400 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 500 1000 2000 3000
Feet
0 2500 5000 10000 15000
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

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- 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 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Kandiyohi County, Minnesota
Survey Area Data: Version 13, Sep 16, 2014

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Kandiyohi County, Minnesota (MN067)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
39	Wadena loam	B	5.2	0.9%
392	Biscay loam	B/D	6.3	1.0%
611D	Hawick gravelly loamy coarse sand, 12 to 20 percent slopes	A	15.1	2.5%
611F	Hawick gravelly loamy coarse sand, 20 to 35 percent slopes	A	0.0	0.0%
804B	Koronis-Hawick complex, 2 to 6 percent slopes	A	4.4	0.7%
833C	Sunburg-Wadenill-Hawick complex, 6 to 12 percent slopes	B	0.3	0.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	A	288.6	47.5%
875C	Hawick-Estherville complex, 6 to 12 percent slopes	A	63.2	10.4%
1016	Udorthents, loamy	A	7.0	1.2%
1029	Pits, gravel		33.6	5.5%
1055	Aquolls and Histosols, ponded	B/D	5.8	1.0%
D105A	Arvilla sandy loam, MLRA 91A, 0 to 2 percent slopes	A	175.8	29.0%
W	Water		1.7	0.3%
Totals for Area of Interest			**607.2**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

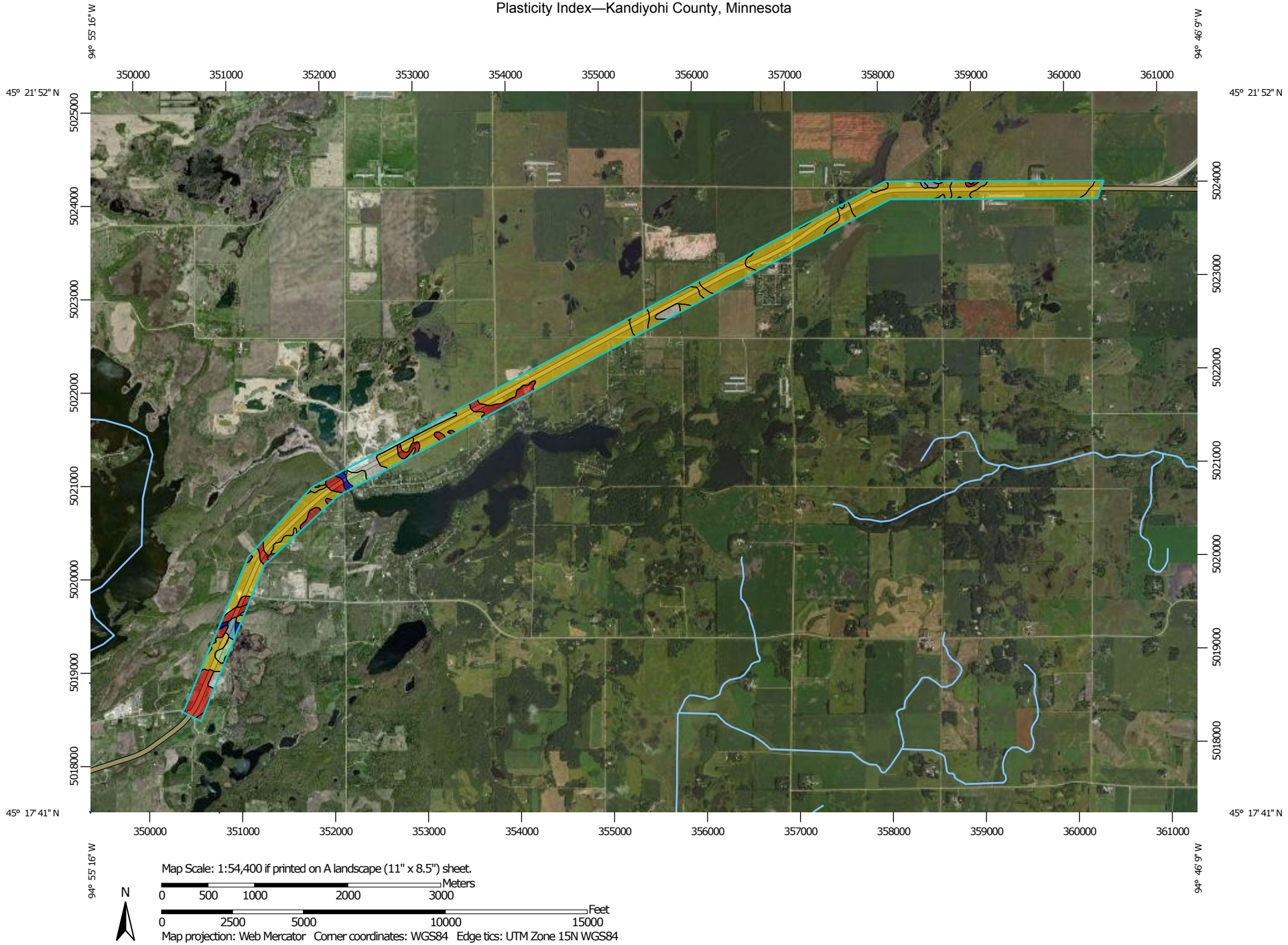
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Map Scale: 1:54,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2500 5000 10000 15000

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

<= 0.0

> 0.0 and <= 3.6

> 3.6 and <= 7.8

> 7.8 and <= 10.1

> 10.1 and <= 14.5

Not rated or not available

Soil Rating Lines

<= 0.0

> 0.0 and <= 3.6

> 3.6 and <= 7.8

> 7.8 and <= 10.1

> 10.1 and <= 14.5

Not rated or not available

Soil Rating Points

<= 0.0

> 0.0 and <= 3.6

> 3.6 and <= 7.8

> 7.8 and <= 10.1

> 10.1 and <= 14.5

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 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Kandiyohi County, Minnesota
Survey Area Data: Version 13, Sep 16, 2014

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.

Plasticity Index

Plasticity Index— Summary by Map Unit — Kandiyohi County, Minnesota (MN067)				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
39	Wadena loam	3.6	5.2	0.9%
392	Biscay loam	7.8	6.3	1.0%
611D	Hawick gravelly loamy coarse sand, 12 to 20 percent slopes	0.0	15.1	2.5%
611F	Hawick gravelly loamy coarse sand, 20 to 35 percent slopes	0.0	0.0	0.0%
804B	Koronis-Hawick complex, 2 to 6 percent slopes	10.1	4.4	0.7%
833C	Sunburg-Wadenill-Hawick complex, 6 to 12 percent slopes	7.8	0.3	0.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	1.7	288.6	47.5%
875C	Hawick-Estherville complex, 6 to 12 percent slopes	0.0	63.2	10.4%
1016	Udorthents, loamy	7.5	7.0	1.2%
1029	Pits, gravel		33.6	5.5%
1055	Aquolls and Histosols, ponded	14.5	5.8	1.0%
D105A	Arvilla sandy loam, MLRA 91A, 0 to 2 percent slopes	2.2	175.8	29.0%
W	Water		1.7	0.3%
Totals for Area of Interest			**607.2**	**100.0%**

Description

Plasticity index (PI) is one of the standard Atterberg limits used to indicate the plasticity characteristics of a soil. It is defined as the numerical difference between the liquid limit and plastic limit of the soil. It is the range of water content in which a soil exhibits the characteristics of a plastic solid.

The plastic limit is the water content that corresponds to an arbitrary limit between the plastic and semisolid states of a soil. The liquid limit is the water content, on a percent by weight basis, of the soil (passing #40 sieve) at which the soil changes from a plastic to a liquid state.

Soils that have a high plasticity index have a wide range of moisture content in which the soil performs as a plastic material. Highly and moderately plastic clays have large PI values. Plasticity index is used in classifying soils in the Unified and AASHTO classification systems.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: percent

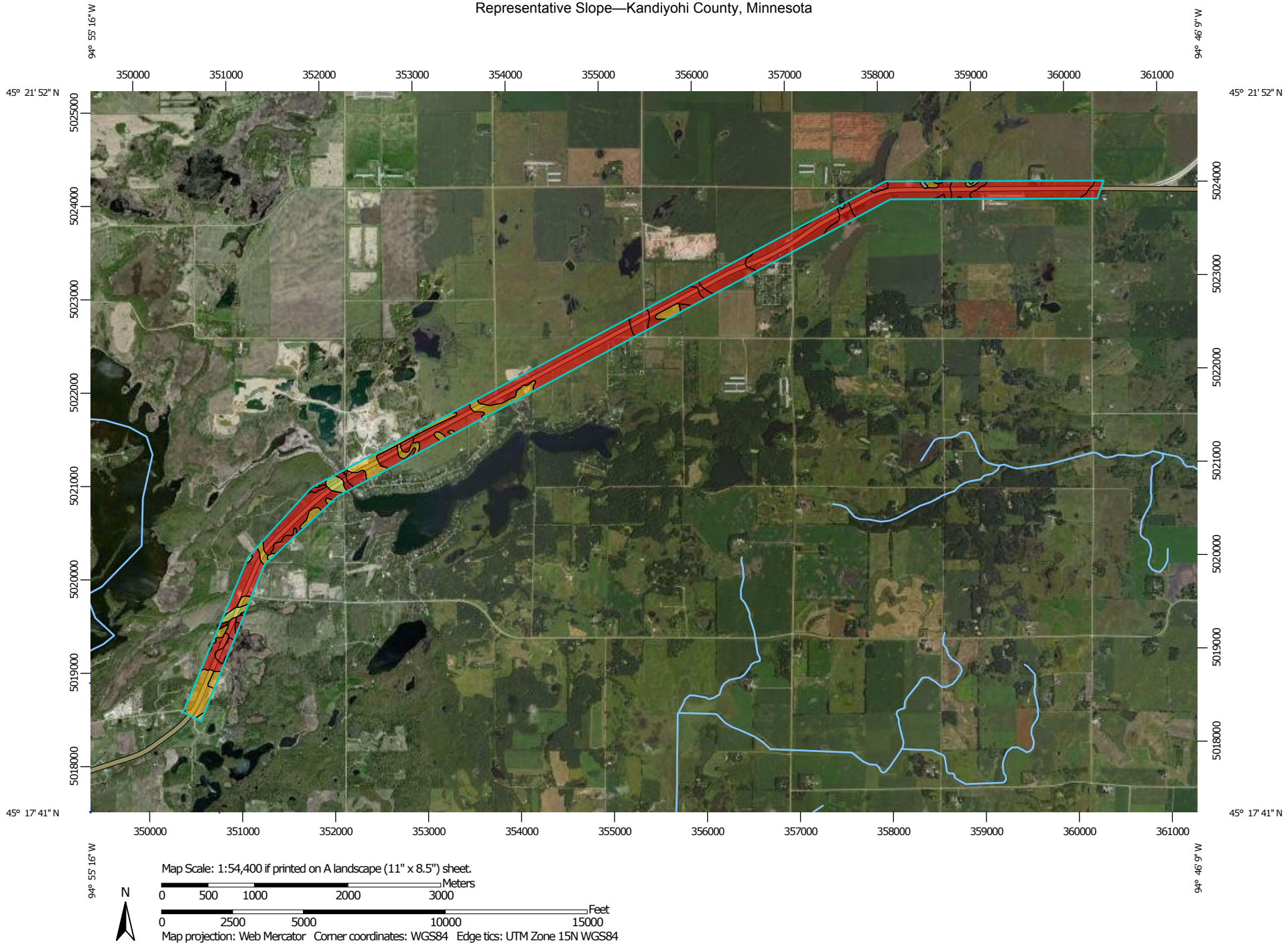
Aggregation Method: Dominant Component

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)



Map Scale: 1:54,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2500 5000 10000 15000

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

- 0 - 5
- 5 - 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 100
- Not rated or not available

Soil Rating Lines

- 0 - 5
- 5 - 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 100
- Not rated or not available

Soil Rating Points

- 0 - 5
- 5 - 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 100
- 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 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Kandiyohi County, Minnesota
Survey Area Data: Version 13, Sep 16, 2014

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.

Representative Slope

Representative Slope— Summary by Map Unit — Kandiyohi County, Minnesota (MN067)				
Map unit symbol	**Map unit name**	**Rating (percent)**	**Acres in AOI**	**Percent of AOI**
39	Wadena loam	2.0	5.2	0.9%
392	Biscay loam	2.0	6.3	1.0%
611D	Hawick gravelly loamy coarse sand, 12 to 20 percent slopes	16.0	15.1	2.5%
611F	Hawick gravelly loamy coarse sand, 20 to 35 percent slopes	27.5	0.0	0.0%
804B	Koronis-Hawick complex, 2 to 6 percent slopes	4.0	4.4	0.7%
833C	Sunburg-Wadenill-Hawick complex, 6 to 12 percent slopes	10.0	0.3	0.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	4.0	288.6	47.5%
875C	Hawick-Estherville complex, 6 to 12 percent slopes	9.0	63.2	10.4%
1016	Udorthents, loamy	2.0	7.0	1.2%
1029	Pits, gravel	10.0	33.6	5.5%
1055	Aquolls and Histosols, ponded	0.5	5.8	1.0%
D105A	Arvilla sandy loam, MLRA 91A, 0 to 2 percent slopes	1.0	175.8	29.0%
W	Water		1.7	0.3%
Totals for Area of Interest			**607.2**	**100.0%**

Description

Slope gradient is the difference in elevation between two points, expressed as a percentage of the distance between those points.

The slope gradient is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

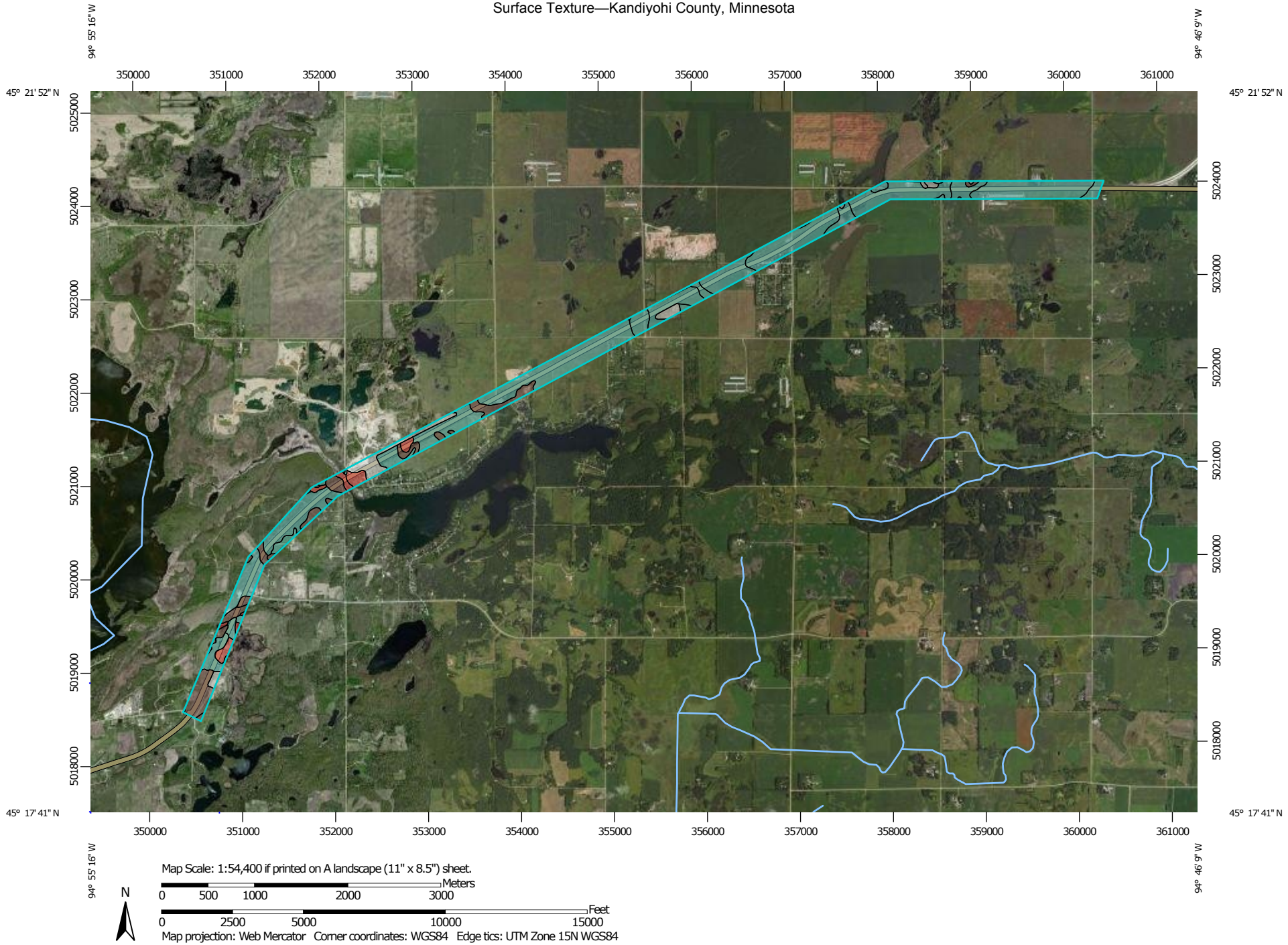
Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Interpret Nulls as Zero: No



Map Scale: 1:54,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2500 5000 10000 15000

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Background
- Aerial Photography

Soils

Soil Rating Polygons
- Loam
- Loamy coarse sand
- Sandy loam
- Not rated or not available

Soil Rating Lines
- Loam
- Loamy coarse sand
- Sandy loam
- Not rated or not available

Soil Rating Points
- Loam
- Loamy coarse sand
- Sandy loam
- Not rated or not available

Water Features
- Streams and Canals

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

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Kandiyohi County, Minnesota
Survey Area Data: Version 13, Sep 16, 2014

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.

Surface Texture

Surface Texture— Summary by Map Unit — Kandiyohi County, Minnesota (MN067)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
39	Wadena loam	Loam	5.2	0.9%
392	Biscay loam	Loam	6.3	1.0%
611D	Hawick gravelly loamy coarse sand, 12 to 20 percent slopes	Loamy coarse sand	15.1	2.5%
611F	Hawick gravelly loamy coarse sand, 20 to 35 percent slopes	Loamy coarse sand	0.0	0.0%
804B	Koronis-Hawick complex, 2 to 6 percent slopes	Sandy loam	4.4	0.7%
833C	Sunburg-Wadenill-Hawick complex, 6 to 12 percent slopes	Loam	0.3	0.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	Sandy loam	288.6	47.5%
875C	Hawick-Estherville complex, 6 to 12 percent slopes	Loamy coarse sand	63.2	10.4%
1016	Udorthents, loamy	Loam	7.0	1.2%
1029	Pits, gravel		33.6	5.5%
1055	Aquolls and Histosols, ponded	Loam	5.8	1.0%
D105A	Arvilla sandy loam, MLRA 91A, 0 to 2 percent slopes	Sandy loam	175.8	29.0%
W	Water		1.7	0.3%
Totals for Area of Interest			**607.2**	**100.0%**

Description

This displays the representative texture class and modifier of the surface horizon.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Rating Options

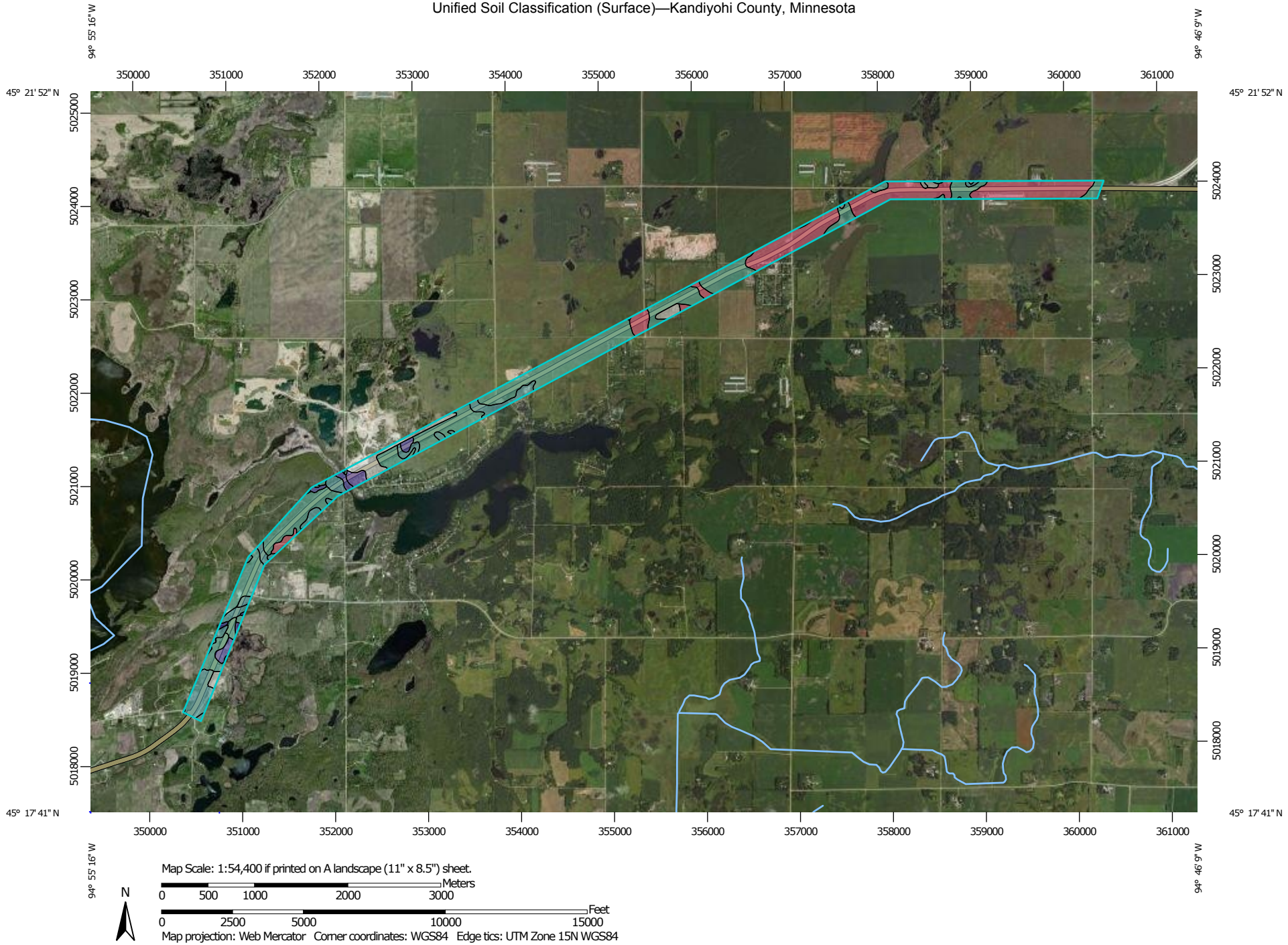
Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Unified Soil Classification (Surface)—Kandiyohi County, Minnesota



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- CH
- CL
- CL-A (proposed)
- CL-K (proposed)
- CL-ML
- CL-O (proposed)
- CL-T (proposed)
- GC
- GC-GM
- GM
- GP
- GP-GC
- GP-GM
- GW
- GW-GC
- GW-GM
- MH
- MH-A (proposed)
- MH-K (proposed)
- MH-O (proposed)
- MH-T (proposed)
- ML
- ML-A (proposed)
- ML-K (proposed)
- ML-O (proposed)
- ML-T (proposed)
- OH
- OH-T (proposed)
- OL
- PT
- SC
- SC-SM
- SM
- SP
- SP-SC
- SP-SM
- SW
- SW-SC
- SW-SM
- Not rated or not available

Soil Rating Lines

- CH
- CL
- CL-A (proposed)
- CL-K (proposed)
- CL-ML
- CL-O (proposed)
- CL-T (proposed)
- GC
- GC-GM
- GM
- GP
- GP-GC
- GP-GM
- GW
- GW-GC
- GW-GM
- MH
- MH-A (proposed)
- MH-K (proposed)
- MH-O (proposed)
- MH-T (proposed)
- ML
- ML-A (proposed)
- ML-K (proposed)
- ML-O (proposed)
- ML-T (proposed)
- OH
- OH-T (proposed)
- OL
- PT
- SC
- SC-SM
- SM
- SP
- SP-SC
- SP-SM
- SW
- SW-SC
- SW-SM
- Not rated or not available

Soil Rating Points

- CH
- CL
- CL-A (proposed)
- CL-K (proposed)
- CL-ML
- CL-O (proposed)
- CL-T (proposed)
- GC
- GC-GM
- GM
- GP
- GP-GC
- GP-GM
- GW
- GW-GC
- GW-GM
- MH
- MH-A (proposed)
- MH-K (proposed)
- MH-O (proposed)
- MH-T (proposed)
- ML
- ML-A (proposed)
- ML-K (proposed)
- ML-O (proposed)
- ML-T (proposed)
- OH
- OH-T (proposed)
- OL
- PT
- SC
- SC-SM
- SM
- SP
- SP-SC
- SP-SM
- SW
- SW-SC
- SW-SM
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails

MAP INFORMATION

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Kandiyohi County, Minnesota
Survey Area Data: Version 13, Sep 16, 2014

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.

Unified Soil Classification (Surface)

Unified Soil Classification (Surface)— Summary by Map Unit — Kandiyohi County, Minnesota (MN067)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
39	Wadena loam	CL	5.2	0.9%
392	Biscay loam	CL	6.3	1.0%
611D	Hawick gravelly loamy coarse sand, 12 to 20 percent slopes	SM	15.1	2.5%
611F	Hawick gravelly loamy coarse sand, 20 to 35 percent slopes	SM	0.0	0.0%
804B	Koronis-Hawick complex, 2 to 6 percent slopes	SC-SM	4.4	0.7%
833C	Sunburg-Wadenill-Hawick complex, 6 to 12 percent slopes	CL-ML	0.3	0.1%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	SC-SM	288.6	47.5%
875C	Hawick-Estherville complex, 6 to 12 percent slopes	SM	63.2	10.4%
1016	Udorthents, loamy	CL-ML	7.0	1.2%
1029	Pits, gravel		33.6	5.5%
1055	Aquolls and Histosols, ponded	CL	5.8	1.0%
D105A	Arvilla sandy loam, MLRA 91A, 0 to 2 percent slopes	SC	175.8	29.0%
W	Water		1.7	0.3%
Totals for Area of Interest			**607.2**	**100.0%**

Description

The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The representative classification is shown here for the surface layer of the soil.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Appendix D- Environmental Correspondence-Early Notification Response Letters

From:	Karnowski, Susann (DOT)
To:	Mark Benson (mbenson@sehinc.com); Jeff Rhoda (jrhoda@sehinc.com); Scott Janowiak (sjanowiak@sehinc.com)
Subject:	FW: DNR Comments on MnDOT Early Notification Memo for TH 23 3408-18 2-lane to 4-lane expansion from New London to Paynesville
Date:	10/06/2014 02:18 PM
Attachments:	SP 3408-18 (TH 23 New London to Paynesville) ENM.DOC DNRbasemap.pdf DNR Prairie Corridors-MnDOT Prairie Passage route (south).pdf

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From: Leete, Peter (DOT)
Sent: Monday, October 06, 2014 2:13 PM
To: Karnowski, Susann (DOT)
Cc: Losinski, Jeremy (DNR); Skancke, Jennie (DNR); Straumanis, Sarma (DOT); Belz, Lori (DOT); Sullivan, Dan (MPCA); Joyal, Lisa (DNR); Mixon, Kevin (DNR); Coahran, Dave A (DNR); Netland, Cory (DNR); Block, Marybeth (DNR); Hanson, David L (DOT)
Subject: DNR Comments on MnDOT Early Notification Memo for TH 23 3408-18 2-lane to 4-lane expansion from New London to Paynesville

Suzann,

This email is the DNR response for your project records. I have not sent this Early Notification Memo (ENM) out for full DNR review, however I've looked at the information in the submitted documents regarding the proposed continuation of the 4-lane expansion between Paynesville and New London. As you are aware, the primary concern will be the impacts to the crossing of outlet of Long Lake and the adjacent Glacial Lakes Trail. Please consider the following comments as final designs and special provisions 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 dark blue), designated aquatic invasive species (red), 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. If you have questions regarding proposed work near any of the data shown, please give me a call. Your GIS folks also can access this data from the DNR's Data Deli website at http://deli.dnr.state.mn.us/. The following files will allow the creation of the same map and ease your cross reference for road locations.
   - MCBS Railroad Rights-of-Way Prairies
   - MCBS Native Plant Communities
   - MCBS Sites of Biodiversity Significance
   - Public Waters Inventory (PWI) Watercourse Delineations
   - Public Waters Inventory (PWI) Basin Delineations
   - DNR managed lands such as Wildlife Management Areas, Scientific & Natural Areas, Public Access, State Parks, State Forests, etc
   - Trout streams, including PLS sections with trout streams
   - FEMA layers for flood impact potential
   - Minnesota Trails (water, state, and snowmobile).

   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.

2. The ENM states that outlet of Long Lake (#34006600) may be impacted. A Public Waters Work Permit will be required. Authorization for the project will require final review at a later date. Please enter the project into the new DNR online permitting system (MPARS) when there is enough information to do so: www.dnr.state.mn.us/mpars. A copy of DNR's General Permit to MnDOT (GP2004-0001) is attached, please review all the conditions of this permit and integrate their requirements into project design. 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 Ice our (~March1 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.

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 construction activity has ceased (and be completed within 24 hours).

C. Construction and demolition methods will need to occur at a later date, though be aware we would like to see impacts to the main flow of the river avoided.

D. Revegetation of disturbed soils should include native mixes in areas that are not proposed for mowed turf grass. Please follow the native recommendations in the 'Turf Establishment Recommendations – dated April 14, 2014' for your district as found on the MnDOT website: 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.

3. Please remind contractors that a separate water use permit is required for withdrawal of more than 10,000 gallons of water per day or 1 million gallons per year from surface water or ground water. GP1997-0005 (temporary water appropriations) covers a variety of activities associated with road construction and should be applied of if applicable. An individual appropriations permit may be required for projects lasting longer than one year or exceeding 50 million gallons. Information is located at: http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/permits.html

4. 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. Based on this query, rare features have been documented within the search area. In order to prevent the inadvertent release of the location of specific listed or rare species contained in the NHIS, we have not identified their location on the attached 'DNRbasemap.pdf'. For details or questions, please contact me. However, given the nature and location of the proposed project, we do not believe the project will negatively affect any known occurrences of rare features. The 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.

5. I'd like to introduce you to a relatively new DNR effort: The Minnesota Prairie Conservation Plan:

http://files.dnr.state.mn.us/eco/mcbs/mn_prairie_conservation_plan.pdf. Corridors that link existing prairie remnants, Wildlife Management Areas, and other natural areas have been identified for this effort (see attached map). These corridors are not identical to the Prairie Passage Route, though often they are in the same vicinity. The section of TH 23 is at the limits of one of the identified corridors. The Prairie Conservation Plan is a 25 year effort to collaborate with local landowners to ensure a minimum amount of prairie-grassland-wetland areas are available for conservation efforts such as wildlife management (pheasants, ducks) and other resource plans. I think MnDOT may be a good partner for this effort, as protection, restoration and enhancement of your right of way with native vegetation may aid in this larger conservation approach for the corridors. More information is here: http://www.dnr.state.mn.us/prairieplan/index.html.

We request that MnDOT consider the use of native vegetation in this area per the guidelines set out in MnDOT's 'Turf Establishment Recommendations – dated April 14, 2014' for your district as found on the MnDOT website: http://www.dot.state.mn.us/environment/erosion/seedmixes.html.

6. The Glacial Lakes State Trail runs parallel to TH23 for much of the project area. Reconstruction of the area should allow for safe use by recreational users of this trail. I am aware that you have already contacted Jeremy Losinski, Area Park & Trails Supervisor in the Spicer Area. Please continue to coordinate with him in regards to trail impacts or cooperative opportunities.

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 Suzann, and myself.

Contact me if you have questions

peter

Peter Leete
Transportation Hydrologist (DNR-MnDOT Liaison)
DNR Ecological & Water Resources
Ph: 651-366-3634

Office location: MnDOT's Office of Environmental Stewardship

From: Karnowski, Susann (DOT)
Sent: Wednesday, September 03, 2014 3:51 PM
To: Leete, Peter (DOT); Alcott, Jason (DOT); *DOT_CulturalResources; Jarman, Sarah (DOT); Klein, Jacqueline (DOT); Mitchell, Timothy (DOT); Sorenson, Debra (DOT); Markeson, Christina (DOT); McFadden, Kathryn (DOT); Barney, Ryan J (DOT); Moates, Christopher (DOT); Milkert, Anjani (DOT); Molnau, Keith (DOT)
Cc: Stoutland, James (DOT); Moynihan, Debra (DOT); Ahrndt, Adam (DOT); Jaeger, Patrick (DOT); Roseen, Melvin (DOT); Mark Benson (mbenson@sehinc.com); Scott Janowiak (sjanowiak@sehinc.com)
Subject: Early Notification Memo for TH 23 3408-18 2-lane to 4-lane expansion from New London to Paynesville

We are requesting your input for a project in District 8. It is located on TH 23 (SP 3408-18) between New London and Paynesville, and includes the expansion of the existing highway from 2-lanes to 4-lanes. The EAW and layout for this project are being funded through the Corridors of Commerce program.

Attached are the Early Notification Memo and associated project location maps for this project. Please note that an ENM was submitted for this project in 2009, but we are requesting updated responses at this time.

We are requesting responses by October 3, 2014. If you have any questions or need any additional information, please let me know.

Thank you.

Susann

Susann H. Karnowski, P.E.
Project Management Engineer
MnDOT - District 8
2505 Transportation Road
Willmar, MN 56201
Ph: (320) 214-6370
email: susann.karnowski@state.mn.us

We all have a stake in A to B

Fw: Information to provide in projects submittals looking for ESA clearance - new for the northern long-eared bat

Bob Rogers to: Samuel Turrentine, Lisa Elliott, Mark Benson, Chris Hiniker, Kristin Petersen 10/16/2015 08:05 AM

Nothing really new here, but Jason is starting to spread the work about the NLEB.

Robert Rogers, AICP | Associate | Senior Planner
SEH Inc. | 3535 Vadnais Center Drive | St. Paul, MN 55110-5196
651.765.2945 direct | 651.490.2000 main
www.sehinc.com
SEH–Building a Better World for All of Us™

From: "Stone, Nancy (DOT)" <nancy.stone@state.mn.us>
To: "ceam@lists.state.mn.us" <ceam@lists.state.mn.us>,
Cc: "Alcott, Jason (DOT)" <jason.alcott@state.mn.us>
Date: 10/15/2015 01:21 PM
Subject: [Ceam] Information to provide in projects submittals looking for ESA clearance - new for the northern long-eared bat
Sent by: <ceam-bounces@lists.state.mn.us>

The new rule under Section 4(d) of the Endangered Species Act establishes measures necessary to protect the Northern Long Eared Bat (NLEB). The rule became effective May 4, 2015.. This now establishes ALL counties in MN have an endangered species and need an impact statement from the Office of Environmental Stewardship (OES) for all federally funded projects or projects that require a separate federal action such as US Army Corp of Engineers, Section 404 Permit. At this time NONE of the state or federal agencies have guidance on how to implement the new status of the NLEB.

As you begin your environmental review process please be aware of the NLEB and provide the Office of Environmental Stewardship with the information requested below so they can effectively review and evaluate the impacts of your project.

Subject: Information to provide in projects submittals looking for ESA clearance - new for the northern long-eared bat

1) Will the project involve tree removal?
2) What is the amount of tree removal in terms of acres?
3) Can the tree removal be done in the winter season (Oct 1 – April 1)?
4) Will the project involve bridge/box culvert work?
5) Can the bridge/box culvert work be done in the winter season (Oct 1- April 1)?

The above questions are new in response to the recent listing of the northern long-eared bat. Knowing these answers will make the selection of the correct Section 7 consultation path much more efficient. These are the same questions that the USFWS requests of MnDOT on all of our actions. I hope this helps, let me know if you need clarification.

Jason Alcott
Minnesota Department of Transportation

Office of Environmental Stewardship
395 John Ireland Boulevard
St. Paul, MN 55155
Phone: 651-366-3605
Email: Jason.alcott@state.mn.us

Appendix E- MnDOT Roadside Vegetation Unit Correspondence

Minnesota Department of Transportation
Roadside Vegetation Management Unit
395 John Ireland Boulevard
Saint Paul, MN 55155

Mail Stop: 620
Office Phone: 651-366-3600
Fax: 651-366-3603

Memo

TO: Susann Karnowski, MnDOT Project Manager

FROM: Dave Hanson, Urban Forester, OES

DATE: October 6, 2014

SUBJECT: SP 3408-18 TH 23, two-lane to four-lane conversion: Review of Vegetation.

In preparing this vegetation review of TH 23 between Paynesville and New London, background information and images from GIS layers, Videolog, and Google maps were used. This vegetation review is in response to ENM dated September 3, 2014.

Vegetation:

Along the length of this project, MnDOT's R/W passes through typical central Minnesota agricultural lands. Vegetation is mostly HPDP Category 1 native vegetation. While there are trees, some planted and some naturally occurring, fortunately the right-of-way and surrounding land is not heavily forested. There are no known threatened or endangered species in this corridor.

Potential Impacts:

It is anticipated that as the layout for this project is refined, there will be tree covered areas requiring clearing and grubbing.

At this time there are no sensitive areas identified, nor threatened or endangered species.

Protection of Vegetation:

In particular Standard Specification 2572.3A discusses construction requirements related to trees and vegetation protection. As construction limits are defined areas of natural vegetation and/or trees to be protected should be identified and protected with fencing. No such trees or natural vegetation are known at this time.

Areas near or under trees should not become staging areas for parking, equipment or materials. Activities of that nature compact the soils resulting in additional stress on already stressful roadsides.

As project initiation draws near and construction limits have been defined, site visits could be arranged to help study the need for tree preservation or protection.

Noxious Weeds:

There are no identified noxious weed infestations. Having stated that, it is anticipated that some of the more common noxious weeds (i.e. Canada thistle and common buckthorn) may be encountered within the area of this project. Following are some general guidelines that can help to limit the spread of noxious weeds during the construction phase:

- identify where weeds are present
- prioritize these areas for weed control before construction begins
- prevent movement of soil harboring a strong seed bank (soil under a weed infestation)
- prevent the spread of reproductive weed parts (seed and roots) by cleaning equipment before it is moved from one site to another
- post construction, monitor for noxious weeds and control as necessary.

Vegetation Replacement:

It is recommended that replanting plans incorporate native plant materials and seed mixes appropriate to site conditions when possible. Local seed source is highly recommended and native seed harvested within fifty miles should be sought. The Roadside Vegetation Management Unit can help with sourcing. A general discussion of vegetation protection and replacement can be found in HPDP Vegetation Subject Guidance.

For more specific recommendations please contact the Roadside Vegetation Management unit once construction limits are clearly defined. Thank you for the opportunity to review this project, if there are further concerns as this project draws closer please feel free to contact me.

Dave Hanson

Cc. Lynn Clarkowski
Roadside Vegetation Management Unit

Appendix G- MnDOT Cultural Resources Unit

Minnesota Department of Transportation

Office of Environmental Stewardship
Mail Stop 620
395 John Ireland Boulevard
St. Paul, MN 55155-1800

Office Tel: (651) 366-3614
Fax: (651) 366-3603

January 12, 2016

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

Re: S.P. 3408-18. Two to four lane conversion of TH 23, Kandiyohi County

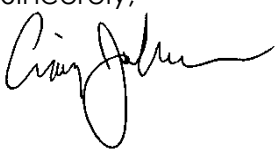
Dear Mr. Barney:

We have reviewed the above-referenced state-funded undertaking pursuant to MnDOT's responsibilities under the Minnesota Historic Sites Act (MS 138.665-.666), the Field Archaeology Act of Minnesota (MS 138.40), and the Private Cemeteries Act (MS 307.08, Subd. 9 and 10).

The project involves the conversion of TH 23 from a two to a four lane road from the north junction of CR 31 to CR 6. Phase I and II archaeological and history surveys and evaluations of the area of potential effect (APE) are currently underway. Results from both studies indicate that there are no archaeological sites in the APE that are eligible for listing in National Register of Historic Places and no historic properties that are listed in the State or National Registers of Historic Places. Once the reports are complete, copies will be sent to you.

It is the finding 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 significant known or suspected archaeological sites; therefore, no consultation with the Minnesota Historical Society or the Office of the State Archaeologist is required, and the historical/archaeological review is complete. If the project does receive FHWA funds or the project scope changes, please notify our office and we will conduct any needed additional reviews.

Sincerely,



Craig Johnson
Archaeologist
Cultural Resources Unit (CRU)

cc: MnDOT CRU Project File

Appendix H- Noise Analysis Report

DRAFT Traffic Noise Analysis Report

TH 23 South Gap Project

S.P. 3408-18
SEH No. MNT08 129296

October 15, 2015

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Traffic Noise Analysis Report

TH 23 South 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 South 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 New London and Paynesville 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 7.4 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 sections straightened out to improve safety and operations.

1.1 Project Limits

The noise modeling include the following roadway limits:

- TH 23 from CSAH 31 (near New London) to CR 20 (near Paynesville); approximately 7.4 miles.
- Approach roadways connecting to TH 23 include the following:
  - 199th Avenue NE, 115th Street NE, CR 135, 225th Avenue NE/CR 106, CR 2 (North Leg), CR 4/160th Street NE, 240th Avenue NE, 175th Street NE, CR 6/CR 143

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 (2014) and future (2035) no build and build conditions.

2.0 Noise Description

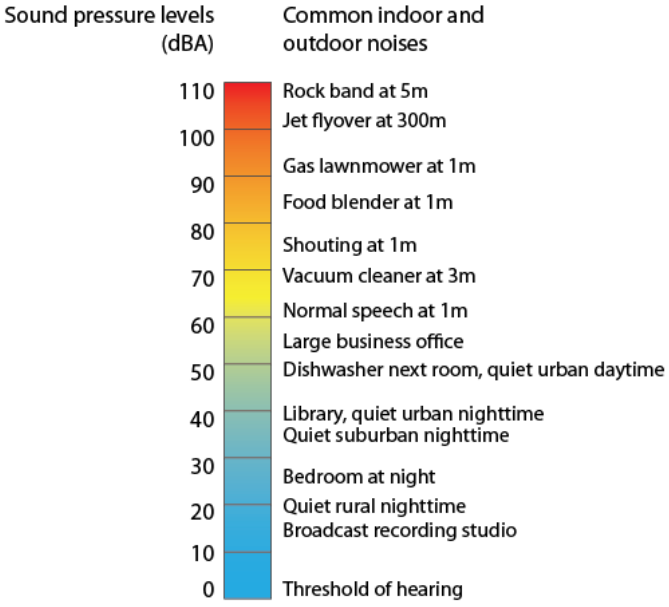
Noise is defined as any unwanted sound. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels. A-weighted decibels (dBA) represent the logarithmic increase (decrease) in sound energy relative to a reference energy level. A sound 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” (May 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.

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 new location, 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 modeling; there are other noise sources in the project area that have some effect on the ambient noise levels.

The project will expand approximately 7.4 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 CSAH 31, approximately 600 feet beyond construction, and the east TH 23 limit is at CR 20, over ½ mile beyond construction.

The project will retain the majority of the existing 2-lane roadway as portion of the 4-lane design. The western most approximate 4.5 miles of existing 2-lane roadway will be converted to the southbound lanes and the new northbound lanes will be constructed parallel to the existing roadway. The eastern most approximate 1.25 miles of existing 2-lane roadway will be converted to the northbound lanes and the new southbound lanes will be constructed parallel to the existing roadway. The remaining middle segment will be completely reconstructed to accommodate a new alignment along the corridor.

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.

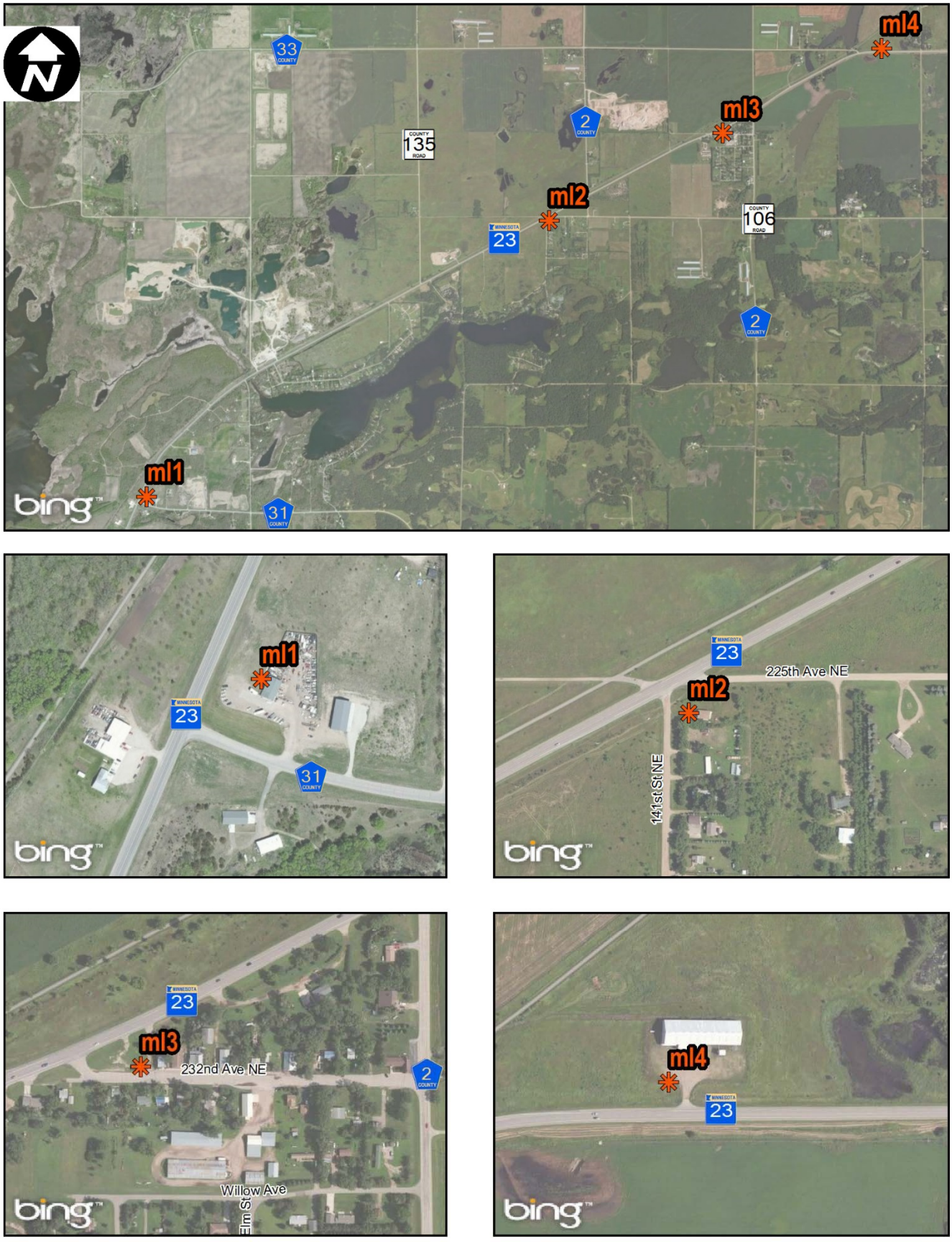
The existing noise levels along the TH 23 corridor were monitored in September 2014. A total of 4 sites were monitored in 2014; noise level monitoring results ranged from 59.5 dBA (L_{10}) to 68.7 dBA (L_{10}). Both the AM and PM monitoring time periods had good weather (no precipitation with winds less than 12 mph), and dry pavement; the sound level meter utilized was a Larson Davis model 814 that was laboratory calibrated in February of 2014.

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	Commercial - Automobile Dealership 10618 199th Ave NE	9/18/2014	1:03 PM	1:33 PM	59.5	61.7	2.2
		9/18/2014	4:01 PM	4:34 PM	60.6	63.4	2.8
ML 2	Residential - 22491 141st Street NE	9/18/2014	12:26 PM	12:57 PM	66.3	67.5	1.2
		9/18/2014	3:24 PM	3:55 PM	67.3	69.3	2.0
ML 3	Commercial - Vacant Parcel in Haywick	9/18/2014	11:52 AM	12:22 PM	66.6	66.5	-0.1
		9/18/2014	2:51 PM	3:23 PM	68.0	68.3	0.3
ML 4	Commercial - 17026 240th Ave NE	9/18/2014	11:17 AM	11:47 AM	67.9	67.3	-0.6
		9/18/2014	2:17 PM	2:47 PM	68.7	69.0	0.3

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 sites likely to be affected by the construction of the proposed project. Traffic noise levels were modeled at a total of 251 representative receptor locations throughout the project area. The Existing and No Build models include only 250 receptors that exist today. The Build condition removes 11 receptors, through right-of-way acquisitions, and adds 1 additional trail receptor along the proposed trail underpass near CR 135; therefore the Build Condition has a total of 240 receptors.

The majority of the receptors, a total of 156, represent the Glacial Lakes State Trail, though there are both scattered and pockets of residential and commercial properties through the project. 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 locations of the existing modeled receptor sites are illustrated in Appendix A Figures 1 through 10; Existing/No Build Conditions. The locations of the build modeled receptor sites are illustrated in Appendix C Figures 1 through 10; 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 2014) and future (year 2035) No Build and Build forecast traffic volumes. Year 2035 was identified as the design year for the proposed project.
- Vehicular fleet composition was collected from a 48-hour vehicle classification Site #9102 in the project area obtained from MnDOT in August 2014.
- 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 over 270% more traffic than the next highest peak traffic demand during the 10:00 p.m. to 7:00 a.m. “nighttime” period.

- The 1:00 p.m. to 2:00 p.m. hour was identified as the loudest hour of the daytime period.
  - Based on vehicle classification count, the hours starting at 9 a.m., 1 p.m., 3 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 1:00 p.m. to 1:00 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	Commercial	65.9	58.5	66.1	58.7	65.5	58.0	65.4	58.0
ML2	Residential	**69.1**	**61.1**	**69.3**	**61.3**	**68.8**	**60.7**	**68.7**	**60.7**
ML3	Commercial	68.1	60.3	68.3	60.5	67.7	59.8	67.7	59.8
ML4	Commercial	68.8	60.8	69.0	61.0	68.4	60.3	68.3	60.3

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 (2014), future (2035) No Build condition, and future (2035) Build condition.

Existing (2014) daytime modeled noise levels at the modeled receptor locations range from 53.2 dBA (L_{10}) to 71.5 dBA (L_{10}); nighttime noise levels range from 51.8 dBA (L_{10}) to 69.5 dBA (L_{10}). Modeled noise receptors exceeded State daytime standards (L_{10}) at 68 of 250 modeled receptor locations under existing (2014) conditions. Modeled noise receptors exceeded State nighttime standards (L_{10}) at 75 of 250 modeled receptor locations under existing (2014) conditions. Modeled noise receptors exceeded FHWA criteria (L_{10}) at 107 of 250 modeled receptor locations under existing (2014) conditions

Existing (2014) daytime modeled noise levels at the modeled receptor locations range from 48.7 dBA (L_{50}) to 63.0 dBA (L_{50}); nighttime noise levels range from 46.1 dBA (L_{50}) to 60.5 dBA (L_{50}). Modeled noise receptors exceeded State daytime standards (L_{50}) at 13 of 250 modeled receptor locations under existing (2014) conditions. Modeled noise receptors exceeded State nighttime standards (L_{50}) at 72 of 250 modeled receptor locations under existing (2014) conditions.

Future (2035) No Build daytime modeled noise levels at the modeled receptor locations range from 54.7 dBA (L_{10}) to 73.4 dBA (L_{10}); nighttime noise levels range from 53.4 dBA (L_{10}) to 71.6 dBA (L_{10}). Modeled noise receptors exceeded State daytime standards (L_{10}) at 139 of 250 modeled receptor locations under No Build (2035) conditions. Modeled noise receptors exceeded State nighttime standards (L_{10}) at 169 of 250 modeled receptor locations under No

Build (2035) conditions. Modeled noise receptors exceeded FHWA criteria (L_{10}) at 125 of 250 modeled receptor locations under existing (2014) conditions

Future (2035) No Build daytime modeled noise levels at the modeled receptor locations range from 49.9 dBA (L_{50}) to 65.7 dBA (L_{50}); nighttime noise levels range from 49.1 dBA (L_{50}) to 63.3 dBA (L_{50}). Modeled noise receptors exceeded State daytime standards (L_{50}) at 61 of 250 modeled receptor locations under No Build (2035) conditions. Modeled noise receptors exceeded State nighttime standards (L_{50}) at 78 of 250 modeled receptor locations under No Build (2035) conditions.

Future (2035) Build daytime modeled noise levels at the modeled receptor locations range from 54.4 dBA (L_{10}) to 71.7 dBA (L_{10}); nighttime noise levels range from 53.2 dBA (L_{10}) to 70.7 dBA (L_{10}). Modeled noise receptors exceeded State daytime standards (L_{10}) at 140 of 240 modeled receptor locations under Build (2035) conditions. Modeled noise receptors exceeded State nighttime standards (L_{10}) at 160 of 240 modeled receptor locations under Build (2035) conditions. Modeled noise receptors exceeded FHWA criteria (L_{10}) at 126 of 240 modeled receptor locations under existing (2014) conditions

Future (2035) Build daytime modeled noise levels at the modeled receptor locations range from 49.4 dBA (L_{50}) to 64.0 dBA (L_{50}); nighttime noise levels range from 48.6 dBA (L_{50}) to 62.3 dBA (L_{50}). Modeled noise receptors exceeded State daytime standards (L_{50}) at 18 of 240 modeled receptor locations under Build (2035) conditions. Modeled noise receptors exceeded State nighttime standards (L_{50}) at 66 of 240 modeled receptor locations under Build (2035) conditions.

Modeled noise level fluctuations (daytime and nighttime) range from -2.8 dBA to 7.8 dBA for existing receptor locations when comparing the Build (2035) to the existing (2014) 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 27 locations within the project study area. Appendix C Figures 1 through 10 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 12 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 – North side of TH 23 between CR 31 and 199th

Land uses north of TH 23 between CR 31 and 199th Avenue consist of a mix of commercial and residential buildings, and a portion of the Glacier Lakes State Trail.

The proposed Highway 23 alignment in this noise area does not bring the mainline closer to the existing receptors. It expands the mainline away from this noise area, putting more traffic further away from this noise area.

Noise levels were modeled at 20 receptor locations in Area 1. Modeled noise levels exceed State daytime standards at 2 of the 20 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 4 of 20 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 20 receptor locations with future (2035) Build conditions.

5.2.1.1 Barrier SB 1

An approximately 1,305 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 at CSAH 31 to mitigate impacts to receptors "r1" and "r2". The barrier provides a reduction that varies from 0.8 dBA to 5.4 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.1.2 Barrier SB 2

An approximately 953 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "r3". The barrier includes a gap for the driveway access to the receptor and provides a reduction of 1.4 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.1.3 Barrier SB 3

An approximately 509 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "c1". The barrier includes a gap for the driveway access to the receptor and provides a reduction of 1.3 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.1.4 Barrier SB 4

An approximately 415 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "r5" and "c7". The barrier provides a reduction that varies from 7.0 dBA to 7.9 dBA. The cost effectiveness of the 20 foot high barrier is $74,000 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed

An approximately 415 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "r5" and "c7". The barrier provides a reduction that varies from 5.7 dBA to 6.2 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.2 Noise Area 2 – South side of TH 23 between CR 31 and 199th

Land uses south of TH 23 between CR 31 and 199th Avenue consist of a single commercial and single residential 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.

Noise levels were modeled at 2 receptor locations in Area 2. Modeled noise levels exceed State daytime standards at 1 of the 2 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 1 of 2 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 2 receptor locations with future (2035) Build conditions.

5.2.2.1 Barrier NB 1

An approximately 614 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 at 199th Avenue to mitigate impacts to receptors “r6” and “c8”. The barrier provides a reduction that varies from 4.0 dBA to 6.4 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 – North side of TH 23 between 199th and 115th

Land uses north of TH 23 between 199th Avenue and 115th Street consist of only the Glacier Lakes State Trail.

The proposed Highway 23 alignment in this noise area does not bring the mainline closer to the existing receptors. It expands the mainline away from this noise area, putting more traffic further away from this noise area.

Noise levels were modeled at 28 receptor locations in Area 3. Modeled noise levels exceed State daytime standards at 14 of the 28 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 10 of 28 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 18 of 28 receptor locations with future (2035) Build conditions.

5.2.3.1 Barrier SB 5

An approximately 2,709 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT44” through “GLT66”. The barrier provides a reduction that varies from 2.7 dBA to 12.2 dBA. The cost effectiveness of the 20 foot high barrier is $81,969 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 2,709 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT44” through “GLT66”. The barrier provides a reduction that varies from 1.9 dBA to 8.9 dBA. The cost effectiveness of the 15 foot high barrier is $66,958 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 2,709 foot long, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT44” through “GLT66”. The barrier provides a reduction that varies from 1.0 dBA to 4.8 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.3.2 Barrier SB 6

An approximately 1,797 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT69” through “GLT85”. The barrier provides a reduction that varies from 6.6 dBA to 9.8 dBA. The cost effectiveness of the 20 foot high barrier is $77,867 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 1,797 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT69” through “GLT85”. The barrier provides a reduction that varies from 3.0 dBA to 6.6 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 199th and 115th

Land uses south of TH 23 between 199th Avenue and 115th Street consist of a mix of both commercial and residential 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 supporting roadway design removes receptors “c2” and “r13”.

Noise levels were modeled at 11 receptor locations in Area 4. Modeled noise levels exceed State daytime standards at 3 of the 11 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 8 of 11 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 11 receptor locations with future (2035) Build conditions.

5.2.4.1 Barrier NB 2

An approximately 854 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r4”. The barrier provides a reduction of 5.6 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.4.2 Barrier NB 3

An approximately 2,185 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r7”, “r8”, and “r9”. The barrier provides a reduction that varies from 3.5 dBA to 8.7 dBA. The cost effectiveness of the 20 foot high barrier is $428,000 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 receptor “r8”.

5.2.4.2.1 *Barrier NB 3a*

An optimum noise barrier, approximately 477 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r8”. The barrier provides a reduction of 7.1 dBA. The cost effectiveness of the 20 foot high barrier is $172,800 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 477 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r8”. The barrier provides a reduction of 4.8 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.4.3 Barrier NB 4

An approximately 2,443 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r10” to “r17”. The barrier provides a reduction that varies from 3.7 dBA to 8.8 dBA. The cost effectiveness of the 20 foot high barrier is $239,800 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 (4 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 “r14” to “r17”.

5.2.4.3.1 *Barrier NB 4a*

An optimum noise barrier, approximately 1,242 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r14” through “r17”. The barrier provides a reduction that varies from 1.7 dBA to 8.6 dBA. The cost effectiveness of the 20 foot high barrier is $159,600 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 1,242 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r14” through “r17”. The barrier provides a reduction that varies from 0.8 dBA to 5.5 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 – North side of TH 23 between 115th and CR 135

Land uses north of TH 23 between 115th Street and CR 135 consist mainly of the Glacier Lakes State Trail with a single commercial receptor.

The proposed Highway 23 alignment in this noise area does not bring the mainline closer to the existing receptors. It expands the mainline away from this noise area, putting more traffic further away from this noise area.

Noise levels were modeled at 31 receptor locations in Area 5. Modeled noise levels exceed State daytime standards at 29 of the 31 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 27 of 31 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 30 of 31 receptor locations with future (2035) Build conditions.

5.2.5.1 Barrier SB 7

An approximately 6,077 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT88” through “GLT146” and “c4”. The barrier provides a reduction that varies from 4.3 dBA to 12.4 dBA. The cost effectiveness of the 20 foot high barrier is $80,427 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 6,077 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT88” through “GLT146” and “c4”. The barrier provides a reduction that varies from 2.7 dBA to 9.8 dBA. The cost effectiveness of the 15 foot high barrier is $60,463 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 6,077 foot long, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT88” through “GLT146” and “c4”. The barrier provides a reduction that varies from 1.1 dBA to 6.4 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 115th and CR 135

Land uses south of TH 23 between 115th Street and CR 135 consist of a spread out residential buildings and a single proposed trail receptor for the new trail underpass connection.

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 supporting roadway design removes receptor “r31”

Noise levels were modeled at 15 receptor locations in Area 6. Modeled noise levels exceed State daytime standards at 3 of the 15 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 13 of 15 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 2 of 15 receptor locations with future (2035) Build conditions.

5.2.6.1 Barrier NB 5

An approximately 883 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r19” through “r22”. The barrier provides a reduction that varies from 2.9 dBA to 5.3 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.6.2 Barrier NB 6

An approximately 2,124 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r30” through “r36” and “nT1”. The barrier provides a reduction that varies from 3.7 dBA to 9.9 dBA. The cost effectiveness of the 20 foot high barrier is $207,900 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 2,124 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r30” through “r36” and “nT1”. The barrier provides a reduction that varies from 1.8 dBA to 7.5 dBA. The cost effectiveness of the 15 foot high barrier is $628,000 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 either a 20 foot high or 15 foot high noise barrier (3 or 1 receptors respectively), 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 receptor “nT1”.

5.2.6.2.1 *Barrier NB 6a*

An optimum noise barrier, approximately 411 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “nT1”. The barrier provides a reduction of 6.5 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 – North side of TH 23 between CR 135 and CR 2

Land uses north of TH 23 between CR 135 and CR 2 consist mainly of the Glacier Lakes State Trail with a single industrial receptor.

The proposed Highway 23 alignment in this noise area does not bring the mainline closer to the existing receptors. It expands the mainline away from this noise area, putting more traffic further away from this noise area.

Noise levels were modeled at 29 receptor locations in Area 7. Modeled noise levels exceed State daytime standards at 28 of the 29 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 27 of 29 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 28 of 29 receptor locations with future (2035) Build conditions.

5.2.7.1 Barrier SB 8

An approximately 1,791 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT148” through “GLT164” and “I1”. The barrier

provides a reduction that varies from 6.1 dBA to 11.2 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 north side of TH 23 to mitigate impacts to receptors "GLT148" through "GLT164" and "I1". The barrier provides a reduction that varies from 3.0 dBA to 7.7 dBA. The cost effectiveness of the 15 foot high barrier is $66,013 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, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT148" through "GLT164" and "I1". The barrier provides a reduction that varies from 1.0 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 SB 9

An approximately 3,705 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT166" through "GLT202". The barrier provides a reduction that varies from 4.9 dBA to 12.1 dBA. The cost effectiveness of the 20 foot high barrier is $81,333 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 3,705 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT166" through "GLT202". The barrier provides a reduction that varies from 3.9 dBA to 8.9 dBA. The cost effectiveness of the 15 foot high barrier is $61,239 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 3,705 foot long, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT166" through "GLT202". The barrier provides a reduction that varies from 2.3 dBA to 4.9 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 CR 135 and CR 106

Land uses south of TH 23 between CR 135 and CR 106 consist of residential buildings and the Old Wagon Campground.

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 supporting roadway design removes receptors "r40", "r41", "r42", and "r50".

Noise levels were modeled at 14 receptor locations in Area 8. Modeled noise levels exceed State daytime standards at 5 of the 14 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 10 of 14 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 0 of 14 receptor locations with future (2035) Build conditions.

5.2.8.1 Barrier NB 7

An approximately 936 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors "owc1" through "owc4". The barrier provides a reduction that varies from 2.4 dBA to 4.0 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.8.2 Barrier NB 8

An approximately 2,043 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptors “r43” through “r49”. The barrier provides a reduction that varies from 2.1 dBA to 5.8 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 – North side of TH 23 between CR 2 and 240th

Land uses north of TH 23 between CR 2 and 240th Avenue consist of mainly the Glacier Lakes State Trail with a small mix of residential and commercial buildings.

The proposed Highway 23 alignment in this noise area varies from the existing alignment and thus brings the mainline closer to the existing receptors in some areas and further away in some areas.

Noise levels were modeled at 51 receptor locations in Area 9. Modeled noise levels exceed State daytime standards at 43 of the 51 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 31 of 51 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 43 of 51 receptor locations with future (2035) Build conditions.

5.2.9.1 Barrier SB 10

An approximately 3,702 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT204” through “GLT240”, ”r51” and “c10”. The barrier provides a reduction that varies from 1.8 dBA to 10.4 dBA. The cost effectiveness of the 20 foot high barrier is $76,989 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 3,702 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT204” through “GLT240”, ”r51” and “c10”. The barrier provides a reduction that varies from 1.3 dBA to 6.7 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.9.2 Barrier SB 11

An approximately 2,012 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT242” through “GLT260”. The barrier provides a reduction that varies from 6.4 dBA to 11.0 dBA. The cost effectiveness of the 20 foot high barrier is $78,680 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 2,012 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT242” through “GLT260”. The barrier provides a reduction that varies from 5.1 dBA to 7.7 dBA. The cost effectiveness of the 15 foot high barrier is $59,440 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 2,012 foot long, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT242” through “GLT260”. The barrier provides a reduction that varies from 2.9 dBA to 3.8 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.9.3 Barrier SB 12

An approximately 1,371 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “GLT262” through “GLT274”. The barrier provides a

reduction that varies from 7.7 dBA to 11.5 dBA. The cost effectiveness of the 20 foot high barrier is $75,771 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 1,371 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT262" through "GLT274". The barrier provides a reduction that varies from 6.0 dBA to 8.3 dBA. The cost effectiveness of the 15 foot high barrier is $57,443 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 1,371 foot long, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT262" through "GLT274". The barrier provides a reduction that varies from 3.3 dBA to 4.3 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.9.4 Barrier SB 13

An approximately 1,797 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT276" through "GLT292", "r90" and ""r91". The barrier provides a reduction that varies from 1.0 dBA to 11.4 dBA. The cost effectiveness of the 20 foot high barrier is $70,080 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 1,797 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT276" through "GLT292", "r90" and ""r91". The barrier provides a reduction that varies from 0.7 dBA to 8.2 dBA. The cost effectiveness of the 15 foot high barrier is $66,238 per benefitted receptor. The noise barrier does not meet MnDOT's minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 1,797 foot long, 10 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "GLT276" through "GLT292", "r90" and ""r91". The barrier provides a reduction that varies from 0.3 dBA to 4.2 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 CR 106 and 240th

Land uses south of TH 23 between CR 106 and 240th Avenue consist of a mainly residential with a mix of commercial buildings.

The proposed Highway 23 alignment in this noise area varies from the existing alignment and thus brings the mainline closer to the existing receptors in some areas and further away in some areas. The proposed supporting roadway design removes receptors "r55", "r56", "r57", and "r58".

Noise levels were modeled at 30 receptor locations in Area 10. Modeled noise levels exceed State daytime standards at 9 of the 30 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 23 of 30 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 30 receptor locations with future (2035) Build conditions.

5.2.10.1 Barrier NB 9

An approximately 1,914 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to the residential and commercial receptors in the community of Haywick. Due to highway access at 232nd Avenue, CR 2, and a commercial access, the

noise barrier length is limited and divided into two sections; one barrier is 906 foot long and the second is 1008 foot long.

The combined barriers provides a reduction that varies from 1.1 dBA to 6.2 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.10.2 Barrier NB 10

An approximately 385 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor "r92". The barrier includes a gap for the driveway access to the receptor and provides a reduction of 3.1 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 – North side of TH 23 between 240th and CR 20

Land uses north of TH 23 between 240th Avenue and CR 20 consist of spread out residential and commercial buildings and a portion of the Glacier Lakes State Trail.

The proposed Highway 23 alignment in this noise area varies from the existing alignment and thus brings the mainline closer to the existing receptors in some areas and further away in some areas. The proposed supporting roadway design removes receptors "r95" and "r97".

Noise levels were modeled at 16 receptor locations in Area 11. Modeled noise levels exceed State daytime standards at 1 of the 16 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 3 of 16 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 16 receptor locations with future (2035) Build conditions.

5.2.11.1 Barrier SB 14

An approximately 1,070 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors "r93" and "r94". The barrier includes a gap for 175th Street and provides a reduction that varies from 3.5 dBA to 7.6 dBA. The cost effectiveness of the 20 foot high barrier is $392,000 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 (1 receptor), 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 receptor "r94".

5.2.11.1.1 *Barrier SB 14a*

An optimum noise barrier, approximately 403 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "r94". The barrier provides a reduction of 7.0 dBA. The cost effectiveness of the 20 foot high barrier is $143,200 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 403 foot long, 15 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptor "r94". The barrier provides a reduction of 4.7 dBA. The noise barrier does not meet MnDOT's 7dBA noise reduction design goal and is therefore not proposed.

5.2.11.2 Barrier SB 15

An approximately 1,411 foot long, 20 foot high noise barrier was modeled on the north side of TH 23 to mitigate impacts to receptors “r98” and “c21”. The barrier includes a gap for the driveway access to the receptors and provides a reduction that varies from 6.4 dBA to 6.5 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 – South side of TH 23 between 240th and CR 20

Land uses south of TH 23 between 240th Avenue and CR 20 consist of a spread out mix of both commercial and residential buildings.

The proposed Highway 23 alignment in this noise area varies from the existing alignment and thus brings the mainline closer to the existing receptors in some areas and further away in some areas.

Noise levels were modeled at 4 receptor locations in Area 12. Modeled noise levels exceed State daytime standards at 1 of the 4 receptor locations with future (2035) Daytime Build conditions and State nighttime standards at 3 of 4 receptor locations with future (2035) Nighttime Build conditions. Modeled noise levels exceed Federal Standards at 1 of 4 receptor locations with future (2035) Build conditions.

5.2.12.1 Barrier NB 11

An approximately 736 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r96”. The barrier provides a reduction of 7.0 dBA. The cost effectiveness of the 20 foot high barrier is $258,400 per benefitted receptor. The noise barrier does not meet MnDOT’s minimum $43,500 cost effectiveness criteria and is not proposed.

An approximately 736 foot long, 15 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r96”. 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.

5.2.12.2 Barrier NB 12

An approximately 682 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r99”. The barrier provides a reduction of 6.8 dBA. The noise barrier does not meet MnDOT’s 7dBA noise reduction design goal and is therefore not proposed.

5.2.12.3 Barrier NB 13

An approximately 1,518 foot long, 20 foot high noise barrier was modeled on the south side of TH 23 to mitigate impacts to receptor “r100”. The barrier provides a reduction of 5.2 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 (2014) conditions.

In general, the construction of the TH 23 South Gap Project will result in increases in traffic noise levels compared to the existing conditions. Modeled build (2035) condition noise levels (daytime and nighttime) vary from -2.8 dBA to 7.8 dBA from existing (2014) conditions.

Acoustic reasonableness and cost effectiveness were calculated for each noise barrier evaluated. 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 South Gap Project.

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

List of Tables

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 2014 Conditions		2035							
									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 - North side of TH 23 between CR 31 and 199th Avenue																
r1	Residential	NAC-1	65	60	B	70	57.6	52.8	59.3	55.3	1.7	2.5	59.3	55.4	1.7	2.6
r2	Residential	NAC-1	65	60	B	70	64.8	58.1	**66.7**	**60.8**	1.9	2.7	**66.9**	**60.9**	2.1	2.8
r3	Residential	NAC-1	65	60	B	70	59.0	53.8	60.8	56.3	1.8	2.5	61.1	56.6	2.1	2.8
r5	Residential	NAC-1	65	60	B	70	**67.6**	**60.2**	**69.6**	**63.1**	2.0	2.9	**69.4**	**62.6**	1.8	2.4
c1	Commercial	NAC-2	70	65	E	75	63.9	57.4	65.8	60.2	1.9	2.8	65.9	60.2	2.0	2.8
c7	Commercial	NAC-2	70	65	E	75	67.6	60.2	69.6	63.1	2.0	2.9	69.4	62.6	1.8	2.4
GLT2	Trail	NAC-2	70	65	C	70	54.2	49.9	55.9	52.3	1.7	2.4	56.2	52.6	2.0	2.7
GLT4	Trail	NAC-2	70	65	C	70	54.8	50.4	56.5	52.9	1.7	2.5	56.8	53.1	2.0	2.7
GLT6	Trail	NAC-2	70	65	C	70	55.4	50.9	57.1	53.3	1.7	2.4	57.4	53.6	2.0	2.7
GLT8	Trail	NAC-2	70	65	C	70	55.9	51.3	57.6	53.8	1.7	2.5	57.9	54.0	2.0	2.7
GLT10	Trail	NAC-2	70	65	C	70	56.3	51.6	58.0	54.1	1.7	2.5	58.3	54.4	2.0	2.8
GLT12	Trail	NAC-2	70	65	C	70	56.6	51.9	58.3	54.4	1.7	2.5	58.7	54.7	2.1	2.8
GLT14	Trail	NAC-2	70	65	C	70	57.0	52.2	58.7	54.7	1.7	2.5	59.1	55.0	2.1	2.8
GLT16	Trail	NAC-2	70	65	C	70	57.4	52.5	59.2	55.0	1.8	2.5	59.5	55.3	2.1	2.8
GLT18	Trail	NAC-2	70	65	C	70	57.8	52.8	59.6	55.4	1.8	2.6	60.0	55.7	2.2	2.9
GLT20	Trail	NAC-2	70	65	C	70	58.3	53.2	60.1	55.7	1.8	2.5	60.4	56.1	2.1	2.9
GLT22	Trail	NAC-2	70	65	C	70	58.8	53.6	60.6	56.1	1.8	2.5	60.9	56.4	2.1	2.8
GLT24	Trail	NAC-2	70	65	C	70	59.3	54.0	61.1	56.6	1.8	2.6	61.5	56.9	2.2	2.9
GLT26	Trail	NAC-2	70	65	C	70	59.9	54.4	61.7	57.0	1.8	2.6	62.0	57.3	2.1	2.9
GLT28	Trail	NAC-2	70	65	C	70	60.5	54.9	62.4	57.5	1.9	2.6	62.6	57.8	2.1	2.9
Noise Area 2 - South side of TH 23 between CR 31 and 199th Avenue																
r6	Residential	NAC-1	65	60	B	70	63.8	57.3	**65.7**	**60.1**	1.9	2.8	**67.8**	**61.6**	4.0	4.3
c8	Commercial	NAC-2	70	65	E	75	61.0	55.2	62.9	57.8	1.9	2.6	64.7	59.3	3.7	4.1
Noise Area 3 - North side of TH 23 between 199th Avenue and 115th Street																
GLT30	Trail	NAC-2	70	65	C	70	61.2	55.4	63.1	58.1	1.9	2.7	63.3	58.3	2.1	2.9
GLT32	Trail	NAC-2	70	65	C	70	62.0	56.0	63.8	58.7	1.8	2.7	64.0	58.8	2.0	2.8
GLT34	Trail	NAC-2	70	65	C	70	62.8	56.6	64.7	59.3	1.9	2.7	64.8	59.3	2.0	2.7
GLT36	Trail	NAC-2	70	65	C	70	63.7	57.3	65.6	60.0	1.9	2.7	65.6	60.0	1.9	2.7
GLT38	Trail	NAC-2	70	65	C	70	64.6	57.9	66.5	60.7	1.9	2.8	66.5	60.6	1.9	2.7
GLT40	Trail	NAC-2	70	65	C	70	65.4	58.5	67.3	61.3	1.9	2.8	67.3	61.1	1.9	2.6
GLT42	Trail	NAC-2	70	65	C	70	65.9	58.9	67.9	61.7	2.0	2.8	67.8	61.4	1.9	2.5
GLT44	Trail	NAC-2	70	65	C	70	67.3	59.9	69.3	62.7	2.0	2.8	69.0	62.3	1.7	2.4
GLT46	Trail	NAC-2	70	65	C	70	68.0	60.5	**70.1**	63.3	2.1	2.8	69.7	62.7	1.7	2.2
GLT48	Trail	NAC-2	70	65	C	70	69.1	61.3	**71.2**	64.2	2.1	2.9	**70.9**	63.4	1.8	2.1
GLT50	Trail	NAC-2	70	65	C	70	69.5	61.7	**71.6**	64.5	2.1	2.8	**71.3**	63.7	1.8	2.0
GLT52	Trail	NAC-2	70	65	C	70	69.8	61.8	**71.8**	64.7	2.0	2.9	**71.4**	63.8	1.6	2.0
GLT54	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**71.4**	63.8	1.5	1.9
GLT56	Trail	NAC-2	70	65	C	70	69.9	61.9	**71.9**	64.8	2.0	2.9	**71.3**	63.8	1.4	1.9
GLT58	Trail	NAC-2	70	65	C	70	69.8	61.9	**71.9**	64.7	2.1	2.8	**71.3**	63.7	1.5	1.8
GLT60	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**71.4**	63.8	1.5	1.9
GLT62	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**71.3**	63.7	1.4	1.8
GLT64	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.3**	63.8	1.3	1.8
GLT66	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**71.3**	63.7	1.4	1.8
GLT69	Trail	NAC-2	70	65	C	70	69.5	61.6	**71.6**	64.5	2.1	2.9	**70.9**	63.4	1.4	1.8
GLT71	Trail	NAC-2	70	65	C	70	68.9	61.1	**70.9**	64.0	2.0	2.9	**70.3**	63.0	1.4	1.9
GLT73	Trail	NAC-2	70	65	C	70	68.1	60.6	**70.1**	63.4	2.0	2.8	69.5	62.5	1.4	1.9
GLT75	Trail	NAC-2	70	65	C	70	67.2	59.9	69.2	62.7	2.0	2.8	68.6	61.9	1.4	2.0
GLT77	Trail	NAC-2	70	65	C	70	67.2	59.9	69.2	62.7	2.0	2.8	68.6	61.9	1.4	2.0
GLT79	Trail	NAC-2	70	65	C	70	67.3	60.0	69.4	62.8	2.1	2.8	68.7	61.9	1.4	1.9
GLT81	Trail	NAC-2	70	65	C	70	68.4	60.8	**70.4**	63.6	2.0	2.8	69.6	62.4	1.2	1.6
GLT83	Trail	NAC-2	70	65	C	70	69.1	61.3	**71.2**	64.2	2.1	2.9	**70.2**	62.8	1.1	1.5
GLT85	Trail	NAC-2	70	65	C	70	69.8	61.9	**71.9**	64.7	2.1	2.8	**70.8**	63.1	1.0	1.2
Noise Area 4 - South side of TH 23 between 199th Avenue and 115th Street																
c2	Commercial	NAC-2	70	65	E	75	64.7	57.3	66.7	60.1	2.0	2.8	N/A	N/A		

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 2014 Conditions		2035							
									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
c3	Commercial	NAC-2	70	65	E	75	59.7	53.3	61.7	56.0	2.0	2.7	62.7	57.3	3.0	4.0
r4	Residential	NAC-1	65	60	B	70	60.1	54.6	61.9	57.2	1.8	2.6	63.6	58.5	3.5	3.9
r7	Residential	NAC-1	65	60	B	70	58.4	53.3	60.2	55.8	1.8	2.5	61.5	56.9	3.1	3.6
r8	Residential	NAC-1	65	60	B	70	64.6	57.9	**66.5**	**60.6**	1.9	2.7	**69.1**	**62.4**	4.5	4.5
r9	Residential	NAC-1	65	60	B	70	61.9	56.0	63.8	58.7	1.9	2.7	**65.8**	**60.1**	3.9	4.1
r10	Residential	NAC-1	65	60	B	70	57.7	52.7	59.5	55.2	1.8	2.5	61.0	56.6	3.3	3.9
r11	Residential	NAC-1	65	60	B	70	61.3	55.4	63.1	58.1	1.8	2.7	**65.4**	59.8	4.1	4.4
r12	Residential	NAC-1	65	60	B	70	59.0	53.7	60.7	56.3	1.7	2.6	62.4	57.7	3.4	4.0
r13	Residential	NAC-1	65	60	B	70	62.6	56.5	64.5	59.2	1.9	2.7	N/A	N/A		
r14	Residential	NAC-1	65	60	B	70	58.7	53.6	61.4	53.8	2.7	0.2	62.8	56.2	4.1	2.6
Noise Area 5 - North side of TH 23 between 115th Street and CR 135																
c4	Commercial	NAC-2	70	65	E	75	63.9	57.4	65.8	60.2	1.9	2.8	65.5	59.7	1.6	2.3
GLT88	Trail	NAC-2	70	65	C	70	**70.3**	62.2	**72.4**	**65.1**	2.1	2.9	**71.2**	63.3	0.9	1.1
GLT90	Trail	NAC-2	70	65	C	70	**70.4**	62.3	**72.5**	**65.2**	2.1	2.9	**71.3**	63.4	0.9	1.1
GLT92	Trail	NAC-2	70	65	C	70	**70.3**	62.2	**72.4**	**65.1**	2.1	2.9	**71.4**	63.4	1.1	1.2
GLT94	Trail	NAC-2	70	65	C	70	**70.3**	62.2	**72.4**	**65.1**	2.1	2.9	**71.4**	63.4	1.1	1.2
GLT96	Trail	NAC-2	70	65	C	70	**70.1**	62.0	**72.1**	64.9	2.0	2.9	**71.2**	63.4	1.1	1.4
GLT98	Trail	NAC-2	70	65	C	70	**70.3**	62.2	**72.3**	**65.1**	2.0	2.9	**71.4**	63.5	1.1	1.3
GLT100	Trail	NAC-2	70	65	C	70	**70.2**	62.2	**72.3**	**65.1**	2.1	2.9	**71.4**	63.5	1.2	1.3
GLT102	Trail	NAC-2	70	65	C	70	**70.2**	62.1	**72.3**	**65.0**	2.1	2.9	**71.4**	63.6	1.2	1.5
GLT104	Trail	NAC-2	70	65	C	70	**70.2**	62.1	**72.2**	**65.0**	2.0	2.9	**71.5**	63.7	1.3	1.6
GLT106	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	64.9	2.1	2.8	**71.5**	63.8	1.4	1.7
GLT108	Trail	NAC-2	70	65	C	70	69.8	61.6	**71.9**	64.5	2.1	2.9	**71.5**	63.8	1.7	2.2
GLT110	Trail	NAC-2	70	65	C	70	69.7	61.5	**71.8**	64.4	2.1	2.9	**71.4**	63.8	1.7	2.3
GLT112	Trail	NAC-2	70	65	C	70	69.8	61.6	**71.9**	64.5	2.1	2.9	**71.6**	63.9	1.8	2.3
GLT114	Trail	NAC-2	70	65	C	70	**70.0**	61.9	**72.1**	64.8	2.1	2.9	**71.7**	64.0	1.7	2.1
GLT116	Trail	NAC-2	70	65	C	70	**70.3**	62.2	**72.3**	**65.1**	2.0	2.9	**71.7**	64.0	1.4	1.8
GLT118	Trail	NAC-2	70	65	C	70	**70.2**	62.2	**72.3**	**65.0**	2.1	2.8	**71.6**	64.0	1.4	1.8
GLT120	Trail	NAC-2	70	65	C	70	**70.2**	62.2	**72.3**	**65.0**	2.1	2.8	**71.6**	64.0	1.4	1.8
GLT122	Trail	NAC-2	70	65	C	70	**70.3**	62.2	**72.3**	**65.1**	2.0	2.9	**71.6**	63.9	1.3	1.7
GLT124	Trail	NAC-2	70	65	C	70	**70.3**	62.2	**72.4**	**65.1**	2.1	2.9	**71.6**	64.0	1.3	1.8
GLT126	Trail	NAC-2	70	65	C	70	**70.3**	62.2	**72.4**	**65.1**	2.1	2.9	**71.6**	63.9	1.3	1.7
GLT128	Trail	NAC-2	70	65	C	70	**70.2**	62.2	**72.3**	**65.1**	2.1	2.9	**71.6**	63.9	1.4	1.7
GLT130	Trail	NAC-2	70	65	C	70	**70.2**	62.2	**72.3**	**65.1**	2.1	2.9	**71.5**	63.9	1.3	1.7
GLT132	Trail	NAC-2	70	65	C	70	**70.2**	62.2	**72.3**	**65.1**	2.1	2.9	**71.6**	63.9	1.4	1.7
GLT134	Trail	NAC-2	70	65	C	70	**70.2**	62.2	**72.3**	**65.1**	2.1	2.9	**71.5**	63.9	1.3	1.7
GLT136	Trail	NAC-2	70	65	C	70	**70.2**	62.2	**72.3**	**65.1**	2.1	2.9	**71.5**	63.9	1.3	1.7
GLT138	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**71.5**	63.9	1.4	1.8
GLT140	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**71.1**	63.6	1.0	1.5
GLT142	Trail	NAC-2	70	65	C	70	**70.2**	62.1	**72.3**	**65.0**	2.1	2.9	**70.6**	63.1	0.4	1.0
GLT144	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	69.6	61.9	-0.5	-0.2
GLT146	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	64.9	2.1	2.8	**70.8**	63.4	0.7	1.3
Noise Area 6 - South side of TH 23 between 115th Street and CR 135																
r15	Residential	NAC-1	65	60	B	70	59.0	53.8	60.8	56.4	1.8	2.6	62.7	57.8	3.7	4.0
r16	Residential	NAC-1	65	60	B	70	63.8	57.4	**65.7**	**60.1**	1.9	2.7	**69.2**	**62.3**	5.4	4.9
r17	Residential	NAC-1	65	60	B	70	63.8	57.4	**65.7**	**60.1**	1.9	2.7	**69.2**	**62.3**	5.4	4.9
r19	Residential	NAC-1	65	60	B	70	57.4	52.5	59.2	55.0	1.8	2.5	60.8	56.3	3.4	3.8
r20	Residential	NAC-1	65	60	B	70	56.5	51.7	58.2	54.2	1.7	2.5	59.8	55.5	3.3	3.8
r21	Residential	NAC-1	65	60	B	70	58.6	53.4	60.4	56.0	1.8	2.6	62.2	57.4	3.6	4.0
r22	Residential	NAC-1	65	60	B	70	55.8	51.2	57.6	53.7	1.8	2.5	59.0	54.9	3.2	3.7
r29	Residential	NAC-1	65	60	B	70	53.8	49.6	55.5	52.0	1.7	2.4	56.7	53.0	2.9	3.4
r30	Residential	NAC-1	65	60	B	70	62.5	56.4	64.4	59.1	1.9	2.7	**66.5**	**60.5**	4.0	4.1
r31	Residential	NAC-1	65	60	B	70	63.5	57.2	**65.4**	59.9	1.9	2.7	N/A	N/A		
r33	Residential	NAC-1	65	60	B	70	61.1	55.3	62.9	57.9	1.8	2.6	64.7	59.3	3.6	4.0
r34	Residential	NAC-1	65	60	B	70	58.6	53.4	60.4	55.9	1.8	2.5	61.9	57.1	3.3	3.7

Table 5
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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 2014 Conditions		2035							
									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
r35	Residential	NAC-1	65	60	B	70	57.5	52.5	59.2	55.0	1.7	2.5	60.6	56.2	3.1	3.7
r36	Residential	NAC-1	65	60	B	70	59.0	53.7	60.8	56.3	1.8	2.6	62.3	57.5	3.3	3.8
nT1	Trail	NAC-2	70	65	C	70	N/A	N/A	N/A	N/A			68.4	61.6		
Noise Area 7 - North side of TH 23 between CR 135 and CR 2																
I1	Industrial	NAC-3	80	75	F	--	64.0	57.5	65.9	60.3	1.9	2.8	65.8	60.1	1.8	2.6
GLT148	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**70.9**	63.5	0.8	1.4
GLT150	Trail	NAC-2	70	65	C	70	69.8	61.9	**71.9**	64.8	2.1	2.9	**71.3**	63.7	1.5	1.8
GLT152	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**71.5**	63.9	1.4	1.8
GLT154	Trail	NAC-2	70	65	C	70	**70.2**	62.1	**72.2**	**65.0**	2.0	2.9	**71.5**	63.9	1.3	1.8
GLT156	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**71.4**	63.8	1.3	1.7
GLT158	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**71.4**	63.8	1.3	1.7
GLT160	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**71.4**	63.8	1.3	1.7
GLT162	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**71.5**	63.9	1.4	1.8
GLT164	Trail	NAC-2	70	65	C	70	**70.2**	62.1	**72.2**	**65.0**	2.0	2.9	**71.4**	63.8	1.2	1.7
GLT166	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.4**	63.8	1.4	1.8
GLT168	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.4**	63.8	1.4	1.8
GLT170	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.5**	63.9	1.5	1.9
GLT172	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.4**	63.9	1.4	1.9
GLT174	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	64.9	2.1	2.8	**71.4**	63.9	1.3	1.8
GLT176	Trail	NAC-2	70	65	C	70	**70.1**	62.1	**72.2**	**65.0**	2.1	2.9	**71.4**	63.8	1.3	1.7
GLT178	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.3**	63.8	1.3	1.8
GLT180	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**71.3**	63.8	1.4	1.9
GLT182	Trail	NAC-2	70	65	C	70	69.8	61.9	**71.9**	64.7	2.1	2.8	**71.3**	63.8	1.5	1.9
GLT184	Trail	NAC-2	70	65	C	70	69.8	61.9	**71.9**	64.7	2.1	2.8	**71.3**	63.7	1.5	1.8
GLT186	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**71.2**	63.6	1.3	1.7
GLT188	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.0**	64.9	2.0	2.9	**71.1**	63.4	1.1	1.4
GLT190	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.1**	63.5	1.1	1.5
GLT192	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.1**	63.4	1.1	1.4
GLT194	Trail	NAC-2	70	65	C	70	**70.0**	62.0	**72.1**	64.9	2.1	2.9	**71.1**	63.3	1.1	1.3
GLT196	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**71.0**	63.3	1.1	1.4
GLT198	Trail	NAC-2	70	65	C	70	69.9	61.9	**71.9**	64.8	2.0	2.9	**70.9**	63.2	1.0	1.3
GLT200	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**70.9**	63.2	1.0	1.3
GLT202	Trail	NAC-2	70	65	C	70	69.9	61.9	**72.0**	64.8	2.1	2.9	**71.0**	63.2	1.1	1.3
Noise Area 8 - South side of TH 23 between CR 135 and CR 106																
owc1	Residential	NAC-1	65	60	B	70	61.6	55.7	63.5	58.4	1.9	2.7	**65.4**	59.8	3.8	4.1
owc2	Residential	NAC-1	65	60	B	70	61.7	55.8	63.6	58.4	1.9	2.6	**65.4**	59.8	3.7	4.0
owc3	Residential	NAC-1	65	60	B	70	61.6	55.7	63.5	58.4	1.9	2.7	**65.3**	59.7	3.7	4.0
owc4	Residential	NAC-1	65	60	B	70	61.4	55.5	63.2	58.1	1.8	2.6	**65.1**	59.6	3.7	4.1
r40	Residential	NAC-1	65	60	B	70	**68.6**	**61.0**	**70.7**	**63.9**	2.1	2.9	N/A	N/A		
r41	Residential	NAC-1	65	60	B	70	**65.1**	58.4	**67.1**	**61.2**	2.0	2.8	N/A	N/A		
r42	Residential	NAC-1	65	60	B	70	63.3	57.0	**65.2**	59.7	1.9	2.7	N/A	N/A		
r43	Residential	NAC-1	65	60	B	70	61.6	55.7	63.4	58.3	1.8	2.6	**65.6**	59.8	4.0	4.1
r44	Residential	NAC-1	65	60	B	70	59.2	53.9	61.0	56.5	1.8	2.6	62.8	57.8	3.6	3.9
r45	Residential	NAC-1	65	60	B	70	58.0	52.9	59.8	55.5	1.8	2.6	61.3	56.7	3.3	3.8
r47	Residential	NAC-1	65	60	B	70	56.7	51.9	58.4	54.4	1.7	2.5	59.8	55.5	3.1	3.6
r48	Residential	NAC-1	65	60	B	70	57.9	52.9	59.7	55.4	1.8	2.5	61.4	56.7	3.5	3.8
r49	Residential	NAC-1	65	60	B	70	58.7	53.5	60.6	56.0	1.9	2.5	62.4	57.4	3.7	3.9
r50	Residential	NAC-1	65	60	B	70	59.6	54.2	61.4	56.7	1.8	2.5	N/A	N/A		
Noise Area 9 - North side of TH 23 between CR 2 and 240th Avenue																
r51	Residential	NAC-1	65	60	B	70	**65.3**	58.5	**67.1**	**61.1**	1.8	2.6	**66.6**	**60.5**	1.3	2.0
c10	Commercial	NAC-2	70	65	E	75	59.2	53.8	60.9	56.2	1.7	2.4	61.3	56.6	2.1	2.8
r90	Residential	NAC-1	65	60	B	70	57.9	52.8	59.5	55.1	1.6	2.3	59.8	55.3	1.9	2.5
r91	Residential	NAC-1	65	60	B	70	63.2	56.9	64.9	59.3	1.7	2.4	64.4	58.8	1.2	1.9
GLT204	Trail	NAC-2	70	65	C	70	69.9	62.0	**71.9**	64.7	2.0	2.7	**70.9**	63.1	1.0	1.1
GLT206	Trail	NAC-2	70	65	C	70	69.9	61.9	**71.8**	64.6	1.9	2.7	**70.8**	63.0	0.9	1.1

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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 2014 Conditions		2035							
									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
GLT208	Trail	NAC-2	70	65	C	70	69.8	61.8	**71.8**	64.6	2.0	2.8	**70.8**	63.0	1.0	1.2
GLT210	Trail	NAC-2	70	65	C	70	69.9	61.9	**71.8**	64.6	1.9	2.7	**70.9**	63.1	1.0	1.2
GLT212	Trail	NAC-2	70	65	C	70	69.9	61.9	**71.9**	64.6	2.0	2.7	**70.9**	63.1	1.0	1.2
GLT214	Trail	NAC-2	70	65	C	70	69.8	61.8	**71.8**	64.5	2.0	2.7	**70.9**	63.1	1.1	1.3
GLT216	Trail	NAC-2	70	65	C	70	69.8	61.8	**71.8**	64.5	2.0	2.7	**70.9**	63.2	1.1	1.4
GLT218	Trail	NAC-2	70	65	C	70	69.9	61.8	**71.8**	64.5	1.9	2.7	**71.0**	63.3	1.1	1.5
GLT220	Trail	NAC-2	70	65	C	70	69.8	61.8	**71.8**	64.5	2.0	2.7	**71.0**	63.4	1.2	1.6
GLT222	Trail	NAC-2	70	65	C	70	69.8	61.8	**71.7**	64.5	1.9	2.7	**71.0**	63.4	1.2	1.6
GLT224	Trail	NAC-2	70	65	C	70	69.7	61.7	**71.7**	64.4	2.0	2.7	**71.1**	63.5	1.4	1.8
GLT226	Trail	NAC-2	70	65	C	70	69.7	61.7	**71.6**	64.4	1.9	2.7	**71.0**	63.5	1.3	1.8
GLT228	Trail	NAC-2	70	65	C	70	69.7	61.7	**71.6**	64.4	1.9	2.7	**71.0**	63.5	1.3	1.8
GLT230	Trail	NAC-2	70	65	C	70	69.7	61.7	**71.6**	64.4	1.9	2.7	**71.1**	63.5	1.4	1.8
GLT232	Trail	NAC-2	70	65	C	70	69.7	61.7	**71.6**	64.4	1.9	2.7	**71.0**	63.5	1.3	1.8
GLT234	Trail	NAC-2	70	65	C	70	69.6	61.7	**71.6**	64.4	2.0	2.7	**71.0**	63.5	1.4	1.8
GLT236	Trail	NAC-2	70	65	C	70	69.4	61.5	**71.4**	64.2	2.0	2.7	**71.1**	63.5	1.7	2.0
GLT238	Trail	NAC-2	70	65	C	70	68.9	61.1	**70.8**	63.8	1.9	2.7	**71.0**	63.4	2.1	2.3
GLT240	Trail	NAC-2	70	65	C	70	68.0	60.4	69.9	63.1	1.9	2.7	**71.0**	63.4	3.0	3.0
GLT242	Trail	NAC-2	70	65	C	70	67.0	59.7	68.8	62.3	1.8	2.6	**71.0**	63.4	4.0	3.7
GLT244	Trail	NAC-2	70	65	C	70	66.0	59.0	67.8	61.6	1.8	2.6	**71.0**	63.5	5.0	4.5
GLT246	Trail	NAC-2	70	65	C	70	65.2	58.4	67.0	61.0	1.8	2.6	**71.0**	63.5	5.8	5.1
GLT248	Trail	NAC-2	70	65	C	70	64.5	57.9	66.3	60.5	1.8	2.6	**71.0**	63.4	6.5	5.5
GLT250	Trail	NAC-2	70	65	C	70	64.1	57.6	65.9	60.1	1.8	2.5	**71.0**	63.4	6.9	5.8
GLT252	Trail	NAC-2	70	65	C	70	63.8	57.4	65.6	59.9	1.8	2.5	**71.0**	63.4	7.2	6.0
GLT254	Trail	NAC-2	70	65	C	70	63.7	57.3	65.4	59.8	1.7	2.5	**71.0**	63.4	7.3	6.1
GLT256	Trail	NAC-2	70	65	C	70	63.7	57.3	65.4	59.8	1.7	2.5	**71.0**	63.4	7.3	6.1
GLT258	Trail	NAC-2	70	65	C	70	63.7	57.3	65.5	59.8	1.8	2.5	**71.0**	63.4	7.3	6.1
GLT260	Trail	NAC-2	70	65	C	70	63.9	57.4	65.6	59.9	1.7	2.5	**70.9**	63.3	7.0	5.9
GLT262	Trail	NAC-2	70	65	C	70	64.4	57.8	66.4	57.5	2.0	-0.3	**70.7**	63.1	6.3	5.3
GLT264	Trail	NAC-2	70	65	C	70	64.9	58.2	66.6	60.7	1.7	2.5	**70.7**	63.1	5.8	4.9
GLT266	Trail	NAC-2	70	65	C	70	65.6	58.7	67.4	61.2	1.8	2.5	**70.8**	63.2	5.2	4.5
GLT268	Trail	NAC-2	70	65	C	70	66.5	59.3	68.3	61.8	1.8	2.5	**70.8**	63.2	4.3	3.9
GLT270	Trail	NAC-2	70	65	C	70	67.5	60.0	69.2	62.5	1.7	2.5	**70.8**	63.1	3.3	3.1
GLT272	Trail	NAC-2	70	65	C	70	68.4	60.7	**70.2**	63.3	1.8	2.6	**70.7**	63.1	2.3	2.4
GLT274	Trail	NAC-2	70	65	C	70	69.1	61.3	**71.0**	63.8	1.9	2.5	**70.7**	63.1	1.6	1.8
GLT276	Trail	NAC-2	70	65	C	70	69.5	61.6	**71.4**	64.1	1.9	2.5	**70.6**	63.1	1.1	1.5
GLT278	Trail	NAC-2	70	65	C	70	69.6	61.6	**71.5**	64.2	1.9	2.6	**70.7**	63.1	1.1	1.5
GLT280	Trail	NAC-2	70	65	C	70	69.7	61.7	**71.5**	64.2	1.8	2.5	**70.7**	63.1	1.0	1.4
GLT282	Trail	NAC-2	70	65	C	70	69.7	61.7	**71.5**	64.2	1.8	2.5	**70.7**	63.1	1.0	1.4
GLT284	Trail	NAC-2	70	65	C	70	69.7	61.7	**71.5**	64.2	1.8	2.5	**70.6**	63.0	0.9	1.3
GLT286	Trail	NAC-2	70	65	C	70	69.5	61.5	**71.3**	64.1	1.8	2.6	**70.3**	62.8	0.8	1.3
GLT288	Trail	NAC-2	70	65	C	70	69.6	61.6	**71.4**	64.2	1.8	2.6	69.8	62.5	0.2	0.9
GLT290	Trail	NAC-2	70	65	C	70	69.6	61.6	**71.4**	64.1	1.8	2.5	68.8	61.9	-0.8	0.3
GLT292	Trail	NAC-2	70	65	C	70	69.5	61.5	**71.3**	64.1	1.8	2.6	67.6	61.1	-1.9	-0.4
GLT294	Trail	NAC-2	70	65	C	70	69.0	61.2	**70.9**	63.7	1.9	2.5	66.3	60.2	-2.7	-1.0
GLT296	Trail	NAC-2	70	65	C	70	68.0	60.4	69.9	63.0	1.9	2.6	65.2	59.1	-2.8	-1.3
Noise Area 10 - South side of TH 23 between CR 106 and 240th Avenue																
c11	Commercial	NAC-2	70	65	E	75	63.4	56.9	65.2	59.5	1.8	2.6	65.5	59.7	2.1	2.8
r55	Residential	NAC-1	65	60	B	70	**70.1**	**62.0**	**72.0**	**64.7**	1.9	2.7	N/A	N/A		
r56	Residential	NAC-1	65	60	B	70	**71.5**	**63.0**	**73.4**	**65.7**	1.9	2.7	N/A	N/A		
r57	Residential	NAC-1	65	60	B	70	**71.1**	**62.7**	**73.1**	**65.4**	2.0	2.7	N/A	N/A		
r58	Residential	NAC-1	65	60	B	70	**68.5**	**60.7**	**70.5**	**63.4**	2.0	2.7	N/A	N/A		
r60	Residential	NAC-1	65	60	B	70	**65.6**	58.6	**67.5**	**61.1**	1.9	2.5	**65.7**	59.8	0.1	1.2
r61	Residential	NAC-1	65	60	B	70	64.9	58.2	**66.9**	**60.5**	2.0	2.3	**65.2**	59.2	0.3	1.0
r62	Residential	NAC-1	65	60	B	70	64.1	57.5	**66.1**	59.7	2.0	2.2	64.7	58.2	0.6	0.7
r63	Residential	NAC-1	65	60	B	70	60.4	54.0	62.5	55.6	2.1	1.6	61.2	53.8	0.8	-0.2

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 2014 Conditions		2035							
									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	59.3	53.2	61.4	55.0	2.1	1.8	60.4	53.5	1.1	0.3
c12	Commercial	NAC-2	70	65	E	75	58.3	52.5	60.6	53.6	2.3	1.1	59.7	52.2	1.4	-0.3
r65	Residential	NAC-1	65	60	B	70	56.2	50.9	58.1	53.1	1.9	2.2	57.5	52.5	1.3	1.6
r66	Residential	NAC-1	65	60	B	70	55.5	50.3	57.9	51.4	2.4	1.1	57.5	50.8	2.0	0.5
c13	Residential	NAC-1	65	60	B	70	55.7	49.2	57.9	49.9	2.2	0.7	57.6	49.4	1.9	0.2
c14	Residential	NAC-1	65	60	B	70	**69.1**	**61.2**	**71.0**	**63.9**	1.9	2.7	**67.7**	**61.2**	-1.4	0.0
c15	Residential	NAC-1	65	60	B	70	**69.0**	**61.2**	**71.0**	**63.9**	2.0	2.7	**67.4**	**61.0**	-1.6	-0.2
r70	Residential	NAC-1	65	60	B	70	**67.0**	59.7	**68.9**	**62.4**	1.9	2.7	**66.1**	**60.1**	-0.9	0.4
r71	Residential	NAC-1	65	60	B	70	**65.6**	58.6	**67.4**	**61.3**	1.8	2.7	**65.1**	59.4	-0.5	0.8
r72	Residential	NAC-1	65	60	B	70	64.8	58.1	**66.6**	**60.7**	1.8	2.6	64.6	59.1	-0.2	1.0
r73	Residential	NAC-1	65	60	B	70	63.8	57.4	**65.7**	**60.0**	1.9	2.6	63.9	58.6	0.1	1.2
r74	Residential	NAC-1	65	60	B	70	63.6	57.2	**65.4**	59.8	1.8	2.6	63.7	58.4	0.1	1.2
c16	Residential	NAC-1	65	60	B	70	62.8	56.6	64.6	59.1	1.8	2.5	63.1	58.0	0.3	1.4
r76	Residential	NAC-1	65	60	B	70	61.4	55.6	63.2	58.1	1.8	2.5	62.1	57.2	0.7	1.6
r77	Residential	NAC-1	65	60	B	70	61.0	55.3	62.8	57.8	1.8	2.5	61.8	57.0	0.8	1.7
c17	Commercial	NAC-2	70	65	E	75	60.4	51.4	62.5	54.2	2.1	2.8	62.0	53.5	1.6	2.1
r79	Residential	NAC-1	65	60	B	70	**67.1**	59.8	**68.9**	**62.4**	1.8	2.6	**66.1**	**60.2**	-1.0	0.4
r80	Residential	NAC-1	65	60	B	70	63.6	57.3	**65.4**	59.8	1.8	2.5	63.8	58.6	0.2	1.3
r81	Residential	NAC-1	65	60	B	70	**68.1**	**60.6**	**70.0**	**63.2**	1.9	2.6	**66.9**	**60.9**	-1.2	0.3
r82	Residential	NAC-1	65	60	B	70	59.7	48.7	61.9	51.6	2.2	2.9	61.7	51.2	2.0	2.5
r92	Residential	NAC-1	65	60	B	70	**65.5**	58.5	**67.2**	**61.0**	1.7	2.5	**70.4**	**63.0**	4.9	4.5
Noise Area 11 - North side of TH 23 between 240th Avenue and CR 20																
c20	Commercial	NAC-2	70	65	E	75	65.3	58.5	67.0	60.9	1.7	2.4	63.3	58.0	-2.0	-0.5
r93	Residential	NAC-1	65	60	B	70	62.7	56.5	64.5	58.8	1.8	2.3	63.6	57.9	0.9	1.4
r94	Residential	NAC-1	65	60	B	70	**69.2**	**61.4**	**71.1**	**63.9**	1.9	2.5	**69.4**	**62.3**	0.2	0.9
r95	Residential	NAC-1	65	60	B	70	**69.5**	**61.5**	**71.3**	**64.1**	1.8	2.6	N/A	N/A		
r97	Residential	NAC-1	65	60	B	70	**69.7**	**61.7**	**71.6**	**64.3**	1.9	2.6	N/A	N/A		
r98	Residential	NAC-1	65	60	B	70	61.4	55.5	63.0	57.8	1.6	2.3	64.5	58.6	3.1	3.1
c21	Commercial	NAC-2	70	65	E	75	62.8	56.6	64.5	59.0	1.7	2.4	66.5	60.3	3.7	3.7
GLT298	Trail	NAC-2	70	65	C	70	66.2	59.0	68.1	59.7	1.9	0.7	63.9	53.1	-2.3	-5.9
GLT300	Trail	NAC-2	70	65	C	70	63.9	57.3	65.6	59.7	1.7	2.4	62.1	56.9	-1.8	-0.4
GLT302	Trail	NAC-2	70	65	C	70	61.7	55.6	63.4	58.0	1.7	2.4	60.5	55.9	-1.2	0.3
GLT304	Trail	NAC-2	70	65	C	70	59.7	54.1	61.3	56.4	1.6	2.3	59.2	54.8	-0.5	0.7
GLT306	Trail	NAC-2	70	65	C	70	58.0	52.7	59.6	55.0	1.6	2.3	58.0	53.9	0.0	1.2
GLT308	Trail	NAC-2	70	65	C	70	56.5	51.6	58.1	53.8	1.6	2.2	57.0	53.0	0.5	1.4
GLT310	Trail	NAC-2	70	65	C	70	55.3	50.6	56.8	52.8	1.5	2.2	56.0	52.3	0.7	1.7
GLT312	Trail	NAC-2	70	65	C	70	54.2	49.7	55.7	51.9	1.5	2.2	55.2	51.6	1.0	1.9
GLT314	Trail	NAC-2	70	65	C	70	53.2	49.0	54.7	51.1	1.5	2.1	54.4	50.9	1.2	1.9
Noise Area 12 - South side of TH 23 between 240th Avenue and CR 20																
r96	Residential	NAC-1	65	60	B	70	**68.2**	**60.6**	**70.0**	**63.1**	1.8	2.5	**69.5**	**62.4**	1.3	1.8
r99	Residential	NAC-1	65	60	B	70	**65.5**	58.6	**67.2**	**61.0**	1.7	2.4	**66.4**	**60.3**	0.9	1.7
c22	Commercial	NAC-2	70	65	E	75	59.7	54.0	61.3	56.3	1.6	2.3	61.4	56.3	1.7	2.3
r100	Residential	NAC-1	65	60	B	70	58.9	53.3	60.5	55.6	1.6	2.3	60.5	55.6	1.6	2.3

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 2014 Conditions		2035							
									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 - North side of TH 23 between CR 31 and 199th Avenue																
r1	Residential	NAC-1	55	50	B	70	**56.3**	**50.9**	**58.1**	**53.4**	1.8	2.5	**58.1**	**53.5**	1.8	2.6
r2	Residential	NAC-1	55	50	B	70	**63.6**	**56.1**	**65.6**	**58.9**	2.0	2.8	**65.8**	**59.0**	2.2	2.9
r3	Residential	NAC-1	55	50	B	70	**57.7**	**51.8**	**59.5**	**54.4**	1.8	2.6	**59.9**	**54.6**	2.2	2.8
r5	Residential	NAC-1	55	50	B	70	**66.1**	**58.0**	**68.1**	**60.9**	2.0	2.9	**68.4**	**60.8**	2.3	2.8
c1	Commercial	NAC-2	70	65	E	75	62.4	55.3	64.3	58.0	1.9	2.7	64.7	58.3	2.3	3.0
c7	Commercial	NAC-2	70	65	E	75	66.1	58.0	68.1	60.9	2.0	2.9	68.3	60.8	2.2	2.8
GLT2	Trail	NAC-2	70	65	C	70	52.9	48.0	54.7	50.5	1.8	2.5	54.9	50.7	2.0	2.7
GLT4	Trail	NAC-2	70	65	C	70	53.6	48.5	55.3	51.0	1.7	2.5	55.6	51.3	2.0	2.8
GLT6	Trail	NAC-2	70	65	C	70	54.1	49.0	55.9	51.5	1.8	2.5	56.2	51.8	2.1	2.8
GLT8	Trail	NAC-2	70	65	C	70	54.6	49.3	56.3	51.9	1.7	2.6	56.7	52.2	2.1	2.9
GLT10	Trail	NAC-2	70	65	C	70	54.9	49.6	56.7	52.2	1.8	2.6	57.1	52.5	2.2	2.9
GLT12	Trail	NAC-2	70	65	C	70	55.3	49.9	57.0	52.4	1.7	2.5	57.5	52.8	2.2	2.9
GLT14	Trail	NAC-2	70	65	C	70	55.6	50.2	57.4	52.7	1.8	2.5	57.9	53.1	2.3	2.9
GLT16	Trail	NAC-2	70	65	C	70	56.0	50.5	57.8	53.0	1.8	2.5	58.3	53.4	2.3	2.9
GLT18	Trail	NAC-2	70	65	C	70	56.5	50.8	58.2	53.4	1.7	2.6	58.8	53.8	2.3	3.0
GLT20	Trail	NAC-2	70	65	C	70	56.9	51.2	58.7	53.7	1.8	2.5	59.2	54.2	2.3	3.0
GLT22	Trail	NAC-2	70	65	C	70	57.4	51.5	59.2	54.1	1.8	2.6	59.7	54.5	2.3	3.0
GLT24	Trail	NAC-2	70	65	C	70	57.9	51.9	59.7	54.5	1.8	2.6	60.3	54.9	2.4	3.0
GLT26	Trail	NAC-2	70	65	C	70	58.5	52.4	60.3	55.0	1.8	2.6	60.8	55.4	2.3	3.0
GLT28	Trail	NAC-2	70	65	C	70	59.1	52.8	60.9	55.5	1.8	2.7	61.4	55.8	2.3	3.0
Noise Area 2 - South side of TH 23 between CR 31 and 199th Avenue																
r6	Residential	NAC-1	55	50	B	70	**62.2**	**55.1**	**64.1**	**57.9**	1.9	2.8	**65.8**	**59.0**	3.6	3.9
c8	Commercial	NAC-2	70	65	E	75	59.5	53.1	61.4	55.7	1.9	2.6	62.9	57.0	3.4	3.9
Noise Area 3 - North side of TH 23 between 199th Avenue and 115th Street																
GLT30	Trail	NAC-2	70	65	C	70	59.8	53.3	61.6	56.0	1.8	2.7	62.1	56.3	2.3	3.0
GLT32	Trail	NAC-2	70	65	C	70	60.5	53.9	62.4	56.6	1.9	2.7	62.8	56.8	2.3	2.9
GLT34	Trail	NAC-2	70	65	C	70	61.3	54.5	63.2	57.2	1.9	2.7	63.6	57.4	2.3	2.9
GLT36	Trail	NAC-2	70	65	C	70	62.2	55.1	64.1	57.9	1.9	2.8	64.5	58.0	2.3	2.9
GLT38	Trail	NAC-2	70	65	C	70	63.1	55.7	65.0	58.5	1.9	2.8	65.4	58.7	2.3	3.0
GLT40	Trail	NAC-2	70	65	C	70	63.8	56.3	65.8	59.1	2.0	2.8	66.1	59.2	2.3	2.9
GLT42	Trail	NAC-2	70	65	C	70	64.4	56.7	66.4	59.5	2.0	2.8	66.7	59.6	2.3	2.9
GLT44	Trail	NAC-2	70	65	C	70	65.7	57.7	67.8	60.5	2.1	2.8	67.9	60.5	2.2	2.8
GLT46	Trail	NAC-2	70	65	C	70	66.5	58.3	68.5	61.1	2.0	2.8	68.7	61.0	2.2	2.7
GLT48	Trail	NAC-2	70	65	C	70	67.6	59.1	69.6	61.9	2.0	2.8	69.9	61.7	2.3	2.6
GLT50	Trail	NAC-2	70	65	C	70	68.0	59.5	**70.1**	62.3	2.1	2.8	**70.3**	62.1	2.3	2.6
GLT52	Trail	NAC-2	70	65	C	70	68.2	59.6	**70.3**	62.5	2.1	2.9	**70.4**	62.2	2.2	2.6
GLT54	Trail	NAC-2	70	65	C	70	68.4	59.7	**70.5**	62.6	2.1	2.9	**70.4**	62.1	2.0	2.4
GLT56	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.6	2.1	2.9	**70.3**	62.1	2.0	2.4
GLT58	Trail	NAC-2	70	65	C	70	68.3	59.6	**70.4**	62.5	2.1	2.9	**70.3**	62.1	2.0	2.5
GLT60	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.6	2.1	2.9	**70.4**	62.2	2.1	2.5
GLT62	Trail	NAC-2	70	65	C	70	68.4	59.7	**70.5**	62.6	2.1	2.9	**70.3**	62.1	1.9	2.4
GLT64	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.6**	62.7	2.1	2.9	**70.3**	62.1	1.8	2.3
GLT66	Trail	NAC-2	70	65	C	70	68.4	59.7	**70.5**	62.6	2.1	2.9	**70.3**	62.0	1.9	2.3
GLT69	Trail	NAC-2	70	65	C	70	68.0	59.4	**70.1**	62.3	2.1	2.9	69.9	61.7	1.9	2.3
GLT71	Trail	NAC-2	70	65	C	70	67.4	58.9	69.4	61.8	2.0	2.9	69.3	61.3	1.9	2.4
GLT73	Trail	NAC-2	70	65	C	70	66.6	58.4	68.6	61.2	2.0	2.8	68.5	60.8	1.9	2.4
GLT75	Trail	NAC-2	70	65	C	70	65.7	57.7	67.7	60.5	2.0	2.8	67.6	60.1	1.9	2.4
GLT77	Trail	NAC-2	70	65	C	70	65.6	57.7	67.7	60.5	2.1	2.8	67.5	60.1	1.9	2.4
GLT79	Trail	NAC-2	70	65	C	70	65.8	57.8	67.9	60.6	2.1	2.8	67.7	60.2	1.9	2.4
GLT81	Trail	NAC-2	70	65	C	70	66.9	58.6	68.9	61.4	2.0	2.8	68.7	60.8	1.8	2.2
GLT83	Trail	NAC-2	70	65	C	70	67.6	59.1	69.7	62.0	2.1	2.9	69.3	61.2	1.7	2.1
GLT85	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.5	2.1	2.8	**70.0**	61.6	1.7	1.9
Noise Area 4 - South side of TH 23 between 199th Avenue and 115th Street																
c2	Commercial	NAC-2	70	65	E	75	63.0	55.0	65.0	57.8	2.0	2.8	N/A	N/A		

Table 6
Nighttime Noise Analysis Summary
Existing and Future Scenarios

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

Receiver		MN State Standards (dBA)			FHWA Standards (dBA)		Existing 2014 Conditions		2035							
									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
c3	Commercial	NAC-2	70	65	E	75	58.3	51.1	60.2	53.8	1.9	2.7	61.0	54.9	2.7	3.8
r4	Residential	NAC-1	55	50	B	70	**58.6**	**52.5**	**60.4**	**55.1**	1.8	2.6	**61.8**	**56.2**	3.2	3.7
r7	Residential	NAC-1	55	50	B	70	**56.9**	**51.2**	**58.7**	**53.8**	1.8	2.6	**59.9**	**54.7**	3.0	3.5
r8	Residential	NAC-1	55	50	B	70	**62.9**	**55.6**	**64.9**	**58.4**	2.0	2.8	**67.0**	**59.7**	4.1	4.1
r9	Residential	NAC-1	55	50	B	70	**60.4**	**53.8**	**62.2**	**56.5**	1.8	2.7	**63.8**	**57.6**	3.4	3.8
r10	Residential	NAC-1	55	50	B	70	**56.2**	**50.6**	**58.0**	**53.2**	1.8	2.6	**59.3**	**54.3**	3.1	3.7
r11	Residential	NAC-1	55	50	B	70	**59.7**	**53.2**	**61.6**	**55.9**	1.9	2.7	**63.4**	**57.3**	3.7	4.1
r12	Residential	NAC-1	55	50	B	70	**57.5**	**51.6**	**59.3**	**54.2**	1.8	2.6	**60.7**	**55.3**	3.2	3.7
r13	Residential	NAC-1	55	50	B	70	**61.1**	**54.4**	**62.9**	**57.1**	1.8	2.7	N/A	N/A		
r14	Residential	NAC-1	55	50	B	70	**57.3**	**51.5**	**59.0**	**54.0**	1.7	2.5	**60.4**	**55.1**	3.1	3.6
Noise Area 5 - North side of TH 23 between 115th Street and CR 135																
c4	Commercial	NAC-2	70	65	E	75	62.4	55.3	64.3	58.0	1.9	2.7	64.4	57.9	2.0	2.6
GLT88	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.9</u>**	62.9	2.2	2.9	**<u>70.4</u>**	61.9	1.7	1.9
GLT90	Trail	NAC-2	70	65	C	70	68.8	60.0	**<u>70.9</u>**	62.9	2.1	2.9	**<u>70.5</u>**	62.0	1.7	2.0
GLT92	Trail	NAC-2	70	65	C	70	68.8	60.0	**<u>70.9</u>**	62.9	2.1	2.9	**<u>70.6</u>**	62.1	1.8	2.1
GLT94	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.9	2.1	2.9	**<u>70.6</u>**	62.1	1.9	2.1
GLT96	Trail	NAC-2	70	65	C	70	68.5	59.8	**<u>70.6</u>**	62.7	2.1	2.9	**<u>70.4</u>**	62.0	1.9	2.2
GLT98	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.8	2.1	2.8	**<u>70.6</u>**	62.1	1.9	2.1
GLT100	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.8	2.1	2.8	**<u>70.6</u>**	62.1	1.9	2.1
GLT102	Trail	NAC-2	70	65	C	70	68.6	59.9	**<u>70.7</u>**	62.8	2.1	2.9	**<u>70.6</u>**	62.1	2.0	2.2
GLT104	Trail	NAC-2	70	65	C	70	68.6	59.9	**<u>70.7</u>**	62.8	2.1	2.9	**<u>70.6</u>**	62.2	2.0	2.3
GLT106	Trail	NAC-2	70	65	C	70	68.6	59.8	**<u>70.7</u>**	62.7	2.1	2.9	**<u>70.6</u>**	62.2	2.0	2.4
GLT108	Trail	NAC-2	70	65	C	70	68.2	59.4	**<u>70.4</u>**	62.3	2.2	2.9	**<u>70.6</u>**	62.2	2.4	2.8
GLT110	Trail	NAC-2	70	65	C	70	68.2	59.3	**<u>70.3</u>**	62.2	2.1	2.9	**<u>70.5</u>**	62.2	2.3	2.9
GLT112	Trail	NAC-2	70	65	C	70	68.2	59.3	**<u>70.3</u>**	62.2	2.1	2.9	**<u>70.7</u>**	62.3	2.5	3.0
GLT114	Trail	NAC-2	70	65	C	70	68.5	59.7	**<u>70.6</u>**	62.6	2.1	2.9	**<u>70.7</u>**	62.3	2.2	2.6
GLT116	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.9	2.1	2.9	**<u>70.7</u>**	62.3	2.0	2.3
GLT118	Trail	NAC-2	70	65	C	70	68.7	59.9	**<u>70.8</u>**	62.8	2.1	2.9	**<u>70.7</u>**	62.3	2.0	2.4
GLT120	Trail	NAC-2	70	65	C	70	68.6	59.9	**<u>70.7</u>**	62.8	2.1	2.9	**<u>70.6</u>**	62.3	2.0	2.4
GLT122	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.9	2.1	2.9	**<u>70.6</u>**	62.3	1.9	2.3
GLT124	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.9	2.1	2.9	**<u>70.6</u>**	62.3	1.9	2.3
GLT126	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.9	2.1	2.9	**<u>70.6</u>**	62.3	1.9	2.3
GLT128	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.8	2.1	2.8	**<u>70.6</u>**	62.3	1.9	2.3
GLT130	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.9	2.1	2.9	**<u>70.6</u>**	62.3	1.9	2.3
GLT132	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.9	2.1	2.9	**<u>70.6</u>**	62.3	1.9	2.3
GLT134	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.9	2.1	2.9	**<u>70.6</u>**	62.2	1.9	2.2
GLT136	Trail	NAC-2	70	65	C	70	68.7	60.0	**<u>70.8</u>**	62.8	2.1	2.8	**<u>70.6</u>**	62.2	1.9	2.2
GLT138	Trail	NAC-2	70	65	C	70	68.5	59.9	**<u>70.6</u>**	62.7	2.1	2.8	**<u>70.5</u>**	62.2	2.0	2.3
GLT140	Trail	NAC-2	70	65	C	70	68.6	59.9	**<u>70.7</u>**	62.8	2.1	2.9	**<u>70.1</u>**	61.9	1.5	2.0
GLT142	Trail	NAC-2	70	65	C	70	68.6	59.9	**<u>70.8</u>**	62.8	2.2	2.9	<u>69.6</u>	61.4	1.0	1.5
GLT144	Trail	NAC-2	70	65	C	70	68.6	59.9	**<u>70.7</u>**	62.7	2.1	2.8	68.8	60.4	0.2	0.5
GLT146	Trail	NAC-2	70	65	C	70	68.6	59.9	**<u>70.7</u>**	62.7	2.1	2.8	<u>69.8</u>	61.7	1.2	1.8
Noise Area 6 - South side of TH 23 between 115th Street and CR 135																
r15	Residential	NAC-1	55	50	B	70	**57.5**	**51.7**	**59.3**	**54.3**	1.8	2.6	**60.9**	**55.4**	3.4	3.7
r16	Residential	NAC-1	55	50	B	70	**62.2**	**55.2**	**64.1**	**57.9**	1.9	2.7	**66.8**	**59.4**	4.6	4.2
r17	Residential	NAC-1	55	50	B	70	**62.2**	**55.2**	**64.2**	**57.9**	2.0	2.7	**66.9**	**59.4**	4.7	4.2
r19	Residential	NAC-1	55	50	B	70	**56.0**	**50.4**	**57.7**	**53.0**	1.7	2.6	**59.1**	**54.0**	3.1	3.6
r20	Residential	NAC-1	55	50	B	70	**55.1**	49.7	**56.8**	**52.2**	1.7	2.5	**58.1**	**53.3**	3.0	3.6
r21	Residential	NAC-1	55	50	B	70	**57.2**	**51.3**	**59.0**	**53.9**	1.8	2.6	**60.4**	**55.0**	3.2	3.7
r22	Residential	NAC-1	55	50	B	70	54.4	49.2	**56.1**	**51.7**	1.7	2.5	**57.4**	**52.7**	3.0	3.5
r29	Residential	NAC-1	55	50	B	70	52.4	47.6	**54.1**	**50.0**	1.7	2.4	**55.2**	**50.9**	2.8	3.3
r30	Residential	NAC-1	55	50	B	70	**61.0**	**54.2**	**62.8**	**56.9**	1.8	2.7	**64.5**	**58.1**	3.5	3.9
r31	Residential	NAC-1	55	50	B	70	**61.9**	**54.9**	**63.8**	**57.7**	1.9	2.8	N/A	N/A		
r33	Residential	NAC-1	55	50	B	70	**59.5**	**53.1**	**61.4**	**55.8**	1.9	2.7	**62.9**	**56.9**	3.4	3.8
r34	Residential	NAC-1	55	50	B	70	**57.1**	**51.3**	**58.9**	**53.9**	1.8	2.6	**60.2**	**54.9**	3.1	3.6

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 2014 Conditions		2035							
									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
r35	Residential	NAC-1	55	50	B	70	**56.0**	**50.4**	**57.8**	**53.0**	1.8	2.6	**59.0**	**54.0**	3.0	3.6
r36	Residential	NAC-1	55	50	B	70	**57.5**	**51.6**	**59.3**	**54.2**	1.8	2.6	**60.6**	**55.2**	3.1	3.6
nT1	Trail	NAC-2	70	65	C	70	N/A	N/A	N/A	N/A			66.1	58.8		
Noise Area 7 - North side of TH 23 between CR 135 and CR 2																
I1	Industrial	NAC-3	80	75	F	--	62.5	55.4	64.4	58.1	1.9	2.7	64.6	58.2	2.1	2.8
GLT148	Trail	NAC-2	70	65	C	70	68.6	59.9	**70.7**	62.8	2.1	2.9	69.9	61.8	1.3	1.9
GLT150	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.6	2.1	2.9	**70.3**	62.1	2.0	2.4
GLT152	Trail	NAC-2	70	65	C	70	68.6	59.9	**70.7**	62.7	2.1	2.8	**70.5**	62.2	1.9	2.3
GLT154	Trail	NAC-2	70	65	C	70	68.6	59.9	**70.7**	62.8	2.1	2.9	**70.6**	62.2	2.0	2.3
GLT156	Trail	NAC-2	70	65	C	70	68.5	59.9	**70.7**	62.7	2.2	2.8	**70.5**	62.2	2.0	2.3
GLT158	Trail	NAC-2	70	65	C	70	68.5	59.9	**70.6**	62.7	2.1	2.8	**70.4**	62.2	1.9	2.3
GLT160	Trail	NAC-2	70	65	C	70	68.5	59.9	**70.6**	62.7	2.1	2.8	**70.4**	62.2	1.9	2.3
GLT162	Trail	NAC-2	70	65	C	70	68.6	59.9	**70.7**	62.8	2.1	2.9	**70.5**	62.2	1.9	2.3
GLT164	Trail	NAC-2	70	65	C	70	68.6	59.9	**70.7**	62.8	2.1	2.9	**70.5**	62.2	1.9	2.3
GLT166	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.6**	62.7	2.1	2.9	**70.4**	62.1	1.9	2.3
GLT168	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.6**	62.7	2.1	2.9	**70.5**	62.2	2.0	2.4
GLT170	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.6**	62.7	2.1	2.9	**70.5**	62.2	2.0	2.4
GLT172	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.6**	62.7	2.1	2.9	**70.4**	62.2	1.9	2.4
GLT174	Trail	NAC-2	70	65	C	70	68.5	59.9	**70.6**	62.7	2.1	2.8	**70.4**	62.2	1.9	2.3
GLT176	Trail	NAC-2	70	65	C	70	68.6	59.9	**70.7**	62.8	2.1	2.9	**70.4**	62.2	1.8	2.3
GLT178	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.6**	62.7	2.1	2.9	**70.4**	62.1	1.9	2.3
GLT180	Trail	NAC-2	70	65	C	70	68.4	59.7	**70.5**	62.6	2.1	2.9	**70.3**	62.1	1.9	2.4
GLT182	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.5	2.1	2.8	**70.4**	62.1	2.1	2.4
GLT184	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.5	2.1	2.8	**70.4**	62.1	2.1	2.4
GLT186	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.6	2.1	2.9	**70.3**	62.0	2.0	2.3
GLT188	Trail	NAC-2	70	65	C	70	68.4	59.8	**70.5**	62.6	2.1	2.8	**70.1**	61.8	1.7	2.0
GLT190	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.6**	62.7	2.1	2.9	**70.2**	61.9	1.7	2.1
GLT192	Trail	NAC-2	70	65	C	70	68.5	59.8	**70.6**	62.7	2.1	2.9	**70.3**	61.9	1.8	2.1
GLT194	Trail	NAC-2	70	65	C	70	68.4	59.8	**70.5**	62.7	2.1	2.9	**70.2**	61.9	1.8	2.1
GLT196	Trail	NAC-2	70	65	C	70	68.4	59.7	**70.5**	62.6	2.1	2.9	**70.2**	61.8	1.8	2.1
GLT198	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.6	2.1	2.9	**70.1**	61.8	1.8	2.1
GLT200	Trail	NAC-2	70	65	C	70	68.4	59.7	**70.5**	62.6	2.1	2.9	**70.1**	61.8	1.7	2.1
GLT202	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.6	2.1	2.9	**70.1**	61.8	1.8	2.1
Noise Area 8 - South side of TH 23 between CR 135 and CR 106																
owc1	Residential	NAC-1	55	50	B	70	**60.1**	**53.6**	**61.9**	**56.2**	1.8	2.6	**63.5**	**57.3**	3.4	3.7
owc2	Residential	NAC-1	55	50	B	70	**60.2**	**53.6**	**62.0**	**56.3**	1.8	2.7	**63.5**	**57.4**	3.3	3.8
owc3	Residential	NAC-1	55	50	B	70	**60.1**	**53.5**	**61.9**	**56.2**	1.8	2.7	**63.4**	**57.3**	3.3	3.8
owc4	Residential	NAC-1	55	50	B	70	**59.8**	**53.3**	**61.7**	**56.0**	1.9	2.7	**63.3**	**57.2**	3.5	3.9
r40	Residential	NAC-1	55	50	B	70	**66.9**	**58.7**	**68.9**	**61.5**	2.0	2.8	N/A	N/A		
r41	Residential	NAC-1	55	50	B	70	**63.5**	**56.1**	**65.4**	**58.9**	1.9	2.8	N/A	N/A		
r42	Residential	NAC-1	55	50	B	70	**61.7**	**54.8**	**63.6**	**57.5**	1.9	2.7	N/A	N/A		
r43	Residential	NAC-1	55	50	B	70	**60.0**	**53.5**	**61.9**	**56.2**	1.9	2.7	**63.6**	**57.4**	3.6	3.9
r44	Residential	NAC-1	55	50	B	70	**57.7**	**51.8**	**59.5**	**54.4**	1.8	2.6	**61.0**	**55.5**	3.3	3.7
r45	Residential	NAC-1	55	50	B	70	**56.5**	**50.8**	**58.3**	**53.4**	1.8	2.6	**59.6**	**54.5**	3.1	3.7
r47	Residential	NAC-1	55	50	B	70	**55.2**	49.8	**57.0**	**52.3**	1.8	2.5	**58.2**	**53.3**	3.0	3.5
r48	Residential	NAC-1	55	50	B	70	**56.5**	**50.8**	**58.2**	**53.4**	1.7	2.6	**59.6**	**54.5**	3.1	3.7
r49	Residential	NAC-1	55	50	B	70	**57.2**	**51.4**	**59.0**	**54.0**	1.8	2.6	**60.5**	**55.1**	3.3	3.7
r50	Residential	NAC-1	55	50	B	70	**58.1**	**52.1**	**59.9**	**54.7**	1.8	2.6	N/A	N/A		
Noise Area 9 - North side of TH 23 between CR 2 and 240th Avenue																
r51	Residential	NAC-1	55	50	B	70	**63.7**	**56.3**	**65.7**	**59.0**	2.0	2.7	**65.7**	**58.8**	2.0	2.5
c10	Commercial	NAC-2	70	65	E	75	57.8	51.7	59.6	54.2	1.8	2.5	60.2	54.8	2.4	3.1
r90	Residential	NAC-1	55	50	B	70	**56.5**	**50.7**	**58.1**	**53.0**	1.6	2.3	**58.6**	**53.5**	2.1	2.8
r91	Residential	NAC-1	55	50	B	70	**61.7**	**54.7**	**63.5**	**57.2**	1.8	2.5	**63.3**	**56.9**	1.6	2.2
GLT204	Trail	NAC-2	70	65	C	70	68.4	59.8	**70.4**	62.5	2.0	2.7	**70.1**	61.7	1.7	1.9
GLT206	Trail	NAC-2	70	65	C	70	68.3	59.6	**70.4**	62.4	2.1	2.8	**70.0**	61.7	1.7	2.1

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 2014 Conditions		2035							
									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
GLT208	Trail	NAC-2	70	65	C	70	68.3	59.6	**70.4**	62.4	2.1	2.8	**70.1**	61.7	1.8	2.1
GLT210	Trail	NAC-2	70	65	C	70	68.3	59.6	**70.4**	62.4	2.1	2.8	**70.1**	61.7	1.8	2.1
GLT212	Trail	NAC-2	70	65	C	70	68.3	59.7	**70.4**	62.5	2.1	2.8	**70.1**	61.7	1.8	2.0
GLT214	Trail	NAC-2	70	65	C	70	68.3	59.6	**70.3**	62.4	2.0	2.8	**70.0**	61.7	1.7	2.1
GLT216	Trail	NAC-2	70	65	C	70	68.3	59.6	**70.3**	62.4	2.0	2.8	**70.1**	61.8	1.8	2.2
GLT218	Trail	NAC-2	70	65	C	70	68.3	59.6	**70.4**	62.4	2.1	2.8	**70.1**	61.8	1.8	2.2
GLT220	Trail	NAC-2	70	65	C	70	68.3	59.6	**70.4**	62.4	2.1	2.8	**70.1**	61.8	1.8	2.2
GLT222	Trail	NAC-2	70	65	C	70	68.2	59.6	**70.3**	62.4	2.1	2.8	**70.1**	61.9	1.9	2.3
GLT224	Trail	NAC-2	70	65	C	70	68.1	59.5	**70.2**	62.3	2.1	2.8	**70.1**	61.9	2.0	2.4
GLT226	Trail	NAC-2	70	65	C	70	68.1	59.5	**70.2**	62.3	2.1	2.8	**70.1**	61.9	2.0	2.4
GLT228	Trail	NAC-2	70	65	C	70	68.1	59.5	**70.2**	62.3	2.1	2.8	**70.1**	61.9	2.0	2.4
GLT230	Trail	NAC-2	70	65	C	70	68.1	59.5	**70.2**	62.3	2.1	2.8	**70.1**	61.9	2.0	2.4
GLT232	Trail	NAC-2	70	65	C	70	68.1	59.5	**70.2**	62.3	2.1	2.8	**70.1**	61.9	2.0	2.4
GLT234	Trail	NAC-2	70	65	C	70	68.1	59.4	**70.2**	62.2	2.1	2.8	**70.1**	61.9	2.0	2.5
GLT236	Trail	NAC-2	70	65	C	70	67.9	59.3	69.9	62.1	2.0	2.8	**70.1**	61.9	2.2	2.6
GLT238	Trail	NAC-2	70	65	C	70	67.3	58.9	69.3	61.7	2.0	2.8	**70.1**	61.9	2.8	3.0
GLT240	Trail	NAC-2	70	65	C	70	66.4	58.2	68.4	61.0	2.0	2.8	**70.1**	61.8	3.7	3.6
GLT242	Trail	NAC-2	70	65	C	70	65.4	57.5	67.4	60.2	2.0	2.7	**70.1**	61.8	4.7	4.3
GLT244	Trail	NAC-2	70	65	C	70	64.5	56.8	66.4	59.5	1.9	2.7	**70.1**	61.9	5.6	5.1
GLT246	Trail	NAC-2	70	65	C	70	63.6	56.2	65.6	58.9	2.0	2.7	**70.1**	61.9	6.5	5.7
GLT248	Trail	NAC-2	70	65	C	70	63.0	55.7	64.9	58.4	1.9	2.7	**70.0**	61.8	7.0	6.1
GLT250	Trail	NAC-2	70	65	C	70	62.6	55.4	64.5	58.1	1.9	2.7	**70.0**	61.8	7.4	6.4
GLT252	Trail	NAC-2	70	65	C	70	62.3	55.2	64.2	57.9	1.9	2.7	**70.0**	61.8	7.7	6.6
GLT254	Trail	NAC-2	70	65	C	70	62.2	55.1	64.1	57.8	1.9	2.7	**70.0**	61.9	7.8	6.8
GLT256	Trail	NAC-2	70	65	C	70	62.2	55.1	64.1	57.8	1.9	2.7	**70.0**	61.8	7.8	6.7
GLT258	Trail	NAC-2	70	65	C	70	62.2	55.1	64.1	57.8	1.9	2.7	**70.0**	61.8	7.8	6.7
GLT260	Trail	NAC-2	70	65	C	70	62.3	55.2	64.2	57.8	1.9	2.6	69.9	61.7	7.6	6.5
GLT262	Trail	NAC-2	70	65	C	70	62.9	55.6	64.7	58.2	1.8	2.6	69.8	61.5	6.9	5.9
GLT264	Trail	NAC-2	70	65	C	70	63.3	55.9	65.1	58.5	1.8	2.6	69.7	61.5	6.4	5.6
GLT266	Trail	NAC-2	70	65	C	70	64.1	56.5	65.9	59.0	1.8	2.5	69.8	61.5	5.7	5.0
GLT268	Trail	NAC-2	70	65	C	70	64.9	57.1	66.8	59.7	1.9	2.6	69.8	61.5	4.9	4.4
GLT270	Trail	NAC-2	70	65	C	70	65.9	57.8	67.8	60.4	1.9	2.6	69.8	61.5	3.9	3.7
GLT272	Trail	NAC-2	70	65	C	70	66.8	58.5	68.7	61.1	1.9	2.6	69.7	61.5	2.9	3.0
GLT274	Trail	NAC-2	70	65	C	70	67.5	59.0	69.4	61.6	1.9	2.6	69.7	61.4	2.2	2.4
GLT276	Trail	NAC-2	70	65	C	70	67.9	59.3	69.9	61.9	2.0	2.6	69.7	61.4	1.8	2.1
GLT278	Trail	NAC-2	70	65	C	70	68.0	59.4	69.9	62.0	1.9	2.6	69.8	61.5	1.8	2.1
GLT280	Trail	NAC-2	70	65	C	70	68.1	59.4	**70.0**	62.0	1.9	2.6	69.8	61.5	1.7	2.1
GLT282	Trail	NAC-2	70	65	C	70	68.1	59.4	**70.1**	62.1	2.0	2.7	69.7	61.4	1.6	2.0
GLT284	Trail	NAC-2	70	65	C	70	68.1	59.4	**70.1**	62.1	2.0	2.7	69.6	61.4	1.5	2.0
GLT286	Trail	NAC-2	70	65	C	70	67.9	59.3	69.9	61.9	2.0	2.6	69.3	61.1	1.4	1.8
GLT288	Trail	NAC-2	70	65	C	70	68.0	59.4	**70.0**	62.0	2.0	2.6	68.8	60.8	0.8	1.4
GLT290	Trail	NAC-2	70	65	C	70	68.0	59.3	69.9	62.0	1.9	2.7	67.8	60.1	-0.2	0.8
GLT292	Trail	NAC-2	70	65	C	70	67.9	59.2	69.8	61.9	1.9	2.7	66.5	59.2	-1.4	0.0
GLT294	Trail	NAC-2	70	65	C	70	67.4	58.9	69.4	61.5	2.0	2.6	65.2	58.3	-2.2	-0.6
GLT296	Trail	NAC-2	70	65	C	70	66.4	58.1	68.3	60.8	1.9	2.7	64.0	57.2	-2.4	-0.9
Noise Area 10 - South side of TH 23 between CR 106 and 240th Avenue																
c11	Commercial	NAC-2	70	65	E	75	61.8	54.7	63.7	57.4	1.9	2.7	63.6	57.4	1.8	2.7
r55	Residential	NAC-1	55	50	B	70	**68.2**	**59.6**	**70.3**	**62.4**	2.1	2.8	N/A	N/A		
r56	Residential	NAC-1	55	50	B	70	**69.5**	**60.5**	**71.6**	**63.3**	2.1	2.8	N/A	N/A		
r57	Residential	NAC-1	55	50	B	70	**69.2**	**60.3**	**71.3**	**63.1**	2.1	2.8	N/A	N/A		
r58	Residential	NAC-1	55	50	B	70	**66.7**	**58.4**	**68.8**	**61.2**	2.1	2.8	N/A	N/A		
r60	Residential	NAC-1	55	50	B	70	**63.9**	**56.4**	**65.8**	**59.1**	1.9	2.7	**63.8**	**57.4**	-0.1	1.0
r61	Residential	NAC-1	55	50	B	70	**63.2**	**55.9**	**65.1**	**58.6**	1.9	2.7	**63.2**	**57.1**	0.0	1.2
r62	Residential	NAC-1	55	50	B	70	**62.4**	**55.3**	**64.3**	**58.0**	1.9	2.7	**62.5**	**56.6**	0.1	1.3
r63	Residential	NAC-1	55	50	B	70	**58.7**	**51.8**	**60.6**	**54.4**	1.9	2.6	**59.0**	**53.2**	0.3	1.4

Table 6
Nighttime Noise Analysis Summary
Existing and Future Scenarios

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

Receiver		MN State Standards (dBA)			FHWA Standards (dBA)		Existing 2014 Conditions		2035							
									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	**57.7**	**51.0**	**59.6**	**53.6**	1.9	2.6	**58.1**	**52.6**	0.4	1.6
c12	Commercial	NAC-2	70	65	E	75	56.8	50.3	58.6	52.9	1.8	2.6	57.3	52.0	0.5	1.7
r65	Residential	NAC-1	55	50	B	70	54.7	48.7	**56.4**	**51.3**	1.7	2.6	**55.6**	**50.7**	0.9	2.0
r66	Residential	NAC-1	55	50	B	70	54.0	48.2	**55.8**	**50.7**	1.8	2.5	**55.1**	**50.2**	1.1	2.0
c13	Residential	NAC-1	55	50	B	70	54.0	47.1	**56.0**	49.7	2.0	2.6	**55.5**	49.1	1.5	2.0
c14	Residential	NAC-1	55	50	B	70	**67.3**	**58.9**	**<u>69.3</u>**	**61.7**	2.0	2.8	**65.6**	**58.7**	-1.7	-0.2
c15	Residential	NAC-1	55	50	B	70	**67.2**	**58.9**	**<u>69.3</u>**	**61.6**	2.1	2.7	**65.4**	**58.5**	-1.8	-0.4
r70	Residential	NAC-1	55	50	B	70	**65.3**	**57.4**	**67.3**	**60.2**	2.0	2.8	**64.2**	**57.7**	-1.1	0.3
r71	Residential	NAC-1	55	50	B	70	**63.9**	**56.4**	**65.8**	**59.1**	1.9	2.7	**63.3**	**57.1**	-0.6	0.7
r72	Residential	NAC-1	55	50	B	70	**63.1**	**55.8**	**65.0**	**58.5**	1.9	2.7	**62.8**	**56.8**	-0.3	1.0
r73	Residential	NAC-1	55	50	B	70	**62.2**	**55.1**	**64.1**	**57.8**	1.9	2.7	**62.1**	**56.3**	-0.1	1.2
r74	Residential	NAC-1	55	50	B	70	**62.0**	**54.9**	**63.8**	**57.6**	1.8	2.7	**61.9**	**56.2**	-0.1	1.3
c16	Residential	NAC-1	55	50	B	70	**61.2**	**54.3**	**63.0**	**57.0**	1.8	2.7	**61.4**	**55.8**	0.2	1.5
r76	Residential	NAC-1	55	50	B	70	**59.9**	**53.4**	**61.7**	**56.0**	1.8	2.6	**60.4**	**55.0**	0.5	1.6
r77	Residential	NAC-1	55	50	B	70	**59.4**	**53.1**	**61.2**	**55.7**	1.8	2.6	**60.1**	**54.8**	0.7	1.7
c17	Commercial	NAC-2	70	65	E	75	58.4	49.1	60.7	51.8	2.3	2.7	60.0	50.9	1.6	1.8
r79	Residential	NAC-1	55	50	B	70	**65.3**	**57.4**	**67.3**	**60.2**	2.0	2.8	**64.2**	**57.8**	-1.1	0.4
r80	Residential	NAC-1	55	50	B	70	**62.0**	**55.0**	**63.9**	**57.7**	1.9	2.7	**62.1**	**56.3**	0.1	1.3
r81	Residential	NAC-1	55	50	B	70	**66.3**	**58.2**	**68.3**	**60.9**	2.0	2.7	**65.0**	**58.4**	-1.3	0.2
r82	Residential	NAC-1	55	50	B	70	**57.5**	46.1	**60.0**	49.1	2.5	3.0	**59.6**	48.6	2.1	2.5
r92	Residential	NAC-1	55	50	B	70	**63.7**	**56.2**	**65.6**	**58.8**	1.9	2.6	**68.1**	**60.2**	4.4	4.0
Noise Area 11 - North side of TH 23 between 240th Avenue and CR 20																
c20	Commercial	NAC-2	70	65	E	75	63.7	56.2	65.6	58.8	1.9	2.6	62.1	56.2	-1.6	0.0
r93	Residential	NAC-1	55	50	B	70	**61.1**	**54.3**	**62.9**	**56.8**	1.8	2.5	**62.2**	**56.2**	1.1	1.9
r94	Residential	NAC-1	55	50	B	70	**67.6**	**59.1**	**<u>69.6</u>**	**61.7**	2.0	2.6	**68.3**	**60.5**	0.7	1.4
r95	Residential	NAC-1	55	50	B	70	**67.9**	**59.3**	**<u>69.8</u>**	**61.9**	1.9	2.6	N/A	N/A		
r97	Residential	NAC-1	55	50	B	70	**68.2**	**59.5**	**<u>70.1</u>**	**62.1**	1.9	2.6	N/A	N/A		
r98	Residential	NAC-1	55	50	B	70	**59.9**	**53.3**	**61.6**	**55.8**	1.7	2.5	**63.3**	**56.7**	3.4	3.4
c21	Commercial	NAC-2	70	65	E	75	61.3	54.4	63.1	56.9	1.8	2.5	65.4	58.5	4.1	4.1
GLT298	Trail	NAC-2	70	65	C	70	64.6	56.8	66.4	59.4	1.8	2.6	62.4	51.0	-2.2	-5.8
GLT300	Trail	NAC-2	70	65	C	70	62.4	55.1	64.1	57.6	1.7	2.5	61.0	55.0	-1.4	-0.1
GLT302	Trail	NAC-2	70	65	C	70	60.2	53.4	62.0	55.9	1.8	2.5	59.4	54.0	-0.8	0.6
GLT304	Trail	NAC-2	70	65	C	70	58.2	51.9	59.9	54.3	1.7	2.4	58.0	53.0	-0.2	1.1
GLT306	Trail	NAC-2	70	65	C	70	56.5	50.6	58.2	53.0	1.7	2.4	56.8	52.0	0.3	1.4
GLT308	Trail	NAC-2	70	65	C	70	55.1	49.5	56.7	51.9	1.6	2.4	55.7	51.2	0.6	1.7
GLT310	Trail	NAC-2	70	65	C	70	53.9	48.6	55.5	50.9	1.6	2.3	54.8	50.4	0.9	1.8
GLT312	Trail	NAC-2	70	65	C	70	52.8	47.7	54.4	50.0	1.6	2.3	54.0	49.7	1.2	2.0
GLT314	Trail	NAC-2	70	65	C	70	51.8	46.9	53.4	49.2	1.6	2.3	53.2	49.1	1.4	2.2
Noise Area 12 - South side of TH 23 between 240th Avenue and CR 20																
r96	Residential	NAC-1	55	50	B	70	**66.4**	**58.2**	**68.3**	**60.8**	1.9	2.6	**67.3**	**59.7**	0.9	1.5
r99	Residential	NAC-1	55	50	B	70	**63.8**	**56.2**	**65.6**	**58.8**	1.8	2.6	**64.5**	**57.8**	0.7	1.6
c22	Commercial	NAC-2	70	65	E	75	58.0	51.7	59.7	54.1	1.7	2.4	59.7	54.1	1.7	2.4
r100	Residential	NAC-1	55	50	B	70	**57.1**	**51.0**	**58.8**	**53.4**	1.7	2.4	**58.8**	**53.5**	1.7	2.5

Appendix A

Existing/No Build Noise Figures (1-10)

Path: S:\KOM\Mnt08\129296\99_GIS\MXDs\TH 23 Map Booklet Existing.mxd

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

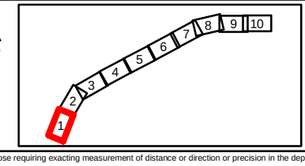


Figure 1

Path: S:\KOM\Mnt\08129296\99_GIS\MXDs\TH 23 Map Booklet Existing.mxd

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

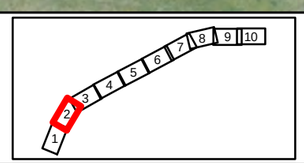


Figure 2

Area 3

Area 4

Area 5

Area 6

c4

GLT69 GLT71 GLT73 GLT75 GLT77 GLT79 GLT81 GLT83 GLT85 GLT88 GLT90 GLT92 GLT94 GLT96 GLT98 GLT100 GLT102 GLT104 GLT106 GLT108 GLT110 GLT112

GLT66

r9 r10 r11 r12 r13 r14 r15 r16 r17 r19 r20 r21 r22

23

115th St NE

132nd St NE

212th Ave NE

bing

Path: S:\KOM\Mnt08\129296\99_GIS\MXDs\TH 23 Map Booklet Existing.mxd

SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

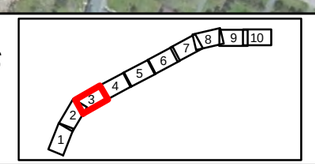
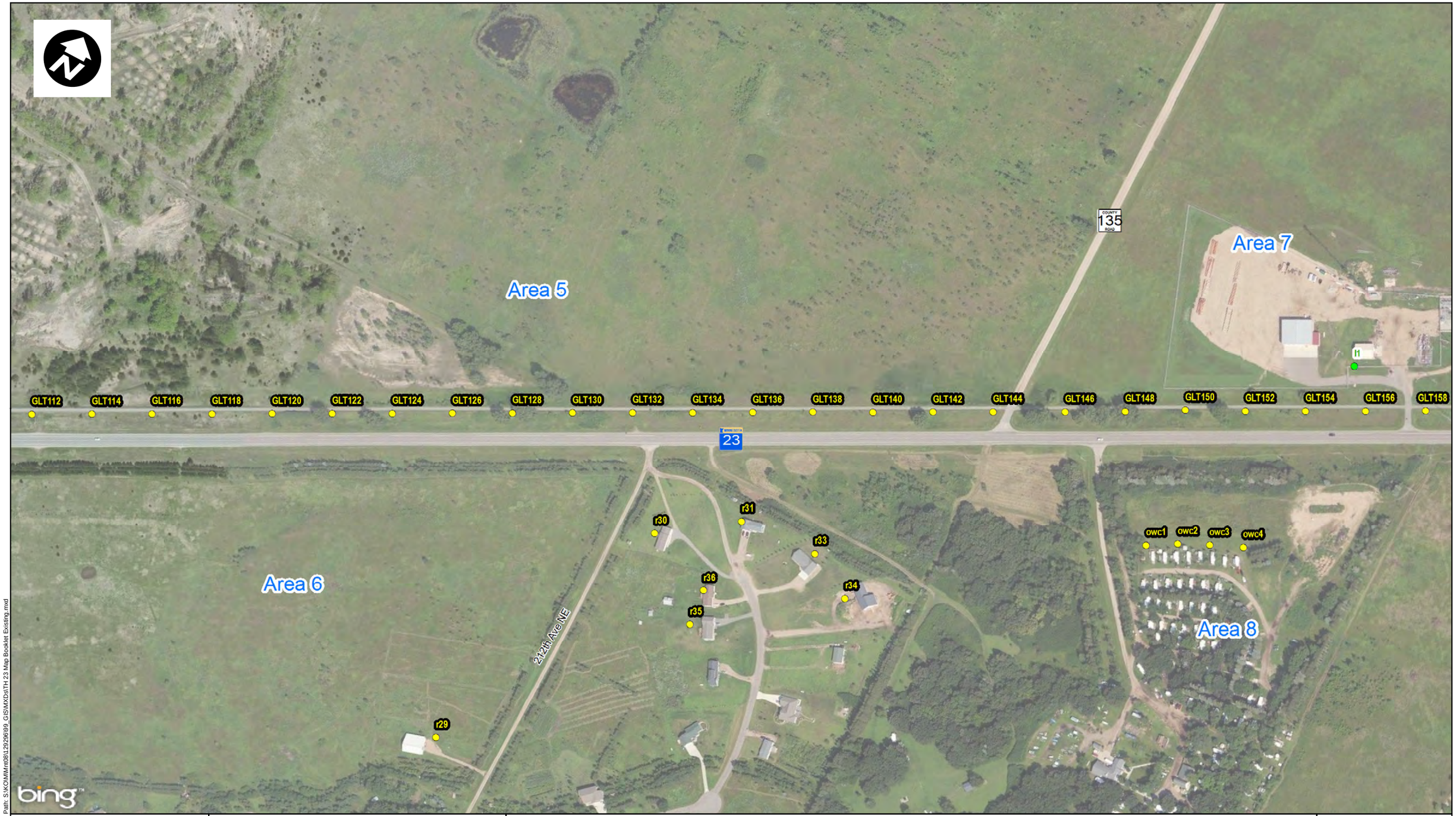


Figure 3



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SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

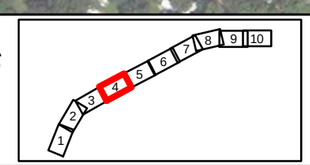


Figure 4

Path: S:\KOM\Mn\08\129296\99_GIS\MXDs\TH 23 Map Booklet Existing.mxd

SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

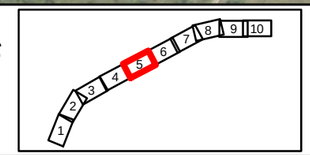


Figure 5

Path: S:\KO\MM\mt08\129296\99_GIS\MXDs\TH 23 Map Booklet Existing.mxd

SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

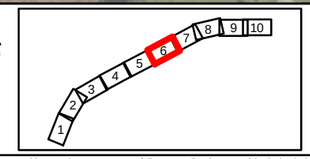


Figure 6

Path: S:\KOM\Mnt08\129296\99_GIS\MXDs\TH 23 Map Booklet Existing.mxd

SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

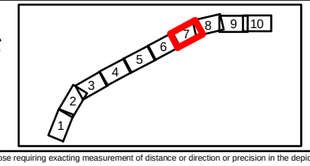


Figure 7

Path: S:\KOI\MM\m08\129296\99_GIS\MXDs\TH 23 Map Booklet Existing.mxd

SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

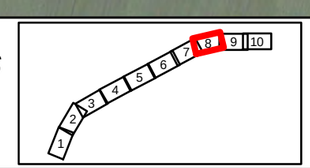
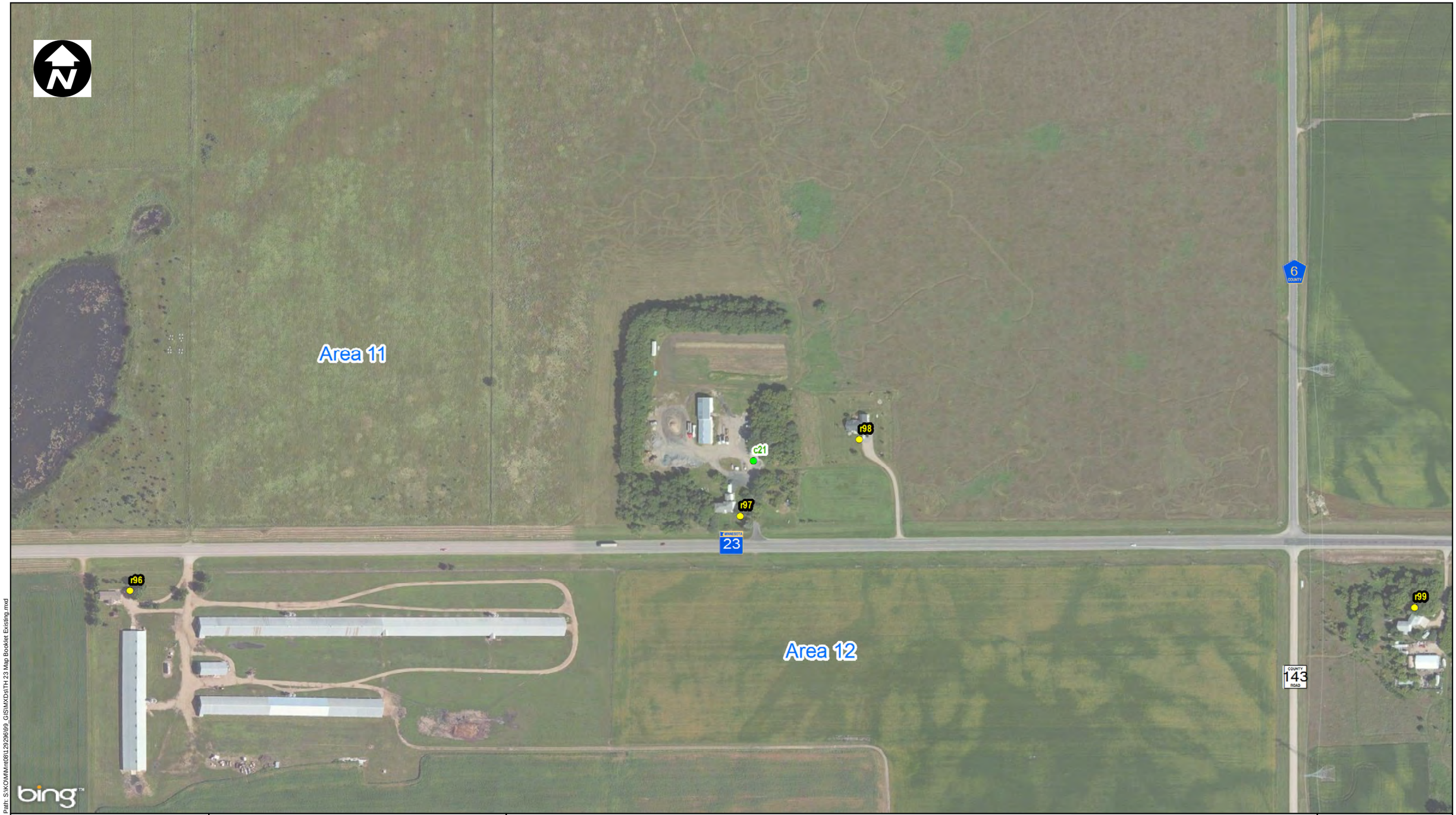


Figure 8



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SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

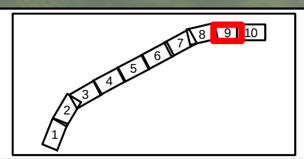


Figure 9

Path: S:\KO\MM\mt\08\129296\99_GIS\MXDs\TH 23 Map Booklet Existing.mxd

SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- Impacted
- Not Impacted

0 150 300 Feet

Noise Barriers - Existing Conditions

TH 23
New London to Paynesville, MN

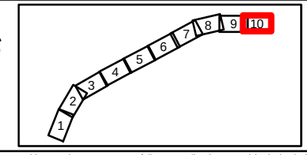


Figure 10

Appendix B

Noise Barrier Tables

Table B1
Build Noise Barrier Cost Effectiveness (Areas 1 & 2)
Noise Barriers - SB1, SB2, SB3, SB4, NB1

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	Build (dBA)	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	
SB1	r1	Residential	Day	65	70	59.3	58.5	-0.8	1	0	**1**	**YES**	NO	1,305	20	25,200	$504,000	$504,000	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r2	Residential	Day	65	70	**66.9**	61.5	**-5.4**	1	1									
	r1	Residential	Night	55	70	**58.1**	**57.2**	-0.9	1	0	**1**	**YES**	NO	1,305	20	25,200	$504,000	$504,000	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r2	Residential	Night	55	70	**65.8**	**60.2**	**-5.6**	1	1									
SB2	r3	Residential	Day	65	70	61.1	59.7	-1.4	1	0	**0**	NO	NO	953	20	17,260	$345,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	r3	Residential	Night	55	70	**59.9**	**58.2**	-1.7	1	0	**0**	NO	NO	953	20	17,260	$345,200	N/A	NOT ACOUSTICALLY EFFECTIVE
SB3	c1	Commercial	Day	70	75	65.9	64.6	-1.3	1	0	**0**	NO	NO	509	20	8,380	$167,600	N/A	NOT ACOUSTICALLY EFFECTIVE
	c1	Commercial	Night	70	75	64.7	63.3	-1.4	1	0	**0**	NO	NO	509	20	8,380	$167,600	N/A	NOT ACOUSTICALLY EFFECTIVE
SB4	r5	Residential	Day	65	70	**69.4**	61.5	**-7.9**	1	1	**2**	**YES**	**YES**	415	20	7,400	$148,000	$74,000	NOT COST EFFECTIVE
	c7	Commercial	Day	70	75	69.4	62.4	**-7.0**	1	1									
	r5	Residential	Night	55	70	**68.4**	**60.5**	**-7.9**	1	1	**2**	**YES**	**YES**	415	20	7,400	$148,000	$74,000	NOT COST EFFECTIVE
	c7	Commercial	Night	70	75	68.3	61.3	**-7.0**	1	1									
SB4	r5	Residential	Day	65	70	**69.4**	63.2	**-6.2**	1	1	**2**	**YES**	NO	415	15	5,765	$115,300	$57,650	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	c7	Commercial	Day	70	75	69.4	63.7	**-5.7**	1	1									
	r5	Residential	Night	55	70	**68.4**	**62.2**	**-6.2**	1	1	**2**	**YES**	NO	415	15	5,765	$115,300	$57,650	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	c7	Commercial	Night	70	75	68.3	62.6	**-5.7**	1	1									
NB1	r6	Residential	Day	65	70	**67.8**	61.4	**-6.4**	1	1	**1**	**YES**	NO	614	20	11,380	$227,600	$227,600	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	c8	Commercial	Day	70	75	64.7	60.7	-4.0	1	0									
	r6	Residential	Night	55	70	**65.8**	**59.7**	**-6.1**	1	1	**1**	**YES**	NO	614	20	11,380	$227,600	$227,600	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	c8	Commercial	Night	70	75	62.9	59.0	-3.9	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B2a
Build Noise Barrier Cost Effectiveness (Area 3)
Noise Barriers - SB5

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	Build (dBA)	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	
SB5	GLT40	Trail	Day	70	70	67.3	64.6	-2.7	1	0	**13**	**YES**	**YES**	2,709	20	53,280	$1,065,600	$81,969	NOT COST EFFECTIVE
	GLT42	Trail	Day	70	70	67.8	60.7	**-7.1**	1	1									
	GLT44	Trail	Day	70	70	69.0	59.3	**-9.7**	1	1									
	GLT46	Trail	Day	70	70	69.7	60.0	**-9.7**	1	1									
	GLT48	Trail	Day	70	70	**70.9**	59.8	**-11.1**	1	1									
	GLT50	Trail	Day	70	70	**71.3**	59.7	**-11.6**	1	1									
	GLT52	Trail	Day	70	70	**71.4**	59.9	**-11.5**	1	1									
	GLT54	Trail	Day	70	70	**71.4**	59.9	**-11.5**	1	1									
	GLT56	Trail	Day	70	70	**71.3**	59.6	**-11.7**	1	1									
	GLT58	Trail	Day	70	70	**71.3**	59.4	**-11.9**	1	1									
	GLT60	Trail	Day	70	70	**71.4**	59.2	**-12.2**	1	1									
	GLT62	Trail	Day	70	70	**71.3**	59.5	**-11.8**	1	1									
	GLT64	Trail	Day	70	70	**71.3**	59.9	**-11.4**	1	1									
	GLT66	Trail	Day	70	70	**71.3**	61.2	**-10.1**	1	1									
	GLT40	Trail	Night	70	70	66.1	63.4	-2.7	1	0	**13**	**YES**	**YES**	2,709	20	53,280	$1,065,600	$81,969	NOT COST EFFECTIVE
	GLT42	Trail	Night	70	70	66.7	59.6	**-7.1**	1	1									
	GLT44	Trail	Night	70	70	67.9	58.3	**-9.6**	1	1									
	GLT46	Trail	Night	70	70	68.7	59.0	**-9.7**	1	1									
	GLT48	Trail	Night	70	70	69.9	58.9	**-11.0**	1	1									
	GLT50	Trail	Night	70	70	**70.3**	58.8	**-11.5**	1	1									
	GLT52	Trail	Night	70	70	**70.4**	59.0	**-11.4**	1	1									
	GLT54	Trail	Night	70	70	**70.4**	58.9	**-11.5**	1	1									
	GLT56	Trail	Night	70	70	**70.3**	58.6	**-11.7**	1	1									
	GLT58	Trail	Night	70	70	**70.3**	58.4	**-11.9**	1	1									
	GLT60	Trail	Night	70	70	**70.4**	58.3	**-12.1**	1	1									
	GLT62	Trail	Night	70	70	**70.3**	58.5	**-11.8**	1	1									
	GLT64	Trail	Night	70	70	**70.3**	58.9	**-11.4**	1	1									
	GLT66	Trail	Night	70	70	**70.3**	60.2	**-10.1**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B2b
Build Noise Barrier Cost Effectiveness (Area 3)
Noise Barriers - SB5

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	Build (dBA)	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	
SB5	GLT40	Trail	Day	70	70	67.3	65.4	-1.9	1	0	**12**	**YES**	**YES**	2,709	15	40,175	$803,500	$66,958	NOT COST EFFECTIVE
	GLT42	Trail	Day	70	70	67.8	63.1	-4.7	1	0									
	GLT44	Trail	Day	70	70	69.0	62.6	**-6.4**	1	1									
	GLT46	Trail	Day	70	70	69.7	63.7	**-6.0**	1	1									
	GLT48	Trail	Day	70	70	**70.9**	63.6	**-7.3**	1	1									
	GLT50	Trail	Day	70	70	**71.3**	63.4	**-7.9**	1	1									
	GLT52	Trail	Day	70	70	**71.4**	63.7	**-7.7**	1	1									
	GLT54	Trail	Day	70	70	**71.4**	63.5	**-7.9**	1	1									
	GLT56	Trail	Day	70	70	**71.3**	63.0	**-8.3**	1	1									
	GLT58	Trail	Day	70	70	**71.3**	62.7	**-8.6**	1	1									
	GLT60	Trail	Day	70	70	**71.4**	62.5	**-8.9**	1	1									
	GLT62	Trail	Day	70	70	**71.3**	62.8	**-8.5**	1	1									
	GLT64	Trail	Day	70	70	**71.3**	63.4	**-7.9**	1	1									
	GLT66	Trail	Day	70	70	**71.3**	64.5	**-6.8**	1	1									
	GLT40	Trail	Night	70	70	66.1	64.2	-1.9	1	0	**12**	**YES**	**YES**	2,709	15	40,175	$803,500	$66,958	NOT COST EFFECTIVE
	GLT42	Trail	Night	70	70	66.7	62.0	-4.7	1	0									
	GLT44	Trail	Night	70	70	67.9	61.7	**-6.2**	1	1									
	GLT46	Trail	Night	70	70	68.7	62.7	**-6.0**	1	1									
	GLT48	Trail	Night	70	70	69.9	62.7	**-7.2**	1	1									
	GLT50	Trail	Night	70	70	**70.3**	62.5	**-7.8**	1	1									
	GLT52	Trail	Night	70	70	**70.4**	62.8	**-7.6**	1	1									
	GLT54	Trail	Night	70	70	**70.4**	62.6	**-7.8**	1	1									
	GLT56	Trail	Night	70	70	**70.3**	62.1	**-8.2**	1	1									
	GLT58	Trail	Night	70	70	**70.3**	61.8	**-8.5**	1	1									
	GLT60	Trail	Night	70	70	**70.4**	61.6	**-8.8**	1	1									
	GLT62	Trail	Night	70	70	**70.3**	61.8	**-8.5**	1	1									
	GLT64	Trail	Night	70	70	**70.3**	62.5	**-7.8**	1	1									
	GLT66	Trail	Night	70	70	**70.3**	63.5	**-6.8**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B2c
Build Noise Barrier Cost Effectiveness (Area 3)
Noise Barriers - SB5

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	Build (dBA)	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	
SB5	GLT40	Trail	Day	70	70	67.3	66.3	-1.0	1	0	**0**	NO	NO	2,709	10	26,990	$539,800	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT42	Trail	Day	70	70	67.8	65.7	-2.1	1	0									
	GLT44	Trail	Day	70	70	69.0	66.2	-2.8	1	0									
	GLT46	Trail	Day	70	70	69.7	67.2	-2.5	1	0									
	GLT48	Trail	Day	70	70	**70.9**	67.7	-3.2	1	0									
	GLT50	Trail	Day	70	70	**71.3**	67.6	-3.7	1	0									
	GLT52	Trail	Day	70	70	**71.4**	67.9	-3.5	1	0									
	GLT54	Trail	Day	70	70	**71.4**	67.7	-3.7	1	0									
	GLT56	Trail	Day	70	70	**71.3**	67.2	-4.1	1	0									
	GLT58	Trail	Day	70	70	**71.3**	66.9	-4.4	1	0									
	GLT60	Trail	Day	70	70	**71.4**	66.6	-4.8	1	0									
	GLT62	Trail	Day	70	70	**71.3**	66.9	-4.4	1	0									
	GLT64	Trail	Day	70	70	**71.3**	67.6	-3.7	1	0									
	GLT66	Trail	Day	70	70	**71.3**	68.4	-2.9	1	0									
	GLT40	Trail	Night	70	70	66.1	65.2	-0.9	1	0	**0**	NO	NO	2,709	10	26,990	$539,800	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT42	Trail	Night	70	70	66.7	64.6	-2.1	1	0									
	GLT44	Trail	Night	70	70	67.9	65.2	-2.7	1	0									
	GLT46	Trail	Night	70	70	68.7	66.1	-2.6	1	0									
	GLT48	Trail	Night	70	70	69.9	66.7	-3.2	1	0									
	GLT50	Trail	Night	70	70	**70.3**	66.6	-3.7	1	0									
	GLT52	Trail	Night	70	70	**70.4**	66.9	-3.5	1	0									
	GLT54	Trail	Night	70	70	**70.4**	66.8	-3.6	1	0									
	GLT56	Trail	Night	70	70	**70.3**	66.3	-4.0	1	0									
	GLT58	Trail	Night	70	70	**70.3**	66.1	-4.2	1	0									
	GLT60	Trail	Night	70	70	**70.4**	65.8	-4.6	1	0									
	GLT62	Trail	Night	70	70	**70.3**	66.0	-4.3	1	0									
	GLT64	Trail	Night	70	70	**70.3**	66.6	-3.7	1	0									
	GLT66	Trail	Night	70	70	**70.3**	67.3	-3.0	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B3
Build Noise Barrier Cost Effectiveness (Area 3)
Noise Barriers - SB6

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	Build (dBA)	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	
SB6	GLT69	Trail	Day	70	70	**70.9**	62.1	**-8.8**	1	1									
	GLT71	Trail	Day	70	70	**70.3**	60.5	**-9.8**	1	1									
	GLT73	Trail	Day	70	70	69.5	60.5	**-9.0**	1	1									
	GLT75	Trail	Day	70	70	68.6	60.8	**-7.8**	1	1									
	GLT77	Trail	Day	70	70	68.6	61.4	**-7.2**	1	1	**9**	**YES**	**YES**	1,797	20	35,040	$700,800	$77,867	NOT COST EFFECTIVE
	GLT79	Trail	Day	70	70	68.7	62.1	**-6.6**	1	1									
	GLT81	Trail	Day	70	70	69.6	63.0	**-6.6**	1	1									
	GLT83	Trail	Day	70	70	**70.2**	61.3	**-8.9**	1	1									
	GLT85	Trail	Day	70	70	**70.8**	61.9	**-8.9**	1	1									
	GLT69	Trail	Night	70	70	69.9	61.0	**-8.9**	1	1									
	GLT71	Trail	Night	70	70	69.3	59.5	**-9.8**	1	1									
	GLT73	Trail	Night	70	70	68.5	59.4	**-9.1**	1	1									
	GLT75	Trail	Night	70	70	67.6	59.5	**-8.1**	1	1									
	GLT77	Trail	Night	70	70	67.5	60.1	**-7.4**	1	1	**9**	**YES**	**YES**	1,797	20	35,040	$700,800	$77,867	NOT COST EFFECTIVE
	GLT79	Trail	Night	70	70	67.7	60.8	**-6.9**	1	1									
	GLT81	Trail	Night	70	70	68.7	61.7	**-7.0**	1	1									
	GLT83	Trail	Night	70	70	69.3	60.3	**-9.0**	1	1									
	GLT85	Trail	Night	70	70	**70.0**	60.9	**-9.1**	1	1									
SB6	GLT69	Trail	Day	70	70	**70.9**	64.3	**-6.6**	1	1									
	GLT71	Trail	Day	70	70	**70.3**	63.8	**-6.5**	1	1									
	GLT73	Trail	Day	70	70	69.5	63.9	**-5.6**	1	1									
	GLT75	Trail	Day	70	70	68.6	64.2	-4.4	1	0									
	GLT77	Trail	Day	70	70	68.6	64.8	-3.8	1	0	**5**	**YES**	NO	1,797	15	26,495	$529,900	$105,980	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	GLT79	Trail	Day	70	70	68.7	65.4	-3.3	1	0									
	GLT81	Trail	Day	70	70	69.6	66.6	-3.0	1	0									
	GLT83	Trail	Day	70	70	**70.2**	64.9	**-5.3**	1	1									
	GLT85	Trail	Day	70	70	**70.8**	65.2	**-5.6**	1	1									
	GLT69	Trail	Night	70	70	69.9	63.2	**-6.7**	1	1									
	GLT71	Trail	Night	70	70	69.3	62.8	**-6.5**	1	1									
	GLT73	Trail	Night	70	70	68.5	62.8	**-5.7**	1	1									
	GLT75	Trail	Night	70	70	67.6	63.0	-4.6	1	0									
	GLT77	Trail	Night	70	70	67.5	63.6	-3.9	1	0	**5**	**YES**	NO	1,797	15	26,495	$529,900	$105,980	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	GLT79	Trail	Night	70	70	67.7	64.3	-3.4	1	0									
	GLT81	Trail	Night	70	70	68.7	65.5	-3.2	1	0									
	GLT83	Trail	Night	70	70	69.3	64.0	**-5.3**	1	1									
	GLT85	Trail	Night	70	70	**70.0**	64.3	**-5.7**	1	1								$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B4
Build Noise Barrier Cost Effectiveness (Area 4)
Noise Barriers - NB2, NB3, NB4

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	Build (dBA)	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	
NB2	r4	Residential	Day	65	70	63.6	58.0	**-5.6**	1	1	**1**	**YES**	NO	854	20	16,180	$323,600	$323,600	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r4	Residential	Night	55	70	**61.8**	**56.5**	**-5.3**	1	1	**1**	**YES**	NO	854	20	16,180	$323,600	$323,600	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
NB3	r7	Residential	Day	65	70	61.5	56.5	**-5.0**	1	1	**2**	**YES**	**YES**	2,185	20	42,800	$856,000	$428,000	NOT COST EFFECTIVE
	r8	Residential	Day	65	70	**69.1**	60.4	**-8.7**	1	1									
	r9	Residential	Day	65	70	**65.8**	62.3	-3.5	1	0									
	r7	Residential	Day	65	70	61.5	56.5	**-5.0**	1	1	**2**	**YES**	**YES**	2,185	20	42,800	$856,000	$428,000	NOT COST EFFECTIVE
	r8	Residential	Day	65	70	**69.1**	60.4	**-8.7**	1	1									
	r9	Residential	Day	65	70	**65.8**	62.3	-3.5	1	0									
NB3a	r8	Residential	Day	65	70	**69.1**	62.0	**-7.1**	1	1	**1**	**YES**	**YES**	477	20	8,640	$172,800	$172,800	NOT COST EFFECTIVE
	r8	Residential	Day	65	70	**69.1**	62.0	**-7.1**	1	1	**1**	**YES**	**YES**	477	20	8,640	$172,800	$172,800	NOT COST EFFECTIVE
NB3a	r8	Residential	Day	65	70	**69.1**	64.3	-4.8	1	0	**0**	NO	NO	477	15	6,695	$133,900	N/A	NOT ACOUSTICALLY EFFECTIVE
	r8	Residential	Day	65	70	**69.1**	64.3	-4.8	1	0	**0**	NO	NO	477	15	6,695	$133,900	N/A	NOT ACOUSTICALLY EFFECTIVE
NB4	r10	Residential	Day	65	70	61.0	57.3	-3.7	1	0	**4**	**YES**	**YES**	2,443	20	47,960	$959,200	$239,800	NOT COST EFFECTIVE
	r11	Residential	Day	65	70	**65.4**	59.4	**-6.0**	1	1									
	r12	Residential	Day	65	70	62.4	57.7	-4.7	1	0									
	r14	Residential	Day	65	70	62.8	57.9	-4.9	1	0									
	r15	Residential	Day	65	70	62.7	56.3	**-6.4**	1	1									
	r16	Residential	Day	65	70	**69.2**	60.5	**-8.7**	1	1									
	r17	Residential	Day	65	70	**69.2**	60.4	**-8.8**	1	1									
	r10	Residential	Night	55	70	**59.3**	**55.8**	-3.5	1	0	**4**	**YES**	**YES**	2,443	20	47,960	$959,200	$239,800	NOT COST EFFECTIVE
	r11	Residential	Night	55	70	**63.4**	**57.4**	**-6.0**	1	1									
	r12	Residential	Night	55	70	**60.7**	**56.3**	-4.4	1	0									
	r14	Residential	Night	55	70	**60.4**	**55.8**	-4.6	1	0									
	r15	Residential	Night	55	70	**60.9**	**55.0**	**-5.9**	1	1									
	r16	Residential	Night	55	70	**66.8**	**58.8**	**-8.0**	1	1									
	r17	Residential	Night	55	70	**66.9**	**58.6**	**-8.3**	1	1									
NB4a	r14	Residential	Day	65	70	62.8	61.1	-1.7	1	0	**3**	**YES**	**YES**	1,242	20	23,940	$478,800	$159,600	NOT COST EFFECTIVE
	r15	Residential	Day	65	70	62.7	57.5	**-5.2**	1	1									
	r16	Residential	Day	65	70	**69.2**	60.6	**-8.6**	1	1									
	r17	Residential	Day	65	70	**69.2**	60.8	**-8.4**	1	1									
	r14	Residential	Night	55	70	**60.4**	**58.9**	-1.5	1	0	**3**	**YES**	**YES**	1,242	20	23,940	$478,800	$159,600	NOT COST EFFECTIVE
	r15	Residential	Night	55	70	**60.9**	**55.9**	**-5.0**	1	1									
	r16	Residential	Night	55	70	**66.8**	**58.9**	**-7.9**	1	1									
	r17	Residential	Night	55	70	**66.9**	**58.9**	**-8.0**	1	1									
NB4a	r14	Residential	Day	65	70	62.8	62.0	-0.8	1	0	**2**	**YES**	NO	1,242	15	18,170	$363,400	$181,700	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r15	Residential	Day	65	70	62.7	59.7	-3.0	1	0									
	r16	Residential	Day	65	70	**69.2**	64.0	**-5.2**	1	1									
	r17	Residential	Day	65	70	**69.2**	63.7	**-5.5**	1	1									
	r14	Residential	Night	55	70	**60.4**	**59.6**	-0.8	1	0	**1**	**YES**	NO	1,242	15	18,170	$363,400	$363,400	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r15	Residential	Night	55	70	**60.9**	**58.0**	-2.9	1	0									
	r16	Residential	Night	55	70	**66.8**	**62.0**	-4.8	1	0									
	r17	Residential	Night	55	70	**66.9**	**61.6**	**-5.3**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B5a
Build Noise Barrier Cost Effectiveness (Area 5)
Noise Barriers - SB7

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	Build (dBA)	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	
SB7	c4	Commercial	Day	70	75	65.5	61.2	-4.3	1	0	**30**	**YES**	**YES**	6,077	20	120,640	$2,412,800	$80,427	NOT COST EFFECTIVE
	GLT88	Trail	Day	70	70	**71.2**	61.1	**-10.1**	1	1									
	GLT90	Trail	Day	70	70	**71.3**	59.7	**-11.6**	1	1									
	GLT92	Trail	Day	70	70	**71.4**	60.1	**-11.3**	1	1									
	GLT94	Trail	Day	70	70	**71.4**	60.3	**-11.1**	1	1									
	GLT96	Trail	Day	70	70	**71.2**	60.2	**-11.0**	1	1									
	GLT98	Trail	Day	70	70	**71.4**	60.2	**-11.2**	1	1									
	GLT100	Trail	Day	70	70	**71.4**	60.7	**-10.7**	1	1									
	GLT102	Trail	Day	70	70	**71.4**	61.3	**-10.1**	1	1									
	GLT104	Trail	Day	70	70	**71.5**	60.7	**-10.8**	1	1									
	GLT106	Trail	Day	70	70	**71.5**	59.9	**-11.6**	1	1									
	GLT108	Trail	Day	70	70	**71.5**	59.7	**-11.8**	1	1									
	GLT110	Trail	Day	70	70	**71.4**	59.6	**-11.8**	1	1									
	GLT112	Trail	Day	70	70	**71.6**	59.3	**-12.3**	1	1									
	GLT114	Trail	Day	70	70	**71.7**	59.3	**-12.4**	1	1									
	GLT116	Trail	Day	70	70	**71.7**	59.5	**-12.2**	1	1									
	GLT118	Trail	Day	70	70	**71.6**	59.8	**-11.8**	1	1									
	GLT120	Trail	Day	70	70	**71.6**	60.1	**-11.5**	1	1									
	GLT122	Trail	Day	70	70	**71.6**	59.8	**-11.8**	1	1									
	GLT124	Trail	Day	70	70	**71.6**	59.8	**-11.8**	1	1									
	GLT126	Trail	Day	70	70	**71.6**	59.9	**-11.7**	1	1									
	GLT128	Trail	Day	70	70	**71.6**	60.1	**-11.5**	1	1									
	GLT130	Trail	Day	70	70	**71.5**	60.2	**-11.3**	1	1									
	GLT132	Trail	Day	70	70	**71.6**	60.2	**-11.4**	1	1									
	GLT134	Trail	Day	70	70	**71.5**	60.1	**-11.4**	1	1									
	GLT136	Trail	Day	70	70	**71.5**	59.9	**-11.6**	1	1									
	GLT138	Trail	Day	70	70	**71.5**	60.1	**-11.4**	1	1									
	GLT140	Trail	Day	70	70	**71.1**	60.2	**-10.9**	1	1									
	GLT142	Trail	Day	70	70	**70.6**	58.3	**-12.3**	1	1									
	GLT144	Trail	Day	70	70	69.6	57.3	**-12.3**	1	1									
	GLT146	Trail	Day	70	70	**70.8**	60.1	**-10.7**	1	1									

Table B5a
Build Noise Barrier Cost Effectiveness (Area 5)
Noise Barriers - SB7

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	Build (dBA)	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	
SB7	c4	Commercial	Night	70	75	64.4	59.7	-4.7	1	0	**30**	**YES**	**YES**	6,077	20	120,640	$2,412,800	$80,427	NOT COST EFFECTIVE
	GLT88	Trail	Night	70	70	**70.4**	60.2	**-10.2**	1	1									
	GLT90	Trail	Night	70	70	**70.5**	58.9	**-11.6**	1	1									
	GLT92	Trail	Night	70	70	**70.6**	59.2	**-11.4**	1	1									
	GLT94	Trail	Night	70	70	**70.6**	59.5	**-11.1**	1	1									
	GLT96	Trail	Night	70	70	**70.4**	59.4	**-11.0**	1	1									
	GLT98	Trail	Night	70	70	**70.6**	59.4	**-11.2**	1	1									
	GLT100	Trail	Night	70	70	**70.6**	59.9	**-10.7**	1	1									
	GLT102	Trail	Night	70	70	**70.6**	60.4	**-10.2**	1	1									
	GLT104	Trail	Night	70	70	**70.6**	59.8	**-10.8**	1	1									
	GLT106	Trail	Night	70	70	**70.6**	59.0	**-11.6**	1	1									
	GLT108	Trail	Night	70	70	**70.6**	58.8	**-11.8**	1	1									
	GLT110	Trail	Night	70	70	**70.5**	58.7	**-11.8**	1	1									
	GLT112	Trail	Night	70	70	**70.7**	58.4	**-12.3**	1	1									
	GLT114	Trail	Night	70	70	**70.7**	58.4	**-12.3**	1	1									
	GLT116	Trail	Night	70	70	**70.7**	58.5	**-12.2**	1	1									
	GLT118	Trail	Night	70	70	**70.7**	58.8	**-11.9**	1	1									
	GLT120	Trail	Night	70	70	**70.6**	59.0	**-11.6**	1	1									
	GLT122	Trail	Night	70	70	**70.6**	58.7	**-11.9**	1	1									
	GLT124	Trail	Night	70	70	**70.6**	58.7	**-11.9**	1	1									
	GLT126	Trail	Night	70	70	**70.6**	58.8	**-11.8**	1	1									
	GLT128	Trail	Night	70	70	**70.6**	59.0	**-11.6**	1	1									
	GLT130	Trail	Night	70	70	**70.6**	59.2	**-11.4**	1	1									
	GLT132	Trail	Night	70	70	**70.6**	59.2	**-11.4**	1	1									
	GLT134	Trail	Night	70	70	**70.6**	59.0	**-11.6**	1	1									
	GLT136	Trail	Night	70	70	**70.6**	58.9	**-11.7**	1	1									
	GLT138	Trail	Night	70	70	**70.5**	59.0	**-11.5**	1	1									
	GLT140	Trail	Night	70	70	**70.1**	59.1	**-11.0**	1	1									
	GLT142	Trail	Night	70	70	69.6	57.4	**-12.2**	1	1									
	GLT144	Trail	Night	70	70	68.8	56.5	**-12.3**	1	1									
	GLT146	Trail	Night	70	70	69.8	59.1	**-10.7**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B5b
Build Noise Barrier Cost Effectiveness (Area 5)
Noise Barriers - SB7

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	Build (dBA)	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	
SB7	c4	Commercial	Day	70	75	65.5	62.8	-2.7	1	0	**30**	**YES**	**YES**	6,077	15	90,695	$1,813,900	$60,463	NOT COST EFFECTIVE
	GLT88	Trail	Day	70	70	**71.2**	63.8	**-7.4**	1	1									
	GLT90	Trail	Day	70	70	**71.3**	63.0	**-8.3**	1	1									
	GLT92	Trail	Day	70	70	**71.4**	63.7	**-7.7**	1	1									
	GLT94	Trail	Day	70	70	**71.4**	64.0	**-7.4**	1	1									
	GLT96	Trail	Day	70	70	**71.2**	63.8	**-7.4**	1	1									
	GLT98	Trail	Day	70	70	**71.4**	63.9	**-7.5**	1	1									
	GLT100	Trail	Day	70	70	**71.4**	64.7	**-6.7**	1	1									
	GLT102	Trail	Day	70	70	**71.4**	65.4	**-6.0**	1	1									
	GLT104	Trail	Day	70	70	**71.5**	64.6	**-6.9**	1	1									
	GLT106	Trail	Day	70	70	**71.5**	63.4	**-8.1**	1	1									
	GLT108	Trail	Day	70	70	**71.5**	63.0	**-8.5**	1	1									
	GLT110	Trail	Day	70	70	**71.4**	63.0	**-8.4**	1	1									
	GLT112	Trail	Day	70	70	**71.6**	62.5	**-9.1**	1	1									
	GLT114	Trail	Day	70	70	**71.7**	62.5	**-9.2**	1	1									
	GLT116	Trail	Day	70	70	**71.7**	62.8	**-8.9**	1	1									
	GLT118	Trail	Day	70	70	**71.6**	63.2	**-8.4**	1	1									
	GLT120	Trail	Day	70	70	**71.6**	63.6	**-8.0**	1	1									
	GLT122	Trail	Day	70	70	**71.6**	63.1	**-8.5**	1	1									
	GLT124	Trail	Day	70	70	**71.6**	63.0	**-8.6**	1	1									
	GLT126	Trail	Day	70	70	**71.6**	63.3	**-8.3**	1	1									
	GLT128	Trail	Day	70	70	**71.6**	63.6	**-8.0**	1	1									
	GLT130	Trail	Day	70	70	**71.5**	63.8	**-7.7**	1	1									
	GLT132	Trail	Day	70	70	**71.6**	63.7	**-7.9**	1	1									
	GLT134	Trail	Day	70	70	**71.5**	63.5	**-8.0**	1	1									
	GLT136	Trail	Day	70	70	**71.5**	63.3	**-8.2**	1	1									
	GLT138	Trail	Day	70	70	**71.5**	63.5	**-8.0**	1	1									
	GLT140	Trail	Day	70	70	**71.1**	63.6	**-7.5**	1	1									
	GLT142	Trail	Day	70	70	**70.6**	61.0	**-9.6**	1	1									
	GLT144	Trail	Day	70	70	69.6	59.8	**-9.8**	1	1									
	GLT146	Trail	Day	70	70	**70.8**	63.3	**-7.5**	1	1									

Table B5b
Build Noise Barrier Cost Effectiveness (Area 5)
Noise Barriers - SB7

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	Build (dBA)	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	
SB7	c4	Commercial	Night	70	75	64.4	61.5	-2.9	1	0	**30**	**YES**	**YES**	6,077	15	90,695	$1,813,900	$60,463	NOT COST EFFECTIVE
	GLT88	Trail	Night	70	70	**70.4**	62.9	**-7.5**	1	1									
	GLT90	Trail	Night	70	70	**70.5**	62.2	**-8.3**	1	1									
	GLT92	Trail	Night	70	70	**70.6**	62.9	**-7.7**	1	1									
	GLT94	Trail	Night	70	70	**70.6**	63.2	**-7.4**	1	1									
	GLT96	Trail	Night	70	70	**70.4**	63.0	**-7.4**	1	1									
	GLT98	Trail	Night	70	70	**70.6**	63.1	**-7.5**	1	1									
	GLT100	Trail	Night	70	70	**70.6**	63.9	**-6.7**	1	1									
	GLT102	Trail	Night	70	70	**70.6**	64.6	**-6.0**	1	1									
	GLT104	Trail	Night	70	70	**70.6**	63.8	**-6.8**	1	1									
	GLT106	Trail	Night	70	70	**70.6**	62.5	**-8.1**	1	1									
	GLT108	Trail	Night	70	70	**70.6**	62.2	**-8.4**	1	1									
	GLT110	Trail	Night	70	70	**70.5**	62.1	**-8.4**	1	1									
	GLT112	Trail	Night	70	70	**70.7**	61.6	**-9.1**	1	1									
	GLT114	Trail	Night	70	70	**70.7**	61.5	**-9.2**	1	1									
	GLT116	Trail	Night	70	70	**70.7**	61.8	**-8.9**	1	1									
	GLT118	Trail	Night	70	70	**70.7**	62.2	**-8.5**	1	1									
	GLT120	Trail	Night	70	70	**70.6**	62.6	**-8.0**	1	1									
	GLT122	Trail	Night	70	70	**70.6**	62.0	**-8.6**	1	1									
	GLT124	Trail	Night	70	70	**70.6**	62.0	**-8.6**	1	1									
	GLT126	Trail	Night	70	70	**70.6**	62.2	**-8.4**	1	1									
	GLT128	Trail	Night	70	70	**70.6**	62.6	**-8.0**	1	1									
	GLT130	Trail	Night	70	70	**70.6**	62.8	**-7.8**	1	1									
	GLT132	Trail	Night	70	70	**70.6**	62.7	**-7.9**	1	1									
	GLT134	Trail	Night	70	70	**70.6**	62.6	**-8.0**	1	1									
	GLT136	Trail	Night	70	70	**70.6**	62.3	**-8.3**	1	1									
	GLT138	Trail	Night	70	70	**70.5**	62.5	**-8.0**	1	1									
	GLT140	Trail	Night	70	70	**70.1**	62.6	**-7.5**	1	1									
	GLT142	Trail	Night	70	70	69.6	60.2	**-9.4**	1	1									
	GLT144	Trail	Night	70	70	68.8	59.0	**-9.8**	1	1									
	GLT146	Trail	Night	70	70	69.8	62.4	**-7.4**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B5c
Build Noise Barrier Cost Effectiveness (Area 5)
Noise Barriers - SB7

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	Build (dBA)	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	
SB7	c4	Commercial	Day	70	75	65.5	64.4	-1.1	1	0	**3**	**YES**	NO	6,077	10	60,670	$1,213,400	$404,467	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	GLT88	Trail	Day	70	70	**71.2**	67.4	-3.8	1	0									
	GLT90	Trail	Day	70	70	**71.3**	67.2	-4.1	1	0									
	GLT92	Trail	Day	70	70	**71.4**	67.9	-3.5	1	0									
	GLT94	Trail	Day	70	70	**71.4**	68.0	-3.4	1	0									
	GLT96	Trail	Day	70	70	**71.2**	67.9	-3.3	1	0									
	GLT98	Trail	Day	70	70	**71.4**	68.1	-3.3	1	0									
	GLT100	Trail	Day	70	70	**71.4**	68.6	-2.8	1	0									
	GLT102	Trail	Day	70	70	**71.4**	69.1	-2.3	1	0									
	GLT104	Trail	Day	70	70	**71.5**	68.6	-2.9	1	0									
	GLT106	Trail	Day	70	70	**71.5**	67.6	-3.9	1	0									
	GLT108	Trail	Day	70	70	**71.5**	67.3	-4.2	1	0									
	GLT110	Trail	Day	70	70	**71.4**	67.2	-4.2	1	0									
	GLT112	Trail	Day	70	70	**71.6**	66.7	-4.9	1	0									
	GLT114	Trail	Day	70	70	**71.7**	66.6	**-5.1**	1	1									
	GLT116	Trail	Day	70	70	**71.7**	67.0	-4.7	1	0									
	GLT118	Trail	Day	70	70	**71.6**	67.4	-4.2	1	0									
	GLT120	Trail	Day	70	70	**71.6**	67.8	-3.8	1	0									
	GLT122	Trail	Day	70	70	**71.6**	67.2	-4.4	1	0									
	GLT124	Trail	Day	70	70	**71.6**	67.2	-4.4	1	0									
	GLT126	Trail	Day	70	70	**71.6**	67.4	-4.2	1	0									
	GLT128	Trail	Day	70	70	**71.6**	67.7	-3.9	1	0									
	GLT130	Trail	Day	70	70	**71.5**	67.9	-3.6	1	0									
	GLT132	Trail	Day	70	70	**71.6**	67.7	-3.9	1	0									
	GLT134	Trail	Day	70	70	**71.5**	67.7	-3.8	1	0									
	GLT136	Trail	Day	70	70	**71.5**	67.5	-4.0	1	0									
	GLT138	Trail	Day	70	70	**71.5**	67.7	-3.8	1	0									
	GLT140	Trail	Day	70	70	**71.1**	67.5	-3.6	1	0									
	GLT142	Trail	Day	70	70	**70.6**	64.8	**-5.8**	1	1									
	GLT144	Trail	Day	70	70	69.6	63.2	**-6.4**	1	1									
	GLT146	Trail	Day	70	70	**70.8**	67.2	-3.6	1	0									

Table B5c
Build Noise Barrier Cost Effectiveness (Area 5)
Noise Barriers - SB7

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	Build (dBA)	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	
SB7	c4	Commercial	Night	70	75	64.4	63.2	-1.2	1	0	**2**	**YES**	NO	6,077	10	60,670	$1,213,400	$606,700	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	GLT88	Trail	Night	70	70	**70.4**	66.6	-3.8	1	0									
	GLT90	Trail	Night	70	70	**70.5**	66.5	-4.0	1	0									
	GLT92	Trail	Night	70	70	**70.6**	67.0	-3.6	1	0									
	GLT94	Trail	Night	70	70	**70.6**	67.1	-3.5	1	0									
	GLT96	Trail	Night	70	70	**70.4**	67.0	-3.4	1	0									
	GLT98	Trail	Night	70	70	**70.6**	67.2	-3.4	1	0									
	GLT100	Trail	Night	70	70	**70.6**	67.7	-2.9	1	0									
	GLT102	Trail	Night	70	70	**70.6**	68.2	-2.4	1	0									
	GLT104	Trail	Night	70	70	**70.6**	67.6	-3.0	1	0									
	GLT106	Trail	Night	70	70	**70.6**	66.7	-3.9	1	0									
	GLT108	Trail	Night	70	70	**70.6**	66.4	-4.2	1	0									
	GLT110	Trail	Night	70	70	**70.5**	66.3	-4.2	1	0									
	GLT112	Trail	Night	70	70	**70.7**	65.9	-4.8	1	0									
	GLT114	Trail	Night	70	70	**70.7**	65.8	-4.9	1	0									
	GLT116	Trail	Night	70	70	**70.7**	66.1	-4.6	1	0									
	GLT118	Trail	Night	70	70	**70.7**	66.5	-4.2	1	0									
	GLT120	Trail	Night	70	70	**70.6**	66.8	-3.8	1	0									
	GLT122	Trail	Night	70	70	**70.6**	66.3	-4.3	1	0									
	GLT124	Trail	Night	70	70	**70.6**	66.2	-4.4	1	0									
	GLT126	Trail	Night	70	70	**70.6**	66.4	-4.2	1	0									
	GLT128	Trail	Night	70	70	**70.6**	66.7	-3.9	1	0									
	GLT130	Trail	Night	70	70	**70.6**	66.9	-3.7	1	0									
	GLT132	Trail	Night	70	70	**70.6**	66.7	-3.9	1	0									
	GLT134	Trail	Night	70	70	**70.6**	66.8	-3.8	1	0									
	GLT136	Trail	Night	70	70	**70.6**	66.6	-4.0	1	0									
	GLT138	Trail	Night	70	70	**70.5**	66.7	-3.8	1	0									
	GLT140	Trail	Night	70	70	**70.1**	66.5	-3.6	1	0									
	GLT142	Trail	Night	70	70	69.6	64.1	**-5.5**	1	1									
	GLT144	Trail	Night	70	70	68.8	62.6	**-6.2**	1	1									
	GLT146	Trail	Night	70	70	69.8	66.2	-3.6	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B6
Build Noise Barrier Cost Effectiveness (Area 6)
Noise Barriers - NB5, NB6

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	Build (dBA)	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	
NB5	r19	Residential	Day	65	70	60.8	57.2	-3.6	1	0	**1**	**YES**	NO	883	20	16,760	$335,200	$335,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r20	Residential	Day	65	70	59.8	56.3	-3.5	1	0									
	r21	Residential	Day	65	70	62.2	56.9	**-5.3**	1	1									
	r22	Residential	Day	65	70	59.0	56.1	-2.9	1	0									
	r19	Residential	Night	55	70	**59.1**	**55.8**	-3.3	1	0	**1**	**YES**	NO	883	20	16,760	$335,200	$335,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r20	Residential	Night	55	70	**58.1**	**55.0**	-3.1	1	0									
	r21	Residential	Night	55	70	**60.4**	**55.2**	**-5.2**	1	1									
	r22	Residential	Night	55	70	**57.4**	54.7	-2.7	1	0									
NB6	r30	Residential	Day	65	70	**66.5**	59.9	**-6.6**	1	1	**4**	**YES**	**YES**	2,124	20	41,580	$831,600	$207,900	NOT COST EFFECTIVE
	r33	Residential	Day	65	70	64.7	59.3	**-5.4**	1	1									
	r34	Residential	Day	65	70	61.9	58.2	-3.7	1	0									
	r35	Residential	Day	65	70	60.6	56.5	-4.1	1	0									
	r36	Residential	Day	65	70	62.3	57.1	**-5.2**	1	1									
	nT1	Trail	Day	70	70	68.4	58.5	**-9.9**	1	1									
	r30	Residential	Night	55	70	**64.5**	**58.4**	**-6.1**	1	1	**3**	**YES**	**YES**	2,124	20	41,580	$831,600	$277,200	NOT COST EFFECTIVE
	r33	Residential	Night	55	70	**62.9**	**57.9**	**-5.0**	1	1									
	r34	Residential	Night	55	70	**60.2**	**56.9**	-3.3	1	0									
	r35	Residential	Night	55	70	**59.0**	**55.2**	-3.8	1	0									
	r36	Residential	Night	55	70	**60.6**	**55.8**	-4.8	1	0									
	nT1	Trail	Night	70	70	66.1	56.4	**-9.7**	1	1									
NB6	r30	Residential	Day	65	70	**66.5**	62.6	-3.9	1	0	**1**	**YES**	**YES**	2,124	15	31,400	$628,000	$628,000	NOT COST EFFECTIVE
	r33	Residential	Day	65	70	64.7	61.6	-3.1	1	0									
	r34	Residential	Day	65	70	61.9	60.1	-1.8	1	0									
	r35	Residential	Day	65	70	60.6	58.2	-2.4	1	0									
	r36	Residential	Day	65	70	62.3	59.1	-3.2	1	0									
	nT1	Trail	Day	70	70	68.4	60.9	**-7.5**	1	1									
	r30	Residential	Night	55	70	**64.5**	**60.9**	-3.6	1	0	**1**	**YES**	**YES**	2,124	15	31,400	$628,000	$628,000	NOT COST EFFECTIVE
	r33	Residential	Night	55	70	**62.9**	**60.1**	-2.8	1	0									
	r34	Residential	Night	55	70	**60.2**	**58.6**	-1.6	1	0									
	r35	Residential	Night	55	70	**59.0**	**56.8**	-2.2	1	0									
	r36	Residential	Night	55	70	**60.6**	**57.6**	-3.0	1	0									
	nT1	Trail	Night	70	70	66.1	58.7	**-7.4**	1	1									
NB6a	nT1	Trail	Day	70	70	68.4	61.9	**-6.5**	1	1	**1**	**YES**	NO	411	20	7,320	$146,400	$146,400	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	nT1	Trail	Night	70	70	66.1	59.7	**-6.4**	1	1	**1**	**YES**	NO	411	20	7,320	$146,400	$146,400	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
																		$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; this area was removed from the calculated barrier area.

Table B7a
Build Noise Barrier Cost Effectiveness (Area 7)
Noise Barriers - SB8

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	Build (dBA)	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	
SB8	I1	Industrial	Day	80	--	65.8	59.7	**-6.1**	1	1	**10**	**YES**	**YES**	1,791	20	34,920	$698,400	$69,840	NOT COST EFFECTIVE
	GLT148	Trail	Day	70	70	**70.9**	64.1	**-6.8**	1	1									
	GLT150	Trail	Day	70	70	**71.3**	61.6	**-9.7**	1	1									
	GLT152	Trail	Day	70	70	**71.5**	61.3	**-10.2**	1	1									
	GLT154	Trail	Day	70	70	**71.5**	61.1	**-10.4**	1	1									
	GLT156	Trail	Day	70	70	**71.4**	60.7	**-10.7**	1	1									
	GLT158	Trail	Day	70	70	**71.4**	60.3	**-11.1**	1	1									
	GLT160	Trail	Day	70	70	**71.4**	60.2	**-11.2**	1	1									
	GLT162	Trail	Day	70	70	**71.5**	60.4	**-11.1**	1	1									
	GLT164	Trail	Day	70	70	**71.4**	62.2	**-9.2**	1	1									
	I1	Industrial	Night	80	--	64.6	58.0	**-6.6**	1	1	**10**	**YES**	**YES**	1,791	20	34,920	$698,400	$69,840	NOT COST EFFECTIVE
	GLT148	Trail	Night	70	70	69.9	62.9	**-7.0**	1	1									
	GLT150	Trail	Night	70	70	**70.3**	60.4	**-9.9**	1	1									
	GLT152	Trail	Night	70	70	**70.5**	60.1	**-10.4**	1	1									
	GLT154	Trail	Night	70	70	**70.6**	60.0	**-10.6**	1	1									
	GLT156	Trail	Night	70	70	**70.5**	59.6	**-10.9**	1	1									
	GLT158	Trail	Night	70	70	**70.4**	59.2	**-11.2**	1	1									
	GLT160	Trail	Night	70	70	**70.4**	59.2	**-11.2**	1	1									
	GLT162	Trail	Night	70	70	**70.5**	59.4	**-11.1**	1	1									
	GLT164	Trail	Night	70	70	**70.5**	61.1	**-9.4**	1	1									
SB8	I1	Industrial	Day	80	--	65.8	62.8	-3.0	1	0	**8**	**YES**	**YES**	1,791	15	26,405	$528,100	$66,013	NOT COST EFFECTIVE
	GLT148	Trail	Day	70	70	**70.9**	66.0	-4.9	1	0									
	GLT150	Trail	Day	70	70	**71.3**	65.1	**-6.2**	1	1									
	GLT152	Trail	Day	70	70	**71.5**	65.0	**-6.5**	1	1									
	GLT154	Trail	Day	70	70	**71.5**	64.9	**-6.6**	1	1									
	GLT156	Trail	Day	70	70	**71.4**	64.4	**-7.0**	1	1									
	GLT158	Trail	Day	70	70	**71.4**	63.8	**-7.6**	1	1									
	GLT160	Trail	Day	70	70	**71.4**	63.8	**-7.6**	1	1									
	GLT162	Trail	Day	70	70	**71.5**	63.8	**-7.7**	1	1									
	GLT164	Trail	Day	70	70	**71.4**	64.5	**-6.9**	1	1									
	I1	Industrial	Night	80	--	64.6	61.4	-3.2	1	0	**9**	**YES**	**YES**	1,791	15	26,405	$528,100	$58,678	NOT COST EFFECTIVE
	GLT148	Trail	Night	70	70	69.9	64.9	**-5.0**	1	1									
	GLT150	Trail	Night	70	70	**70.3**	63.9	**-6.4**	1	1									
	GLT152	Trail	Night	70	70	**70.5**	63.9	**-6.6**	1	1									
	GLT154	Trail	Night	70	70	**70.6**	63.8	**-6.8**	1	1									
	GLT156	Trail	Night	70	70	**70.5**	63.3	**-7.2**	1	1									
	GLT158	Trail	Night	70	70	**70.4**	62.8	**-7.6**	1	1									
	GLT160	Trail	Night	70	70	**70.4**	62.8	**-7.6**	1	1									
	GLT162	Trail	Night	70	70	**70.5**	62.8	**-7.7**	1	1									
	GLT164	Trail	Night	70	70	**70.5**	63.5	**-7.0**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B7b
Build Noise Barrier Cost Effectiveness (Area 7)
Noise Barriers - SB8

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	Build (dBA)	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	
SB8	I1	Industrial	Day	80	--	65.8	64.8	-1.0	1	0	**0**	NO	NO	1,791	10	17,810	$356,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT148	Trail	Day	70	70	**70.9**	68.4	-2.5	1	0									
	GLT150	Trail	Day	70	70	**71.3**	68.3	-3.0	1	0									
	GLT152	Trail	Day	70	70	**71.5**	68.5	-3.0	1	0									
	GLT154	Trail	Day	70	70	**71.5**	68.5	-3.0	1	0									
	GLT156	Trail	Day	70	70	**71.4**	68.3	-3.1	1	0									
	GLT158	Trail	Day	70	70	**71.4**	67.8	-3.6	1	0									
	GLT160	Trail	Day	70	70	**71.4**	67.9	-3.5	1	0									
	GLT162	Trail	Day	70	70	**71.5**	67.9	-3.6	1	0									
	GLT164	Trail	Day	70	70	**71.4**	68.0	-3.4	1	0									
	I1	Industrial	Night	80	--	64.6	63.6	-1.0	1	0	**0**	NO	NO	1,791	10	17,810	$356,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT148	Trail	Night	70	70	69.9	67.4	-2.5	1	0									
	GLT150	Trail	Night	70	70	**70.3**	67.2	-3.1	1	0									
	GLT152	Trail	Night	70	70	**70.5**	67.4	-3.1	1	0									
	GLT154	Trail	Night	70	70	**70.6**	67.4	-3.2	1	0									
	GLT156	Trail	Night	70	70	**70.5**	67.2	-3.3	1	0									
	GLT158	Trail	Night	70	70	**70.4**	66.8	-3.6	1	0									
	GLT160	Trail	Night	70	70	**70.4**	66.9	-3.5	1	0									
	GLT162	Trail	Night	70	70	**70.5**	66.9	-3.6	1	0									
	GLT164	Trail	Night	70	70	**70.5**	67.0	-3.5	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B8a
Build Noise Barrier Cost Effectiveness (Area 7)
Noise Barriers - SB9

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	Build (dBA)	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	
SB9	GLT166	Trail	Day	70	70	**71.4**	66.5	-4.9	1	0									
	GLT168	Trail	Day	70	70	**71.4**	61.2	**-10.2**	1	1									
	GLT170	Trail	Day	70	70	**71.5**	60.7	**-10.8**	1	1									
	GLT172	Trail	Day	70	70	**71.4**	60.6	**-10.8**	1	1									
	GLT174	Trail	Day	70	70	**71.4**	60.4	**-11.0**	1	1									
	GLT176	Trail	Day	70	70	**71.4**	60.2	**-11.2**	1	1									
	GLT178	Trail	Day	70	70	**71.3**	59.9	**-11.4**	1	1									
	GLT180	Trail	Day	70	70	**71.3**	59.6	**-11.7**	1	1									
	GLT182	Trail	Day	70	70	**71.3**	59.4	**-11.9**	1	1									
	GLT184	Trail	Day	70	70	**71.3**	59.2	**-12.1**	1	1	**18**	**YES**	**YES**	3,705	20	73,200	$1,464,000	$81,333	NOT COST EFFECTIVE
	GLT186	Trail	Day	70	70	**71.2**	59.3	**-11.9**	1	1									
	GLT188	Trail	Day	70	70	**71.1**	59.3	**-11.8**	1	1									
	GLT190	Trail	Day	70	70	**71.1**	59.9	**-11.2**	1	1									
	GLT192	Trail	Day	70	70	**71.1**	60.5	**-10.6**	1	1									
	GLT194	Trail	Day	70	70	**71.1**	60.5	**-10.6**	1	1									
	GLT196	Trail	Day	70	70	**71.0**	60.5	**-10.5**	1	1									
	GLT198	Trail	Day	70	70	**70.9**	60.7	**-10.2**	1	1									
	GLT200	Trail	Day	70	70	**70.9**	60.9	**-10.0**	1	1									
	GLT202	Trail	Day	70	70	**71.0**	63.6	**-7.4**	1	1									
	GLT166	Trail	Night	70	70	**70.4**	65.3	**-5.1**	1	1									
	GLT168	Trail	Night	70	70	**70.5**	60.1	**-10.4**	1	1									
	GLT170	Trail	Night	70	70	**70.5**	59.5	**-11.0**	1	1									
	GLT172	Trail	Night	70	70	**70.4**	59.4	**-11.0**	1	1									
	GLT174	Trail	Night	70	70	**70.4**	59.3	**-11.1**	1	1									
	GLT176	Trail	Night	70	70	**70.4**	59.0	**-11.4**	1	1									
	GLT178	Trail	Night	70	70	**70.4**	58.8	**-11.6**	1	1									
	GLT180	Trail	Night	70	70	**70.3**	58.5	**-11.8**	1	1									
	GLT182	Trail	Night	70	70	**70.4**	58.3	**-12.1**	1	1									
	GLT184	Trail	Night	70	70	**70.4**	58.2	**-12.2**	1	1	**19**	**YES**	**YES**	3,705	20	73,200	$1,464,000	$77,053	NOT COST EFFECTIVE
	GLT186	Trail	Night	70	70	**70.3**	58.2	**-12.1**	1	1									
	GLT188	Trail	Night	70	70	**70.1**	58.3	**-11.8**	1	1									
	GLT190	Trail	Night	70	70	**70.2**	58.9	**-11.3**	1	1									
	GLT192	Trail	Night	70	70	**70.3**	59.4	**-10.9**	1	1									
	GLT194	Trail	Night	70	70	**70.2**	59.5	**-10.7**	1	1									
	GLT196	Trail	Night	70	70	**70.2**	59.5	**-10.7**	1	1									
	GLT198	Trail	Night	70	70	**70.1**	59.8	**-10.3**	1	1									
	GLT200	Trail	Night	70	70	**70.1**	60.0	**-10.1**	1	1									
	GLT202	Trail	Night	70	70	**70.1**	62.5	**-7.6**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B8b
Build Noise Barrier Cost Effectiveness (Area 7)
Noise Barriers - SB9

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	Build (dBA)	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	
SB9	GLT166	Trail	Day	70	70	**71.4**	67.5	-3.9	1	0									
	GLT168	Trail	Day	70	70	**71.4**	64.4	**-7.0**	1	1									
	GLT170	Trail	Day	70	70	**71.5**	64.1	**-7.4**	1	1									
	GLT172	Trail	Day	70	70	**71.4**	64.2	**-7.2**	1	1									
	GLT174	Trail	Day	70	70	**71.4**	64.0	**-7.4**	1	1									
	GLT176	Trail	Day	70	70	**71.4**	63.7	**-7.7**	1	1									
	GLT178	Trail	Day	70	70	**71.3**	63.4	**-7.9**	1	1									
	GLT180	Trail	Day	70	70	**71.3**	62.9	**-8.4**	1	1									
	GLT182	Trail	Day	70	70	**71.3**	62.5	**-8.8**	1	1									
	GLT184	Trail	Day	70	70	**71.3**	62.4	**-8.9**	1	1	**18**	**YES**	**YES**	3,705	15	55,115	$1,102,300	$61,239	NOT COST EFFECTIVE
	GLT186	Trail	Day	70	70	**71.2**	62.4	**-8.8**	1	1									
	GLT188	Trail	Day	70	70	**71.1**	62.3	**-8.8**	1	1									
	GLT190	Trail	Day	70	70	**71.1**	63.4	**-7.7**	1	1									
	GLT192	Trail	Day	70	70	**71.1**	64.2	**-6.9**	1	1									
	GLT194	Trail	Day	70	70	**71.1**	64.2	**-6.9**	1	1									
	GLT196	Trail	Day	70	70	**71.0**	64.1	**-6.9**	1	1									
	GLT198	Trail	Day	70	70	**70.9**	64.4	**-6.5**	1	1									
	GLT200	Trail	Day	70	70	**70.9**	64.5	**-6.4**	1	1									
	GLT202	Trail	Day	70	70	**71.0**	65.6	**-5.4**	1	1									
	GLT166	Trail	Night	70	70	**70.4**	66.4	-4.0	1	0									
	GLT168	Trail	Night	70	70	**70.5**	63.3	**-7.2**	1	1									
	GLT170	Trail	Night	70	70	**70.5**	63.0	**-7.5**	1	1									
	GLT172	Trail	Night	70	70	**70.4**	63.1	**-7.3**	1	1									
	GLT174	Trail	Night	70	70	**70.4**	62.9	**-7.5**	1	1									
	GLT176	Trail	Night	70	70	**70.4**	62.6	**-7.8**	1	1									
	GLT178	Trail	Night	70	70	**70.4**	62.3	**-8.1**	1	1									
	GLT180	Trail	Night	70	70	**70.3**	61.9	**-8.4**	1	1									
	GLT182	Trail	Night	70	70	**70.4**	61.5	**-8.9**	1	1									
	GLT184	Trail	Night	70	70	**70.4**	61.3	**-9.1**	1	1	**18**	**YES**	**YES**	3,705	15	55,115	$1,102,300	$61,239	NOT COST EFFECTIVE
	GLT186	Trail	Night	70	70	**70.3**	61.4	**-8.9**	1	1									
	GLT188	Trail	Night	70	70	**70.1**	61.3	**-8.8**	1	1									
	GLT190	Trail	Night	70	70	**70.2**	62.4	**-7.8**	1	1									
	GLT192	Trail	Night	70	70	**70.3**	63.2	**-7.1**	1	1									
	GLT194	Trail	Night	70	70	**70.2**	63.2	**-7.0**	1	1									
	GLT196	Trail	Night	70	70	**70.2**	63.2	**-7.0**	1	1									
	GLT198	Trail	Night	70	70	**70.1**	63.5	**-6.6**	1	1									
	GLT200	Trail	Night	70	70	**70.1**	63.6	**-6.5**	1	1									
	GLT202	Trail	Night	70	70	**70.1**	64.7	**-5.4**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B8c
Build Noise Barrier Cost Effectiveness (Area 7)
Noise Barriers - SB9

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	Build (dBA)	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	
SB9	GLT166	Trail	Day	70	70	**71.4**	69.1	-2.3	1	0									
	GLT168	Trail	Day	70	70	**71.4**	68.1	-3.3	1	0									
	GLT170	Trail	Day	70	70	**71.5**	67.9	-3.6	1	0									
	GLT172	Trail	Day	70	70	**71.4**	68.0	-3.4	1	0									
	GLT174	Trail	Day	70	70	**71.4**	67.9	-3.5	1	0									
	GLT176	Trail	Day	70	70	**71.4**	67.7	-3.7	1	0									
	GLT178	Trail	Day	70	70	**71.3**	67.5	-3.8	1	0									
	GLT180	Trail	Day	70	70	**71.3**	67.1	-4.2	1	0									
	GLT182	Trail	Day	70	70	**71.3**	66.6	-4.7	1	0									
	GLT184	Trail	Day	70	70	**71.3**	66.6	-4.7	1	0	**0**	NO	NO	3,705	10	36,950	$739,000	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT186	Trail	Day	70	70	**71.2**	66.5	-4.7	1	0									
	GLT188	Trail	Day	70	70	**71.1**	66.2	-4.9	1	0									
	GLT190	Trail	Day	70	70	**71.1**	67.4	-3.7	1	0									
	GLT192	Trail	Day	70	70	**71.1**	68.0	-3.1	1	0									
	GLT194	Trail	Day	70	70	**71.1**	67.8	-3.3	1	0									
	GLT196	Trail	Day	70	70	**71.0**	67.8	-3.2	1	0									
	GLT198	Trail	Day	70	70	**70.9**	68.0	-2.9	1	0									
	GLT200	Trail	Day	70	70	**70.9**	68.0	-2.9	1	0									
	GLT202	Trail	Day	70	70	**71.0**	68.2	-2.8	1	0									
	GLT166	Trail	Night	70	70	**70.4**	68.0	-2.4	1	0									
	GLT168	Trail	Night	70	70	**70.5**	67.0	-3.5	1	0									
	GLT170	Trail	Night	70	70	**70.5**	66.8	-3.7	1	0									
	GLT172	Trail	Night	70	70	**70.4**	67.0	-3.4	1	0									
	GLT174	Trail	Night	70	70	**70.4**	66.8	-3.6	1	0									
	GLT176	Trail	Night	70	70	**70.4**	66.7	-3.7	1	0									
	GLT178	Trail	Night	70	70	**70.4**	66.5	-3.9	1	0									
	GLT180	Trail	Night	70	70	**70.3**	66.1	-4.2	1	0									
	GLT182	Trail	Night	70	70	**70.4**	65.7	-4.7	1	0									
	GLT184	Trail	Night	70	70	**70.4**	65.6	-4.8	1	0	**0**	NO	NO	3,705	10	36,950	$739,000	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT186	Trail	Night	70	70	**70.3**	65.6	-4.7	1	0									
	GLT188	Trail	Night	70	70	**70.1**	65.3	-4.8	1	0									
	GLT190	Trail	Night	70	70	**70.2**	66.5	-3.7	1	0									
	GLT192	Trail	Night	70	70	**70.3**	67.0	-3.3	1	0									
	GLT194	Trail	Night	70	70	**70.2**	66.9	-3.3	1	0									
	GLT196	Trail	Night	70	70	**70.2**	66.8	-3.4	1	0									
	GLT198	Trail	Night	70	70	**70.1**	67.0	-3.1	1	0									
	GLT200	Trail	Night	70	70	**70.1**	67.0	-3.1	1	0									
	GLT202	Trail	Night	70	70	**70.1**	67.3	-2.8	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B9
Build Noise Barrier Cost Effectiveness (Area 8)
Noise Barriers - NB7, NB8

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	Build (dBA)	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	
NB7	owc1	Residential	Day	65	70	**65.4**	63.0	-2.4	1	0	**0**	NO	NO	936	20	17,820	$356,400	N/A	NOT ACOUSTICALLY EFFECTIVE
	owc2	Residential	Day	65	70	**65.4**	62.8	-2.6	1	0									
	owc3	Residential	Day	65	70	**65.3**	62.3	-3.0	1	0									
	owc4	Residential	Day	65	70	**65.1**	61.1	-4.0	1	0									
	owc1	Residential	Night	55	70	**63.5**	**61.0**	-2.5	1	0	**0**	NO	NO	936	20	17,820	$356,400	N/A	NOT ACOUSTICALLY EFFECTIVE
	owc2	Residential	Night	55	70	**63.5**	**60.9**	-2.6	1	0									
	owc3	Residential	Night	55	70	**63.4**	**60.4**	-3.0	1	0									
	owc4	Residential	Night	55	70	**63.3**	**59.2**	-4.1	1	0									
NB8	r43	Residential	Day	65	70	**65.6**	59.8	**-5.8**	1	1	**1**	**YES**	NO	2,043	20	39,960	$799,200	$799,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r44	Residential	Day	65	70	62.8	58.3	-4.5	1	0									
	r45	Residential	Day	65	70	61.3	57.3	-4.0	1	0									
	r47	Residential	Day	65	70	59.8	56.5	-3.3	1	0									
	r48	Residential	Day	65	70	61.4	59.3	-2.1	1	0									
	r49	Residential	Day	65	70	62.4	59.3	-3.1	1	0									
	r43	Residential	Night	55	70	**63.6**	**57.4**	**-6.2**	1	1	**1**	**YES**	NO	2,043	20	39,960	$799,200	$799,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r44	Residential	Night	55	70	**61.0**	**56.5**	-4.5	1	0									
	r45	Residential	Night	55	70	**59.6**	**55.7**	-3.9	1	0									
	r47	Residential	Night	55	70	**58.2**	**55.0**	-3.2	1	0									
	r48	Residential	Night	55	70	**59.6**	**57.6**	-2.0	1	0									
	r49	Residential	Night	55	70	**60.5**	**57.4**	-3.1	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B10a
Build Noise Barrier Cost Effectiveness (Area 9)
Noise Barriers - SB10

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	Build (dBA)	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	
SB10	r51	Residential	Day	65	70	**66.6**	58.9	**-7.7**	1	1									
	GLT204	Trail	Day	70	70	**70.9**	63.1	**-7.8**	1	1									
	GLT206	Trail	Day	70	70	**70.8**	60.7	**-10.1**	1	1									
	GLT208	Trail	Day	70	70	**70.8**	60.6	**-10.2**	1	1									
	GLT210	Trail	Day	70	70	**70.9**	60.7	**-10.2**	1	1									
	GLT212	Trail	Day	70	70	**70.9**	60.8	**-10.1**	1	1									
	GLT214	Trail	Day	70	70	**70.9**	60.9	**-10.0**	1	1									
	GLT216	Trail	Day	70	70	**70.9**	60.7	**-10.2**	1	1									
	GLT218	Trail	Day	70	70	**71.0**	60.6	**-10.4**	1	1									
	GLT220	Trail	Day	70	70	**71.0**	60.8	**-10.2**	1	1									
	GLT222	Trail	Day	70	70	**71.0**	60.9	**-10.1**	1	1	**19**	**YES**	**YES**	3,702	20	73,140	$1,462,800	$76,989	NOT COST EFFECTIVE
	GLT224	Trail	Day	70	70	**71.1**	61.0	**-10.1**	1	1									
	GLT226	Trail	Day	70	70	**71.0**	60.8	**-10.2**	1	1									
	GLT228	Trail	Day	70	70	**71.0**	60.9	**-10.1**	1	1									
	GLT230	Trail	Day	70	70	**71.1**	60.9	**-10.2**	1	1									
	GLT232	Trail	Day	70	70	**71.0**	61.1	**-9.9**	1	1									
	GLT234	Trail	Day	70	70	**71.0**	61.3	**-9.7**	1	1									
	GLT236	Trail	Day	70	70	**71.1**	61.2	**-9.9**	1	1									
	GLT238	Trail	Day	70	70	**71.0**	61.4	**-9.6**	1	1									
	GLT240	Trail	Day	70	70	**71.0**	69.2	-1.8	1	0									
	c10	Commercial	Day	70	75	61.3	56.4	-4.9	1	0									
	r51	Residential	Night	55	70	**65.7**	**57.6**	**-8.1**	1	1									
	GLT204	Trail	Night	70	70	**70.1**	62.0	**-8.1**	1	1									
	GLT206	Trail	Night	70	70	**70.0**	59.7	**-10.3**	1	1									
	GLT208	Trail	Night	70	70	**70.1**	59.7	**-10.4**	1	1									
	GLT210	Trail	Night	70	70	**70.1**	59.6	**-10.5**	1	1									
	GLT212	Trail	Night	70	70	**70.1**	59.8	**-10.3**	1	1									
	GLT214	Trail	Night	70	70	**70.0**	59.9	**-10.1**	1	1									
	GLT216	Trail	Night	70	70	**70.1**	59.6	**-10.5**	1	1									
	GLT218	Trail	Night	70	70	**70.1**	59.6	**-10.5**	1	1									
	GLT220	Trail	Night	70	70	**70.1**	59.8	**-10.3**	1	1									
	GLT222	Trail	Night	70	70	**70.1**	59.8	**-10.3**	1	1	**20**	**YES**	**YES**	3,702	20	73,140	$1,462,800	$73,140	NOT COST EFFECTIVE
	GLT224	Trail	Night	70	70	**70.1**	59.9	**-10.2**	1	1									
	GLT226	Trail	Night	70	70	**70.1**	59.7	**-10.4**	1	1									
	GLT228	Trail	Night	70	70	**70.1**	59.7	**-10.4**	1	1									
	GLT230	Trail	Night	70	70	**70.1**	59.8	**-10.3**	1	1									
	GLT232	Trail	Night	70	70	**70.1**	59.9	**-10.2**	1	1									
	GLT234	Trail	Night	70	70	**70.1**	60.1	**-10.0**	1	1									
	GLT236	Trail	Night	70	70	**70.1**	60.0	**-10.1**	1	1									
	GLT238	Trail	Night	70	70	**70.1**	60.3	**-9.8**	1	1									
	GLT240	Trail	Night	70	70	**70.1**	68.2	-1.9	1	0									
	c10	Commercial	Night	70	75	60.2	54.7	**-5.5**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B10b
Build Noise Barrier Cost Effectiveness (Area 9)
Noise Barriers - SB10

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	Build (dBA)	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	
SB10	r51	Residential	Day	65	70	**66.6**	61.7	-4.9	1	0	**18**	**YES**	NO	3,702	15	55,070	$1,101,400	$61,189	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	GLT204	Trail	Day	70	70	**70.9**	65.3	**-5.6**	1	1									
	GLT206	Trail	Day	70	70	**70.8**	64.1	**-6.7**	1	1									
	GLT208	Trail	Day	70	70	**70.8**	64.3	**-6.5**	1	1									
	GLT210	Trail	Day	70	70	**70.9**	64.4	**-6.5**	1	1									
	GLT212	Trail	Day	70	70	**70.9**	64.6	**-6.3**	1	1									
	GLT214	Trail	Day	70	70	**70.9**	64.8	**-6.1**	1	1									
	GLT216	Trail	Day	70	70	**70.9**	64.4	**-6.5**	1	1									
	GLT218	Trail	Day	70	70	**71.0**	64.4	**-6.6**	1	1									
	GLT220	Trail	Day	70	70	**71.0**	64.7	**-6.3**	1	1									
	GLT222	Trail	Day	70	70	**71.0**	64.8	**-6.2**	1	1									
	GLT224	Trail	Day	70	70	**71.1**	64.8	**-6.3**	1	1									
	GLT226	Trail	Day	70	70	**71.0**	64.6	**-6.4**	1	1									
	GLT228	Trail	Day	70	70	**71.0**	64.7	**-6.3**	1	1									
	GLT230	Trail	Day	70	70	**71.1**	64.7	**-6.4**	1	1									
	GLT232	Trail	Day	70	70	**71.0**	64.9	**-6.1**	1	1									
	GLT234	Trail	Day	70	70	**71.0**	65.1	**-5.9**	1	1									
	GLT236	Trail	Day	70	70	**71.1**	64.9	**-6.2**	1	1									
	GLT238	Trail	Day	70	70	**71.0**	65.1	**-5.9**	1	1									
	GLT240	Trail	Day	70	70	**71.0**	69.7	-1.3	1	0									
	c10	Commercial	Day	70	75	61.3	58.8	-2.5	1	0									
	r51	Residential	Night	55	70	**65.7**	**60.6**	**-5.1**	1	1	**19**	**YES**	NO	3,702	15	55,070	$1,101,400	$57,968	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	GLT204	Trail	Night	70	70	**70.1**	64.4	**-5.7**	1	1									
	GLT206	Trail	Night	70	70	**70.0**	63.2	**-6.8**	1	1									
	GLT208	Trail	Night	70	70	**70.1**	63.4	**-6.7**	1	1									
	GLT210	Trail	Night	70	70	**70.1**	63.4	**-6.7**	1	1									
	GLT212	Trail	Night	70	70	**70.1**	63.6	**-6.5**	1	1									
	GLT214	Trail	Night	70	70	**70.0**	63.8	**-6.2**	1	1									
	GLT216	Trail	Night	70	70	**70.1**	63.5	**-6.6**	1	1									
	GLT218	Trail	Night	70	70	**70.1**	63.4	**-6.7**	1	1									
	GLT220	Trail	Night	70	70	**70.1**	63.7	**-6.4**	1	1									
	GLT222	Trail	Night	70	70	**70.1**	63.7	**-6.4**	1	1									
	GLT224	Trail	Night	70	70	**70.1**	63.8	**-6.3**	1	1									
	GLT226	Trail	Night	70	70	**70.1**	63.6	**-6.5**	1	1									
	GLT228	Trail	Night	70	70	**70.1**	63.6	**-6.5**	1	1									
	GLT230	Trail	Night	70	70	**70.1**	63.6	**-6.5**	1	1									
	GLT232	Trail	Night	70	70	**70.1**	63.8	**-6.3**	1	1									
	GLT234	Trail	Night	70	70	**70.1**	64.0	**-6.1**	1	1									
	GLT236	Trail	Night	70	70	**70.1**	63.8	**-6.3**	1	1									
	GLT238	Trail	Night	70	70	**70.1**	64.0	**-6.1**	1	1									
	GLT240	Trail	Night	70	70	**70.1**	68.7	-1.4	1	0									
	c10	Commercial	Night	70	75	60.2	57.4	-2.8	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B11a
Build Noise Barrier Cost Effectiveness (Area 9)
Noise Barriers - SB11

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	Build (dBA)	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	
SB11	GLT242	Trail	Day	70	70	**71.0**	61.6	**-9.4**	1	1	**10**	**YES**	**YES**	2,012	20	39,340	$786,800	$78,680	NOT COST EFFECTIVE
	GLT244	Trail	Day	70	70	**71.0**	60.9	**-10.1**	1	1									
	GLT246	Trail	Day	70	70	**71.0**	60.6	**-10.4**	1	1									
	GLT248	Trail	Day	70	70	**71.0**	60.4	**-10.6**	1	1									
	GLT250	Trail	Day	70	70	**71.0**	60.3	**-10.7**	1	1									
	GLT252	Trail	Day	70	70	**71.0**	60.4	**-10.6**	1	1									
	GLT254	Trail	Day	70	70	**71.0**	60.3	**-10.7**	1	1									
	GLT256	Trail	Day	70	70	**71.0**	60.0	**-11.0**	1	1									
	GLT258	Trail	Day	70	70	**71.0**	60.1	**-10.9**	1	1									
	GLT260	Trail	Day	70	70	**70.9**	64.5	**-6.4**	1	1									
	GLT242	Trail	Night	70	70	**70.1**	60.5	**-9.6**	1	1	**10**	**YES**	**YES**	2,012	20	39,340	$786,800	$78,680	NOT COST EFFECTIVE
	GLT244	Trail	Night	70	70	**70.1**	59.8	**-10.3**	1	1									
	GLT246	Trail	Night	70	70	**70.1**	59.4	**-10.7**	1	1									
	GLT248	Trail	Night	70	70	**70.0**	59.3	**-10.7**	1	1									
	GLT250	Trail	Night	70	70	**70.0**	59.2	**-10.8**	1	1									
	GLT252	Trail	Night	70	70	**70.0**	59.3	**-10.7**	1	1									
	GLT254	Trail	Night	70	70	**70.0**	59.1	**-10.9**	1	1									
	GLT256	Trail	Night	70	70	**70.0**	58.9	**-11.1**	1	1									
	GLT258	Trail	Night	70	70	**70.0**	59.0	**-11.0**	1	1									
	GLT260	Trail	Night	70	70	69.9	63.4	**-6.5**	1	1									
SB11	GLT242	Trail	Day	70	70	**71.0**	65.0	**-6.0**	1	1	**10**	**YES**	**YES**	2,012	15	29,720	$594,400	$59,440	NOT COST EFFECTIVE
	GLT244	Trail	Day	70	70	**71.0**	64.6	**-6.4**	1	1									
	GLT246	Trail	Day	70	70	**71.0**	64.1	**-6.9**	1	1									
	GLT248	Trail	Day	70	70	**71.0**	64.1	**-6.9**	1	1									
	GLT250	Trail	Day	70	70	**71.0**	63.9	**-7.1**	1	1									
	GLT252	Trail	Day	70	70	**71.0**	64.0	**-7.0**	1	1									
	GLT254	Trail	Day	70	70	**71.0**	63.9	**-7.1**	1	1									
	GLT256	Trail	Day	70	70	**71.0**	63.4	**-7.6**	1	1									
	GLT258	Trail	Day	70	70	**71.0**	63.3	**-7.7**	1	1									
	GLT260	Trail	Day	70	70	**70.9**	65.8	**-5.1**	1	1									
	GLT242	Trail	Night	70	70	**70.1**	63.9	**-6.2**	1	1	**10**	**YES**	**YES**	2,012	15	29,720	$594,400	$59,440	NOT COST EFFECTIVE
	GLT244	Trail	Night	70	70	**70.1**	63.4	**-6.7**	1	1									
	GLT246	Trail	Night	70	70	**70.1**	63.0	**-7.1**	1	1									
	GLT248	Trail	Night	70	70	**70.0**	63.0	**-7.0**	1	1									
	GLT250	Trail	Night	70	70	**70.0**	62.9	**-7.1**	1	1									
	GLT252	Trail	Night	70	70	**70.0**	62.9	**-7.1**	1	1									
	GLT254	Trail	Night	70	70	**70.0**	62.7	**-7.3**	1	1									
	GLT256	Trail	Night	70	70	**70.0**	62.3	**-7.7**	1	1									
	GLT258	Trail	Night	70	70	**70.0**	62.3	**-7.7**	1	1									
	GLT260	Trail	Night	70	70	69.9	64.7	**-5.2**	1	1									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B11b
Build Noise Barrier Cost Effectiveness (Area 9)
Noise Barriers - SB11

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	Build (dBA)	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	
SB11	GLT242	Trail	Day	70	70	**71.0**	68.1	-2.9	1	0	**0**	NO	NO	2,012	10	20,020	$400,400	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT244	Trail	Day	70	70	**71.0**	68.0	-3.0	1	0									
	GLT246	Trail	Day	70	70	**71.0**	67.8	-3.2	1	0									
	GLT248	Trail	Day	70	70	**71.0**	67.8	-3.2	1	0									
	GLT250	Trail	Day	70	70	**71.0**	67.7	-3.3	1	0									
	GLT252	Trail	Day	70	70	**71.0**	67.7	-3.3	1	0									
	GLT254	Trail	Day	70	70	**71.0**	67.6	-3.4	1	0									
	GLT256	Trail	Day	70	70	**71.0**	67.3	-3.7	1	0									
	GLT258	Trail	Day	70	70	**71.0**	67.2	-3.8	1	0									
	GLT260	Trail	Day	70	70	**70.9**	67.8	-3.1	1	0									
	GLT242	Trail	Night	70	70	**70.1**	67.1	-3.0	1	0	**0**	NO	NO	2,012	10	20,020	$400,400	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT244	Trail	Night	70	70	**70.1**	66.9	-3.2	1	0									
	GLT246	Trail	Night	70	70	**70.1**	66.7	-3.4	1	0									
	GLT248	Trail	Night	70	70	**70.0**	66.7	-3.3	1	0									
	GLT250	Trail	Night	70	70	**70.0**	66.7	-3.3	1	0									
	GLT252	Trail	Night	70	70	**70.0**	66.7	-3.3	1	0									
	GLT254	Trail	Night	70	70	**70.0**	66.6	-3.4	1	0									
	GLT256	Trail	Night	70	70	**70.0**	66.3	-3.7	1	0									
	GLT258	Trail	Night	70	70	**70.0**	66.2	-3.8	1	0									
	GLT260	Trail	Night	70	70	69.9	66.8	-3.1	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B12
Build Noise Barrier Cost Effectiveness (Area 9)
Noise Barriers - SB12

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	Build (dBA)	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	
SB12	GLT262	Trail	Day	70	70	**70.7**	61.8	**-8.9**	1	1	**7**	**YES**	**YES**	1,371	20	26,520	$530,400	$75,771	NOT COST EFFECTIVE
	GLT264	Trail	Day	70	70	**70.7**	59.5	**-11.2**	1	1									
	GLT266	Trail	Day	70	70	**70.8**	59.3	**-11.5**	1	1									
	GLT268	Trail	Day	70	70	**70.8**	59.6	**-11.2**	1	1									
	GLT270	Trail	Day	70	70	**70.8**	59.7	**-11.1**	1	1									
	GLT272	Trail	Day	70	70	**70.7**	59.9	**-10.8**	1	1									
	GLT274	Trail	Day	70	70	**70.7**	63.0	**-7.7**	1	1									
	GLT262	Trail	Night	70	70	69.8	60.7	**-9.1**	1	1	**7**	**YES**	**YES**	1,371	20	26,520	$530,400	$75,771	NOT COST EFFECTIVE
	GLT264	Trail	Night	70	70	69.7	58.5	**-11.2**	1	1									
	GLT266	Trail	Night	70	70	69.8	58.3	**-11.5**	1	1									
	GLT268	Trail	Night	70	70	69.8	58.5	**-11.3**	1	1									
	GLT270	Trail	Night	70	70	69.8	58.6	**-11.2**	1	1									
	GLT272	Trail	Night	70	70	69.7	58.8	**-10.9**	1	1									
	GLT274	Trail	Night	70	70	69.7	61.7	**-8.0**	1	1									
SB12	GLT262	Trail	Day	70	70	**70.7**	64.2	**-6.5**	1	1	**7**	**YES**	**YES**	1,371	15	20,105	$402,100	$57,443	NOT COST EFFECTIVE
	GLT264	Trail	Day	70	70	**70.7**	62.6	**-8.1**	1	1									
	GLT266	Trail	Day	70	70	**70.8**	62.5	**-8.3**	1	1									
	GLT268	Trail	Day	70	70	**70.8**	63.0	**-7.8**	1	1									
	GLT270	Trail	Day	70	70	**70.8**	63.0	**-7.8**	1	1									
	GLT272	Trail	Day	70	70	**70.7**	63.1	**-7.6**	1	1									
	GLT274	Trail	Day	70	70	**70.7**	64.7	**-6.0**	1	1									
	GLT262	Trail	Night	70	70	69.8	63.1	**-6.7**	1	1	**7**	**YES**	**YES**	1,371	15	20,105	$402,100	$57,443	NOT COST EFFECTIVE
	GLT264	Trail	Night	70	70	69.7	61.6	**-8.1**	1	1									
	GLT266	Trail	Night	70	70	69.8	61.5	**-8.3**	1	1									
	GLT268	Trail	Night	70	70	69.8	61.9	**-7.9**	1	1									
	GLT270	Trail	Night	70	70	69.8	61.9	**-7.9**	1	1									
	GLT272	Trail	Night	70	70	69.7	62.1	**-7.6**	1	1									
	GLT274	Trail	Night	70	70	69.7	63.6	**-6.1**	1	1									
SB12	GLT262	Trail	Day	70	70	**70.7**	67.4	-3.3	1	0	**0**	NO	NO	1,371	10	13,610	$272,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT264	Trail	Day	70	70	**70.7**	66.6	-4.1	1	0									
	GLT266	Trail	Day	70	70	**70.8**	66.5	-4.3	1	0									
	GLT268	Trail	Day	70	70	**70.8**	67.0	-3.8	1	0									
	GLT270	Trail	Day	70	70	**70.8**	67.0	-3.8	1	0									
	GLT272	Trail	Day	70	70	**70.7**	67.1	-3.6	1	0									
	GLT274	Trail	Day	70	70	**70.7**	67.4	-3.3	1	0									
	GLT262	Trail	Night	70	70	69.8	66.4	-3.4	1	0	**0**	NO	NO	1,371	10	13,610	$272,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	GLT264	Trail	Night	70	70	69.7	65.6	-4.1	1	0									
	GLT266	Trail	Night	70	70	69.8	65.5	-4.3	1	0									
	GLT268	Trail	Night	70	70	69.8	66.0	-3.8	1	0									
	GLT270	Trail	Night	70	70	69.8	66.0	-3.8	1	0									
	GLT272	Trail	Night	70	70	69.7	66.0	-3.7	1	0									
	GLT274	Trail	Night	70	70	69.7	66.4	-3.3	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B13a
Build Noise Barrier Cost Effectiveness (Area 9)
Noise Barriers - SB13

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	Build (dBA)	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	
SB13	r90	Residential	Day	65	70	59.8	55.1	-4.7	1	0	**10**	**YES**	**YES**	1,797	20	35,040	$700,800	$70,080	NOT COST EFFECTIVE
	r91	Residential	Day	65	70	64.4	58.1	**-6.3**	1	1									
	GLT276	Trail	Day	70	70	**70.6**	62.0	**-8.6**	1	1									
	GLT278	Trail	Day	70	70	**70.7**	60.1	**-10.6**	1	1									
	GLT280	Trail	Day	70	70	**70.7**	60.4	**-10.3**	1	1									
	GLT282	Trail	Day	70	70	**70.7**	59.8	**-10.9**	1	1									
	GLT284	Trail	Day	70	70	**70.6**	59.2	**-11.4**	1	1									
	GLT286	Trail	Day	70	70	**70.3**	59.4	**-10.9**	1	1									
	GLT288	Trail	Day	70	70	69.8	59.6	**-10.2**	1	1									
	GLT290	Trail	Day	70	70	68.8	60.3	**-8.5**	1	1									
	GLT292	Trail	Day	70	70	67.6	62.4	**-5.2**	1	1									
	GLT294	Trail	Day	70	70	66.3	65.3	-1.0	1	0									
	r90	Residential	Night	55	70	**58.6**	53.4	**-5.2**	1	1	**11**	**YES**	**YES**	1,797	20	35,040	$700,800	$63,709	NOT COST EFFECTIVE
	r91	Residential	Night	55	70	**63.3**	**56.6**	**-6.7**	1	1									
	GLT276	Trail	Night	70	70	69.7	60.7	**-9.0**	1	1									
	GLT278	Trail	Night	70	70	69.8	59.0	**-10.8**	1	1									
	GLT280	Trail	Night	70	70	69.8	59.2	**-10.6**	1	1									
	GLT282	Trail	Night	70	70	69.7	58.6	**-11.1**	1	1									
	GLT284	Trail	Night	70	70	69.6	58.1	**-11.5**	1	1									
	GLT286	Trail	Night	70	70	69.3	58.3	**-11.0**	1	1									
	GLT288	Trail	Night	70	70	68.8	58.5	**-10.3**	1	1									
	GLT290	Trail	Night	70	70	67.8	59.2	**-8.6**	1	1									
	GLT292	Trail	Night	70	70	66.5	61.3	**-5.2**	1	1									
	GLT294	Trail	Night	70	70	65.2	64.0	-1.2	1	0									
SB13	r90	Residential	Day	65	70	59.8	57.4	-2.4	1	0	**8**	**YES**	**YES**	1,797	15	26,495	$529,900	$66,238	NOT COST EFFECTIVE
	r91	Residential	Day	65	70	64.4	60.8	-3.6	1	0									
	GLT276	Trail	Day	70	70	**70.6**	64.0	**-6.6**	1	1									
	GLT278	Trail	Day	70	70	**70.7**	63.4	**-7.3**	1	1									
	GLT280	Trail	Day	70	70	**70.7**	64.1	**-6.6**	1	1									
	GLT282	Trail	Day	70	70	**70.7**	63.2	**-7.5**	1	1									
	GLT284	Trail	Day	70	70	**70.6**	62.4	**-8.2**	1	1									
	GLT286	Trail	Day	70	70	**70.3**	62.7	**-7.6**	1	1									
	GLT288	Trail	Day	70	70	69.8	63.0	**-6.8**	1	1									
	GLT290	Trail	Day	70	70	68.8	63.4	**-5.4**	1	1									
	GLT292	Trail	Day	70	70	67.6	63.9	-3.7	1	0									
	GLT294	Trail	Day	70	70	66.3	65.6	-0.7	1	0									
	r90	Residential	Night	55	70	**58.6**	**56.0**	-2.6	1	0	**8**	**YES**	**YES**	1,797	15	26,495	$529,900	$66,238	NOT COST EFFECTIVE
	r91	Residential	Night	55	70	**63.3**	**59.4**	-3.9	1	0									
	GLT276	Trail	Night	70	70	69.7	62.9	**-6.8**	1	1									
	GLT278	Trail	Night	70	70	69.8	62.3	**-7.5**	1	1									
	GLT280	Trail	Night	70	70	69.8	63.0	**-6.8**	1	1									
	GLT282	Trail	Night	70	70	69.7	62.1	**-7.6**	1	1									
	GLT284	Trail	Night	70	70	69.6	61.4	**-8.2**	1	1									
	GLT286	Trail	Night	70	70	69.3	61.6	**-7.7**	1	1									
	GLT288	Trail	Night	70	70	68.8	61.9	**-6.9**	1	1									
	GLT290	Trail	Night	70	70	67.8	62.3	**-5.5**	1	1									
	GLT292	Trail	Night	70	70	66.5	62.8	-3.7	1	0									
	GLT294	Trail	Night	70	70	65.2	64.4	-0.8	1	0									
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B13b
Build Noise Barrier Cost Effectiveness (Area 9)
Noise Barriers - SB13

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	Build (dBA)	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	
SB13	r90	Residential	Day	65	70	59.8	59.0	-0.8	1	0	**0**	NO	NO	1,797	10	17,870	$357,400	N/A	NOT ACOUSTICALLY EFFECTIVE
	r91	Residential	Day	65	70	64.4	63.0	-1.4	1	0									
	GLT276	Trail	Day	70	70	**70.6**	67.0	-3.6	1	0									
	GLT278	Trail	Day	70	70	**70.7**	67.1	-3.6	1	0									
	GLT280	Trail	Day	70	70	**70.7**	67.7	-3.0	1	0									
	GLT282	Trail	Day	70	70	**70.7**	67.1	-3.6	1	0									
	GLT284	Trail	Day	70	70	**70.6**	66.4	-4.2	1	0									
	GLT286	Trail	Day	70	70	**70.3**	66.5	-3.8	1	0									
	GLT288	Trail	Day	70	70	69.8	66.7	-3.1	1	0									
	GLT290	Trail	Day	70	70	68.8	66.5	-2.3	1	0									
	GLT292	Trail	Day	70	70	67.6	65.8	-1.8	1	0									
	GLT294	Trail	Day	70	70	66.3	66.0	-0.3	1	0									
	r90	Residential	Night	55	70	**58.6**	**57.8**	-0.8	1	0	**0**	NO	NO	1,797	10	17,870	$357,400	N/A	NOT ACOUSTICALLY EFFECTIVE
	r91	Residential	Night	55	70	**63.3**	**61.8**	-1.5	1	0									
	GLT276	Trail	Night	70	70	69.7	66.0	-3.7	1	0									
	GLT278	Trail	Night	70	70	69.8	66.1	-3.7	1	0									
	GLT280	Trail	Night	70	70	69.8	66.6	-3.2	1	0									
	GLT282	Trail	Night	70	70	69.7	66.1	-3.6	1	0									
	GLT284	Trail	Night	70	70	69.6	65.4	-4.2	1	0									
	GLT286	Trail	Night	70	70	69.3	65.5	-3.8	1	0									
	GLT288	Trail	Night	70	70	68.8	65.6	-3.2	1	0									
	GLT290	Trail	Night	70	70	67.8	65.4	-2.4	1	0									
	GLT292	Trail	Night	70	70	66.5	64.7	-1.8	1	0									
	GLT294	Trail	Night	70	70	65.2	64.8	-0.4	1	0									
																		$43,500	MnDOT Threshold

NOTES:

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

Table B14
Build Noise Barrier Cost Effectiveness (Area 10)
Noise Barriers - NB9, NB10

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	Build (dBA)	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	
NB9	c11	Commercial	Day	70	75	65.5	59.4	**-6.1**	1	1	**5**	**YES**	NO	1,914	20	36,480	$729,600	$145,920	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	c14	Residential	Day	65	70	**67.7**	64.2	-3.5	1	0									
	c15	Residential	Day	65	70	**67.4**	62.5	-4.9	1	0									
	r70	Residential	Day	65	70	**66.1**	60.8	**-5.3**	1	1									
	r71	Residential	Day	65	70	**65.1**	59.6	**-5.5**	1	1									
	r72	Residential	Day	65	70	64.6	59.3	**-5.3**	1	1									
	r73	Residential	Day	65	70	63.9	59.1	-4.8	1	0									
	r74	Residential	Day	65	70	63.7	58.9	-4.8	1	0									
	c16	Residential	Day	65	70	63.1	58.7	-4.4	1	0									
	r76	Residential	Day	65	70	62.1	58.6	-3.5	1	0									
	r77	Residential	Day	65	70	61.8	58.6	-3.2	1	0									
	r79	Residential	Day	65	70	**66.1**	59.9	**-6.2**	1	1									
	r80	Residential	Day	65	70	63.8	60.3	-3.5	1	0									
	r81	Residential	Day	65	70	**66.9**	62.5	-4.4	1	0									
	r82	Residential	Day	65	70	61.7	60.4	-1.3	1	0									
	c17	Commercial	Day	70	75	62.0	60.1	-1.9	1	0									
	r60	Residential	Day	65	70	**65.7**	61.5	-4.2	1	0									
	r61	Residential	Day	65	70	**65.2**	61.3	-3.9	1	0									
	r62	Residential	Day	65	70	64.7	60.8	-3.9	1	0									
	r63	Residential	Day	65	70	61.2	60.0	-1.2	1	0									
	r64	Residential	Day	65	70	60.4	59.3	-1.1	1	0									
	c11	Commercial	Night	70	75	63.6	57.9	**-5.7**	1	1	**5**	**YES**	NO	1,914	20	36,480	$729,600	$145,920	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	c14	Residential	Night	55	70	**65.6**	**62.0**	-3.6	1	0									
	c15	Residential	Night	55	70	**65.4**	**60.5**	-4.9	1	0									
	r70	Residential	Night	55	70	**64.2**	**58.9**	**-5.3**	1	1									
	r71	Residential	Night	55	70	**63.3**	**57.8**	**-5.5**	1	1									
	r72	Residential	Night	55	70	**62.8**	**57.5**	**-5.3**	1	1									
	r73	Residential	Night	55	70	**62.1**	**57.2**	-4.9	1	0									
	r74	Residential	Night	55	70	**61.9**	**57.1**	-4.8	1	0									
	c16	Residential	Night	55	70	**61.4**	**56.8**	-4.6	1	0									
	r76	Residential	Night	55	70	**60.4**	**56.7**	-3.7	1	0									
	r77	Residential	Night	55	70	**60.1**	**56.9**	-3.2	1	0									
	r79	Residential	Night	55	70	**64.2**	**58.4**	**-5.8**	1	1									
	r80	Residential	Night	55	70	**62.1**	**58.7**	-3.4	1	0									
	r81	Residential	Night	55	70	**65.0**	**60.7**	-4.3	1	0									
	r82	Residential	Night	55	70	**59.6**	**58.5**	-1.1	1	0									
	c17	Commercial	Night	70	75	60.0	58.1	-1.9	1	0									
	r60	Residential	Night	55	70	**63.8**	**59.6**	-4.2	1	0									
	r61	Residential	Night	55	70	**63.2**	**59.4**	-3.8	1	0									
	r62	Residential	Night	55	70	**62.5**	**58.9**	-3.6	1	0									
	r63	Residential	Night	55	70	**59.0**	**58.2**	-0.8	1	0									
	r64	Residential	Night	55	70	**58.1**	**57.4**	-0.7	1	0									
NB10	r92	Residential	Day	65	70	**70.4**	**67.3**	-3.1	1	0	**0**	NO	NO	385	20	5,900	$118,000	N/A	NOT ACOUSTICALLY EFFECTIVE
	r92	Residential	Night	55	70	**68.1**	**64.9**	-3.2	1	0	**0**	NO	NO	385	20	5,900	$118,000	N/A	NOT ACOUSTICALLY EFFECTIVE
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Table B15
Build Noise Barrier Cost Effectiveness (Areas 11 & 12)
Noise Barriers - SB14, SB15, NB11, NB12, NB13

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	Build (dBA)	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	
SB14	r93	Residential	Day	65	70	63.6	60.1	-3.5	1	0	**1**	**YES**	**YES**	1,070	20	19,600	$392,000	$392,000	NOT COST EFFECTIVE
	r94	Residential	Day	65	70	**69.4**	61.8	**-7.6**	1	1									
	r93	Residential	Night	55	70	**62.2**	**58.3**	-3.9	1	0	**1**	**YES**	**YES**	1,070	20	19,600	$392,000	$392,000	NOT COST EFFECTIVE
	r94	Residential	Night	55	70	**68.3**	**60.5**	**-7.8**	1	1									
SB14a	r94	Residential	Day	65	70	**69.4**	62.4	**-7.0**	1	1	**1**	**YES**	**YES**	403	20	7,160	$143,200	$143,200	NOT COST EFFECTIVE
	r94	Residential	Night	55	70	**68.3**	**61.2**	**-7.1**	1	1	**1**	**YES**	**YES**	403	20	7,160	$143,200	$143,200	NOT COST EFFECTIVE
SB14a	r94	Residential	Day	65	70	**69.4**	64.7	-4.7	1	0	**0**	NO	NO	403	20	7,160	$143,200	N/A	NOT ACOUSTICALLY EFFECTIVE
	r94	Residential	Night	55	70	**68.3**	**63.5**	-4.8	1	0	**0**	NO	NO	403	20	7,160	$143,200	N/A	NOT ACOUSTICALLY EFFECTIVE
SB15	c21	Commercial	Day	70	75	66.5	60.0	**-6.5**	1	1	**2**	**YES**	NO	1,411	20	26,420	$528,400	$264,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r98	Residential	Day	65	70	64.5	58.1	**-6.4**	1	1									
	c21	Commercial	Night	70	75	65.4	58.7	**-6.7**	1	1	**2**	**YES**	NO	1,411	20	26,420	$528,400	$264,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r98	Residential	Night	55	70	**63.3**	**56.8**	**-6.5**	1	1									
NB11	r96	Residential	Day	65	70	**69.5**	62.5	**-7.0**	1	1	**1**	**YES**	**YES**	736	20	12,920	$258,400	$258,400	NOT COST EFFECTIVE
	r96	Residential	Night	55	70	**67.3**	**60.6**	**-6.7**	1	1	**1**	**YES**	NO	736	20	12,920	$258,400	$258,400	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
NB11	r96	Residential	Day	65	70	**69.5**	**65.3**	-4.2	1	0	**0**	NO	NO	736	15	10,580	$211,600	N/A	NOT ACOUSTICALLY EFFECTIVE
	r96	Residential	Night	55	70	**67.3**	**63.2**	-4.1	1	0	**0**	NO	NO	736	15	10,580	$211,600	N/A	NOT ACOUSTICALLY EFFECTIVE
NB12	r99	Residential	Day	65	70	**66.4**	59.6	**-6.8**	1	1	**1**	**YES**	NO	682	20	12,740	$254,800	$254,800	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r99	Residential	Night	55	70	**64.5**	**58.0**	**-6.5**	1	1	**1**	**YES**	NO	682	20	12,740	$254,800	$254,800	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
NB13	r100	Residential	Day	65	70	60.5	55.3	**-5.2**	1	1	**1**	**YES**	NO	1,518	20	29,460	$589,200	$589,200	DESIGN GOAL AND COST EFFECTIVENESS NOT MET
	r100	Residential	Night	55	70	**58.8**	53.9	-4.9	1	0	**0**	NO	NO	1,518	20	29,460	$589,200	N/A	NOT ACOUSTICALLY EFFECTIVE
																		$43,500	MnDOT Threshold

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

NOTES:

**Noise barrier tapers were included on all evaluated barriers; this area was removed from the calculated barrier area.

Appendix C

Build Noise Barrier Figures (1-10)

Path: S:\KOM\Mnt\08\129296\99_GIS\MXD\STH 23 Map Booklet Build_New.mxd

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- IMPACTED
- NOT IMPACTED
- BENEFITTED

Not Proposed Noise Barrier
Proposed Noise Barrier
Acquired Building

0 150 300 Feet

Noise Barriers - Build Conditions

TH 23
New London to Paynesville, MN

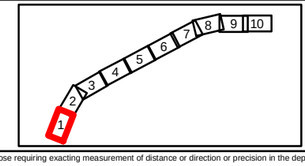
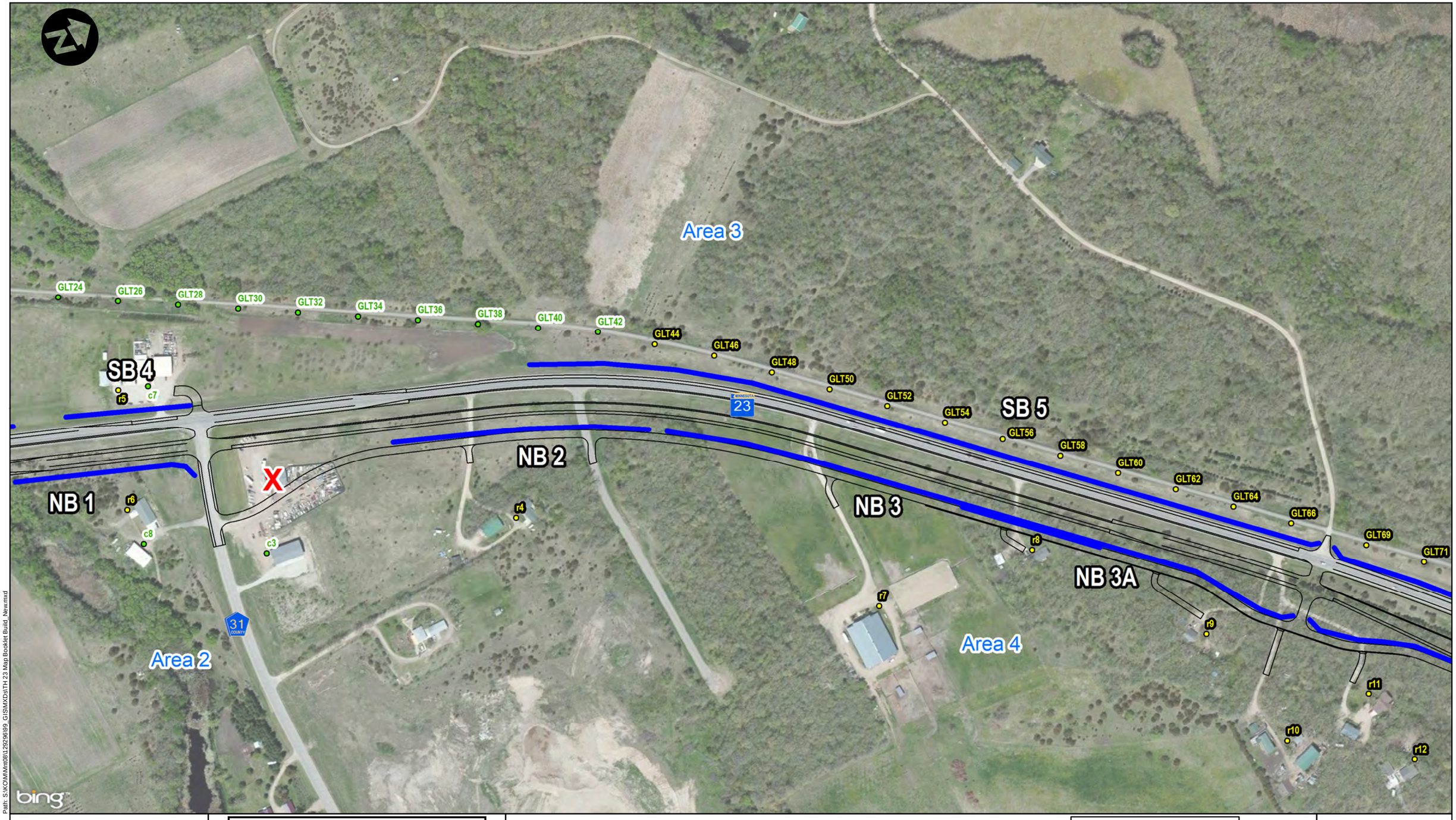


Figure 1



Path: S:\KO\MM\mnt08\129296\99_GIS\MXDs\TH 23 Map Booklet Build_New.mxd

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- IMPACTED
- NOT IMPACTED
- BENEFITTED

Not Proposed Noise Barrier
Proposed Noise Barrier
X Acquired Building

0 150 300 Feet

Noise Barriers - Build Conditions

TH 23

New London to Paynesville, MN

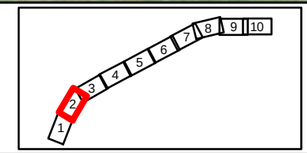


Figure 2

Path: S:\KOI\MNt08\129296\99_GIS\MXDs\TH 23 Map Booklet Build_New.mxd

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
- IMPACTED
- NOT IMPACTED
- BENEFITTED

Not Proposed Noise Barrier
Proposed Noise Barrier
X Acquired Building

0 150 300 Feet

Noise Barriers - Build Conditions

TH 23
New London to Paynesville, MN

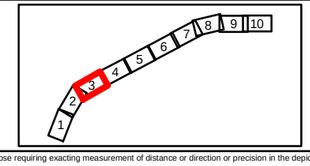
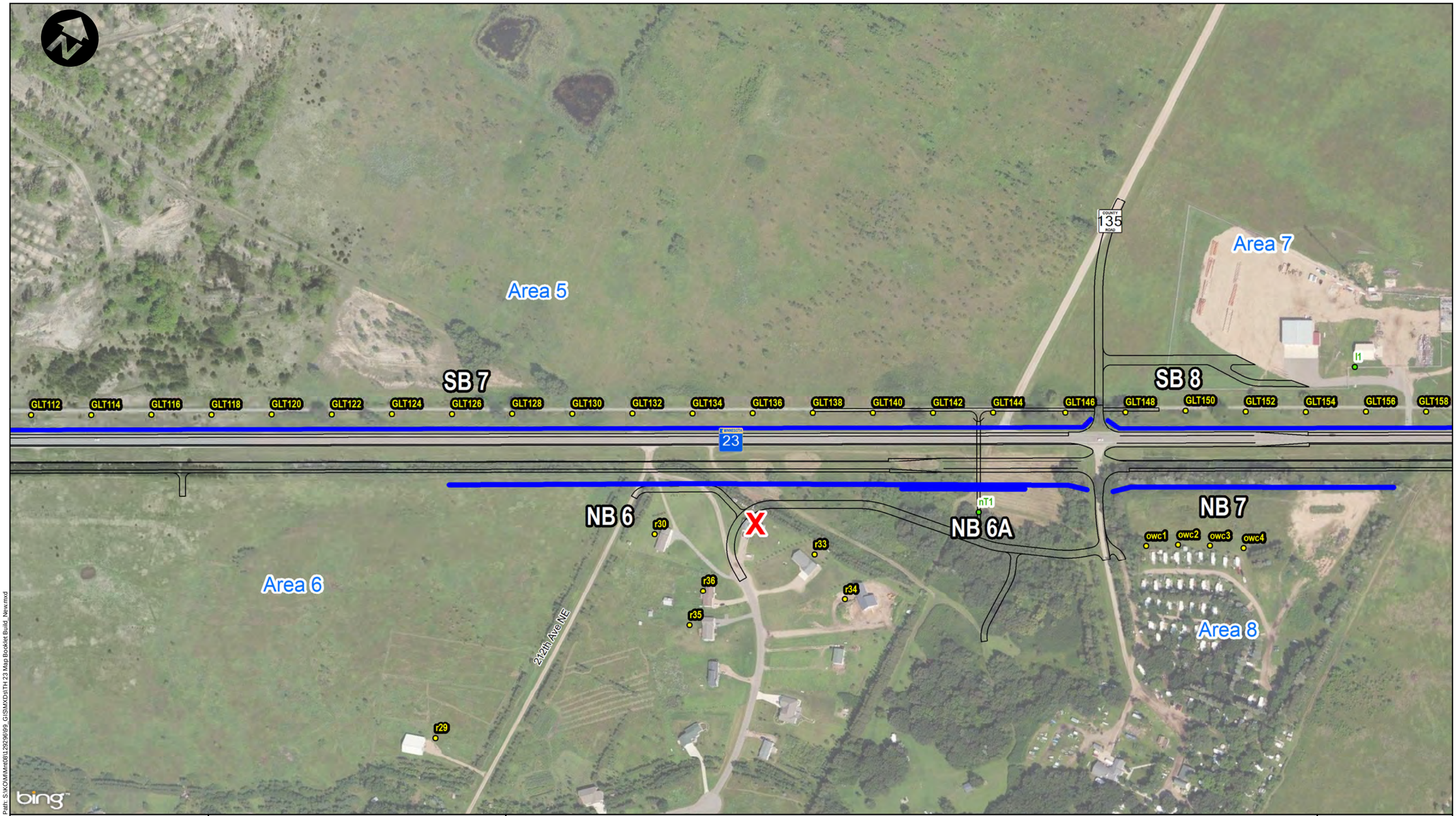


Figure 3



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Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

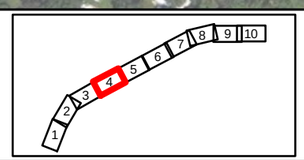
Noise Receptors
- IMPACTED
- NOT IMPACTED
- BENEFITTED

- Not Proposed Noise Barrier
- Proposed Noise Barrier
- X Acquired Building

0 150 300 Feet

Noise Barriers - Build Conditions

TH 23
New London to Paynesville, MN



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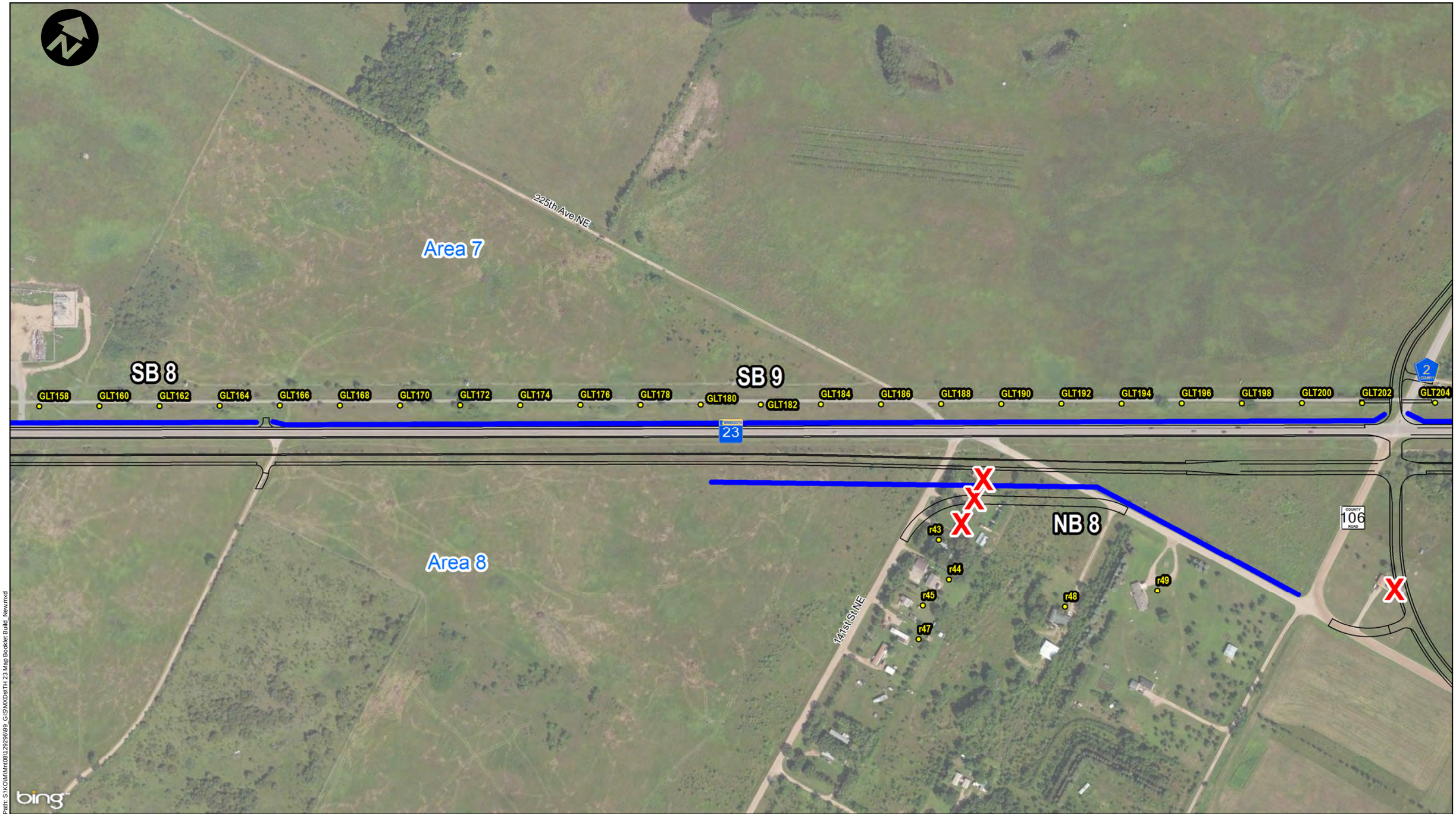

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Noise Barriers - Build Conditions

TH 23
New London to Paynesville, MN

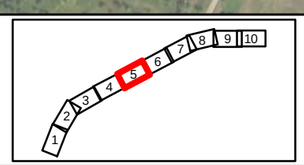
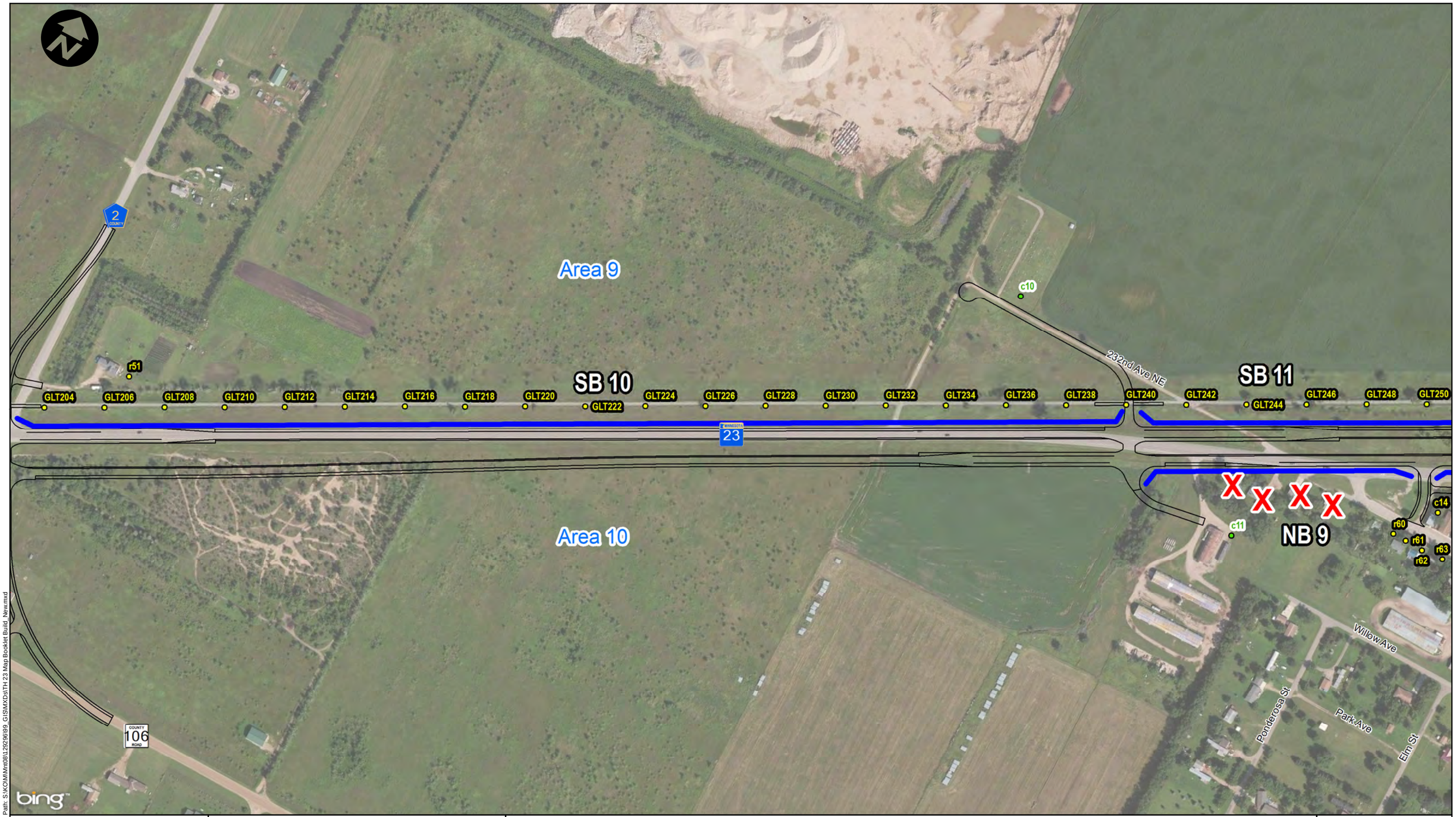


Figure 5



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Project: MNT08 129296
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Noise Barriers - Build Conditions

TH 23
New London to Paynesville, MN

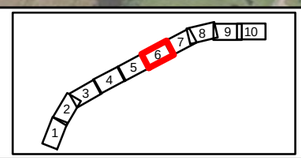

Figure 6

Path: S:\KOM\Mnt08\129296\99_GIS\MXDs\TH 23 Map Booklet Build_New.mxd

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors

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- Proposed Noise Barrier
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0 150 300 Feet

Noise Barriers - Build Conditions

TH 23

New London to Paynesville, MN

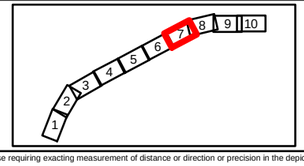

Figure 7

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SEH

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

Noise Receptors
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Not Proposed Noise Barrier
Proposed Noise Barrier
X Acquired Building

0 150 300 Feet

Noise Barriers - Build Conditions

TH 23
New London to Paynesville, MN

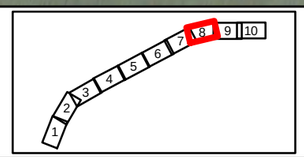
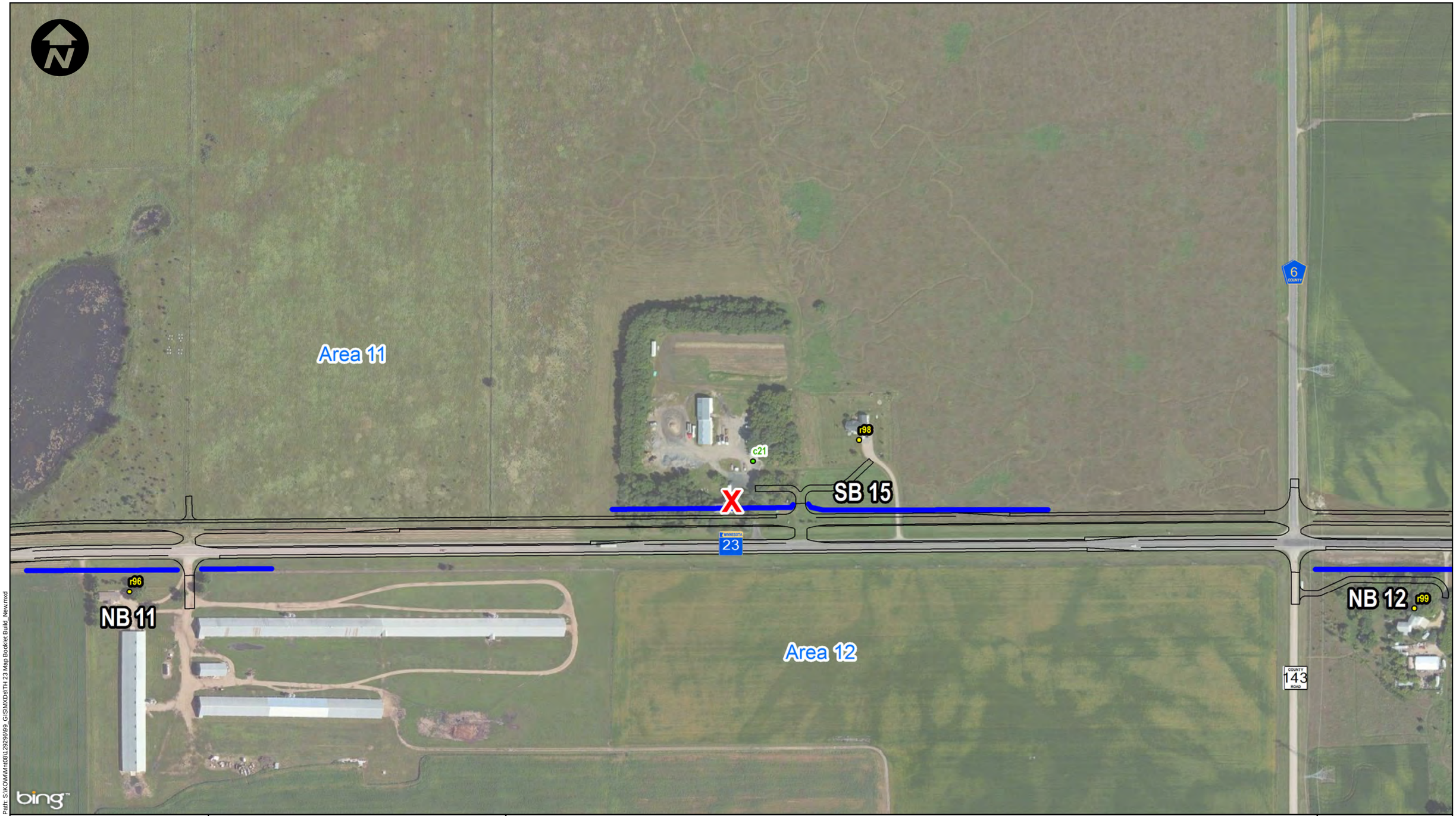


Figure 8



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Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

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Noise Barriers - Build Conditions

TH 23
New London to Paynesville, MN

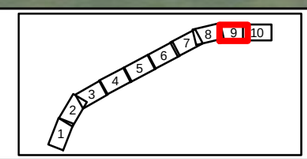

Figure 9

Path: S:\KO\MM\mt08\129296\99_GIS\MXDs\TH 23 Map Booklet Build_New.mxd

Project: MNT08 129296
Print Date: 10/14/2015

Map by: MSS
Projection:Kandiyohi County Coordinates
Source: BING, MnDOT

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Noise Barriers - Build Conditions

TH 23
New London to Paynesville, MN

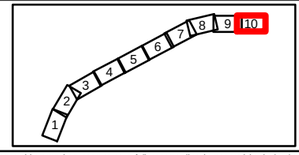

Figure 10