GREAT RIVER ENERGY
and
MINNESOTA POWER

APPLICATION TO THE
MINNESOTA PUBLIC UTILITIES COMMISSION
FOR A
CERTIFICATE OF NEED and ROUTE PERMIT

MOTLEY AREA **115 KV PROJECT**

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TABLE OF CONTENTS

Motley Area 115 kV PROJECT 1

1 SUMMARY OF THE APPLICATION 1-1
1.1 Introduction 1-1
1.2 Great River Energy 1-1
1.3 Minnesota Power 1-2
1.4 Project Contact 1-2
1.5 Proposed Project 1-5
1.6 Project Need and Purpose 1-6
1.6.1 Load-Serving Need 1-6
1.6.2 MPL Need 1-7
1.7 Proposed Route 1-10
1.8 Alternatives 1-10
1.9 Potential Environmental Effects 1-10
1.10 Public Involvement 1-10
1.11 Conclusion 1-13

2 GENERAL PROJECT INFORMATION 2-1
2.1 Certificate of Need Requirement 2-1
2.2 Route Permit 2-1
2.3 Regulatory Process 2-2
2.4 Public Participation 2-4
2.5 Other Permits/Approvals 2-5
2.5.1 Local Approvals 2-5
2.5.2 State of Minnesota Approvals 2-7
2.5.3 Federal Approvals 2-8
2.5.4 Other Approvals 2-8

3 APPLICANT INFORMATION 3-1
3.1 Proposed Ownership 3-1
3.2 Organization and System Background 3-1
3.2.1 Great River Energy 3-1
3.2.2 Minnesota Power 3-2
3.3 Existing Transmission System 3-2
3.3.1 Dog Lake–Baxter 34.5 kV System 3-2

4 PROPOSED PROJECT 4-1
4.1 Project Description 4-1
4.1.1 Transmission Line 4-1
4.1.2 Associated Facilities 4-11
4.2 Estimated Costs 4-12
4.2.1 Great River Energy Costs 4-13
4.2.2 Minnesota Power Costs 4-14
4.2.3 Transmission Line Construction Costs 4-14

4.2.4 Operation and Maintenance Costs 4-15
4.3 Effect on Rates 4-15
4.4 Project Schedule 4-15
4.5 Estimated Line Losses 4-15
4.6 Construction Practices 4-17
4.7 Operation and Maintenance Practices 4-17
4.8 Work Force Required 4-17

5 PROJECT NEED AND PURPOSE 5-1
5.1 Summary of Need 5-1
5.1.1 MPL Pump Station Need 5-1
5.1.2 Load-Serving Need 5-3
5.2 Relationship Between Proposed Project and Overall State Energy Needs 5-6
5.3 Data Exemptions 5-10
5.4 Affected Load Area 5-11
5.5 Peak Demand and Annual Electrical Consumption 5-12
5.5.1 Peak Demand 5-12
5.5.2 Annual Electrical Consumption 5-13
5.6 Forecasts 5-14
5.6.1 Methodology 5-14
5.6.2 Demand Forecast Results 5-21
5.6.3 Consumption Forecast Results 5-22
5.6.4 System Capacity 5-23
5.6.5 Transmission Planning/Net Demand and Net Capability 5-23
5.7 Increased Efficiency 5-25
5.8 Load Management and Energy Conservation Programs 5-26
5.8.1 Load Management 5-26
5.8.2 Energy Conservation 5-26
5.8.3 Conclusion 5-28
5.9 Delay of the Project 5-29
5.10 Effect of Promotional Practices 5-30

6 ALTERNATIVES TO THE PROJECT 6-1
6.1 Analysis of Alternatives 6-1
6.2 Generation Alternative 6-2
6.2.1 Peaking Generation 6-2
6.2.2 Distributed Generation 6-2
6.2.3 Renewable Generation 6-3
6.3 Upgrade of Existing Facilities 6-4
6.4 Alternative Voltages 6-4
6.4.1 Distribution Voltage 6-4
6.4.2 Higher Voltages 6-5
6.5 Different Conductor 6-5
6.6 Alternative Endpoints 6-5
6.6.1 “47 Line” Interconnection 6-6
6.7 Double Circuiting 6-6
6.8 Direct Current Alternative 6-6

6.9 Undergrounding 6-6
6.10 No-Build Alternative 6-8
6.10.1 Demand Side Management and Conservation 6-8
6.10.2 Reactive Power Supply 6-8

7 ALTERNATIVE ROUTES CONSIDERED 7-1
7.1 Alternative Requirement 7-1
7.2 Rejected Route Alternatives 7-1
7.2.1 Dog Lake Substation–Fish Trap Lake Substation 7-1
7.2.2 Dog Lake Substation–Ward Substation–Fish Trap Lake Substation 7-1
7.2.3 "47" Transmission Line–Ward Substation–Fish Trap Lake Substation 7-2

8 ENGINEERING, DESIGN, CONSTRUCTION AND RIGHT-OF-WAY ACQUISITION 8-1
8.1 Transmission Line Engineering and Operation Design 8-1
8.1.1 Transmission Structure Design and Right-of-Way Requirements 8-1
8.1.2 Design Options to Accommodate Future Expansion 8-1
8.2 Identification of Existing Utility and Public Rights-of-Way 8-1
8.3 Transmission Line Right-of-Way Acquisition Procedures 8-2
8.4 Construction Procedures 8-3
8.5 Restoration Procedures 8-5
8.6 Operation and Maintenance 8-6
8.7 Electric and Magnetic Fields (EMF) 8-6
8.7.1 Electric Fields 8-6
8.7.2 Magnetic Fields 8-9
8.8 Stray Voltage 8-11
8.9 Corona 8-11
8.9.1 Radio and Television Interference 8-12
8.9.2 Audible Noise 8-12
8.9.3 Ozone and Nitrogen Oxide Emissions 8-12

9 Environmental Analysis of Routes 9-1
9.1 Environmental Setting 9-1
9.2 Human Settlement 9-2
9.2.1 Public Health and Safety 9-2
9.2.2 Displacement 9-5
9.2.3 Noise 9-6
9.2.4 Aesthetics 9-9
9.2.5 Socioeconomic 9-10
9.2.6 Cultural Values 9-11
9.2.7 Recreation 9-12
9.2.8 Public Services and Transportation 9-16
9.3 Land Use/Zoning 9-17
9.4 Land-based Economies 9-24
9.4.1 Agriculture 9-24
9.4.2 Forestry 9-26

9.4.3 Tourism 9-27
9.4.4 Mining 9-27
9.5 Archaeological and Historic Resources 9-27
9.5.1 Previously Recorded Archaeological Sites 9-28
9.5.2 Previously Recorded Standing Historic Structures 9-29
9.6 Natural Environment 9-31
9.6.1 Air Quality 9-31
9.6.2 Water Resources 9-31
9.6.3 Flora and Fauna 9-39
9.6.4 Invasive Species Management 9-41
9.7 Rare and Unique Natural Resources 9-42
9.8 Physiographic Features 9-47
9.8.1 Topography 9-47
9.8.2 Geology 9-47
9.8.3 Soils 9-47
9.9 Unavoidable Impacts 9-54

10 APPLICATION OF RULE CRITERIA 10-1
10.1 Certificate of Need 10-1
10.1.1 Denial Would Adversely Affect the Energy Supply 10-1
10.1.2 There is No Reasonable and Prudent Alternative 10-2
10.1.3 The Project will Protect the Environment and Provide Benefits 10-2
10.1.4 The Project will Comply with All Applicable Requirements 10-2
10.2 Route Permit 10-3
10.3 Conclusion 10-3

LIST OF TABLES

Table 2-1. List of Possible Permits 2-6
Table 3-1. Affected Load Area and Project Area Conductors 3-4
Table 4-1. Estimated Project Costs (2014$) 4-12
Table 4-2. Estimated Great River Energy Project Costs for West Route Option (2014$) ... 4-13
Table 4-3. Estimated Great River Energy Project Costs for East Route Option (2014$)..... 4-14
Table 4-4. Estimated Minnesota Power Project Costs (2014$) 4-14
Table 4-5. Summary of Line Losses 4-16
Table 5-1. Substation Voltage Criteria 5-5
Table 5-2. Transmission Line Thermal Loading Criteria 5-5
Table 5-3. Historical Monthly Peak Demand (MW) 5-12
Table 5-4. Historical Monthly Energy Consumption (MWh) 5-13
Table 5-5. Affected Load Area 10-Year Historical Coincident Peak Load Served by Great River Energy Member Cooperatives (MW) 5-15
Table 5-6. Affected Load Area Five-Year Historical Coincident Peak Load Served by Great River Energy Member Cooperatives (MW) 5-16
Table 5-7. Forecasted Average Annual Growth Rate 5-17
Table 5-8. Forecasted 2018 Load Levels Used for the Out-Year Study 5-18
Table 5-9. 10-Year Historical Peak Load Data for Affected Load Area Served by Minnesota Power (MW) 5-19
Table 5-10. Forecasted 2018 Minnesota Power Load Levels Used for the Out-Year Study . 5-21
Table 5-11. Great River Energy & Minnesota Power Winter Season Forecast Peak Demand 5-22
Table 5-12. Forecasted Great River Energy and Minnesota Power Annual Energy Consumption 5-22
Table 5-13. Duration that the Affected Load Area is at Risk of Experiencing Inadequacies. 5-23
Table 5-14. Minnesota Power - CIP Projects in the Menahga Project Area 5-28
Table 5-15. Critical Demand Analysis 5-29
Table 8-1. Calculated Electric Fields (kV/M) for Proposed Transmission Line Designs (One meter (3.28 feet) above ground) 8-7
Table 8-2. Magnetic Fields of Common Electric Appliances (mG) 8-10
Table 8-3. Calculated Magnetic Fields (mG) for Proposed Transmission Line Designs (One meter (3.28 feet) above ground) 8-10
Table 9-1. Proximity of Homes and Businesses to Proposed Transmission Line Centerline 9-5
Table 9-2. Common Noise Sources and Levels 9-6
Table 9-3. MPCA Noise Limits by Noise Area Classification (dBA) 9-7
Table 9-4. Anticipated Noise Levels with Heavy Rain 9-8
Table 9-5. Agriculture Statistics within the Project Area 9-24
Table 9-6. Previously Recorded Archeological Resources in Project Vicinity 9-28
Table 9-7. Previously Recorded Standing Historic Structures in Project Vicinity 9-30
Table 9-8. PWI Waters (Cass and Wadena Counties) 9-36
Table 9-9. Wetland Types Intersected by Proposed Transmission Line Centerline (NWI) . 9-37
Table 9-10. Rare and Unique Resources in the Vicinity of the Project 9-42
Table 9-11. Soil Associations in the Vicinity of the Project 9-48

LIST OF FIGURES

Figure 1-1. Great River Energy Service Territory 1-3
Figure 1-2. Minnesota Power Service Territory 1-4
Figure 1-3. Proposed Project 1-8
Figure 1-4. Dog Lake–Baxter System 1-9
Figure 3-1. Dog Lake-Baxter 34.5 kV Sub-transmission System 3-3
Figure 4-1. Proposed Project 4-4
Figure 4-1A. Proposed Project-Dog Lake Substation 4-5
Figure 4-1B. Proposed Project-North 4-6
Figure 4-1C. Proposed Project-South 4-7
Figure 4-2. Typical Transmission Structure Types 4-9
Figure 4-3. Photos of Typical 115 kV Transmission Structures 4-10
Figure 5-1. Affected Load Area 5-4
Figure 5-2. Dog Lake Outage 34.5 kV Outage with Existing System Conditions 5-8
Figure 5-3. Baxter 34.5 kV Outage with Existing System Conditions 5-9
Figure 5-4. Historical Monthly Peak Demand of the Affected Load Area (MW) 5-13
Figure 5-5. Five-Year Historical Annual Energy Consumption of the Affected Load Area 5-14
Figure 5-6. Affected Load Area Served by Great River Energy Member Cooperatives 10-Year Historical Peak Demand Growth Trend 5-16
Figure 5-7. Affected Load Area Five-Year Historical Peak Load Growth Trend 5-17
Figure 5-8. Affected Load Area 10-Year Historical Peak Demand Growth Trend Served by Minnesota Power 5-20
Figure 5-9. Affected Load Area Five-Year Historical Peak Demand Growth Trend Served by Minnesota Power 5-20
Figure 5-10. Load Duration Curve 5-24
Figure 5-11. Capacity of the Affected Load Area Transmission System with the Proposed Project versus Peak Demand 5-25
Figure 5-12. Minnesota Power's 2004–2013 CIP Achievements 5-27
Figure 7-1. Rejected Routes 7-3
Figure 8-1. Standard Tree Removal Practices 8-4
Figure 8-2. 115 kV Single Circuit Line Electric Field Profile 8-7
Figure 8-3. 115 kV Single Circuit Line Magnetic Field Profile 8-11
Figure 9-1A. Recreation Areas - Dog Lake Substation 9-13
Figure 9-1B. Recreation Areas – North 9-14
Figure 9-1C. Recreation Area – South 9-15
Figure 9-2A. Land Use-Dog Lake Substation 9-18
Figure 9-2B. Land Use-North 9-19
Figure 9-2C. Land Use-South 9-20
Figure 9-3A. Zoning-Dog Lake Substation 9-21
Figure 9-3B. Zoning-North 9-22
Figure 9-3C. Zoning-South 9-23
Figure 9-5A. Hydrologic Features-Dog Lake Substation 9-32
Figure 9-5B. Hydrologic Features-North 9-33
Figure 9-5C. Hydrologic Features-South 9-34
Figure 9-6A. Rare Features-Dog Lake Substation 9-44

Figure 9-6B. Rare Features-North 9-45
Figure 9-6C. Rare Features-South 9-46
Figure 9-7A. Soils-Dog Lake Substation 9-51
Figure 9-7B. Soils-North 9-52
Figure 9-7C. Soils-South 9-53

APPENDICES

Appendix A Notice of Project and Open House to Local Governmental Units (Example Letter)

Appendix B Order of the Minnesota Public Utilities Commission Granting Exemptions, dated December 3, 2014

Appendix C Certificate of Need Application Requirements Completeness Checklist

Appendix D Letter from Carole Schmidt of Great River Energy to Dr. Burl Haar, Executive Secretary of the Minnesota Public Utilities Commission, informing the Commission of the Applicants' intent to file a route permit application under the alternative review procedures, dated December __, 2014

Appendix E Route Permit Application Requirements Completeness Checklist

Appendix F Detailed Route Maps

Appendix G Substation Plot Plans (Preliminary)

Appendix H Great River Energy Demand Side Management Programs

Appendix I List of Landowners within Proposed Route

Appendix J Agency Correspondence

LIST OF ACRONYMS

ACRONYMS	
AC	Alternating Current
ACSR	Aluminum Conductor Steel Reinforced
ACSS	Aluminum Conductor Steel Supported
ALJ	Administrative Law Judge
Applicants	Great River Energy and Minnesota Power
BMPs	Best Management Practices
BPA	Bonneville Power Administration
CIP	Conservation Improvement Program
Commission	Minnesota Public Utilities Commission
CON	Certificate of Need
Corps	United States Army Corps of Engineers
CR	County Road
CSAH	County State Aid Highway
CWP	Crow Wing Power
dBA	Decibel – A weighted
DC	Direct Current
DNR	Minnesota Department of Natural Resources
DSM	Demand Side Management
EA	Environmental Assessment
EERA	Energy Environmental Review and Analysis
EF	Electric Fields
ELF	Extremely Low Frequency
EMF	Electromagnetic Fields
EPA	United States Environmental Protection Agency
EQB	Minnesota Environmental Quality Board
G	Gauss
HVDC	High Voltage Direct Current
HVTL	High Voltage Transmission Line
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronic Engineers
IMDs	Implantable Medical Devices
kV	Kilovolt
kV/m	Kilovolts Per Meter
LGUs	Local Governmental Units
LHVTL	Large High Voltage Transmission Line
mA rms	MilliAmperes Root Mean Square
MF	Magnetic Fields
mG	MilliGauss
MHS	Minnesota Historical Society
MISO	Midcontinent Independent System Operator
MnDOT	Minnesota Department of Transportation
MPL	Minnesota Pipe Line Company

ACRONYMS	
MPCA	Minnesota Pollution Control Agency
MRO	Midwest Reliability Organization
MW	Megawatt
MWh	Megawatt hours
MVAr	MegaVolt Amperes reactive
NAC	Noise Area Classifications
NERC	North American Electric Reliability Council
NESC	National Electrical Safety Code
NIEHS	National Institute of Environmental Health Sciences
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
Project	Motley Area 115 kV Project
PWI	Public Waters Inventory
ROW	Right-of-Way
SHPO	State Historic Preservation Office
SNA	Scientific and Natural Area
SWPPP	Stormwater Pollution Prevention Plan
TH	Trunk Highway
Todd-Wadena	Todd-Wadena Electric Cooperative
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WHO	World Health Organization
WMA	Wildlife Management Area

1 SUMMARY OF THE APPLICATION

1.1 Introduction

Great River Energy and Minnesota Power (Applicants) are applying to the Minnesota Public Utilities Commission (Commission) for a Certificate of Need (CON) and a Route Permit to construct approximately 15.5 to 16.5 miles of new overhead 115 kilovolt (kV) transmission line in Morrison, Cass and Todd counties, Minnesota (Project).

Applicants propose to:

- Construct a new single circuit 115 kV transmission line between the existing Minnesota Power "24 Line" transmission line[1] and the new Crow Wing Power (CWP) Fish Trap Lake Substation. Some segments of the transmission line will carry distribution line underbuild.

- Convert the existing 34.5 kV Motley Substation to 115 kV service and add a three-way switch.

- Construct the new CWP Fish Trap Lake Substation to serve the new Minnesota Pipe Line Company (MPL) Fish Trap pump station.

- Add breakers to the existing Minnesota Power Dog Lake Substation using a more reliable ring bus design and construct a one-half mile transmission line between the substation and the "24 Line" 115 kV transmission line.

- Install a three-way switch to allow for the construction of a future CWP Shamineau Substation.

Applicants anticipate start of construction in fall 2016 and energization of the line in summer 2017.

1.2 Great River Energy

Great River Energy is a not-for-profit generation and transmission cooperative based in Maple Grove, Minnesota. Great River Energy provides electrical energy and related services to 28 member cooperatives, including the Crow Wing Power distribution cooperative serving the area proposed to be supplied by the new transmission line (**Figure 1-1**). Great River Energy's

[1] The existing Minnesota Power "24 Line" transmission line segment between the Dog Lake Substation and the Verndale Substation, including where the Motley project will interconnect, will be renamed the "155 Line" transmission line upon completion of the Project.

distribution cooperatives, in turn, supply electricity and related services to more than 650,000 residential, commercial, and industrial customers in Minnesota and Wisconsin.

Crow Wing Power provides electricity and related services to approximately 37,000 residential, commercial and industrial customers in Minnesota. Approximately 1500 residential, commercial and industrial members of this cooperative would benefit from the proposed high voltage transmission line during normal system operation and up to 600 more would benefit during contingency conditions.

Great River Energy's generation system includes a mix of baseload and peaking plants, including coal-fired, refuse-derived fuel, natural gas and oil plants as well as wind generators (a total of approximately 3,500 megawatts (MW)). Great River Energy owns approximately 4,600 miles of transmission line in Minnesota, North Dakota, South Dakota, and Wisconsin.

Great River Energy's transmission network is interconnected with the regional transmission grid to promote reliability and Great River Energy is a member of the Midwest Reliability Organization (MRO) and the Midcontinent Independent System Operator (MISO).

1.3 Minnesota Power

Minnesota Power is an investor-owned public utility headquartered in Duluth, Minnesota. Minnesota Power supplies retail electric service to 143,000 retail customers and wholesale electric service to 16 municipalities in a 26,000-square-mile electric service territory located in northeastern Minnesota (**Figure 1-2)**. Minnesota Power generates and delivers electric energy through a network of transmission and distribution lines and substations throughout northeastern Minnesota. Minnesota Power's transmission network is interconnected with the regional transmission grid to promote reliability and Minnesota Power is a member of the MRO and MISO.

1.4 Project Contact

The contact for the Motley Area Project is:

Mark Strohfus
Great River Energy
Environmental Project Lead
12300 Elm Creek Blvd.
Maple Grove, MN 55369
763-445-5210
MStrohfus@GREnergy.com

Figure 1-1. Great River Energy Service Territory

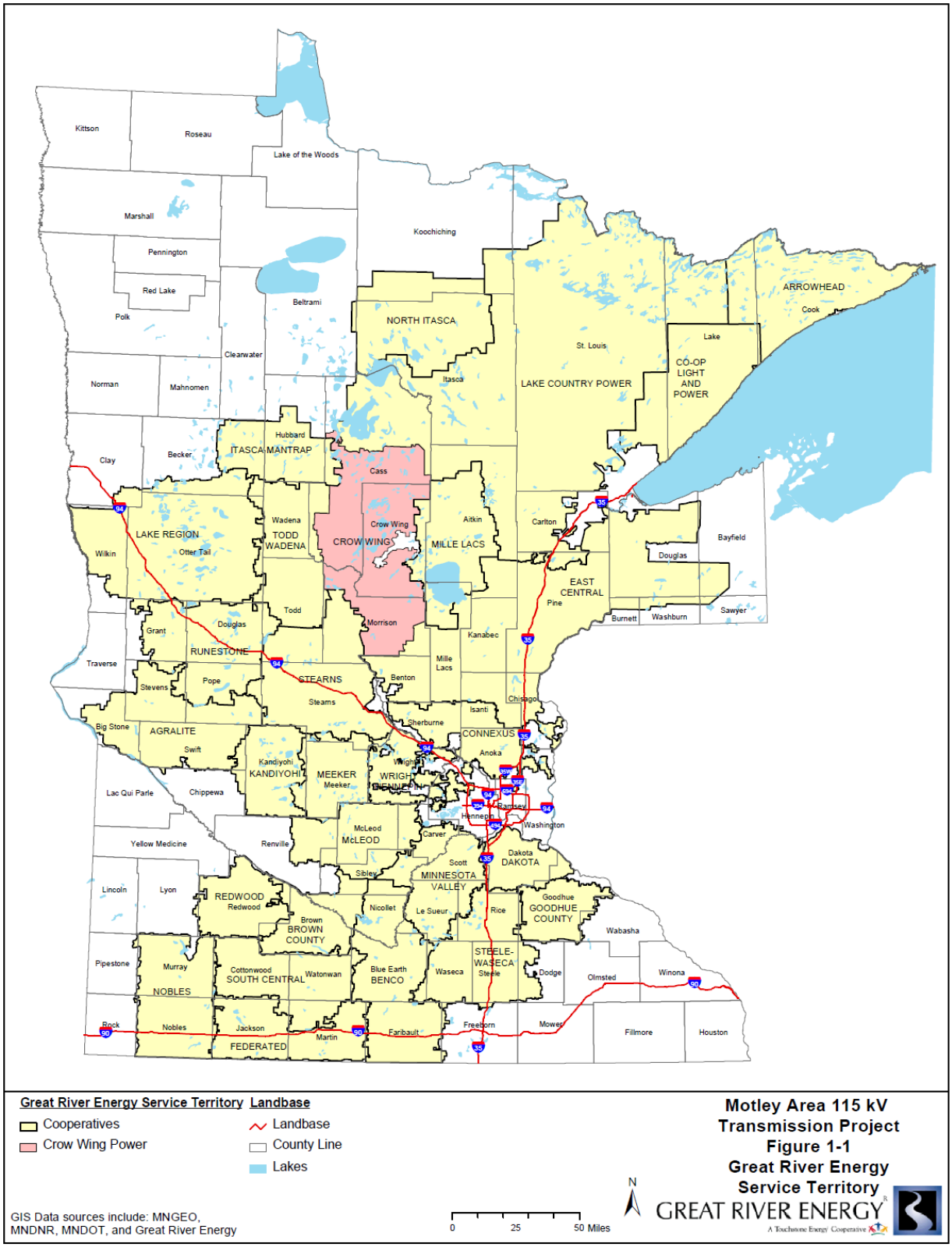
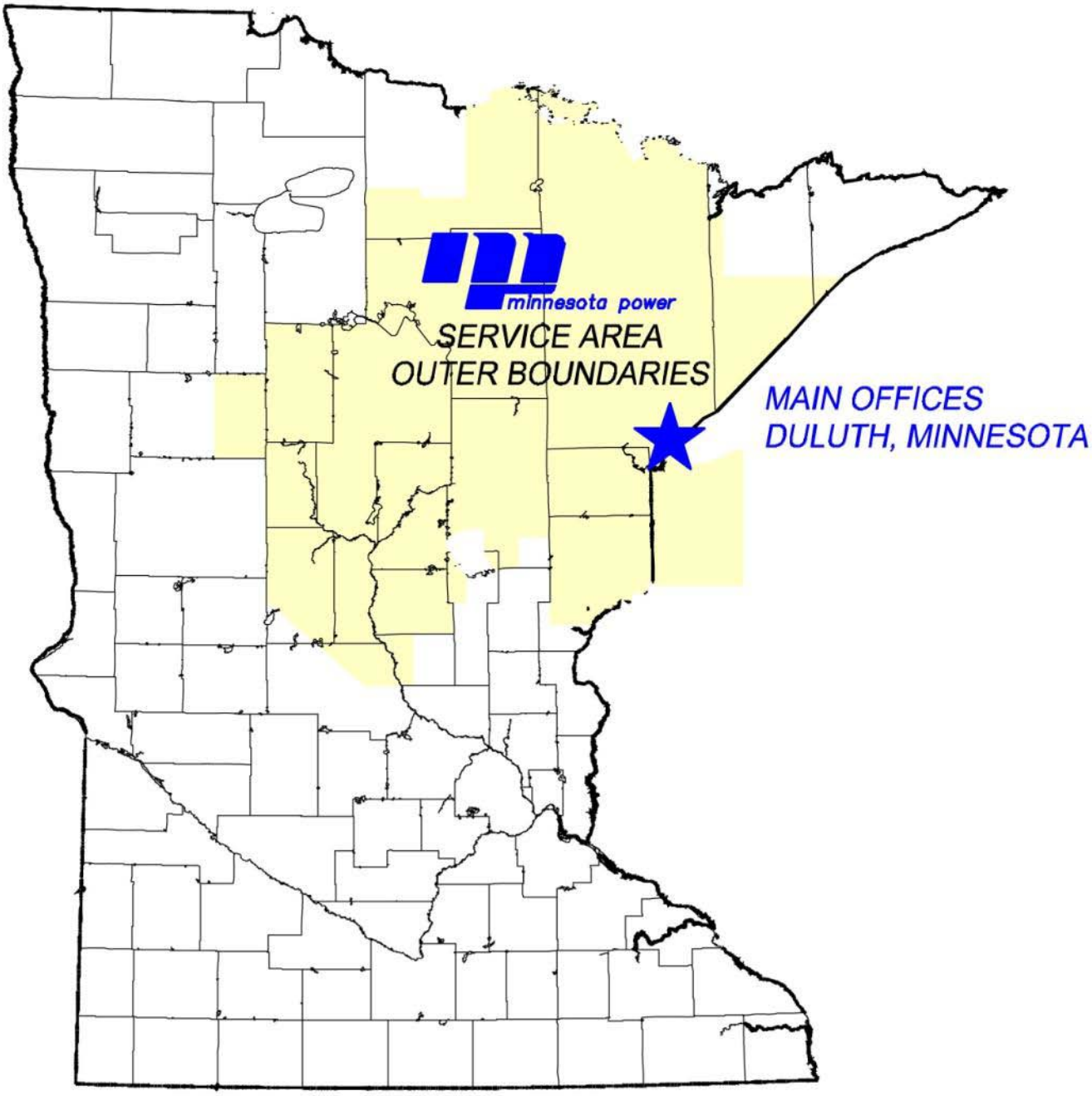


Figure 1-2. Minnesota Power Service Territory



1.5 Proposed Project

Great River Energy and Minnesota Power have studied the power service to the region and have determined that new 115 kV electrical facilities are needed to meet existing electric load and future electric load requirements. Great River Energy has an additional need to provide electric service to the new Crow Wing Power Substation that will serve the proposed MPL Fish Trap pump station. MPL submitted a Certificate of Need application for the Minnesota Pipe Line Reliability Project on July 25, 2014 (MPUC Docket No. PL-5/CN-14-320).

The proposed plan to ensure reliability of the transmission system in the area and to serve the new Crow Wing Power Substation includes multiple components. **Figure 1-3** depicts the Project and its components, which are as follows:

- **"24 Line" transmission line – Motley Substation transmission segment (West and East Route Options)** – The Applicants propose two route options for this transmission line segment. Either segment would connect with Minnesota Power's "24 Line" 115 kV transmission[2] line northeast of Motley, MN, and extend to the existing Crow Wing Power 34.5 kV Motley Substation. A motor-operated three-way switch would be installed to interconnect the new transmission line to the "24 Line". The **West Route Option** would entail constructing approximately four miles of new 115 kV transmission line and the **East Route Option** would entail constructing approximately five miles of new 115 kV transmission line.

- **Motley Substation – Fish Trap Lake Substation transmission segment (Common Route) –** This transmission line segment would be common to the project for either the West Route Option or the East Route Option. It would entail constructing a new single circuit 115 kV transmission line totaling approximately 10.5 miles from the existing Crow Wing Power Motley Substation to the proposed Crow Wing Power Fish Trap Lake Substation.

- **Dog Lake Substation ring bus conversion –** This component would entail converting Minnesota Power's existing Dog Lake Substation to a more reliable ring bus design.

- **"24 Line" transmission line – Dog Lake Substation segment –** As part of the new ring bus design, Applicant propose constructing a new 115 kV transmission line segment extending approximately one-half mile to loop Minnesota Power's "24 Line" 115 kV transmission line into and out of the Dog Lake Substation

- **Motley Substation conversion –** Converting Crow Wing Power's Motley Substation from 34.5 kV to 115 kV. A manual three-way switch would be installed to provide the 115 kV service to the substation.

---

[2] The existing Minnesota Power "24 Line" transmission line segment between the Dog Lake Substation and the Verndale Substation, including where the Motley project will interconnect, will be renamed the "155 Line" transmission line upon completion of the Project.

- **Fish Trap Lake Substation –** Constructing the new Crow Wing Power Fish Trap Lake 115 kV Substation to serve the electric load of Minnesota Pipe Line Company's proposed Fish Trap pump station.

- **Shamineau Tap Switch –** Installing a manual three-way switch along Highway 10 to allow for the future Shamineau Substation to interconnect to the proposed 115 kV transmission line without having to take an outage on the 115 kV transmission line.

Applicants are requesting approval of different route widths depending on the existing land uses of the adjacent properties. Total route widths will vary between 250 feet and 995 ft. See **Section 4.1.1** for more detail.

Great River Energy and Minnesota Power will acquire easements for the new 115 kV transmission line.

The Project will cost between approximately $16 and $17 million depending on which route option is permitted by the Commission.

1.6 Project Need and Purpose

The Motley Area Project will serve two needs as described below. A detailed discussion of Project need is provided in **Chapter 5**.

1.6.1 Load-Serving Need

The 34.5 kV sub-transmission system sourced from the Dog Lake – Baxter 115/34.5 kV system (Figure 1-4) is at risk of experiencing low voltage and near overloading of equipment, and is no longer adequate to serve the existing power demands in the area nor the needs and the new MPL pump station.

The 34.5 kV sub-transmission system sourced from the Dog Lake 115/34.5 kV Substation and the Baxter 115/34.5 kV Substation is currently at risk of experiencing low voltage and near overloading of equipment. The potential low voltage on the 34.5 kV sub-transmission system was first identified in 2008 and included in Great River Energy's Long Range Plan. Low voltage and near overloading of equipment could occur if there was a contingency on the Baxter Substation 115/34.5 kV transformer. In the event of such a contingency, system operators would be required to reconfigure the system by use of switches to transfer the load normally served by the Baxter Substation to the Dog Lake Substation. If this scenario were to happen during peak loading times, the additional load would cause low voltage.

The proposed new MPL pump station load, in addition to the loads currently served by the Dog Lake–Baxter area 34.5 kV system, will exceed the system's maximum capacity. A solution is needed to either unload the system or build more capacity into the system. The most economical plan is to remove a large load from the 34.5 kV system and place it on a new higher voltage system (therefore alleviating the capacity constraint), rather than rebuilding the entire 34.5 kV system. The Project proposes to remove a large load (the Motley Substation) from the 34.5 kV system and place it on a new 115 kV circuit. Removing Motley from the 34.5 kV system

alleviates the capacity constraint on the Dog Lake–Baxter 34.5 kV system and also provides a more robust 115 kV source to the Motley Substation.

In addition to addressing the load service needs discussed above, the Project will prepare the area transmission system for additional loads in the Shamineau Lake area. The need for the proposed new Shamineau Substation has been identified in the Biennial Plan ("Plan"). The 2009 Plan states, however, that the substation is on hold due to a reduction in load growth. If growth rates return to historically higher levels, the existing 34.5 kV transmission system could not reliably serve the Shamineau Lake area. The proposed Project would provide the needed support. CWP has indicated that a prudent location for the Shamineau Substation would be near U.S. Highway 10 westerly of Shamineau Lake. The Project would support such a location with minimal additional high voltage transmission line construction.

1.6.2 **MPL Need**

MPL is proposing to construct six new pump stations along its newest pipeline (Line 4) to ensure that Minnesota refineries continue to have access to reliable and sufficient crude oil supplies to meet demand for transportation fuels. MPL plans to use available capacity on Line 4 to ensure reliability of its pipeline system, which is the primary crude oil pipeline system supplying Minnesota's two refineries. In addition to the local load-serving need discussed above, the Project is needed to provide electrical service to the new Crow Wing Power Fish Trap Lake Substation, which will serve one of these six proposed pump stations (the Fish Trap Pump Station), which will be located at the southern terminus of the Project.

Figure 1-3. Proposed Project

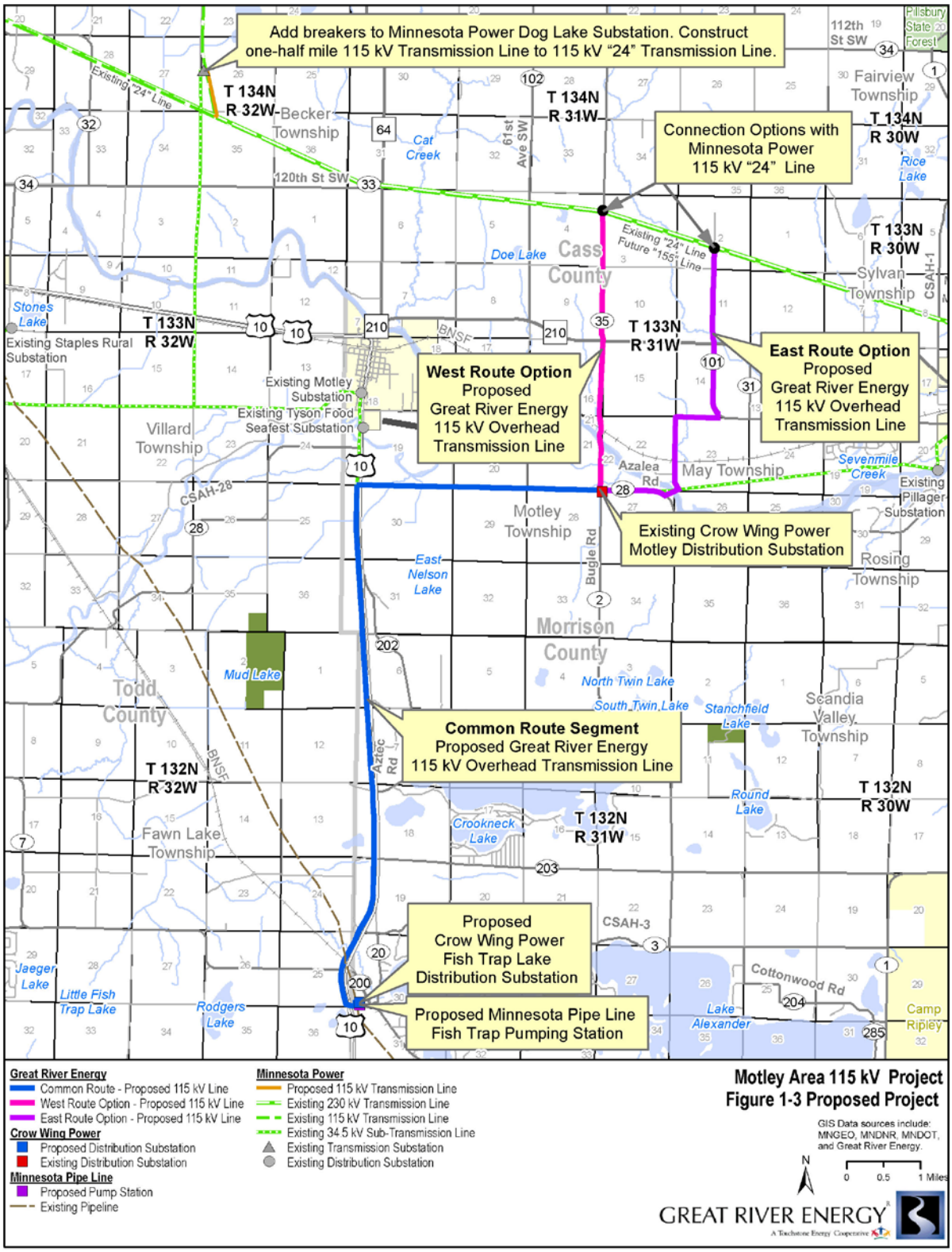
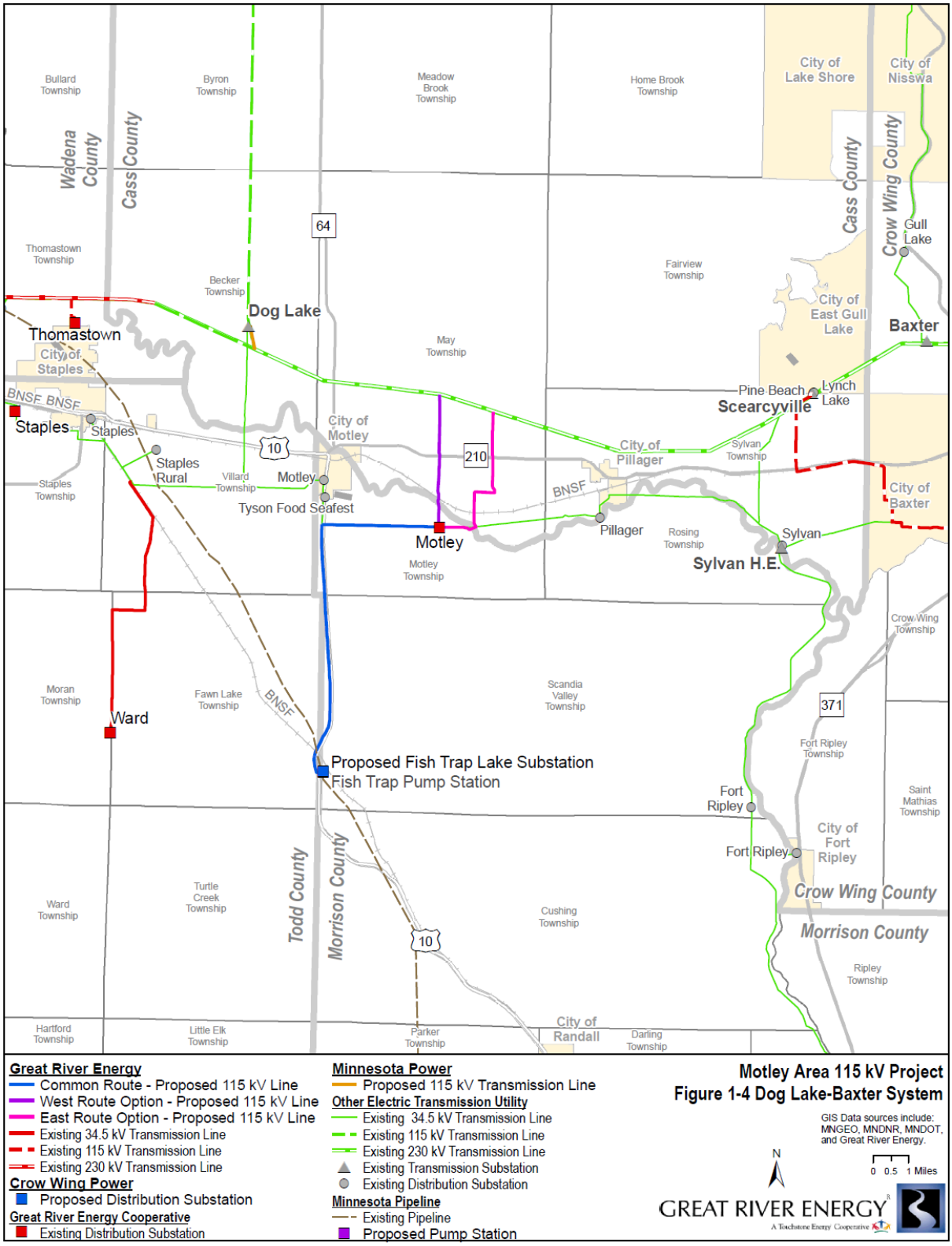


Figure 1-4. Dog Lake–Baxter System



1.7 Proposed Route

The Project provides two route alternatives (**Figure 1-3)**, West and East Route Options, extending southerly approximately four miles or five miles respectively from Minnesota Power's "24 Line" 115 kV line to CWP's existing Motley Substation. From this point, the Project continues with a single route extending westerly and southerly approximately 11 miles in length from the Motley Substation and terminating at CWP's proposed Fish Trap Lake Substation. In addition, a short segment of proposed 115 kV transmission line would be constructed from Minnesota Power's Dog Lake substation and extending approximately 0.5 miles southerly to connect to Minnesota Power's "24 Line" 115 kV transmission line.

1.8 Alternatives

Great River Energy and Minnesota Power considered several alternatives to the proposed Project, including: 1) new local generation alternative; 2) various transmission solutions, including upgrading other existing facilities, different conductors, different voltage levels and different endpoints; and 3) a no-build alternative focusing on demand side management. Alternatives to the proposed Project are discussed further in **Chapter 6**.

1.9 Potential Environmental Effects

Applicants analyzed the potential environmental effects from the proposed Project. No significant unavoidable impacts will result from construction of the new 115 kV transmission line and associated facilities.

No homeowners will be displaced by construction of the new transmission line. All agricultural land impacted during construction will be returned to its natural condition to the best extent practicable and landowners will be compensated for any losses from construction. All water bodies will be protected during construction. The electric fields associated with the new line will be significantly less than the maximum levels permitted by state regulators. No stray voltage issues are anticipated to affect farm animals along the routes.

The Department of Commerce, Energy Environmental Review and Analysis (EERA) is responsible for environmental review of the Project. The Certificate of Need rules require preparation of an Environmental Report, whereas the Route Permit rules require preparation of an Environmental Assessment (EA). The Department of Commerce may elect to prepare an EA for the Project that analyzes potential environmental impacts from the Project and meets all statutory and rule requirements of both the Environmental Report and the EA.

1.10 Public Involvement

Great River Energy held a public open house informational meeting on September 23, 2014, at the Motley United Methodist Church located in Motley, Minnesota to provide information about the Project to the public. Great River Energy sent 172 post card invitations (copy included in **Appendix A**) announcing the open house to all landowners within 1,000 feet of a preliminary route for the project, which did not include the East Route Option for the proposed 115 kV transmission line segment between Minnesota Power's "24 Line" transmission line and the

existing Crow Wing Power Motley Substation. Great River Energy also mailed 73 letters and project fact sheets (an example letter is provided in **Appendix A)** providing details of the Project and open house meeting to agencies, elected officials, and local governmental units (LGUs).

Approximately 20 members of the public attended the open house meeting on September 23rd. Inquiries/concerns from the public attending the open house included whether the transmission line will extend across their property, indicating a preference of which side of the road for the transmission line alignment, proximity of the proposed line to houses, tree removal, Project schedule, dimensions of easements, electric and magnetic fields (EMF) and stray voltage.

Following the open house meeting on September 23rd, Great River Energy identified an alternate route, the East Route Option, for the transmission line segment situated between Minnesota Power's "24 Line" transmission line and the existing Motley Substation. In an effort to engage the property stakeholders impacted by this additional route option, Great River Energy mailed letters and project fact sheets to 61 landowners potentially impacted by the East Route Option, along with 83 elected officials and LGU representatives (an example letter is provided in **Appendix A)**. In addition, project fact sheets and updated project letters were also mailed to six new landowners and all of the 172 landowners who had previously received the post card announcing the September 23rd open house meeting.

At the open house meeting, several of the attendees expressed an opinion regarding the transmission line alignment along U.S. Highway 10 and Azalea Road (County Road 28). There was a relatively common opinion the alignment should follow the west side of U.S. Highway 10 and the south side of Azalea Road. Since the open house meeting in September, there have been approximately thirteen property owners who have been in contact with Great River Energy staff and four who have made arrangements to meet them on their property. Of those who have called or emailed their comments directly to Great River Energy staff, most have reiterated a preference for the alignment following the west side of U.S. Highway 10 and the south side of Azalea Road. Four property owners representing both the north and south sides of the Crow Wing River crossing on the West Route Option have expressed a preference for the East Route Option. One property owner in Cass County who resides on the East Route Option has indicated a preference for the West Route Option as he contends he wasn't given the same opportunity to be heard.

The need for the Project has been discussed in the Minnesota Biennial Transmission Projects Report since 2009 (Tracking number 2009-NE-N6)[3].

The public will have an opportunity to review this application and submit comments to the Commission and EERA about the Project. A copy of the application will be available on the Commission eDockets website (www.mn.gov/puc), on the Department of Commerce Project website (http://mn.gov/commerce/energyfacilities) and on the Great River Energy webpage at http://www.greatriverenergy.com/deliveringelectricity/currentprojects/. Additionally, a copy of this application will be available for the public to review at the:

[3] http://www.minnelectrans.com/documents/2009_Biennial_Report/html/Map_Sec_6.3_NE-sm.htm

- Motley City Hall
  316 Hwy. 10 South
  Motley, MN 56466

- Carnegie Public Library
  108 3rd Street NE
  Little Falls, MN 56345

- Brainerd Public Library
  416 South 5th Street
  Brainerd, MN 56401

- Great River Regional Library
  122 6th Street NE
  Staples, MN 56479

A scoping meeting will be held in the area by EERA within 60 days of acceptance of this application as complete to answer questions about the Project and to solicit public comments and suggestions for matters to examine during its environmental review. In a few months, assuming the Department of Commerce chooses to prepare an EA that includes all requirements of an Environmental Report, a public hearing will be held in the Project area after the EA is complete. At this hearing, members of the public will be given an opportunity to ask questions and submit comments. Applicants will also present further evidence to support the need and route for the Project. Applicants anticipate that the Commission will hold a joint public hearing on both the Certificate of Need and the Route Permit pursuant to Minnesota Statutes Section 216B.243, subdivision 4.

There are two options for citizens, landowners, and interested persons to receive project information:

1. **Sign up for the Project Mailing List.** To sign up to receive notices about project milestones and opportunities to participate (meetings, comment periods, etc.) email docketing.puc@state.mn.us or call 651-201-2234 with the docket number (14-853 or 15-204), your name, mailing address and email address.

   You may request to receive notices by email or U.S. Mail. For projects with more than one docket (e.g., a project requiring a Certificate of Need and a Route Permit), you will be added to both mailing lists.

2. **Subscribe to the Docket.** To receive email notifications when new documents are filed in the Certificate of Need or Route Permit dockets:

   1. Go to: mn.gov/puc
   2. Select the green box *Subscribe to a Docket*
   3. Type your e-mail address
   4. For *Type of Subscription*, select *Docket Number*

5. For *Docket Number*, select *14* in the first box, type *853* (for the Certificate of Need docket) or *15* and *204* (for the Route Permit docket) in the second box
6. Select *Add to List*
7. Select *Save*

Note - subscribing may result in a large number of emails

Commission and Commerce staff contact information for the Project are as follows:

Minnesota Public Utilities Commission
Hwikwon Ham, Staff Analyst
121 7th Place East, Suite 350
St. Paul, MN 55101
651.201.2253
800.657.3782
Hwikwon.Ham@state.mn.us
www.mn.gov/puc

Department of Commerce, EERA
Richard Davis, Environmental Review Manager
85 7th Place East, Suite 500
St. Paul, MN 55101
651.539.1846
800.657.3794
Richard.Davis@state.mn.us
mn.gov/commerce/energyfacilities

1.11 Conclusion

The Commission has established criteria in Minnesota Rule 7849.0120 to apply in determining whether a proposed high voltage transmission line is needed. An applicant for a Certificate of Need must show that the probable result of denying the request would be an adverse effect on the future adequacy and reliability of the system, there is not a more reasonable and prudent alternative, the proposed facility will provide benefits to society compatible with protecting the environment, and the project will comply with all applicable standards and regulations. Applicants have demonstrated in the Application that the proposed Project meets all the requirements required to obtain a Certificate of Need. The Project will address transmission system overloads in the area and provide electric service to a new pump station proposed by MPL.

With regard to route selection for high voltage transmission lines, the applicable rules are found in Minnesota Rules Chapter 7850. This Project satisfies the criteria for a route permit: the transmission line conserves resources, minimizes environmental impacts, and minimizes effects on human settlement and land-based economies by the use of existing transmission line corridors and road corridors.

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2 GENERAL PROJECT INFORMATION

2.1 Certificate of Need Requirement

Minnesota Statutes Section 216B.243, subdivision 2, provides that "No large energy facility shall be sited or constructed in Minnesota without the issuance of a certificate of need by the [public utilities] commission pursuant to sections 216C.05 to 216C.30 and this section and consistent with the criteria for assessment of need." A large energy facility is defined in Minnesota Statutes Section 216B.2421 subdivision 2(3) as, among other things, "any high-voltage transmission line with a capacity of 100 kilovolts or more with more than ten miles of its length in Minnesota."

The proposed 115 kV transmission lines will be located in Minnesota and will, in total, be greater than 15 miles long. Because the Project consists of a transmission line in excess of 100 kV and is more than ten miles in length, a CON is required.

The Commission has adopted rules for the consideration of applications for certificates of need. Minn. R. Ch. 7849. On October 30, 2014, Great River Energy, on behalf of Applicants, filed a Petition for Exemption under Minnesota Rule 7849.0200, subpart 6, requesting that the Applicants be exempt from certain filing requirements under Chapter 7849. The Commission approved the Exemption Petition on January 22, 2015, and issued its written Order on January 30, 2015 (Exemption Order). This Application contains the information required under Minnesota Rules Chapter 7849, as modified by the Commission in its Exemption Order. A copy of the Commission's Exemption Order is provided in **Appendix B**.

The CON application content requirements are provided in **Appendix C** with cross references indicating where information can be found in this Application.

2.2 Route Permit

Minnesota Statutes Section 216E.03, subdivision 2, provides that "[n]o person may construct a high voltage transmission line without a route permit from the commission." A high voltage transmission line (HVTL) is defined by Minnesota Statutes Section 216E.01, subdivision 4, as "a conductor of electric energy and associated facilities designed for and capable of operation at a nominal voltage of 100 kilovolts or more and is greater than 1,500 feet in length." Because the Project consists of a 115 kV transmission line that is greater than 1,500 feet, a Route Permit is required.

The rules that apply to the review of Route Permit applications are found in Minnesota Rules Chapter 7850. Minnesota Rule 7850.1900, subparts 2 and 3, set forth the information that must be included in a Route Permit application.

Minnesota Statutes Section 216E.04, subdivision 2(3) provides for an Alternative Review Process for transmission lines between 100 and 200 kilovolts. This Alternative Review Process is

shorter than the process required for transmission lines over 200 kV. As a 115 kV project, the Project qualifies for the Alternative Review Process. Minnesota Rule 7850.2800, subpart 2 requires the Applicant to notify the Commission of its intent to utilize the Alternative Review Process at least 10 days prior to submitting an application. Great River Energy notified the Commission on March 5, 2015 of its intent to utilize the Alternative Review Process. A copy of the notification letter is provided in **Appendix D**.

Under the Alternative Review Process, an applicant is not required to propose any alternative routes, but must disclose any other routes that were rejected by the applicant (Minn. Stat. § 216E.04, subd. 3.). Further, an Environmental Impact Statement is not required under the Alternative Review Process. Instead, the Department of Commerce is required to prepare an EA. Minn. Stat. § 216E.04, subd. 5. Unlike the full route permit process for higher voltage lines, which requires a formal contested case hearing, the Commission has discretion to determine what kind of public hearing to conduct. (Minn. Stat. § 216E.04, subd. 6.) In **Section 2.3** below, the procedures described are those required for the lower voltage lines under the Alternative Review Process.

The Route Permit application content requirements are provided in **Appendix E** with cross references indicating where information can be found in this Application.

2.3 Regulatory Process

As a result of legislation passed in 2005, the Commission has jurisdiction over both Certificates of Need and Route Permits. (2005 Minn. Laws ch. 97, art. 3, § 17. Minnesota Statutes.) Section 216E.02, subdivision 2, states that "[t]he commission is hereby given the authority to provide for site and route selection for large electric power facilities." The legislature transferred these siting and routing responsibilities to the Commission to "ensure greater public participation in energy infrastructure approval proceedings and to better integrate and align state energy and environmental policy goals with economic decisions involving large energy infrastructure." (2005 Minn. Laws ch. 97, art. 3, § 17.)

Applicants chose to file for a CON and a Route Permit at the same time and in a single document, as it was efficient to compile the necessary information to request a Route Permit concurrently with the CON.

Combining the CON and the Route Permit proceedings into one proceeding is consistent with the goal of the Legislature to simplify public participation and to expedite agency review and decision-making. The Legislature provided in the 2005 Act transferring siting and routing authority to the Commission that "Unless the commission determines that a joint hearing on siting and need under this subdivision and section 216E.03, subdivision 6, is not feasible or more efficient or otherwise not in the public interest, a joint hearing under those subdivisions shall be held." (Minn. Stat. § 216B.243, subd. 4 and Minn. R. 7849.1900, subp. 4.) A joint hearing in this case is certainly feasible, it is definitely efficient, and it will promote the public interest.

The regulatory process described in this section, then, is the process that is followed to satisfy all the requirements under the CON rules (Chapter 7849) and all the requirements under the Route

Permit rules (Chapter 7850). In the end, the Commission can make a decision on the need and authorize construction along a designated route in one proceeding.

The Commission's rules establish requirements that apply prior to the submission of a CON application. Minn. R. 7829.2550, subp. 1, requires the applicant for a high voltage transmission line CON to submit a proposed plan for providing notice three months prior to the filing of the application. In this matter, Great River Energy, on behalf of Applicants, filed a proposed Notice Plan Petition with the Commission on October 1, 2014. The proposed Notice Plan incorporated the notice requirements of the Commission's Certificate of Need rules (Minn. R. 7829.2550). The Commission approved the Notice Plan Petition on January 22, 2015, and issued its written Order on January 30, 2015. A copy of the Commission's Order is provided in **Appendix B.**

In accordance with Minnesota Statute Section 216E.04, subdivision 4, upon filing this CON and Route Permit Application, Applicants will mail a notice of the filing to potentially affected landowners, to those persons who have registered their names with the Commission and expressed an interest in large energy projects, and to the area tribal government and several local units of government whose jurisdictions are reasonably likely to be affected by the proposed Project. (Minn. Stat. § 216E.04, subd. 4; Minn. R. 7850.2100.) In addition, Applicants will publish notice in a number of local newspapers announcing the filing of this Application.

An electronic version of the Application will be available on eDockets in docket numbers 14-853 and 15-204. The Application will also be available on Great River Energy's transmission projects webpage (http://www.greatriverenergy.com/deliveringelectricity/currentprojects/) with a link to the Motley Area Project by clicking on either Morrison, Cass or Todd counties on the map.

Upon submission of an application for a CON or a Route Permit, the Department of Commerce, EERA has the obligation to conduct environmental review of the Project. (Minn. R. 7849.1200 and 7850.3700.) In this matter, because the Applicant is applying for both a CON and a Route Permit, the environmental review will consider issues relating both to the need for the Project, including size, type, timing, voltage, and system configurations, and also to the proposed route, such as construction impacts, environmental features, and impacts on homeowners. EERA has the option to elect to combine the environmental review and prepare one document, an EA. Minn. R. 7849.1900. Applicants believe that combining the environmental review into one document is appropriate and preferable in this matter – it is more expeditious, it will be easier for the public to follow, and it is consistent with legislative intent to combine the need and routing processes.

The process EERA must follow in preparing the EA is set forth in Minnesota Rule 7850.3700. This process requires EERA to schedule at least one scoping meeting in the area of the proposed Project. The purpose of the meeting is to advise the public of the Project and to solicit public input into the scope of the environmental review. Applicants and EERA will both have representatives at the public meeting to answer questions and provide information for the public. The public meeting is to be held within 60 days after the Application is accepted and deemed complete.

Once the public meeting has been held, EERA will issue a Scoping Decision describing the issues and alternatives that will be evaluated in the EA. EERA has four months from the time the Application is submitted to complete the environmental review and prepare the EA. (Minn. R. 7849.1400, Subp. 9.) Upon completion of the EA, EERA will publish notice in the *EQB Monitor*, a bi-weekly publication of the Environmental Quality Board (EQB) that can be accessed on the EQB webpage, https://www.eqb.state.mn.us/eqb-monitor, and will mail notice to persons who have registered their names with EERA to receive notices about this Project. Persons wishing to place their names on the mailing list for this Project can do so by contacting EERA directly (contact information in **Section 1.10**) or electronically on the EERA webpage. A copy of the EA will also be accessible through eDockets by searching the Project docket numbers.

After the EA is completed, the Commission will schedule a public hearing to again solicit public input and to create an administrative record. The Commission will select a person to preside at the hearing; it may be an administrative law judge (ALJ) from the Office of Administrative Hearings or another person acceptable to the Commission. The Commission will establish the procedures to be followed at the hearing. (Minn. R. 7850.3800.) The EA will become part of the record for consideration by the Commission. Interested persons will be notified of the date of the public hearing and will have an opportunity to participate in the proceeding. The hearing will likely be a joint hearing to consider both the CON and the Route Permit. (Minn. R. 7849.1900 and 7850.3800.)

Once the hearing is concluded, the ALJ will prepare a report based on the record and briefs filed by parties to the proceeding. After the ALJ issues the report, the matter will come to the Commission for a decision. At that time, the Commission may afford interested persons an opportunity to provide additional comments.

The Commission has one year from the time a CON Application is submitted to reach a final decision. (Minn. Stat. § 216B.243, subd. 5.) A route permit under the Alternative Permitting Process can be issued in six months after the Commission's determination that the Application is complete (Minn. Stat. § 216E.04, subd. 7); however, Minnesota Rule 7850.2700, Subpart 3 prohibits the Commission from making a final decision on a route permit until the CON is approved. (Minn. Stat. § 216E.02, subd. 2.)

Applicants anticipate that a final decision on the Certificate of Need and the Route Permit for this Project can be made by March 2016.

2.4 Public Participation

Great River Energy held a public open house informational meeting on the Project on September 23, 2014, at the Motley United Methodist Church in Motley, Minnesota. Approximately 20 members of the public attended the open house.

The meeting was publicized in several local papers approximately one week prior to the open house. Landowners potentially impacted received a post card invitation, and local government officials and resource agencies were also invited by letter (copies included in **Appendix A**). (Minn. Stat. § 216E.03, subd. 3a.) Large aerial maps of the proposed Project, photos of proposed

transmission structures, fact sheets, information on the permitting process and need for the Project, ROW information, and a post card for meeting participants to pose questions or comments were available at the open house.

Inquiries and potential concerns from the public included whether the transmission line will extend across their property, concerns regarding impacts to waterfowl migration on the West Route Option crossing of the Crow Wing River, preferences as to which side of the road the transmission line should be built, proximity of the proposed transmission line to houses, extent of tree removal, Project schedule, dimensions of easements, and electric and magnetic fields (EMF) and stray voltage.

Since the open house meeting on September 23rd, approximately 13 citizens have requested specific project information or provided additional feedback on the Project. Feedback received from these 13 citizens indicates a greater preference for the Project to utilize the East Route Option, and a greater preference for the alignment to follow the south side of Azalea Road and the west side of U.S. Highway 10. One property owner who is directly impacted by the West Route Option south of the Crow Wing River advised us they were not opposed to the West Route Option. One Cass County property owner who resides on the East Route Option has reported a strong preference for the West Route Option as he contends he has not had the same opportunity to be heard.

The need for the Project has also been discussed in the Projects Report since 2009. The public participation process associated with the Biennial Transmission Projects Report provided the public and LGUs opportunities to offer comments and suggestions.

In accordance with the Notice Plan, Great River Energy mailed 248 letters to landowners and residents, and 83 letters to LGU officials, elected officials, and state and federal agencies on March 9, 2015. Great River Energy also published notice of the Project, in accordance with the Notice Plan, in the Motley County Record, the Staples World, and the Brainerd Dispatch between March 7, 2015, and March 12, 2015.

2.5 Other Permits/Approvals

In addition to the CON and Route Permit sought in this Application, several other permits may be required for the Project depending on the actual routes selected and the conditions encountered during construction. A list of the local, state and federal permits that might be required for this Project is provided in **Table 2-1**.

2.5.1 Local Approvals

Great River Energy will work with local units of government to address any concerns related to the following possible approvals.

Road Crossing/Right-of-Way Permits

These permits may be required to cross or occupy county, township, and city road ROW.

Over width/Loads Permits

These permits may be required to move over width or heavy loads on county, township, or city roads.

Driveway/Access Permits

These permits may be required to construct access roads or driveways from county, township, or city roadways.

Table 2-1. List of Possible Permits

Permit	Jurisdiction
Local Approvals	
Road Crossing/ROW Permits	County, Township
Building Permits	County, Township
Seasonal Overweight Load Permits	County, Township
Driveway/Access Permits	County, Township
Local Snowmobile Trail Crossing Permit	County, Township
Minnesota State Approvals	
Endangered Species Consultation	Minnesota Department of Natural Resources – Ecological Services
Licenses to Cross Public Waters and Lands	Minnesota Department of Natural Resources – Lands and Minerals
Utility Crossing Permits – State Highways	Minnesota Department of Transportation
Wetland Conservation Act	Board of Water and Soil Resources
National Pollutant Discharge Elimination System Permit	Minnesota Pollution Control Agency
Federal Approvals	
Section 10 Permit	U.S. Army Corps of Engineers
Section 404 Permit	U.S. Army Corps of Engineers
Endangered Species Consultation	United States Fish and Wildlife Service
Other Approvals	
Crossing Permits/Licenses	Railroads and/or other Utilities

2.5.2 State of Minnesota Approvals

Endangered Species Consultation

The DNR Natural Heritage and Nongame Research Program collects, manages, and interprets information about nongame species. Consultation was requested from the DNR for the Project regarding rare and unique species. Great River Energy will work with the DNR to identify any areas that may require marking transmission line shield wires and/or to use alternate structures to reduce the likelihood of avian collisions.

License to Cross Public Lands and Waters

The DNR Division of Lands and Minerals regulates utility crossings over, under, or across any State land or public water identified on the Public Waters and Wetlands Maps. A license to cross Public Waters is required under Minnesota Statutes Section 84.415 and Minnesota Rules Chapter 6135. The Proposed Project will require a license for four or five Public Waters crossed by the new transmission line depending on which route option the Commission approves. Great River Energy will file the license application once the design of the transmission line is complete and will acquire the license prior to construction.

Utility Permit

A permit from the Minnesota Department of Transportation (MnDOT) is required for construction, placement, or maintenance of utility lines that occur adjacent or across the highway ROW. Great River Energy will file for this permit once the design of the transmission lines is complete and will acquire the permit prior to construction.

Wetland Conservation Act

The Minnesota Board of Water and Soil Resources administers the state Wetland Conservation Act under Minnesota Rules Chapter 8420. The proposed Project may require a permit under these rules if permanent impacts to wetlands are anticipated to result from construction. Great River Energy will apply for this permit (which is a joint application with the Section 404 permit) or for an exemption if applicable once the design of the transmission line is complete.

NPDES Permit

A National Pollutant Discharge Elimination System (NPDES) permit from the Minnesota Pollution Control Agency (MPCA) is required for stormwater discharges associated with construction activities disturbing equal to or greater than one acre. A requirement of the permit is to develop and implement a stormwater pollution prevention plan (SWPPP), which includes Best Management Practices (BMPs) to minimize discharge of pollutants from the site. This permit will be acquired if construction of the transmission line will cause a disturbance of greater than one acre.

2.5.3 Federal Approvals

Section 10 Permit

The U.S. Army Corps of Engineers (Corps) regulates impacts to navigable waters of the United States. There are no rivers in the Project area that are classified by the Corps as navigable.

Section 404 Permit

A Section 404 permit is required from the Corps for discharges of dredged or fill material into waters of the United States. If impacts exceed the permitting threshold, Great River Energy will apply for this permit once the design of the transmission line is complete.

United States Fish and Wildlife Service (USFWS)

Review of the Project was requested from the USFWS regarding federally-listed species or critical habitat. Great River Energy will work with the USFWS to identify any areas that may require marking transmission line shield wires and/or to use alternate structures to reduce the likelihood of avian collisions. Any eagle or other migratory bird nests discovered during survey of the line or in the land acquisition process will be reported to the USFWS and Great River Energy will adhere to guidance provided.

2.5.4 Other Approvals

The proposed transmission line would cross over four parallel crude oil pipelines owned by Minnesota Pipe Line Company in two locations: 1) the NE ¼ of SE ¼ of Section 25, Fawn Lake Township, Todd County, and 2) the First Government Lot west of the NW ¼ of NW ¼ of Section 31, Scandia Valley Township, Morrison County,.

Great River Energy will engage Minnesota Pipe Line Company to obtain any necessary crossing permits. Induction of electric currents on the buried pipeline can cause corrosion of the metal pipes. If Minnesota Pipe Line Company determines an engineering study is necessary to analyze corrosion potential of the four pipelines, Great River Energy will work with them to complete the study. Minnesota Pipeline will ultimately determine if corrosion protection is necessary, and Great River Energy will facilitate the installation of corrosion mitigation measures.

3 APPLICANT INFORMATION

3.1 Proposed Ownership

Minnesota Power will continue to own the Dog Lake Substation and the proposed half-mile of new 115 kV transmission line from the substation to the existing "24 Line" transmission line (to be renamed the "155 Line" transmission line upon project completion). Great River Energy will own the 3-way tap switch interconnecting the new 115 kV transmission line to Minnesota Powers "24 Line" transmission line, approximately 15 to 16 miles of new 115 kV transmission line, and the three-way tap switch for the future Shamineau Substation. Crow Wing Power will continue to own the existing Motley Substation (proposed to be converted to 115 kV service) and the proposed new Fish Trap Lake Substation.

3.2 Organization and System Background

3.2.1 Great River Energy

Great River Energy is a not-for-profit generation and transmission cooperative based in Maple Grove, Minnesota. Great River Energy provides electrical energy and related services to 28 member cooperatives, including Todd-Wadena, the distribution cooperative serving the areas that will benefit from the proposed Project. Great River Energy's distribution cooperatives, in turn, supply electricity and related services to more than 650,000 residential, commercial and industrial customers in Minnesota and Wisconsin.

Great River Energy and its cooperatives' mission is to provide safe, reliable and affordable energy to those they serve.

Great River Energy's generation system includes a mix of baseload and peaking plants, including coal-fired, refuse-derived fuel, natural gas and oil plants as well as wind generators (a total of approximately 3,500 MW). Great River Energy owns approximately 4,600 miles of transmission line in Minnesota, North Dakota, South Dakota, and Wisconsin.

Crow Wing Power provides electricity and related services to approximately 37,000 residential, commercial and industrial customers in Minnesota. Approximately 1500 residential, commercial and industrial members of this cooperative would benefit from the proposed high voltage transmission line during normal system operation and up to 600 more would benefit during contingency conditions.

Figure 1-1 shows Great River Energy's service territory and highlights the service area of Crow Wing Power. Great River Energy's electric system is interconnected directly with neighboring suppliers. Great River Energy is a member of the MRO and MISO.

3.2.2 **Minnesota Power**

Minnesota Power is an investor-owned public utility headquartered in Duluth, Minnesota. Minnesota Power supplies retail electric service to 143,000 retail customers and wholesale electric service to 16 municipalities in a 26,000-square-mile electric service territory located in northeastern Minnesota (**Figure 1-2)**. Minnesota Power generates and delivers electric energy through a network of transmission and distribution lines and substations throughout northeastern Minnesota. Minnesota Power's transmission network is interconnected with the regional transmission grid to promote reliability and Minnesota Power is a member of the MRO and MISO.

3.3 Existing Transmission System

3.3.1 Dog Lake–Baxter 34.5 kV System

The 34.5 kV sub-transmission system (**Figure 3-1**) is sourced by the Minnesota Power 115/34.5 kV Dog Lake Substation located near Staples and the Minnesota Power 115/34.5 kV Baxter Substation located near Baxter. Between these substations there are 47 miles of 34.5 kV sub-transmission lines (39 miles owned by Minnesota Power and eight miles owned by Great River Energy).

Along the Dog Lake-Baxter 34.5 kV system, there are switches that are used to serve substations and to sectionalize the line for outages, maintenance or system performance. With a 34.5 kV sub-transmission system such as Dog Lake-Baxter, it is typical to have one switch designated as a normally open switch between the sources, meaning power cannot flow from one source to the other. The normally open switch maximizes operational flexibility and reduces outage times. The Dog Lake-Baxter system is operated with a normally open switch between the Great River Energy Motley Substation and the Minnesota Power Tyson Food Substation.

The 34.5 kV sub-transmission system serves a mix of loads including agricultural, residential, commercial, and light industrial loads in the cities and towns in the affected load area through various distribution substations: Staples Rural, Ward, Motley (MP), Tyson Food, Motley (GRE), Pillager, Pine Beach, Lynch Lake, and Gull Lake.

During contingencies when the normally open switch (503-534 Tie Switch) near Tyson Food substation is closed, for example the loss of the Dog Lake 115/34.5 kV source, increased power flows from the Baxter source which could cause low voltage. Additionally, if the aforementioned tie switch is closed through for contingency purposes, the Dog Lake 115/34.5 kV transformer will pick up all of the load normally served by Baxter resulting in low voltage and near overloading of equipment. The Project proposes to remove a large load, the CWP Motley Substation, from the Dog Lake-Baxter 34.5 kV system to mitigate the potential low voltage.

Figure 3-1. Dog Lake-Baxter 34.5 kV Sub-transmission System

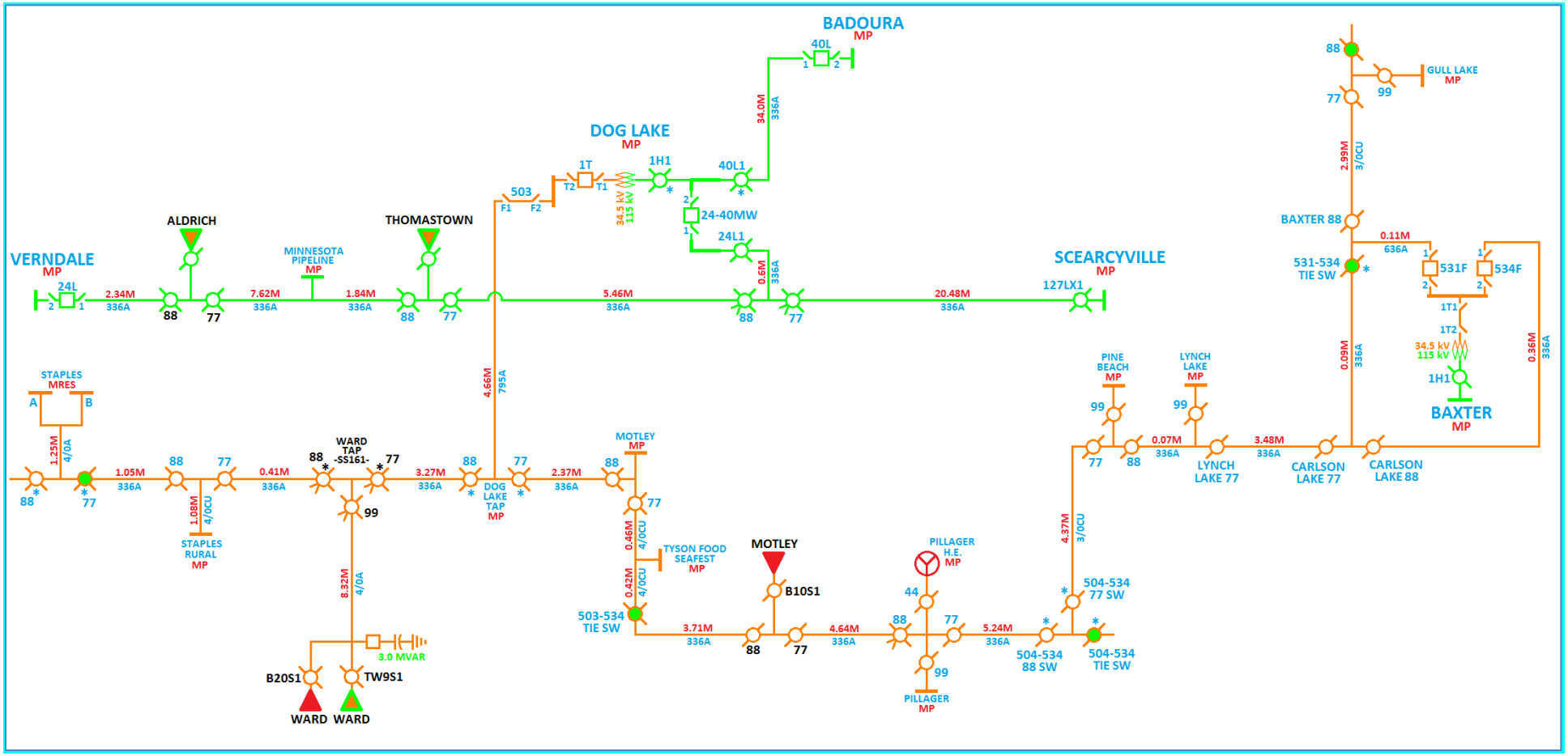


Table 3-1 summarizes the conductor type, length, and rating of the existing 34.5 kV sub-transmission lines in the affected load area.

Table 3-1. Affected Load Area and Project Area Conductors

	Dog Lake–Baxter System	
Conductor Type	**Length (in miles)**	**Rating (in MVA)**
3/0CU	7.36	30
4/0A	8.32	30.1
4/0 CU	1.96	34
336 A	24.69	37
795 A	4.66	63
Total Length	**46.99**	**N/A**

4 PROPOSED PROJECT

4.1 Project Description

The proposed Project is located entirely in Minnesota, within the Counties of Morrison, Cass and Todd as shown in **Figure 4-1 and Figures 4-1A through 4-1C.**

Applicants propose to:

- Construct an approximately 15- to 16-mile-long single circuit 115 kV transmission line between the existing Minnesota Power "24 Line" transmission line[4] and the new Crow Wing Power (CWP) Fish Trap Lake Substation. Some segments of the new transmission line will carry existing distribution line underbuild owned by Minnesota Power and Crow Wing Power.

- Convert the existing 34.5 kV Motley Substation to 115 kV service.

- Construct the new CWP Fish Trap Lake Substation to serve the new Minnesota Pipe Line Company (MPL) Fish Trap pump station.

- Add breakers to the existing Minnesota Power Dog Lake Substation using a more reliable ring bus design and construct a one-half-mile 115 kV transmission line, between the substation and Minnesota Power's existing "24 Line" 115 kV transmission line, to loop into and out of the Dog Lake Substation. This will sectionalize the existing "24 Line" and limit the amount of load at risk from a fault.

- Install a three-way switch to allow for the construction of a future Shamineau Substation.

4.1.1 Transmission Line

<u>Route Widths</u>

Applicants are requesting approval of different route widths depending on the existing land uses of the adjacent properties. Total route widths will vary between 250 feet and 995 ft as follows:

- Where the route extends across open land that does not follow existing roadways, a 250-foot route width is requested.

[4] The existing Minnesota Power "24 Line" transmission line segment between the Dog Lake Substation and the Verndale Substation, including where the Motley project will interconnect, will be renamed the "155 Line" transmission line upon completion of the Project.

- Where the route follows rural roads or county highways, a 300-foot route width is requested, extending 150 feet perpendicular from the road centerline in each direction.

- Where the route follows U.S. Highway 10, the requested route extends 250 feet west of the outside road edge of southbound Hwy. 10, 250 feet east of the outside road edge of northbound Hwy. 10, and encompasses the entire roadway and median area between these outer edges. The total route width for the Project segment along U.S. Highway 10 ranges between 975 and 995 feet due to non-parallel centerline alignments of the northbound and southbound traffic lanes which results in some variation in the width of the median.

- Additional route width is requested at the points where the new transmission line segments interconnect with Minnesota Power's "24 Line" transmission line; where both the East and West Option route segments cross the Crow Wing River; in the area of the Motley Substation; near a large native elm tree located on the south side of Azalea Road; along the East Route Option in Cass County where County Road 31 (51st Ave. SW) intersects 132nd St. SW); in the area of the proposed MPL pump station and Crow Wing Power Fish Trap Lake Substation; and in specific areas to allow for the use of guy wires.

Proposed Route

The proposed route (the larger corridor within which the Applicants seek approval to build) and a conceptual alignment (the initial concept as to where the transmission line will be physically located within the limits of the route boundary) are described in this section and depicted in detailed route and alignment maps (with aerial photo background) in **Appendix F**. The Route Permit that will be issued by the Public Utilities Commission will generally allow the alignment within the route to be modified from what is discussed and depicted in this application. This facilitates the Applicants' ability to collaborate with landowners in establishing structure locations on their properties without having to significantly modify the route permit.

The proposed Project will entail constructing at total of approximately 15.5 to 16.5 miles of new 115 kV overhead transmission line. The transmission line is separated into three segments for discussion purposes, as follows:

1. **"24 Line" transmission line – Motley Substation:** This segment would be approximately 4.0 miles (West Route Option) or 5.0 miles (East Route Option) in length depending on which route option is approved.

    a. The **West Route Option** would interconnect Minnesota Power's "24 Line" 115 kV transmission line in May Township adjacent to Cass County Highway 35 (57th Avenue SW) approximately 1.75 miles north of State Trunk Highway 210. The route would extend approximately three miles southerly along 57th Avenue SW to the Burlington Northern Santa Fe (BNSF) railroad corridor. The route would then continue southerly approximately 1/3 mile across the BNSF railroad corridor and the Crow Wing River. The route over the Crow Wing River is skewed over the river resulting in nearly a 1000-foot crossing length from north to south shorelines. The route continues south approximately 2/3 mile to the Motley

Substation, overtaking an existing Crow Wing Power 3-phase distribution line, which would be attached to the new transmission line as underbuild.

b. The **East Route Option** would interconnect Minnesota Power's "24 Line" 115 kV transmission line in May Township adjacent to 51st Avenue SW approximately 1.25 miles north of State Trunk Highway 210. The route would extend approximately 2.25 miles southerly along 51st Avenue to the intersection with 132nd Street SW. The route then extends westerly along 51st Avenue SW a distance of 0.5 miles to the intersection with 53rd Avenue SW. The route continues southerly along 53rd Avenue SW a distance of 1.0 mile to where it would intersect Minnesota Power's existing 34.5 kV sub-transmission line crossing the Crow Wing River. The route turns westerly approximately 0.30 miles crossing over the Crow Wing River and intersecting Morrison County Road 28 (Azalea Road). At the Crow Wing River Crossing, the Applicant's proposed alignment would deviate from the existing alignment of Minnesota Power's existing 34.5 kV sub-transmission line; Minnesota Power's existing 34.5 kV line would be relocated and attached to the proposed 115 kV transmission line structures as underbuild. The route continues along Morrison County Road 28 (Azalea Road) approximately 0.80 miles to the existing Motley Substation. The last two segments crossing (the Crow Wing River and following along Azalea Road) would carry the existing Minnesota Power 34.5 kV sub-transmission line as underbuild.

2. **Motley Substation – Fish Trap Lake Substation**: This segment would be approximately 10.5 miles in length extending from the existing Motley Substation in Section 27 in Motley Township to the proposed Fish Trap Lake Substation in the southwest corner of Section 30 in Scandia Valley Township. With the exception of approximately 0.75 miles located in Todd County, this entire route segment is located in Morrison County. From the Motley Substation, the route extends westerly along Morrison County Road 28 (Azalea Road) a distance of 3.3 miles to U.S. Highway 10. If the final approved alignment is on the south side of Azalea Road, this route segment would carry the existing Minnesota Power 34.5 kV transmission line as underbuild. The route continues southerly along U.S. Highway 10 a distance of 7.0 miles to the intersection of Holt Road. The route continues easterly along Holt Road a short distance of 0.2 miles where it terminates at the proposed Fish Trap Lake Substation.

3. **"24 Line" transmission line – Dog Lake Substation**: This segment would be approximately 0.5 miles in length and is located in Sections 26 and 36 of Becker Township in Cass County. The route would extend southeasterly from Minnesota Power's existing Dog Lake substation a distance of 0.5 miles to the interconnection with Minnesota Power's existing "24 Line" 115 kV transmission line (to be renamed the "155 Line" line upon completion of this Project segment). The route is common with and immediately adjacent to an existing Minnesota Power 115 kV transmission line currently providing power to the Dog Lake Substation as a radial feed.

Figure 4-1. Proposed Project

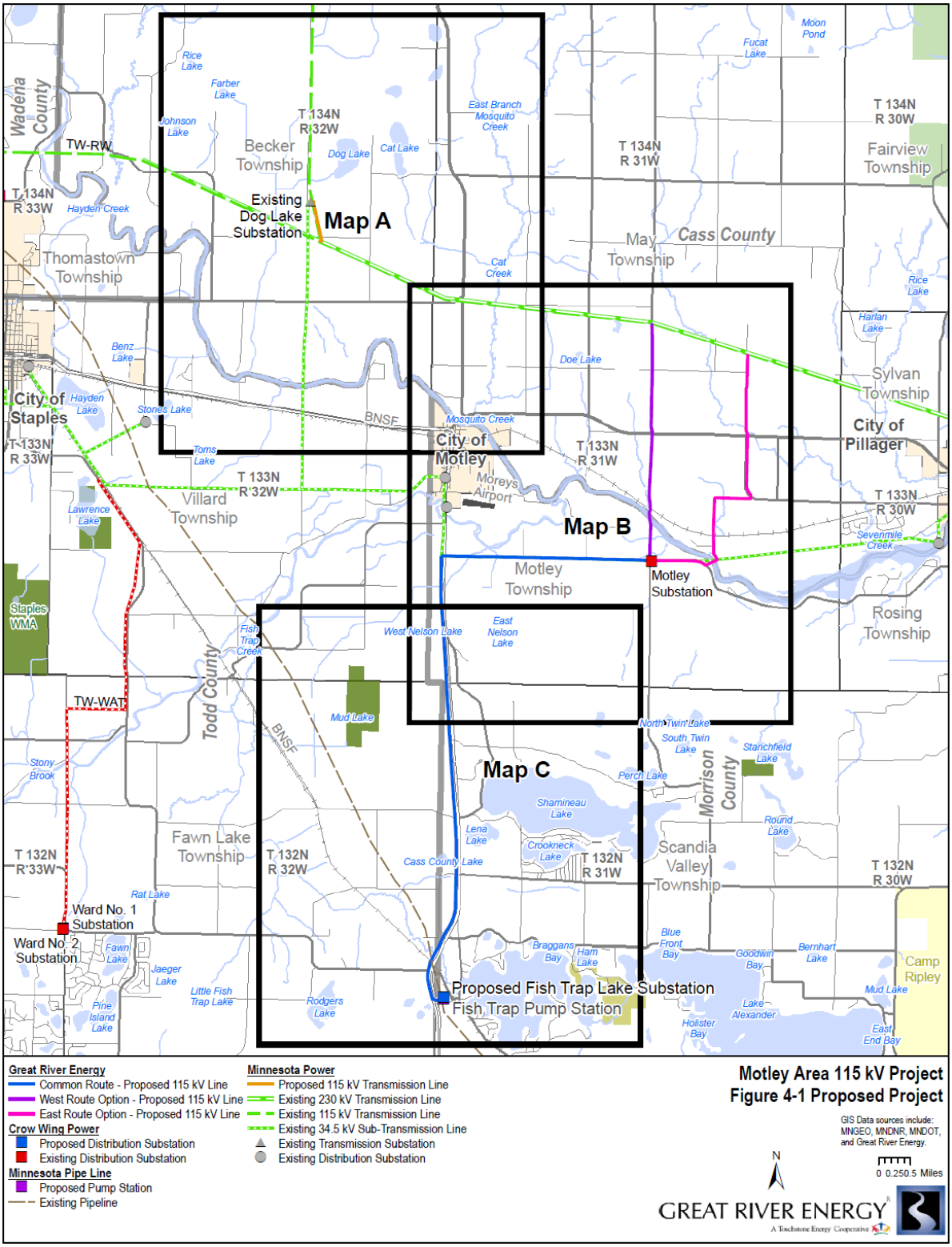


Figure 4-1A. Proposed Project-Dog Lake Substation

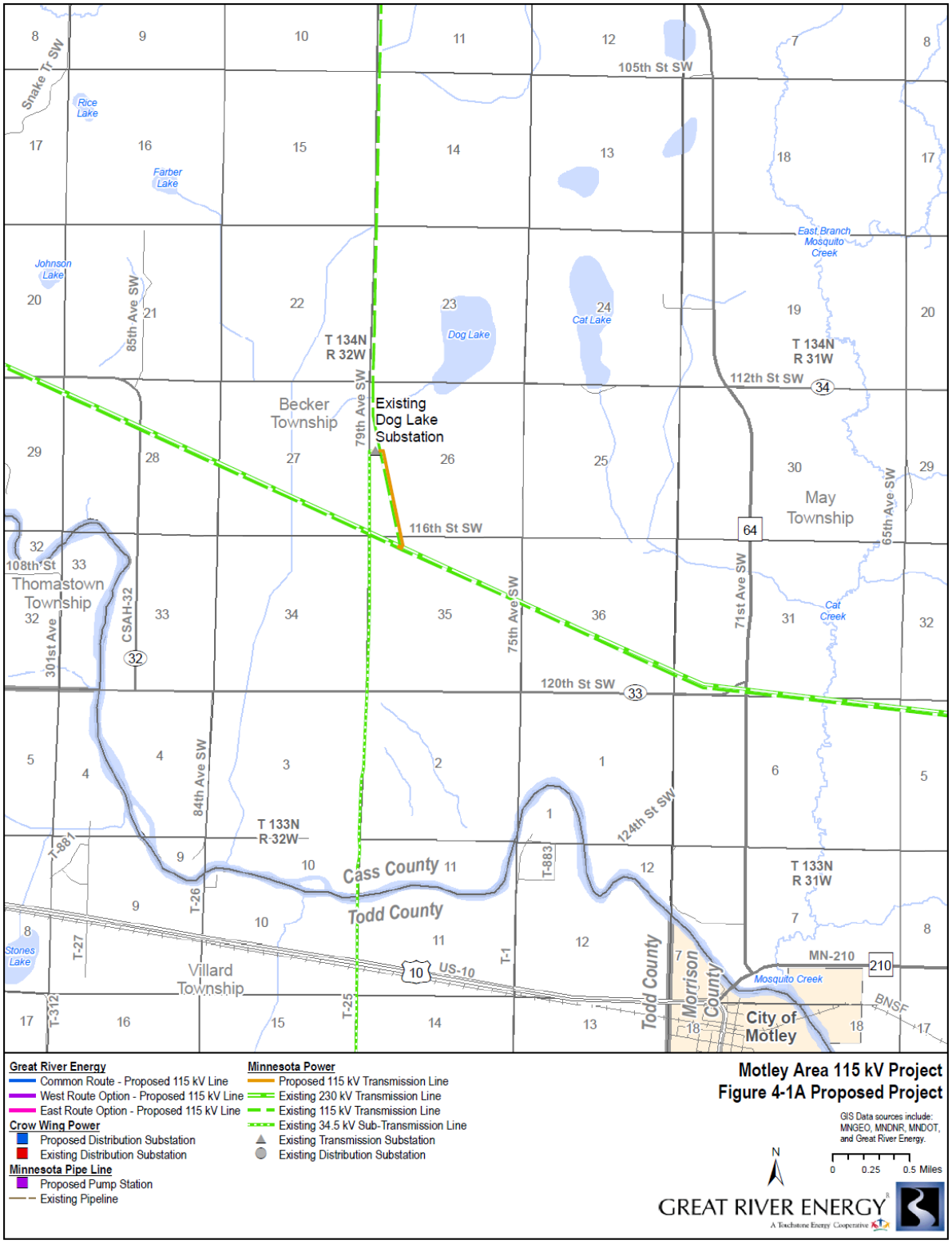


Figure 4-1B. Proposed Project-North

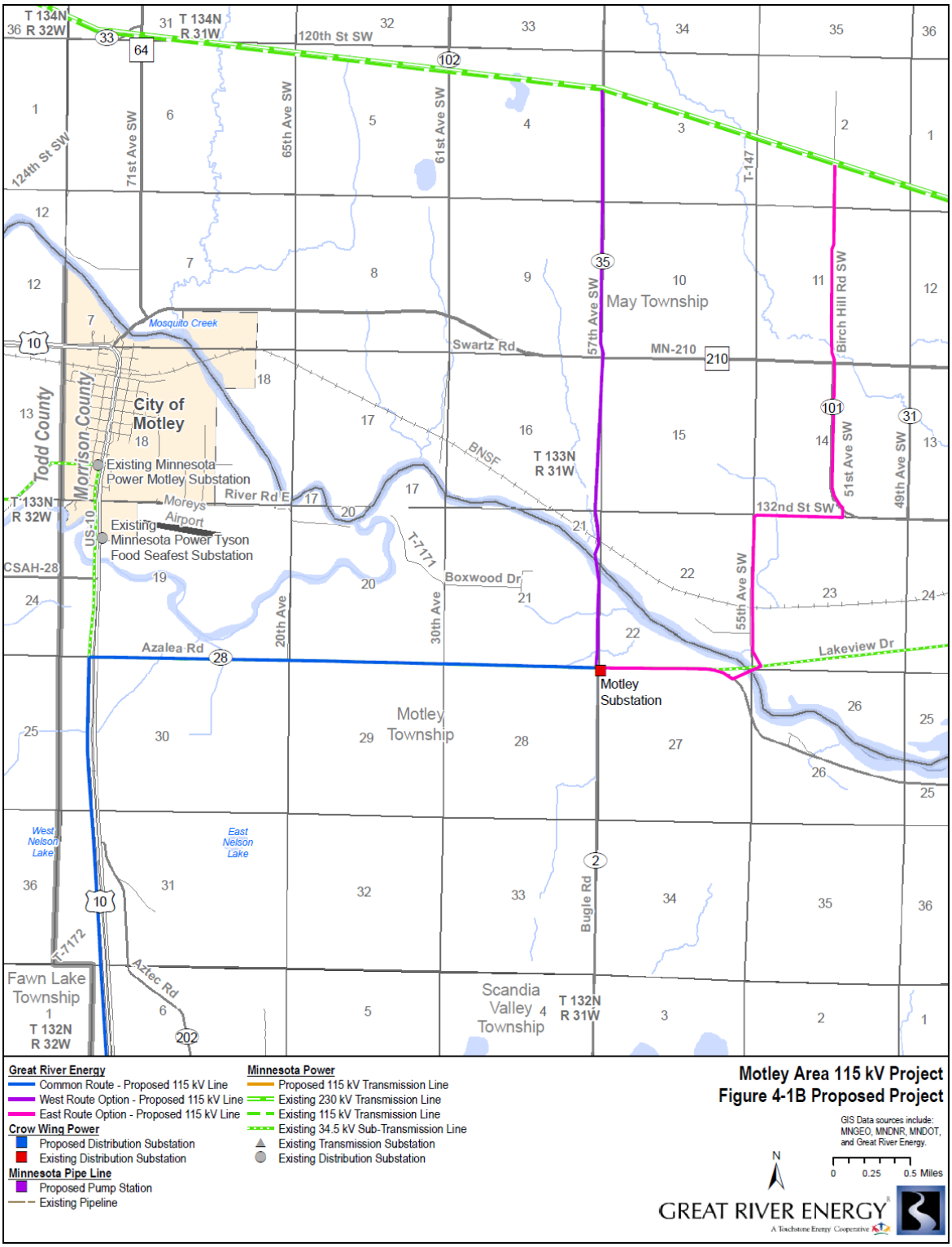
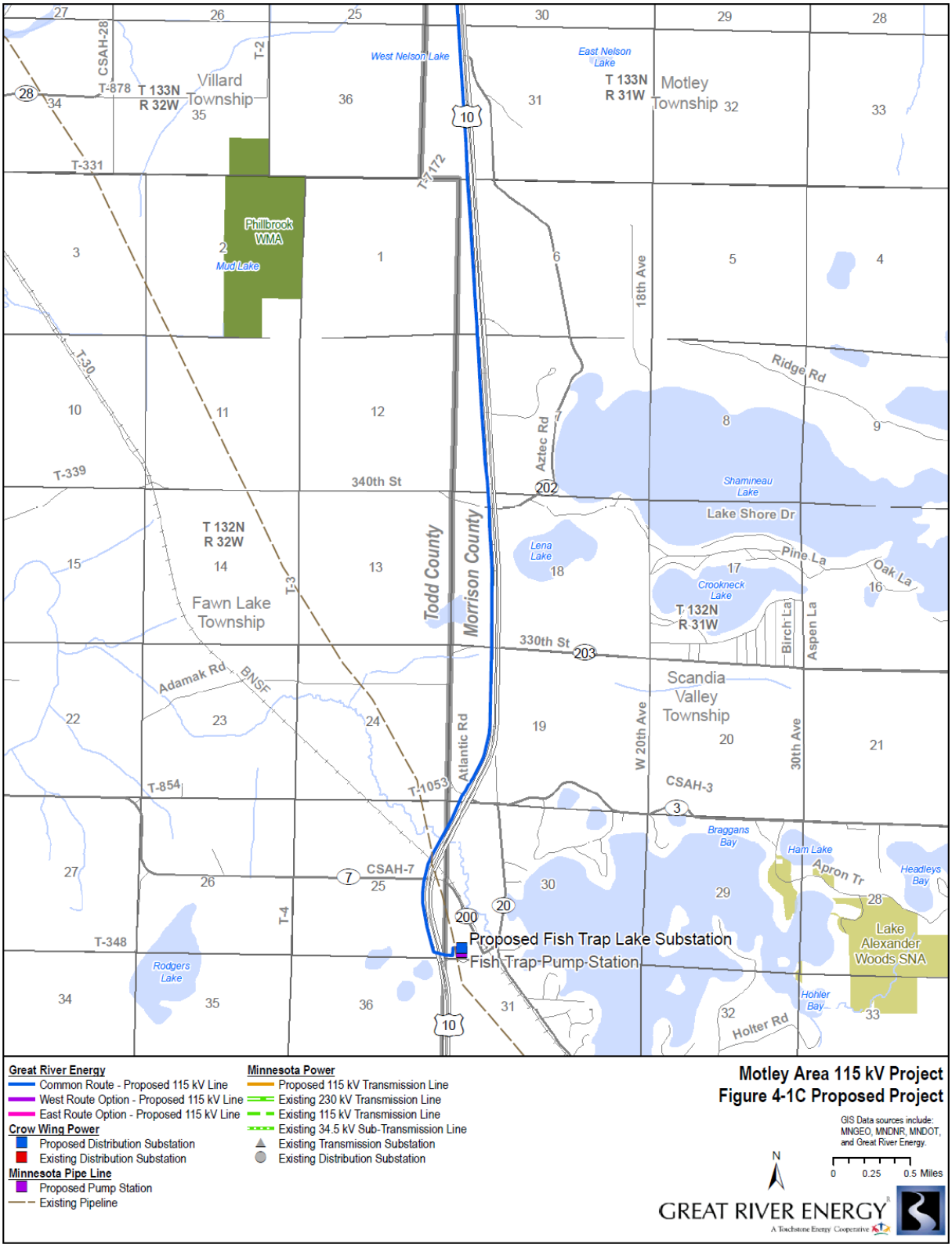


Figure 4-1C. Proposed Project-South



Right-of-Way

The Applicant has worked closely with the local, state and federal agencies and landowners regarding the Project. For most segments of the new transmission line, a 100-foot wide permanent ROW (50 feet on each side of the transmission line centerline) will be acquired. In special restrictive or physically limiting areas, the applicant may consider a reduced right of way width of 70 feet (35 feet of each side of the transmission centerline). Where the transmission line follows along existing distribution lines or roadways, a portion of the proposed transmission line right of way would overlap and be common with the existing distribution line right of way and/or the existing road right of way.

Structures

The majority of the new 115 kV line will consist of single pole wood structures spaced approximately 250 to 400 feet apart. Transmission structures will typically range in height from 60 to 90 feet above ground, depending upon the terrain and environmental constraints (such as highway crossings, river and stream crossings, and required angle structures). The average diameter of the wood structures at ground level is 20 inches.

Some sections of the Project will have distribution lines attached to the transmission structures, which is commonly called underbuild. If underbuild is included in a segment of the Project, the spacing of the transmission line structures would be approximately 250 to 350 feet.

H-Frame design structures may be used in areas with rugged topography and where longer spans are required to avoid or minimize impacts to wetlands or waterways. Span lengths average 600 to 800 feet, with 1,000-foot spans possible with certain topography. Structure heights typically range from 60 to 90 feet above ground with taller structures required for exceptionally long spans and in circumstances requiring additional vertical clearance exceeding the National Electrical Safety Code (NESC) and other agency requirements.

Typical 115 kV structure types (single circuit, single circuit with distribution underbuild, braced post and H-Frame) are shown in **Figure 4-2** and **Figure 4-3**.

The new section of line which would be constructed by Minnesota Power from the Dog Lake substation to the existing “24 Line” transmission line would be H-Frame design. Structure heights typically range from 60 to 90 feet above ground with spans ranging from 500 to 900 feet in length.

Conductors

Great River Energy’s single circuit structures will have three single conductor phase wires and one shield wire. It is anticipated that the phase wires will be 477 thousand circular mil aluminum conductor steel-supported (ACSR) with seven steel core strands and twenty-six outer aluminum strands. The shield wire will be 0.528 optical ground wire.

Minnesota Power’s single circuit structure will have three single conductor phase wires and two shield wires. It is anticipated that the phase wires will be 636ACSR with seven steel core strands and 24 outer aluminum strands.

Figure 4-2. Typical Transmission Structure Types

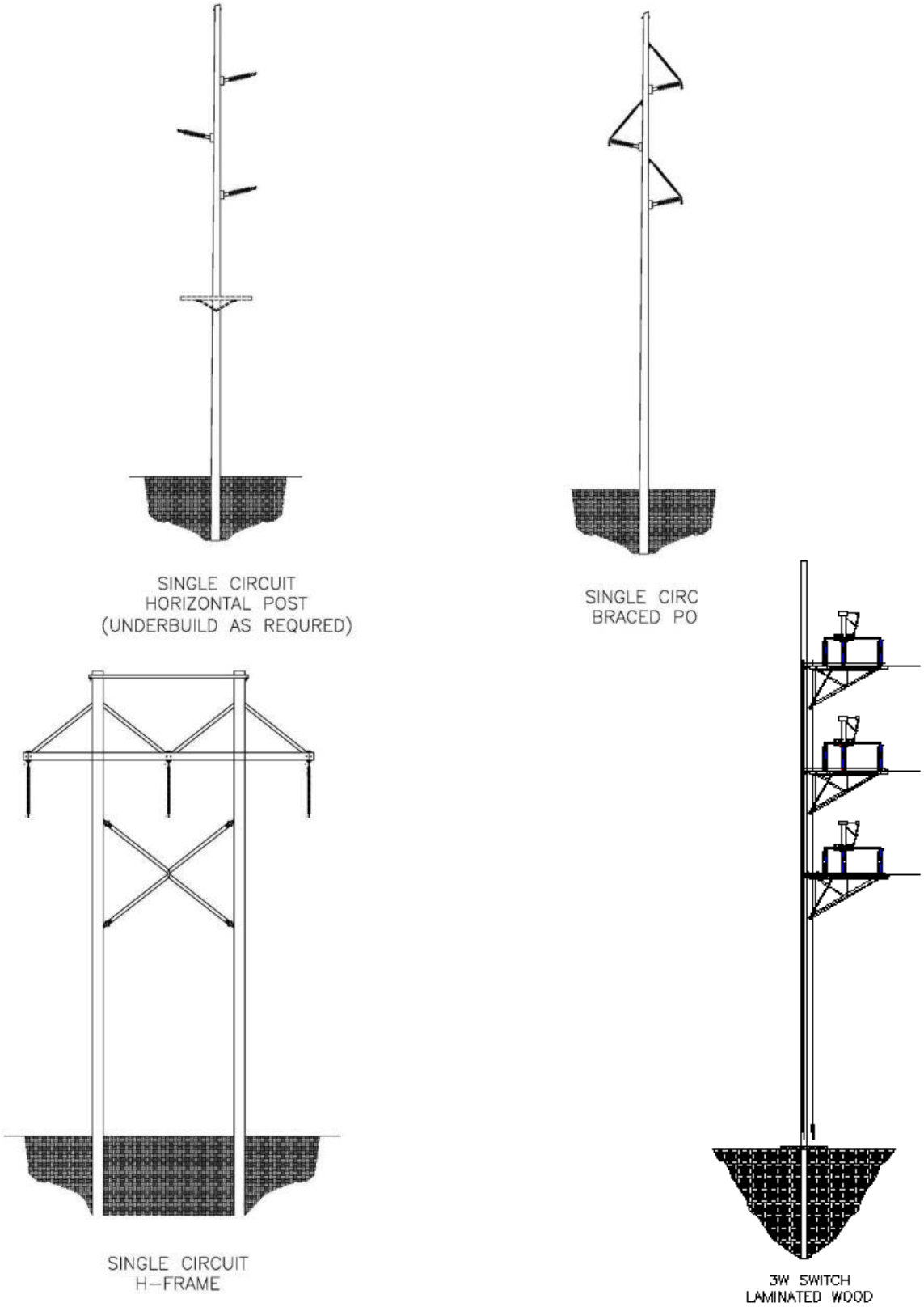


Figure 4-3. Photos of Typical 115 kV Transmission Structures

Typical Single Circuit Structure with Distribution Underbuild

Typical Braced Post Structure

Typical H-Frame Structure

Service Life

The service life of a transmission line is approximately 40 years, although based on experience, it is quite possible that the line and structures will last longer than 40 years.

Annual Availability

An average new 115 kV transmission line is expected to be available approximately 99.9 percent of the year. Applicants expect that these lines should not be out of service for any extended period of time other than the rare times when scheduled maintenance is required or when a natural event, such as a tornado, thunderstorm, or ice storm causes an outage.

4.1.2 Associated Facilities

The proposed Project associated facilities include:

- The existing Minnesota Power Dog Lake Substation, which will be modified to enhance system reliability;
- The existing Crow Wing Power Motley Substation, which will be upgraded from 34.5 kV service to 115 kV service;
- The new Crow Wing Power Fish Trap Lake Substation, which will serve the MPL pump station.
- A new manual three-way switch pole to accommodate a future Shamineau Substation.

Preliminary plot plans for the proposed new and modified substations are provided in **Appendix G**.

Minnesota Power Dog Lake Substation

Minnesota Power proposed to add breakers to the 115/34.5 kV Substation to ensure reliability of the regional transmission system with the addition load from the proposed pump station load. The modifications will entail the construction of a more reliable ring bus system. The redesigned substation will include an expansion of the fenceline 50 feet to the east and south. A preliminary plot plan for the substation is provided in **Appendix G**.

New facilities at the Dog Lake Substation will include:

- New structural steel and bus work for the ring bus structure.
- Multiple breakers 3-way 115 kV motor operated switch
- A new tap line – approximately 0.5 mile.
- Other associated equipment required for the conversion

Crow Wing Power Motley Substation

Crow Wing Power proposes to convert the voltage of the existing Motley Substation from 34.5 kV to 115 kV. The 115 kV substation will be constructed adjacent and directly east of the

existing 34.5 kV substation to minimize outages to those customers served by the Motley Substation.

Facilities at the upgraded Motley Substation will include:

- 3-way manual switch to feed 115 kV service to the substation
- 115/12.47 kV transformer
- Structural steel
- Meter building
- Bus work
- Low side sectionalizing equipment

Crow Wing Power Fish Trap Lake Substation

Crow Wing Power proposes to construct the Fish Trap Lake 115/4.16 kV Substation to support the motor loads for the MPL Fish Trap pump station. Crow Wing Power plans to construct the new substation on MPL's property in Section 30, T132N, R31W in Scandia Valley Township. It is anticipated that the fenced area of the 115 kV substation will be approximately 125 feet by 125 feet.

Facilities at the Fish Trap Lake Substation will include:

- 115/4.16 kV transformer
-
- Structural steel
- Bus work and fittings
- Low side sectionalizing equipment
- Meter equipment
- Conduit, Grounding
- Fiber optic communication

4.2 Estimated Costs

Total Project costs are estimated to be approximately $16 - $17 million depending on which route option the Commission approves. Total costs are summarized in **Table 4-1.**

Table 4-1. Estimated Project Costs (2014$)

	West Route Cost ($1000)	East Route Cost ($1000)
Great River Energy	$12,039	$13,061
Minnesota Power	$3,930	$3,930
Total:	**$15,969**	**$16,961**

4.2.1 Great River Energy Costs

Estimated costs for Great River Energy's portion of the proposed Project are divided into five phases. The tasks associated with each phase are outlined below and estimated costs for each phase are summarized in **Tables 4-2 and 4-3**.

Planning
Siting and routing preliminary activities
Project presentation to the public
Certificate of Need and Route Permit development/state permitting process
Establishing centerline for survey
Land Acquisition/Miscellaneous Permits
Easements, ROW and environmental permits

Design
Line and structure design
Survey and probes/soil borings

Procurement
Cost of all construction materials, i.e. poles, conductor and hardware

Construction
Staking for clearing and construction
ROW clearing and restoration
All construction labor and heavy equipment

Close Out
Remaining ROW restoration activities
Field verification surveys
Financial, engineering, and environmental close out activities

Table 4-2. Estimated Great River Energy Project Costs for West Route Option (2014$)

Facility	Planning ($1000)	Design ($1000)	Procurement ($1000)	Construction ($1000)	Close Out ($1000)	Total ($1000)
Transmission Line	$388	$413	$4,140	$4,000	$138	**$9,079**
Line Switches	$25	$112	$316	$324	$23	**$800**
Motley substation Upgrade	$9	$70	$551	$356	$14	**$1,000**
Fish Trap Substation	$9	$70	$551	$356	$14	**$1,000**
Meters	$0	$40	$69	$49	$2	**$160**
Total:	**$449**	**$774**	**$5,861**	**$5,350**	**$205**	**$12,039**

Table 4-3. Estimated Great River Energy Project Costs for East Route Option (2014$)

Facility	Planning ($1000)	Design ($1000)	Procurement ($1000)	Construction ($1000)	Close Out ($1000)	Total ($1000)
Transmission Line	$432	$459	$4,606	$4,451	$153	**$10,101**
Line Switches	$25	$112	$316	$324	$23	**$800**
Motley Substation Upgrade	$9	$70	$551	$356	$14	**$1,000**
Fish Trap Substation	$9	$70	$551	$356	$14	**$1,000**
Meters	$0	$40	$69	$49	$2	**$160**
Total:	**$475**	**$751**	**$6,093**	**$5,536**	**$206**	**$13,061**

Costs for the Motley Substation upgrade and the new Fish Trap Lake Substation will be borne by Crow Wing Power. All other costs will be borne by Great River Energy.

4.2.2 Minnesota Power Costs

Estimated costs for Minnesota Power's portion of the proposed Project are summarized in **Table 4-4**.

Table 4-4. Estimated Minnesota Power Project Costs (2014$)

Component	Cost ($1000)
Transmission	$1,140
Dog Lake Substation	$2,680
Distribution	$100
Communications	$10
Total:	**$3,930**

All costs for the Dog Lake Substation modifications and the tap line will be borne by Minnesota Power.

4.2.3 Transmission Line Construction Costs

Single pole construction costs are approximately $498,000 per mile. H-Frame construction costs are approximately $550,000 per mile and the double circuit construction costs are approximately $747,000 per mile.

There may be areas where construction is more difficult (e.g. where there are access issues or where greater span lengths must be employed to avoid sensitive features). In these areas the use of wooden mats, the Dura-Base Composite Mat System, or specialized construction vehicles to minimize environmental impacts during line construction may be required and could increase costs by $50,000 or more per mile.

4.2.4 Operation and Maintenance Costs

The estimated annual cost of ROW maintenance and operation and maintenance of Great River Energy's transmission lines (69 kV to 500 kV) in Minnesota currently average about $2,000 per mile. Storm restoration, annual inspections and ordinary replacement costs are included in these annual operating and maintenance costs.

4.3 Effect on Rates

The Commission's rules require an applicant to provide the annual revenue requirements to recover the costs of a proposed project. The Commission's January 30, 2015, Order granting exemptions authorized Applicants to describe the Project's effect on rates using the format as set forth and discussed in this section.

Great River Energy has submitted the Motley area project and MP has submitted the Dog Lake project for consideration as part of the 2014 MISO Transmission Expansion Plan (MTEP 14). The initial annual revenue requirement for the Great River Energy and Minnesota Power projects is estimated to be in the range of $920 thousand. This is based off a combined investment of $4.2 million from the Applicants that may be included in MISO rates. Assuming a 10-MW increase in load associated with the projects, the effect on the zonal rate for the Minnesota Power pricing zone is estimated to be an increase in the range of $0.02 to $0.03 per kW-month.

4.4 Project Schedule

Provided Applicants obtain a CON and a Route Permit by early 2016, Great River Energy plans to commence construction of the Project late in 2016 and complete it early in the fall of 2017. Great River Energy anticipates that construction will take approximately 8 months and that the entire Project will be energized in August 2017.

4.5 Estimated Line Losses

When electrical energy is sent over a transmission line, some of it is lost through conversion into heat from the resistance in the conductor. The losses that occur are directly related to the square of the current flowing through the transmission line, the conductor size, and the length of the line. Additionally, transmission lines operated at higher voltages need less current to transfer the same amount of power than lower voltage lines. Therefore, the higher the operating voltage of a transmission network, the lower the amount of losses encountered for the same amount of power transferred, wire size, and line length. Also, because the current across a transmission line usually varies over time, losses are seldom constant from hour to hour, or from month to month.

Losses are a measure of the energy flow across the system that is converted into heat due to the resistance within the elements of the transmission system. It is necessary for utilities to provide

enough generation to serve their respective system demands (plus reserves), taking into account the loss of the energy before it can be usefully consumed. By reducing and minimizing the amount of system losses, more efficient delivery of the electrical energy to the end user is achieved, which can help to defer the need to add more generation resources to a utility's portfolio. Therefore, system loss reduction results in monetary savings in the form of less fuel required to meet the system demand plus delayed capital investment in generating plant construction.

In determining the amount of losses associated with a particular project, it is not reasonable to consider only the project's transmission and calculate the losses directly from operation of that transmission. It is necessary to look at the total losses of the system that result with and without the proposed project. In its Exemption Order, the Commission authorized Applicants to provide line loss data for the system as a whole, rather than line loss data specific to the individual transmission lines. In this case Applicants considered a significantly larger area served by a number of utilities to determine the resulting effect of the Project's transmission upgrades.

Applicants calculated losses at peak demand based on the 2013 winter peak loadings. The results are summarized in **Table 4-5**.

Table 4-5. Summary of Line Losses

Scenario	System Losses (MW)
Existing System	155.59
System with Project Transmission	155.44
Difference	-0.15

Table 4-5 shows that the Project's proposed transmission infrastructure reduces the losses on the electrical system. Under summer peak demand conditions, the losses incurred are 0.15 MW less when the Project is energized as compared to the existing system configuration.

Because demand for electric power is not constant and losses are related to the square of current flowing through the transmission lines in the electric system, the losses will change over time, increasing as demand increases and decreasing as demand decreases. Because losses change over time, there is no precise method to calculate average annual loss reductions. One common method is to use the loss savings at peak demand to estimate the average annual loss savings in megawatt hours (MWh) based on the following formulas[5]:

$$\text{Loss Factor} = (0.3 \times \text{Load Factor}) + (0.7 \times \text{Load Factor}^2)$$

$$\text{Annual Loss Savings (MWh)} = (\text{Loss Factor x Peak Loss Savings}) \text{ x } 8760 \text{ hours/year}$$

[5] Gönen, Turan. *Electric Power Distribution System Engineering*. McGraw Hill, 1986. 55, 58-59.

The average load factor for the Project area is 74.65 percent. Using the method described above and the calculated loss savings at peak demand (see **Table 5-3**), the Project will reduce average transmission losses by an estimated 1793.89 MWh annually.

4.6 Construction Practices

Great River Energy intends to employ normal practices in construction of the new transmission line. No unusual or difficult features are expected along the route. Construction practices to be followed are described in more detail in **Section 8.4**.

4.7 Operation and Maintenance Practices

Great River Energy will periodically use its transmission line ROW to perform inspections, maintain equipment, and repair damage. Regular maintenance and inspections will be performed over the life of the facility to ensure a reliable system. Annual inspections will be done by foot, snowmobile, All-Terrain Vehicle, pickup truck, or by aerial means. These inspections will normally be limited to the acquired ROW except in those areas where obstructions or terrain would require access from outside of the ROW. If problems are found during inspection, repairs will be performed and the landowners will be compensated for any losses incurred.

Great River Energy's Transmission Construction & Maintenance Department will conduct vegetation surveys and remove undesired vegetation that will interfere with the safe operation of the transmission lines. A three- to seven-year cycle of vegetation maintenance is desirable. ROW practices include a combination of mechanical and hand clearing, along with an application of herbicides where allowed.

4.8 Work Force Required

During construction, there will be positive impacts to community services, hotels and restaurants to support the utility personnel and contractors. It is estimated that 15 to 20 workers at a time will be employed during construction of the Project.

It is not expected that additional permanent jobs would be created by this Project. The construction activities would provide seasonal influx of additional revenue into the communities during the construction phase, and some materials may be purchased locally.

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5 PROJECT NEED AND PURPOSE

5.1 Summary of Need

The proposed Project is needed by 2017 to:

- Meet the in-service date for the proposed MPL Fish Trap pump station that will be served by the new Crow Wing Power Fish Trap Substation.
- Address circuit overloads that currently exist on the Dog Lake-Baxter 34.5 kV system and alleviate capacity issues identified on the lines between Dog Lake and Baxter.

These needs are discussed in the sections below.

5.1.1 MPL Pump Station Need

MPL Reliability Project

The Minnesota Pipe Line Reliability Project will increase the pump capacity on the MPL System's newest pipeline (MPL Line 4) to maintain reliable crude oil supplies to Minnesota refineries.

MPL is currently the only pipeline system supplying crude oil directly to Minnesota's two refineries: the Northern Tier Energy, LLC Refinery in St. Paul Park, Minnesota, and the Flint Hills Resources, LP Refinery in Rosemount, Minnesota. These refineries are responsible for producing the vast majority of transportation fuels on which Minnesotans rely, and other essential products such as asphalt and home heating fuels. The refineries also help meet regional demand for these products, supplying significant percentages of the fuels used in surrounding states.

The MPL System is composed of four pipelines that originate at a crude oil station in Clearbrook, Minnesota. The first pipeline in the system was installed in 1954. A second pipeline was built in the 1970s, and the third in the 1980s. The system was most recently expanded in 2008 with the addition of MPL Line 4 – formerly known as the MinnCan Project.

Today the MPL System has insufficient pump capacity to maintain reliable crude oil supplies to the Minnesota refineries.

Since MPL Line 4 was built in 2008, both refineries have improved their utilizations and increased their operating capacity which, in turn, has increased demand on the MPL System. Wood River Pipeline, which had been capable of supplying Minnesota refineries with 90,000

barrels per day of crude oil, also has since been idled, shifting additional demand from the two Minnesota refineries to the MPL System.

As pipelines age, they also require more frequent inspections and maintenance, and occasionally must be taken out of service for extended periods of time to remain in good working condition. The MPL System currently lacks the pump capacity needed to perform preventative maintenance on segments of the pipeline without disrupting crude oil supplies to Minnesota refineries. The MPL System also currently has insufficient sprint capacity, which is the ability to transport surplus barrels to refineries when needed to satisfy a sudden increase in demand or to make up for prior production or pipeline outages.

Supply disruptions caused by system outages, production constraints, or a lack of adequate pipeline capacity can have serious implications for local economies and people's daily lives. For example, in early 2014 a failure of a primary pipeline that supplies natural gas to Minnesota resulted in a sharp increase in prices, product rationing, and a prolonged shortage of home heating fuels. Similarly, in the summer of 2013, a series of regional refinery outages and system constraints caused record high gasoline prices in Minnesota and much of the Upper Midwest.

The continued reliability of the MPL System is critical to maintaining adequate supplies of the fuels Minnesotans and other Midwesterners depend on for transportation, home heating, powering motorized equipment, and numerous other applications.

MPL Line 4 was originally designed with a capacity of approximately 350,000 barrels of crude oil per day, but it currently transports approximately 165,000 barrels per day. The MPL Reliability Project will add six pump stations to MPL Line 4 and upgrade two existing stations to allow the pipeline to operate at its original design capacity. The total volume of crude oil reaching the market is not expected to change significantly as a result of this Project, but it will give MPL the flexibility to shift volumes to MPL Line 4 as needed to maintain reliable crude oil supplies and meet demand.

The expected maximum operating pressure of MPL Line 4 will not change as a result of the MPL's pump station projects. Rather, the pump stations will allow the pipeline to maintain a more consistent pressure across the entire 305 mile pipeline expanse.

The new pump stations will be located in rural areas along the MPL Line 4 route in Hubbard, Wadena, Morrison, Meeker, McLeod and Scott counties. No new pipeline will be constructed and no new ROW will be acquired for the MPL Reliability Project.

The pump station related to the Motley Area Project is the "Fish Trap" pump station in Morrison County.

The MPL System is operated and maintained by Koch Pipeline Company, L.P., which has a best-in-class program to inspect and repair pipelines through proactive reliability strategies. This includes an in-line integrity program and pump station equipment maintenance reliability programs.

The MPL Reliability Project is an estimated $125 million private investment that will bring increased property tax benefits to the counties where construction will occur. Additionally, 40 to 50 new construction jobs will be created as a result of the Project. MPL anticipates using local contractors, as it does with most projects.

Gasoline, diesel, jet fuel, and other petroleum-based products remain essential to the economy. The MPL Reliability Project is critical to maintaining adequate supplies of these products while maintaining the long-term safety and reliability of the MPL System.

Fish Trap Pump Station Electrical Needs

The electrical facility nearest the proposed Fish Trap pump station is the Dog Lake-Baxter 34.5 kV system. The Dog Lake-Baxter 34.5 kV system is not robust enough to serve the pump station, which includes three 4500-horsepower electric motors that will create an electric demand of 10 MW at full output, as explained below.

When a motor is started, it typically draws a current 6 to 7 times its full load current for a short duration (commonly called the locked rotor current). During a motor start, there is a large increase in current that will result in a larger voltage drop across the system. This means that there can be large momentary voltage drops system-wide. If the system does not have a strong enough voltage source, the motor itself may not start. Meanwhile, the rest of the customers served from the same 34.5 kV system will see suppressed voltages.

Additionally, the Dog Lake-Baxter 34.5 kV system does not have the capacity to serve 10 MW of electrical demand. The transition of Great River Energy's Motley load from the 34.5 kV system to a new 115 kV system creates capacity on the Dog Lake-Baxter 34.5 kV system, but not nearly enough capacity to serve the proposed 10-MW Fish Trap pump station load.

Because it has been determined that the Dog Lake-Baxter 34.5 kV system is not a feasible load-serving option for the proposed pump station, a new, larger voltage source at the Fish Trap Substation is needed to provide reliable electric service to the pump station.

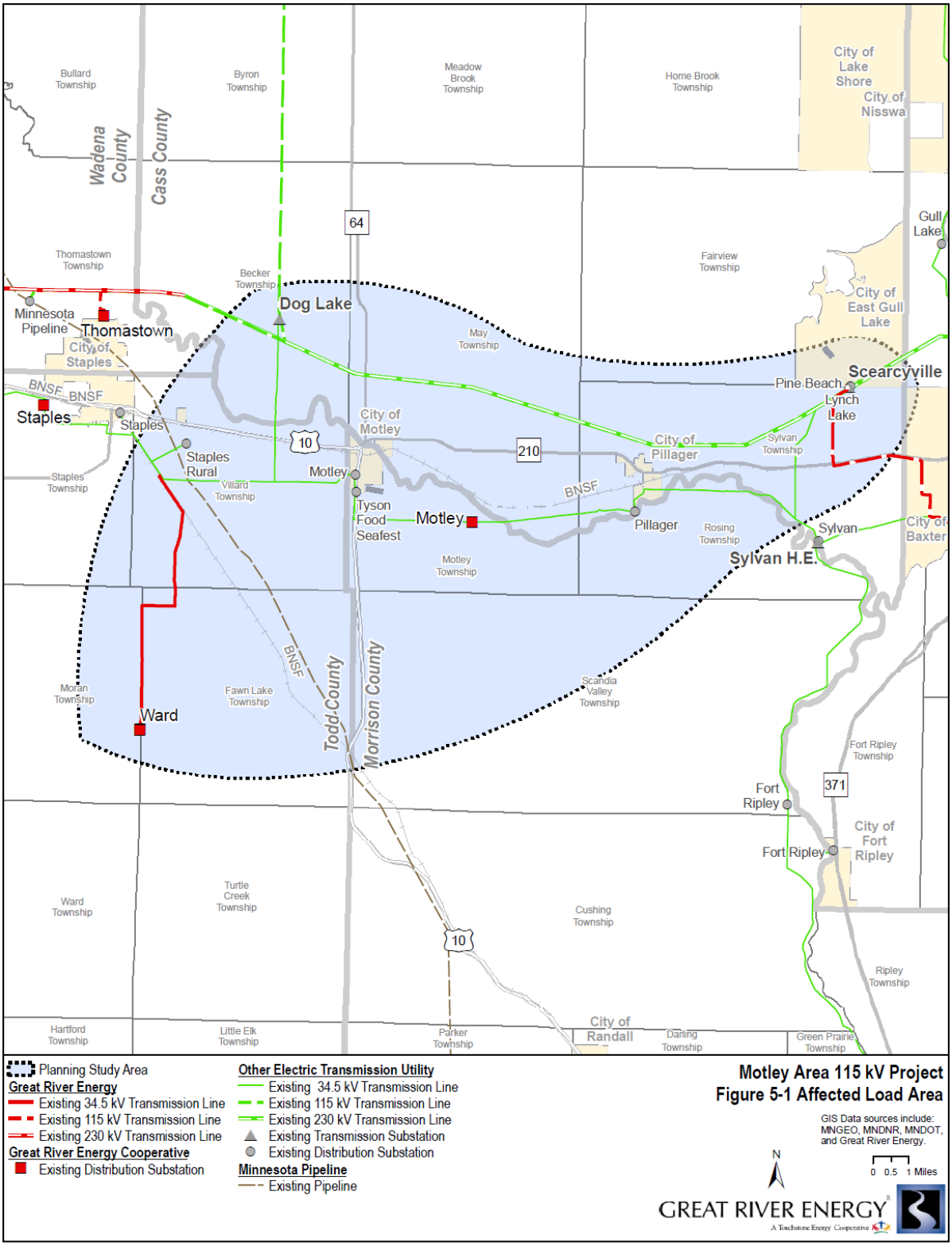
5.1.2 Load-Serving Need

Operational Contingencies

The proposed Project is required to address system overloads in the affected load area (**Figure 5-1**). System overload concerns are due to the growth of the peak electrical demand that has surpassed the level that can be served, and the age of the 34.5 kV transmission lines combined with the overall length of the 34.5 kV network. The Project will also improve an aged transmission infrastructure prone to operational concerns.

Maintaining the voltage of the power system is essential for the normal operation of electrical equipment connected to the power system. Electric appliances, for example, draw a large amount of current (above rated current) during low voltage conditions. This condition creates heat within the electric appliance that can damage the appliance. **Table 5-1** identifies the voltage criteria

Figure 5-1. Affected Load Area



applied by substation owners and operators in the affected load area under both system intact and contingency conditions. Great River Energy and Minnesota Power both operate substations in the affected load area.

Table 5-1. Substation Voltage Criteria

Transmission System	System Intact		Contingency	
	Minimum Voltage (per unit)	Maximum Voltage (per unit)	Minimum Voltage (per unit)	Maximum Voltage (per unit)
Great River Energy	0.95	1.05	0.92	1.10
Minnesota Power	0.97	1.05	0.92	1.10

Concerns with transmission line and transformer overloads are directly related to the amount of current operating through the conductor. Electrical equipment requires sufficient current to function properly. Conductors are rated to allow a certain amount of current to be carried. As electrical demand grows or when additional equipment is connected to the system, the conductor continues to supply the required current until the conductor reaches its maximum rating. An overload situation occurs when the conductor transfers current above its rating. In an overload situation, a conductor can heat up and begin to sag. Similarly, a transformer can overload and cause loss of life and/or fail catastrophically. If the overload condition is great enough or prolonged enough, the conductor can break. A break in a conductor can cause service interruption, equipment damage, or other system concerns. **Table 5-2** identifies the thermal loading criteria applied by transmission line owners and operators in the affected load area under both system intact and contingency conditions.

Table 5-2. Transmission Line Thermal Loading Criteria

Transmission System	Normal (percent)	Emergency (30 minutes) (percent)
Great River Energy	100	100
Minnesota Power	100	110

There are several single-system outages scenarios, if they were to occur, that lead to low voltage and near overloading of equipment. Outages on the Baxter 115/34.5 kV substation or the Dog Lake 115/34.5 kV substation can lead to conditions that result in low voltage and near overloading of equipment, as described in next section.

System Contingencies

Dog Lake Outage

If the Dog Lake source of power to the Dog Lake-Baxter 34.5 kV system is lost due to an outage inside the Dog Lake Substation or on the Dog Lake – Dog Lake Tap segment of MP's 34.5 kV "503" Feeder, service may be restored to all customers by opening a switch to isolate the affected equipment and closing the normally-open 503-534 Tie Switch to allow power to flow from the Baxter Substation onto the Dog Lake-Baxter 34.5 kV system. Based on the historical coincident winter peak loading in the area, which was recorded on February 1, 2013, at 9:00a.m., loss of the power supply through the Dog Lake Substation would have resulted in low voltage at the Motley (GRE), Tyson Food, Motley (MP), Ward, and Staples Rural Substations when the load is shifted to the Baxter Substation. These low voltage concerns are under existing system conditions. **Figure 5-2** identifies the substations that experience these operational concerns during this contingency.

Baxter Outage

If the Baxter source to the Dog Lake-Baxter 34.5 kV system is lost due to an outage inside the Baxter substation, service may be restored to all customers by opening a switch to isolate the affected equipment and closing the normally-open 503-534 Tie Switch in order to pick up all the load on the Dog Lake-Baxter 34.5 kV system from Dog Lake. Based on the historical coincident winter peak loading in the area, which was recorded on February 1, 2013, at 9:00a.m., loss of the Baxter source at that time would have resulted in low voltage if all load of the Dog Lake-Baxter 34.5 kV system were to be served from Dog Lake. Additionally, the Dog Lake transformer reaches 99 percent of its capacity nearing overload. The low voltage concerns and near overloading of equipment is under existing system conditions. **Figure 5-3** identifies the substations and lines that experience these operational concerns during this contingency.

5.2 Relationship Between Proposed Project and Overall State Energy Needs

The most urgent need for the Project is driven by the additional load of the proposed MPL Fish Trap Pump Station. While the pipeline pump station has not been discussed in the Minnesota Biennial Transmission Projects Report, the Project would support a future Shamineau Substation that has been included in the biennial planning process since 2009[6].

The proposed Project is a baseline reliability project that will ensure a continuous supply of secure and reliable electric energy to homes and businesses in the area. The affected load area will benefit from the proposed Project. The benefit will be experienced in areas between Baxter and Staples: Motley, Pillager, "Ward Area," Staples, Baxter, and areas in between. This Project is consistent with the goals of the Minnesota Energy Security and Reliability Act that addressed a wide range of energy issues, including building the infrastructure necessary to deliver electric

[6] "2013 Minnesota Biennial Transmission Projects Report" http://www.minnelectrans.com/documents/2013_Biennial_Report/html/Ch_6_Needs.htm#sec6.4

energy in a timely, efficient, secure, and reliable manner while at the same time minimizing cost and impact on the environment.

If the proposed Project or one of its alternatives is not constructed, studies indicate that electric security in the Project area will decrease, which will lead to reduced reliability throughout the region. An insecure unreliable electric supply is not in the best interest of the area's residents or the State; therefore, doing nothing would not be consistent with the energy policies of the State. In addition, the electrical needs of the proposed MPL Fish Trap pump station could not be met if the Project is not constructed.

Figure 5-2. Dog Lake Outage 34.5 kV Outage with Existing System Conditions

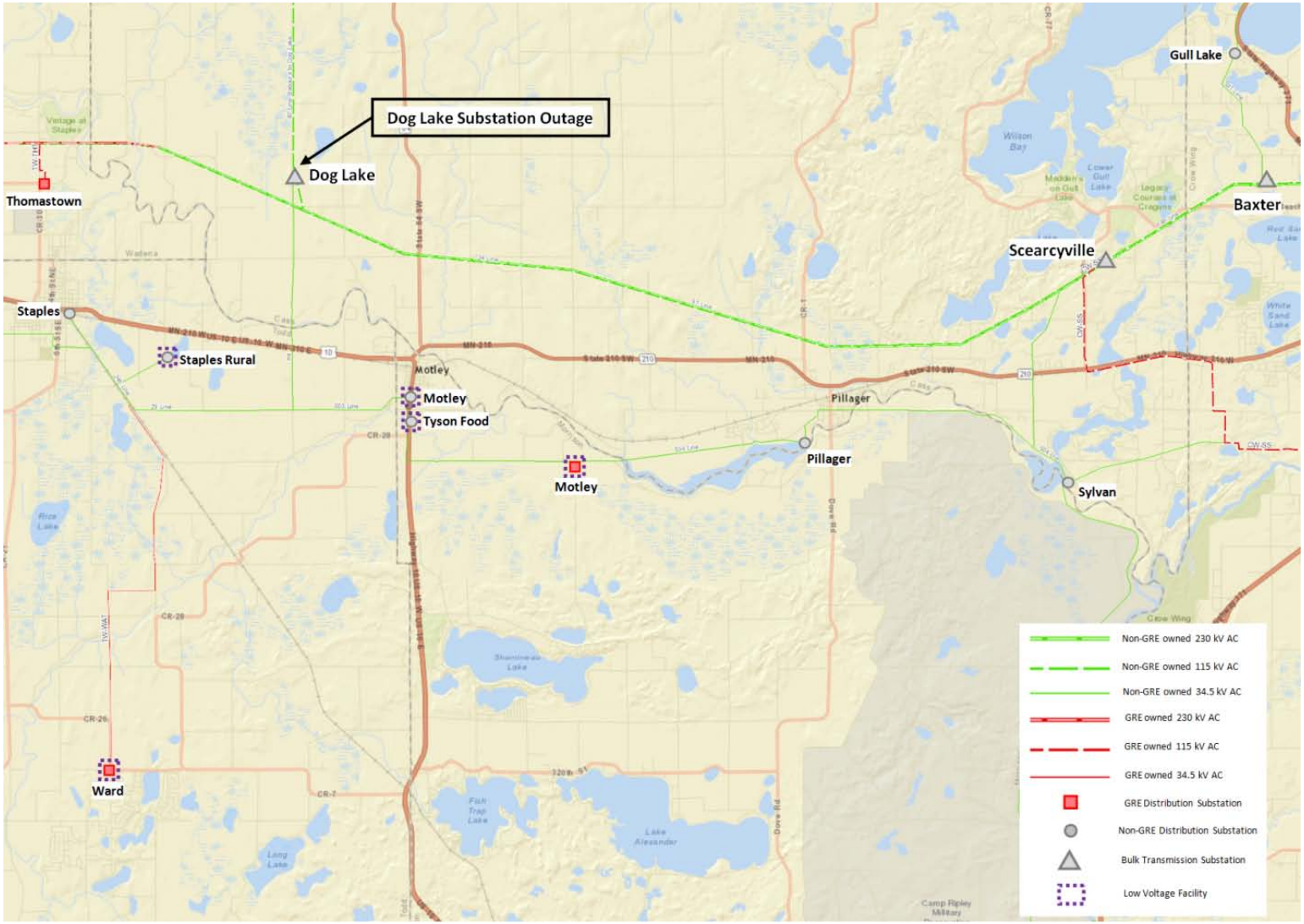
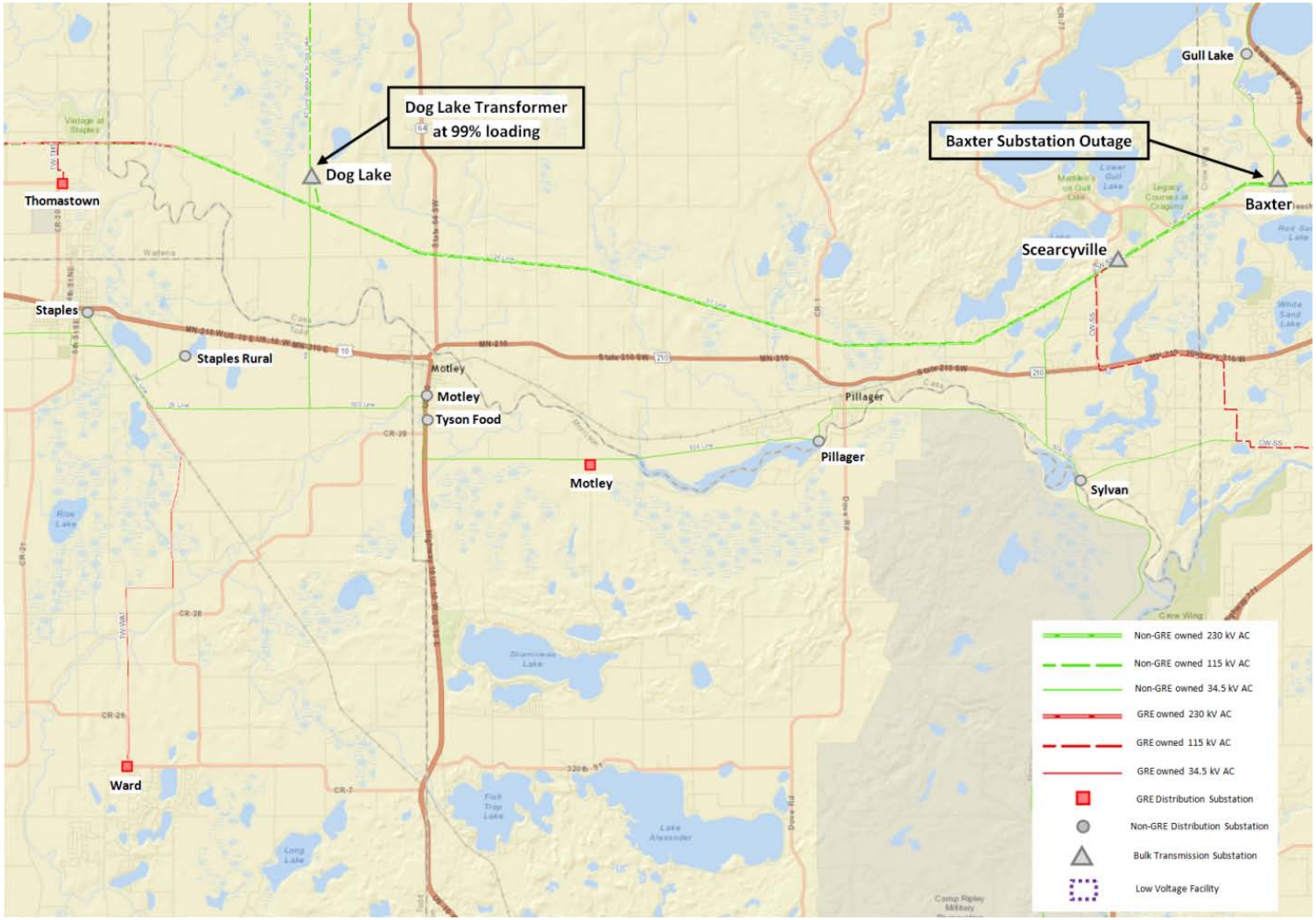


Figure 5-3. Baxter 34.5 kV Outage with Existing System Conditions



5.3 Data Exemptions

On September 24, 2014, Great River Energy, on behalf of Applicants, submitted a Petition for Exemption to the Commission requesting that Applicants be exempted from certain filing requirements of the Minnesota Rules relating to information that must be included in a Certificate of Need application. The Commission, after soliciting and considering comments from interested persons, granted the exemption request on January 22, 2015, and issued its written Order on January 30, 2015. A copy of the Order is attached as **Appendix B**. In its Order, the Commission relieved Applicants from submitting certain information required under Minnesota Rules Chapter 7849 and specified other type of information that should be included in the CON application instead.

Applicants have included in this Application the information relating to the need for this Project required by the Minnesota Rules, as modified by the Commission in its Order granting the exemption request. The following summarizes the exemptions that were granted.

Minn. R. 7849.0260, Subps. A(3) and C(6). The Commission granted the request for an exemption from certain portions of Minnesota Rules 7849.0260, Subparts A(3) and C(6) requiring information on estimated line losses. The Commission authorized Applicants to provide line loss data for the system as a whole, rather than line loss data specific to the individual transmission lines.

Minn. R. 7849.0270, Subps. 1 and 2 (B-F). The Commission granted the request for an exemption from certain portions of Minnesota Rule 7849.0270 requiring information on predicted energy consumption for the utility's entire service area. Because the transmission upgrades proposed here are intended to serve the Dog Lake-Baxter system, the Commission authorized Applicants to provide the requested data only for the affected load area. Historic demand data will be provided for customers served from the Minnesota Power Substations and Great River Energy member cooperative substations in the affected load area that are relevant to the Project. Peak demand forecast will be based on historical loading by substation, and growth rates of the affected load area that are part of the Minnesota Power, Crow Wing Power and Todd-Wadena systems.

The Commission also exempted Applicants from providing data on forecasted consumption and peak demand by customer class (Minn. R. 7849.0270, Subps. 2(B) and 2(C)) for the northern portion of the Project. Instead, Applicants will provide aggregate data on an annual coincident peak basis for the Minnesota Power, Crow Wing Power and Todd-Wadena load in the Dog Lake-Baxter system.

Because the southern half of the Project is needed to serve the new MPL pump station, Great River Energy will provide information on the pump station to satisfy this rule.

The Commission exempted Applicants from providing information on the system peak demand by month as required in Minnesota Rule 7849.0270, Subpart 2(D). Instead of this information, Applicants will provide historical summer and winter peak power demand data and forecast of

power demand at each Minnesota Power substation, Crow Wing Power substation and Todd-Wadena substation in the Dog Lake-Baxter system that will benefit from the Project.

In lieu of providing the estimated annual revenue requirement per kilowatt hour for the system in current dollars (Minn. R. 7849.0270, Subp. 2(E)), the Commission granted Applicants' request to provide: 1) a description of how MISO spreads wholesale electricity costs among users of the transmission grid, and 2) the general financial effect of the Project on Great River Energy's member cooperatives and on Minnesota Power.

Minnesota Rule 7849.0270, Subpart 2(F) requires average system weekday load factors for each month. The Commission granted the exemption from this requirement because load factor is not relevant when evaluating the need for a transmission facility.

Minn. R. 7849.0270, Subps. 3-5 requires information on the forecast methodology employed, identification of databases, and details on the assumptions made in preparing the forecasts provided under Minnesota Rule 7849.0270, Subpart 2. Instead of this information, Applicants proposed providing substation load forecasts and line operation data. The Commission granted this exemption and Applicants will provide Minnesota Power, Crow Wing Power and Todd-Wadena substation load data for those relevant substations within the Dog Lake-Baxter system.

Minn. R. 7849.0280. The Commission exempted Applicants from the requirements of paragraphs B through G and I, as those sections apply to generation, not transmission proposals. The Commission also granted the request that the remaining requirements of Minnesota Rule 7849.0280, Subparts A and H, would be satisfied by providing information related to the affected load area for the Project.

Minn. R. 7849.0290. This rule requires an applicant to submit information about its conservation programs throughout its entire system. The Commission authorized Applicants to provide this information only for the applicable load area.

Minn. R. 7849.0300 and 7849.0340 requires detailed information regarding the consequences of delay on three specific statistically-based levels of demand and energy consumption. Applicants proposed to provide information regarding the consequences of delay in the context of the potential impacts on the local community's service reliability, and proposed to identify the threshold level of demand that places service at risk and the effect of incremental change in growth rather than evaluate system performance at three discrete demand levels. The Commission granted the requested exemption to these rules.

5.4 Affected Load Area

The customers who will benefit from the proposed Project will be in areas between Baxter and Staples: Motley, Pillager, "Ward Area," Staples, Baxter, and areas in between.

Great River Energy has two member cooperatives (Crow Wing Power and Todd-Wadena) serving homes and businesses in the affected load area from several substations. Crow Wing Power serves residential, commercial, agricultural and industrial customers in Morrison and Cass

counties from the Motley Substation. Todd-Wadena serves customers in Todd County from the Ward Substation. Customers served from the Motley or Ward Substation will be benefit from the completion of the proposed Project.

Minnesota Power serves several areas in the affected load area. The load centers served by Minnesota Power in the affected load area include Staples Rural, Motley, Tyson Food Seafest, Pillager, Pine Beach, Lynch Lake, and Gull Lake. These areas will directly benefit from the proposed Project.

5.5 Peak Demand and Annual Electrical Consumption

Minnesota Rule 7849.0270 requires an applicant for a CON to provide information about the peak demand and annual electrical consumption within the applicant's service area and system. Because the Project's transmission upgrades are designed to address localized system reliability issues, the Commission exempted Applicants from providing this information for their entire systems and authorized Applicants to provide the data only for the affected load area. Also, because there are small numbers of customers in the affected load area, the Commission agreed with Applicants that it was not necessary to provide the data for the various consumer classes served in the northern part of the Project and need only address customer class as it relates to the MPL pump station in the southern half of the Project. Finally, the Commission also agreed that the average system weekday load factor by month was not information that was required in this case.

5.5.1 Peak Demand

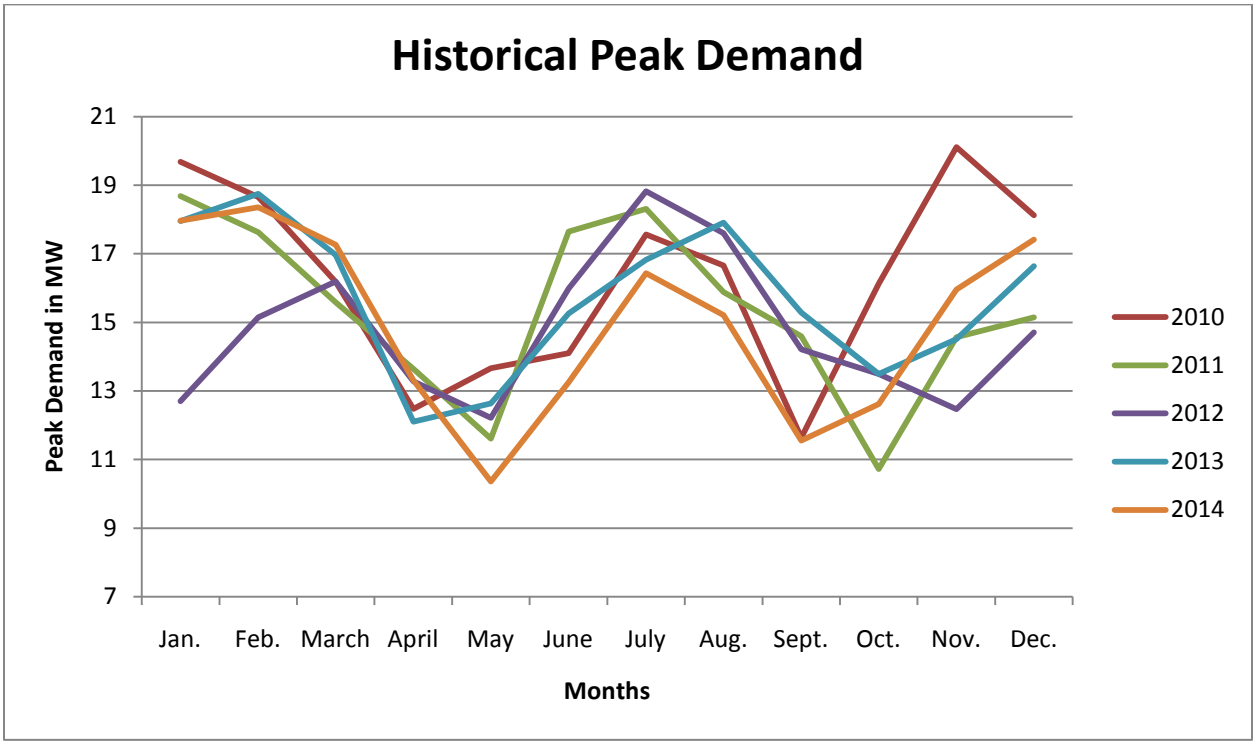
The peak demand for the affected load area for the previous five years is shown by month in **Table 5-3**. These peak demand values are based on the affected load area coincident peak demands.

Table 5-3. Historical Monthly Peak Demand (MW)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2010	19.68	18.65	16.18	12.48	13.66	14.10	17.56	16.66	11.64	16.13	20.11	18.12
2011	18.68	17.63	15.58	13.64	11.61	17.65	18.31	15.88	14.60	10.72	14.57	15.15
2012	12.70	15.15	16.19	13.28	12.22	15.99	18.82	17.60	14.21	13.49	12.47	14.71
2013	17.95	18.75	16.97	12.10	12.64	15.26	16.83	17.91	15.29	13.49	14.51	16.64
2014	17.96	18.36	17.26	13.31	10.36	13.25	16.43	15.21	11.55	12.62	15.96	17.41

Figure 5-4 shows the plots of the historical monthly peak demand shown in **Table 5-3**. The figure shows the affected load area highest electric demand occurs in the months between November and February. These are winter season months and the study models were based on addressing the winter peak demand of the affected load area. The load forecasts are mainly for expected winter season peak demands, as there is little value in creating a projection for summer season.

Figure 5-4. Historical Monthly Peak Demand of the Affected Load Area (MW)



5.5.2 Annual Electrical Consumption

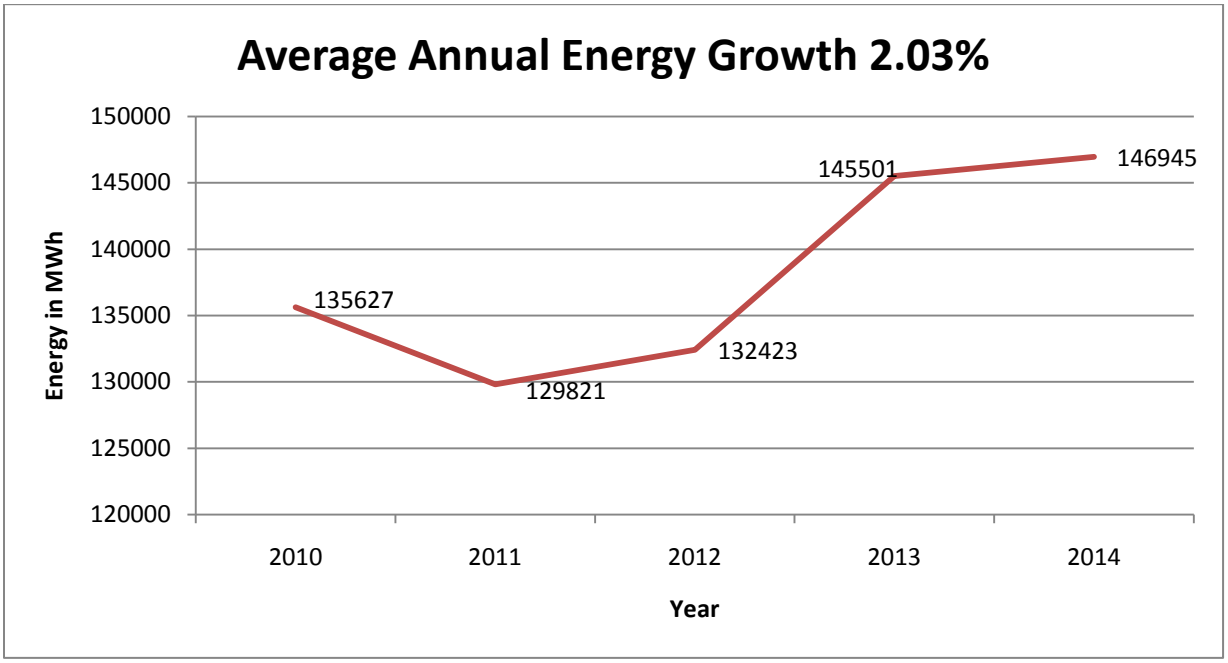
The total annual electric energy consumption in MWh for Great River Energy and Minnesota Power loads in the affected load area for the previous five years is shown by month in **Table 5-4.**

Table 5-4. Historical Monthly Energy Consumption (MWh)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
2010	15352	12716	11922	8686	9625	9453	11657	11302	8896	9650	12663	13704	**135627**
2011	13185	10572	12034	9833	9310	9477	12423	11121	9415	9497	10516	12439	**129821**
2012	13061	11367	9901	8759	9169	10280	13623	11242	9562	10394	11157	13907	**132423**
2013	14638	12744	12755	11354	10131	10326	12817	12263	10007	10730	12041	15695	**145501**
2014	16208	14438	13378	11078	10600	10398	12166	11700	9700	10324	12975	13981	**146945**

Figure 5-5 shows the annual historical energy consumption from 2010 through 2014 of the affected load area plotted versus year. The historical five year energy growth rate of the affected load area is calculated to be 2.03 percent.

Figure 5-5. Five-Year Historical Annual Energy Consumption of the Affected Load Area



5.6 Forecasts

Minnesota Rule 7849.0270 requires an applicant to explain the manner in which the applicant has conducted forecasting of its future energy needs. In the current filing, the Commission granted certain exemptions as summarized in **Section 5.3** and included in **Appendix B**, which is expected to result in a more streamlined filing focusing on the elements of the forecast that are more relevant to the need for the facilities. The affected load centers are mostly served by Great River Energy and Minnesota Power. The load forecasting methodology used by Applicants when determining the need for the proposed transmission Project is discussed in **Section 5.6.1**.

5.6.1 Methodology

When developing the long-range load forecast of the area for the affected load area, multiple load forecasts scenarios were compared. A more conservative load forecast, which has a high probability of occurring in the system, was chosen for the study. In fact, the existing and projected load profile and type of customers, such as residential, agricultural, commercial or industrial of the affected load area are different from one area to another. To be more predictive of the load growth trends at a specific load center in the affected load area, more emphasis was given to forecast loads based on growth rate by individual substations.

Great River Energy

Great River Energy member cooperatives serve the majority of the load centers in the affected load area. The following data were analyzed and compared when determining the growth rate percentage and projected peak load data that were used during the study for loads served by Great River Energy member cooperatives:

1. Past 10-year historical cooperative coincident peak load data and growth rate;
2. Recent 5-year historical cooperative peak load data and growth rate; and
3. Average annual growth rate per substation as forecasted by Great River Energy member cooperatives.

Great River Energy retrieved 10 years of historical coincident peak load data for the affected load centers served by its member cooperatives. The historical coincident peaks are chosen so that switching peaks due to transferring loads between substations are removed when determining the peak demand at a substation. Note that switching peak is a peak demand at a substation when load is transferred to the substation from another substation by switching feeders. This mostly occurs during contingencies in the distribution system. **Table 5-5** shows the 10 years, from 2005 through 2014, recorded historical coincident peak demands in Megawatts (MW) for the affected load area served by Great River Energy member cooperatives.

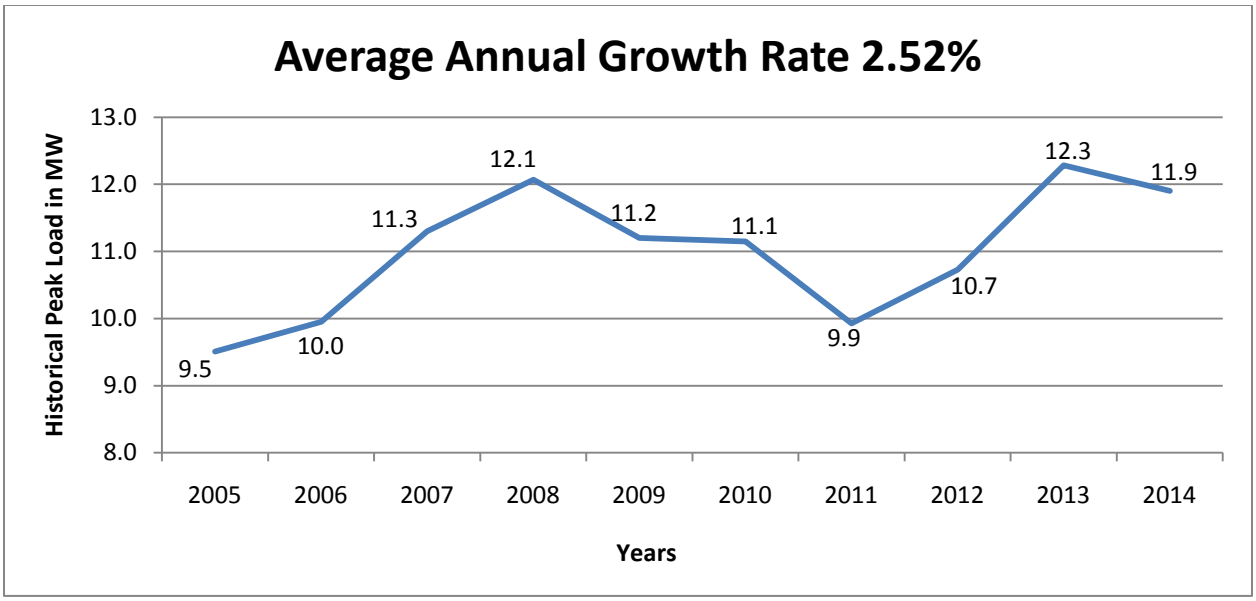
Table 5-5. Affected Load Area 10-Year Historical Coincident Peak Load Served by Great River Energy Member Cooperatives (MW)

Substation	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Motley	3.46	5.09	4.23	4.72	4.52	4.46	3.88	4.08	4.82	4.61
Ward	6.05	4.86	7.07	7.36	6.68	6.69	6.05	6.65	7.47	7.29
Total	**9.51**	**9.95**	**11.30**	**12.07**	**11.20**	**11.15**	**9.93**	**10.73**	**12.28**	**11.90**

Figure 5-6 illustrates the annual growth trend of the affected load area peak demand for the past ten years for loads served by Great River Energy member cooperatives.

Figure 5-6 shows that the peak load demand for the cooperative loads in the affected load area has shown consistent growth starting 2005 and onward. The peak demand average annual growth rate of the affected load area served by Great River Energy member cooperatives for the prior 10 years is about 2.52 percent.

Figure 5-6. Affected Load Area Served by Great River Energy Member Cooperatives 10-Year Historical Peak Demand Growth Trend



Great River Energy also looked at historical peak demands of the affected load area for the past five years to get a more descriptive trend of the peak load growth rate of the affected load area for the near-term. The five-year historical load growth rate portrays the near-term peak load growth trend of the affected load area better than the growth rate based on the 10-year historical data. **Table 5-6** shows the five years, from 2010 through 2014, historical coincident peak loads recorded in the system.

Table 5-6. Affected Load Area Five-Year Historical Coincident Peak Load Served by Great River Energy Member Cooperatives (MW)

Substation	2010	2011	2012	2013	2014
Motley	4.46	3.88	4.08	4.82	4.61
Ward	6.69	6.05	6.65	7.47	7.29
TOTAL	**11.15**	**9.93**	**10.73**	**12.28**	**11.90**

The annual peak load demand of the affected load area in **Table 5-6** is plotted in **Figure 5-7** to graphically illustrate the peak load growth trend from 2010 through 2014.

Figure 5-7. Affected Load Area Five-Year Historical Peak Load Growth Trend

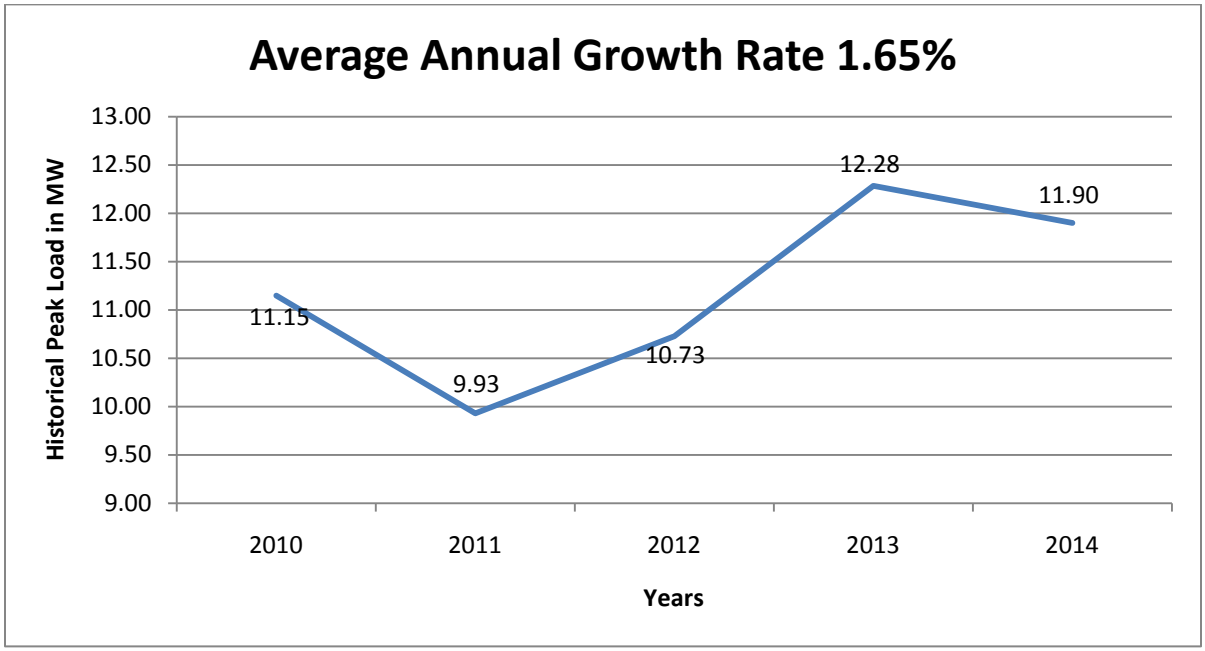


Figure 5-7 shows consistent growth of the peak demand for the affected load area served by Great River Energy member cooperatives. The historical peak load average annual growth rate was calculated to be about 1.65 percent.

Great River Energy also considered the load growth percentage as forecasted by Todd-Wadena and Crow Wing Power. The load projection was done for individual substations that serve the affected load area. The load projection takes into account the projected land use data that are available from city and county agencies in Todd-Wadena and Crow Wing Power's service territory. The number of new residential, commercial and industrial consumers for each substation was projected as part of long range load forecast analysis. **Table 5-7** shows the projected average annual load growth percentages for each substation.

Table 5-7. Forecasted Average Annual Growth Rate

Substation	Annual Growth Rates
Motley	1.00%
Ward	1.00%

When determining the average annual growth rates for forecasting the future peak demand of the affected load area, Great River Energy compared the three percentage growth rates (the ten year, five year and the weighted annual average growth rate) from the data provided by its member cooperatives. The 10-year historical peak load data showed an average annual growth rate of 2.52 percent, the five-year historical peak load data showed an average annual growth rate of about 1.65 percent and the load projection of individual substations showed a weighted average

annual growth rate of 1.0 percent. The weighted average annual growth rate was calculated based on the following formula and uses the 2013 historical substation peak loads from **Table 5-5**.

$$\text{Weighted average annual growth rate} = \frac{\text{LC P\#1} * \%\text{GR1} + \text{LC P\#2} * \%\text{GR2} + \text{LC P\#3} * \%\text{GR3} + \cdots \text{etc}}{\text{LC P\#1} + \text{LCP\#2} + \text{LCP\#3} + \cdots \text{etc}}$$

Where: LCP# 1 = Historical Peak Load of Load Center 1 (Substation 1)

LCP# 2 = Historical Peak Load of Load Center 2 (Substation 2)

%GR1 = % percentage growth rate substation #1

%GR2= % percentage growth rate of substation # 2

With the transmission system showing inadequacies under recent historical peak load during contingencies, it was decided to use a conservative growth rate with which the forecasted peak load has the high probability of occurring on the years for which it is forecasted. The weighted average annual load growth rate produced from Great River Energy's member cooperative load growth rate forecast (**Table 5-7**) showed a weighted annual average annual growth rate that is not as high as the historical five-year average annual growth rate or the ten year historical average annual load growth rate. Therefore, the peak demand of the affected load area will be forecasted using the average of the three forecasted annual growth rate percentages (1.72 percent) for loads served by Great River Energy member cooperatives, and individual substation peaks are forecasted using the growth rate provided for each substation in **Table 5-8**. This table shows the forecasted 2017/18 load levels per substation used when determining the need for the proposed Project. The starting load for the load forecast is the 2013 peak load recorded at each substation serving the affected load area.

Table 5-8. Forecasted 2018 Load Levels Used for the Out-Year Study

Substations	Winter Peak – 2013/14 Load		Applied Growth Rate	Winter Peak – 2017/18 Load	
	MW	MVAr		MW	MVAr
Motley	4.00	-0.18	1.72%	4.28	-0.19
Ward	6.14	0.10	1.72%	6.57	0.11
TOTAL	**10.14**	**-0.08**	**-**	**10.85**	**-0.08**

Minnesota Power

Minnesota Power provides service in the affected load area though seven Substations, Staples Rural, Motley, Tyson Food Seafest, Pillager, Pine Beach, Lynch Lake, and Gull Lake. Similar to the load forecast for affected area loads served by Great River Energy member cooperatives, a conservative growth rate was used when forecasting affected area loads served by Minnesota Power. The historical peak load growth of the affected load area served by Minnesota Power

grew in the same trend as the affected load area served by Great River Energy member cooperatives. **Table 5-9** shows the 10-year historical load recorded for the substations in the affected load area served by Minnesota Power.

Table 5-9. 10-Year Historical Peak Load Data for Affected Load Area Served by Minnesota Power (MW)

Substation	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Motley	0.80	0.52	0.94	0.78	0.98	2.22	1.41	1.40	1.36	1.09
Tyson Food Seafest	1.96	1.27	2.30	1.91	2.40	5.44	3.45	3.44	3.33	2.66
Staples Rural	0.23	0.15	0.27	0.23	0.28	0.64	0.41	0.41	0.39	0.32
Lynch Lake	0.94	0.74	1.24	0.88	1.04	1.93	1.96	2.15	1.97	1.85
Pine Beach	0.94	0.74	1.24	0.88	1.04	1.93	1.96	2.15	1.97	1.85
Pillager	0.85	0.68	1.13	0.80	0.95	1.76	1.79	1.96	1.79	1.68
Gull Lake	1.97	3.35	3.35	2.77	2.78	4.20	4.13	4.43	4.97	4.94
TOTAL	**5.73**	**4.11**	**7.13**	**5.46**	**6.69**	**13.94**	**10.98**	**11.51**	**10.80**	**9.44**

Figure 5-8 shows that the customer load in the affected load area served by Minnesota Power grew at an average annual rate of 5.70 percent in the last ten years (2005 – 2014). Conversely, the plot of the five-year historical peak loads, **Figure 5-9**, shows that the affected load area had negative growth at an average annual rate of -9.28 percent between 2010 and 2014.

The ten year historical load growth rate, at 5.70 percent, gives a more realistic sense of the growth taking place in the area. The five year historical load rate, at -9.28 percent, is more of a snapshot in time that appears less realistic. Due to the large disparity in the five year and ten year historical growth rates, the growth rate of the peak loads in affected load area served by Minnesota Power will be one percent which is a safe, reasonable growth rate. The proposed Project is based on a conservative average annual growth rate of one percent that was applied to Minnesota Power's 2013 peak load. A one percent annual growth rate was applied to the 2012/13 peak loads when forecasting and modeling the 2017/18 (out-year) load level of the affected load area served by Minnesota Power. **Table 5-10** shows the 2012/13 peak loads recorded for Minnesota Power substations serving the affected load area, the applied growth rate and the forecasted 2017/18 load level. It should be noted that use of the ten-year historical load growth percentage would result in higher 2017/18 load levels than shown in **Table 5-10.**

The peak demand projection was made for the winter season using the recorded historical peak of the 2012-2013 season as the starting point. The weighted average annual load growth percentage, which is calculated from the 2013 historical substation peak demand and substation growth rates in **Table 5-8** and **Table 5-10,** is used to forecast the peak demand shown in **Table 5-11**.

Figure 5-8. Affected Load Area 10-Year Historical Peak Demand Growth Trend Served by Minnesota Power

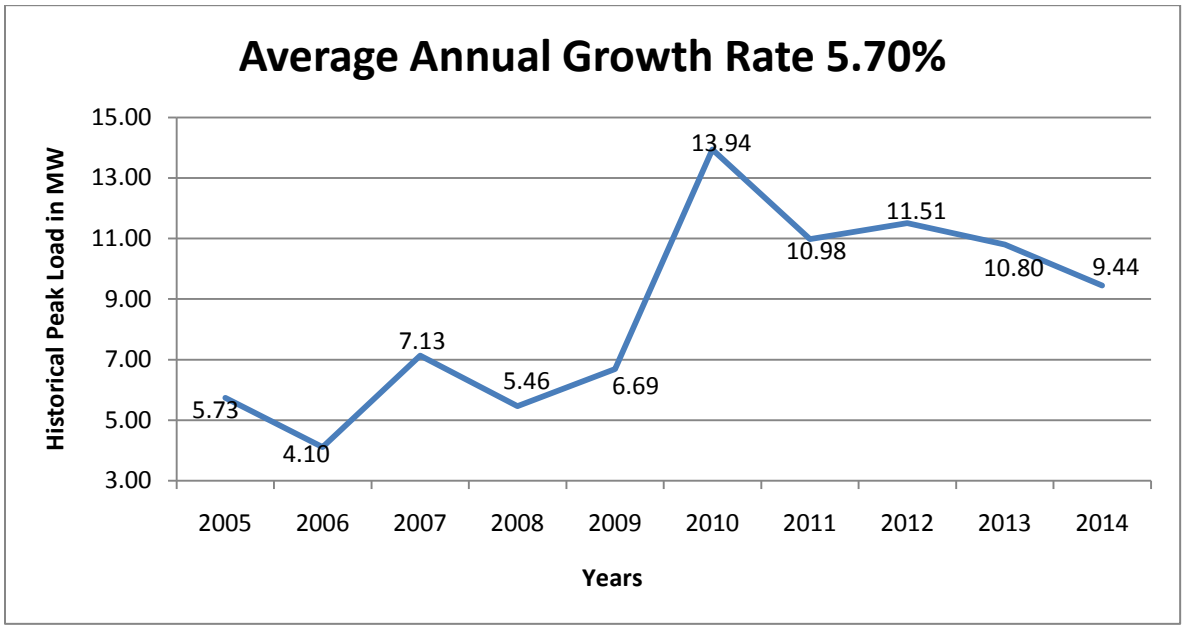


Figure 5-9. Affected Load Area Five-Year Historical Peak Demand Growth Trend Served by Minnesota Power

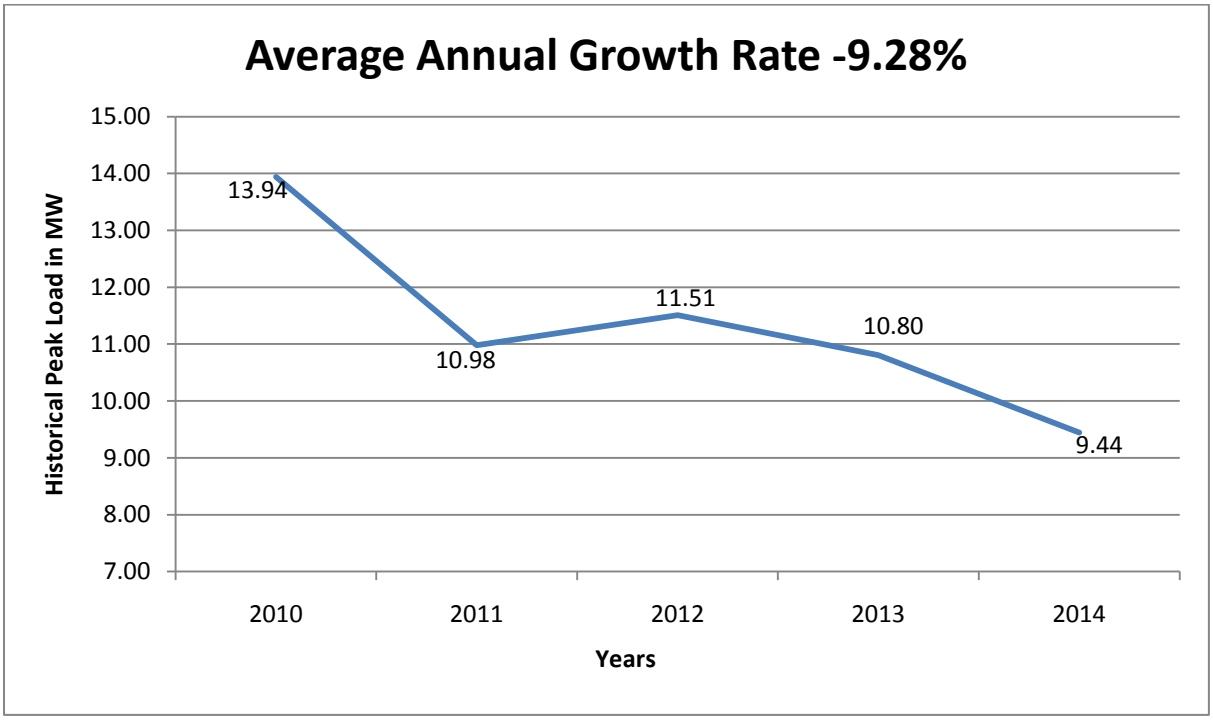


Table 5-10. Forecasted 2018 Minnesota Power Load Levels Used for the Out-Year Study

Substations	Winter Peak-2013/14 Load		Applied Growth Rate	Winter Peak-2017/18	
	MW	MVAr		MW	MVAr
Motley	1.290	0.424	1.00%	1.340	0.441
Tyson Food	3.170	1.042	1.00%	3.300	1.084
Staples Rural	0.370	0.122	1.00%	0.390	0.127
Lynch Lake	1.300	0.427	1.00%	1.350	0.444
Pine Beach	1.300	0.427	1.00%	1.350	0.444
Pillager	1.180	0.388	1.00%	1.230	0.404
Gull Lake	3.770	1.239	1.00%	3.920	1.289
TOTAL	**12.380**	**4.069**	**-**	**12.880**	**4.233**

The maximum peak demand was calculated based on the five-year hourly historical peak demand data. To eliminate switching peaks, the coincident peaks were calculated for each month as provided in **Table 5-3**. The winter coincident peak load of the affected load area was found to be 22.25 MW, which was observed in February 2013. This peak demand and the weighted average annual growth rate are used when forecasting the winter peak demand of the affected load area from winter 2014-2015 through winter 2024-2025 as shown in **Table 5-11**. The weighted average annual load growth rate is calculated to be 1.0 percent.

The recorded 2014 historical energy consumption of the affected load area was used as a starting point when forecasting energy consumption for the affected load area. For purposes of studying the transmission system and monitoring load growth, Substation data are used to calculate and forecast load. These Substations are closer to the load than bulk substations and the data from Substations are more reflective of load patterns. The growth rate used for forecasting energy is calculated from the historical five year (2009/10-2013/14) annual energy usage data. The average annual energy growth rate of the affected area in the past five years is calculated to be 2.03 percent.

5.6.2 Demand Forecast Results

Table 5-11 shows the Applicants' results of forecasting peak demand in the affected load area from winter 2013-2014 through winter 2023-24.

Table 5-11. Great River Energy & Minnesota Power Winter Season Forecast Peak Demand

Winter Season	Peak Demand (MW)	Weighted Average Annual Growth Rate
2012-2013	22.25	-
2013-2014	22.47	1.00%
2014-2015	22.70	1.00%
2015-2016	22.92	1.00%
2016-2017	23.15	1.00%
2017-2018	23.38	1.00%
2018-2019	23.62	1.00%
2019-2020	23.86	1.00%
2020-2021	24.09	1.00%
2021-2022	24.33	1.00%
2022-2023	24.58	1.00%
2023-2024	24.82	1.00%

5.6.3 Consumption Forecast Results

Table 5-12 shows the Applicants' results of forecasting energy consumption in the affected load area from 2014 through 2024.

Table 5-12. Forecasted Great River Energy and Minnesota Power Annual Energy Consumption

Year	Energy (MWh)	Growth Rate
2014	146,944.84	-
2015	149,927.82	2.03%
2016	152,971.36	2.03%
2017	156,076.68	2.03%
2018	159,245.03	2.03%
2019	162,477.71	2.03%
2020	165,776.01	2.03%
2021	169,141.26	2.03%
2022	172,574.83	2.03%
2023	176,078.10	2.03%
2024	179,652.48	2.03%

5.6.4 System Capacity

Minnesota Rule 7849.0280 provides that an applicant for a CON must provide information about the ability of the existing system to meet the demand for energy predicted to occur in upcoming years. Applicants applied for an exemption from most of the requirements in this rule because they are applicable to proposed generating plants, not transmission lines. The Commission granted the exemption. The only two provisions in the rule that Applicants must respond to are subpart A (relating to planning programs) and subpart H (relating to net demand and net capability). Those discussions are provided below.

5.6.5 Transmission Planning/Net Demand and Net Capability

Great River Energy was part of the Minnesota Transmission Owners that prepared the 2009 Biennial Transmission Projects Report. The 2009 Biennial Transmission Projects Report discusses a need for improvement in the affected load area and provided alternatives considered for addressing the inadequacies (tracking number 2009-NE-N6).

Load duration curves were developed to illustrate the number of hours the affected load area is exposed to inadequacies in the system. **Figure 5-10** shows the load duration curve for 2012/13 and five years of forecasted load duration curves. The forecasted load duration curves are based on the 2012/13 historical hourly flows record in the system and the weighted average annual growth rate of 1.0 percent.

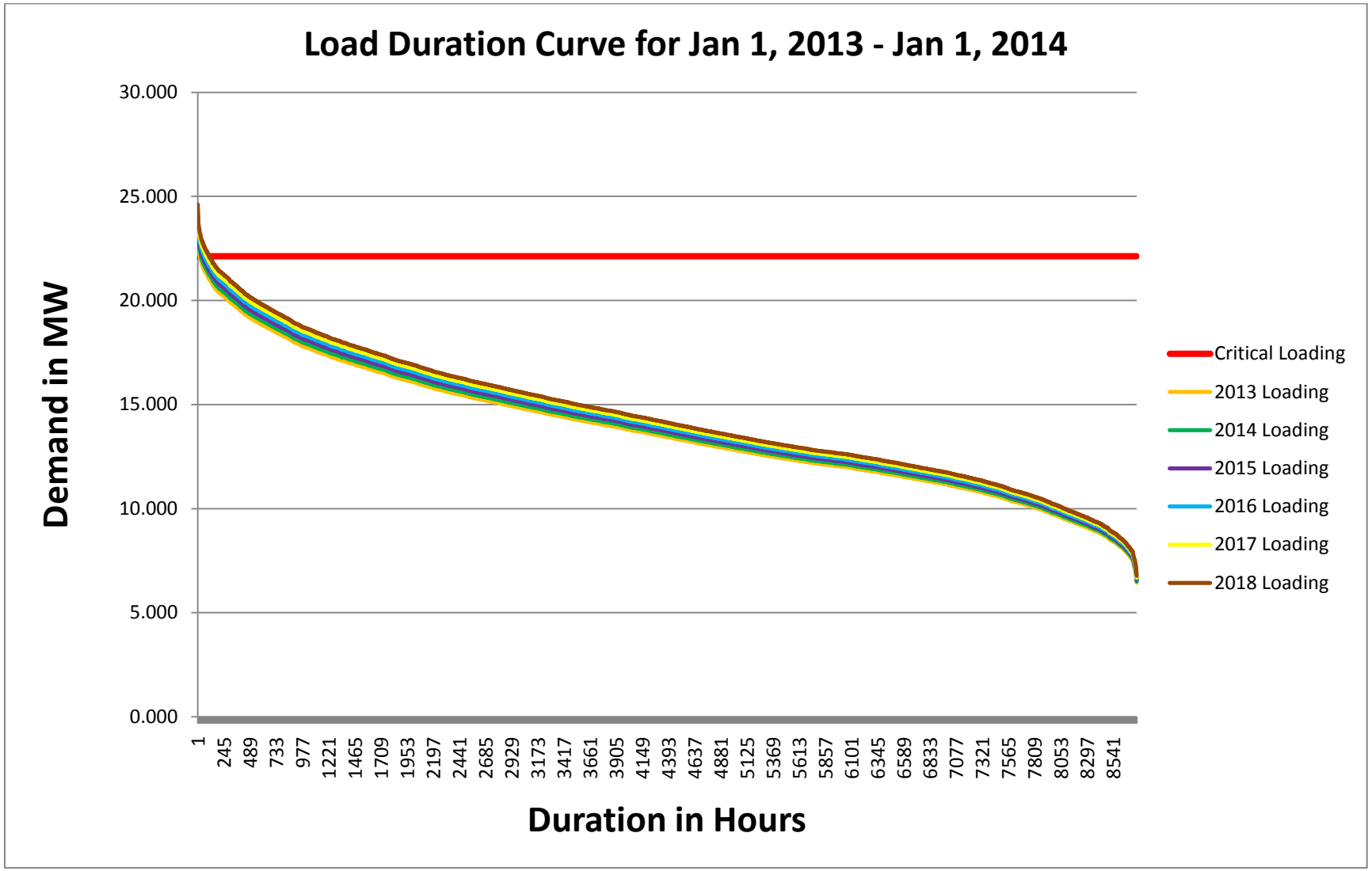
The system analysis showed that the existing transmission system serving the affected load area can reliably serve loads up to 20.12 MW level. The area was found at risk to experience thermal overloads during critical contingencies when the peak load of the affected load area exceeds the critical load level of 20.12 MW. The load duration curve shows that the system was at a risk of experiencing thermal overloads in the 2013 for about 19 hours of the year.

Table 5-13 summarizes the number of hours the system will be at risk of experiencing inadequacies without the Project.

Table 5-13. Duration that the Affected Load Area is at Risk of Experiencing Inadequacies

Year	Duration at risk (hours)
2014	30
2015	45
2016	63
2017	85
2018	105

Figure 5-10. Load Duration Curve



The Applicant conducted computer modeling of various alternatives designed to address the identified electric system inadequacies to determine what the impact on the system would be under various operating conditions and contingencies. The modeling showed that the development of a single circuit 115 kV line from a new interconnection on the "24 Line" to the Crow Wing Power Motley Substation (converting from 34.5 kV to 115 kV), and continuing the 115 kV line to Crow Wing Power's Fish Trap Substation in the 2017 timeframe would provide adequate and reliable service in the area up to 2032, given anticipated growth levels. **Figure 5-11** shows the increase in available capacity of the transmission system with the proposed Project versus peak demand.

Figure 5-11. Capacity of the Affected Load Area Transmission System with the Proposed Project versus Peak Demand

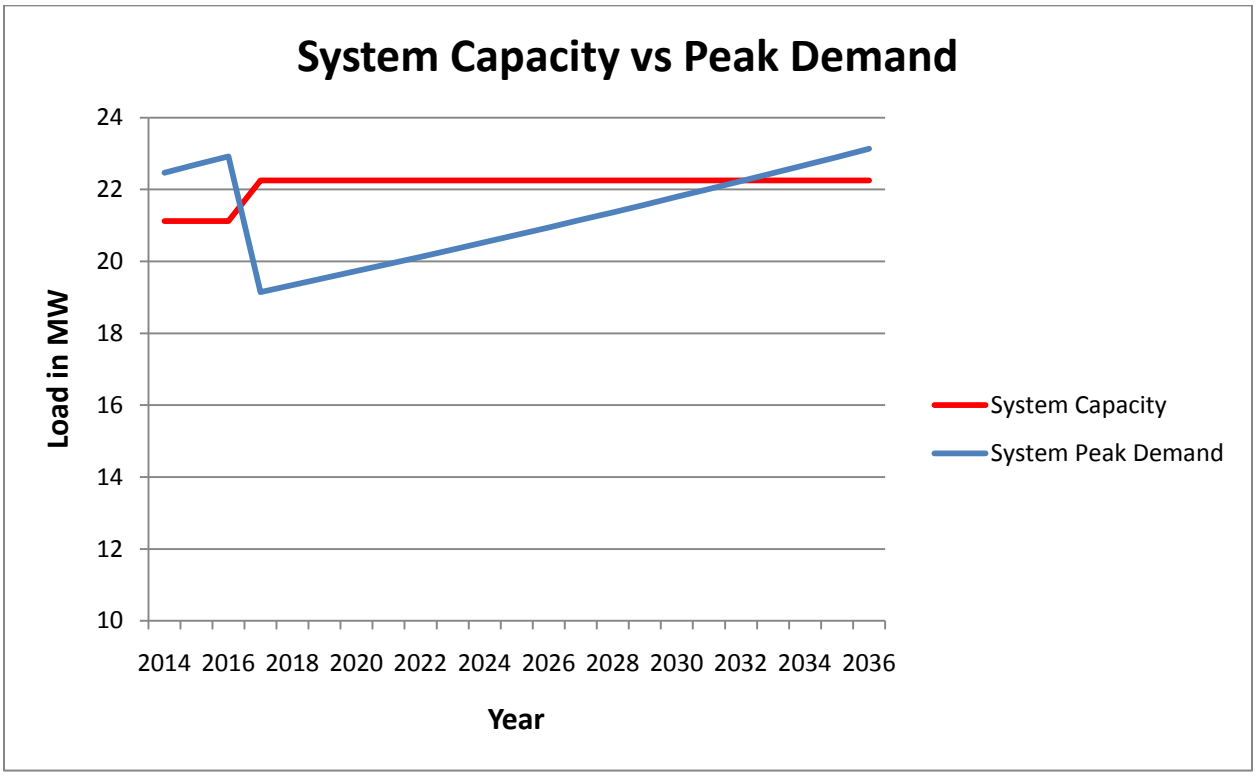


Figure 5-11 shows that the transmission capacity follows the load growth of the affected load area provided that the load growth in the system will sustain as forecasted.

5.7 Increased Efficiency

The proposed Project includes building a new 115 kV circuit from a new interconnection to the 24 Line to Crow Wing Powers Motley Substation and then continuing south to Crow Wing Power's Fish Trap Substation. The Motley Substation will be removed from the 34.5 kV system and will be served via the new 115 kV line. Upon completion of the Project, the Motley Substation will no longer create a power flow demand on the 34.5 kV system, which has greater transmission losses than the 115 kV system. Therefore, the proposed Project, in general, increases the efficiency of the transmission system and results in annual loss savings of

approximately 0.15 MW and annual energy savings of 1793.89 MWh annually as discussed in **Section 4.5**.

5.8 Load Management and Energy Conservation Programs

5.8.1 Load Management

Pursuant to Minn. Stat. §216B.2422, Great River Energy and Minnesota Power have submitted separate Resource Plans to the Commission. These Resource Plans detail, among other things, the Applicants' programs to manage customer demand and energy consumption. As a part of this effort, each of the "demand side management" (DSM) programs are directed at minimizing peak load conditions by reducing the load of participating customers at system peak conditions.

Current Great River Energy DSM activities include interruptible demand programs, off-peak storage programs and Conservation Improvement Program (CIP) programs offered in partnership with Great River Energy's member-owners. In aggregate, the load management programs for the entire Great River Energy system curtail an estimated 15 percent of maximum seasonal peak demand (360 MW summer/320 MW winter).

Current Minnesota Power DSM activities include the CIP along with Dual Fuel, Controlled Access, and Interruptible Rates.

The impact of the load management program is included in the Great River Energy and Minnesota Power load forecasts, and do not provide enough capacity to delay or avoid the need for the proposed facilities.

5.8.2 Energy Conservation

<u>Great River Energy</u>

Great River Energy has a robust portfolio of rebate programs, promotions and energy efficiency expertise. These programs help Great River Energy achieve the requirements outlined in Minnesota Statutes Section 216B.241. In 2013, Great River Energy and its member cooperatives invested approximately $19.85 million in the energy efficiency, conservation and DSM programs.

Great River Energy and its member owners not only provide rebates to meet the Minnesota Energy Conservation Policy goals, but also consider energy conservation and load management as an important resource in the planning process. Individual member-system participation goals are used in conjunction with Great River Energy's diversified demand assumptions and loss factors to calculate total system peak reduction. Great River Energy's goal is to maintain and enhance existing programs and continue to introduce new programs that provide net benefits to cooperative members, cooperatives and Great River Energy. The programs are designed to save natural resources and delay the need for additional transmission and/or generation resources.

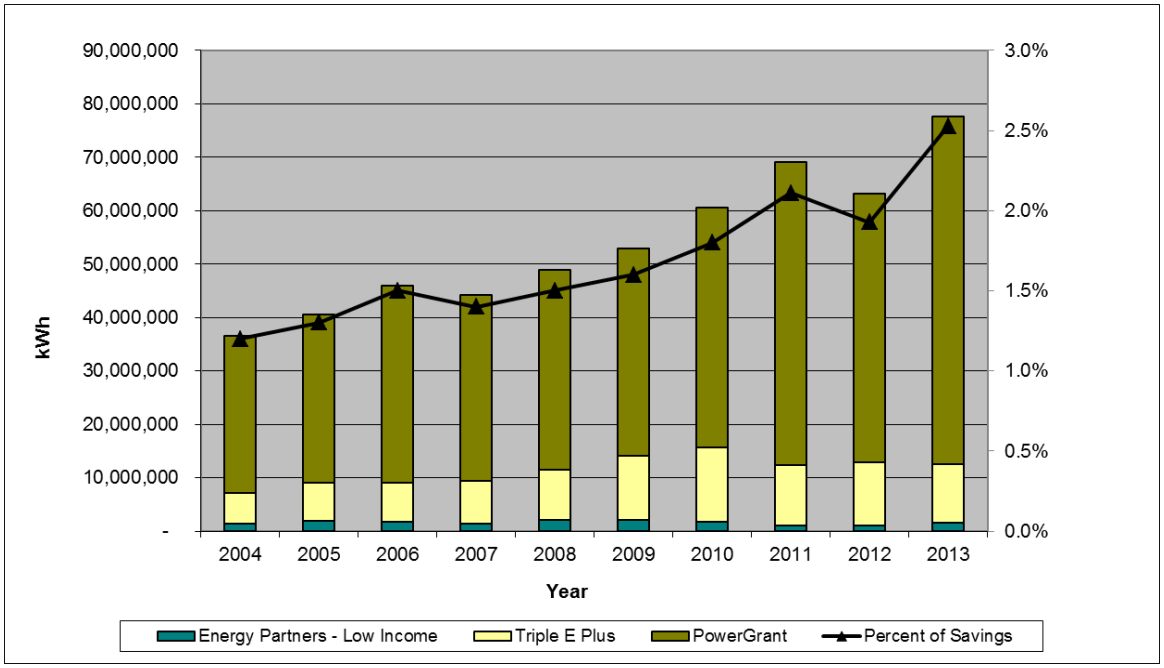
Great River Energy's conservation programs are described in more detail in **Appendix I**.

Minnesota Power

Minnesota Power's CIP remains part of core service offerings and is highlighted as part of its *Energy***Forward** resource strategy.[7] CIP focuses on increased efficiencies that reduce the amount of energy needed for certain uses and processes. Minnesota Power's CIP includes residential, commercial, and small-scale renewable programs.

The Next Generation Energy Act of 2007 introduced, in addition to a minimum spending requirement of 1.5 percent, an energy-saving goal of 1.5 percent of gross annual retail electric energy sales by 2010. Minnesota Power has a proven track record with successful conservation program delivery, meeting or exceeding the 1.5 percent energy-saving goal in Minnesota. As shown in Figure 5-12, Minnesota Power has delivered at or above the 1.5 percent savings target since the goal went into effect in 2010 and delivered similar savings levels in the two years preceding the establishment of an energy-savings goal as defined in the Next Generation Energy Act of 2007.

Figure 5-12. Minnesota Power's 2004–2013 CIP Achievements



[7] Minnesota Power's Integrated Resource Plan; Docket No. E015/RP-13-53.

Minnesota Power's commercial program under its CIP delivers around 80 percent of total claimed savings. Energy savings and rebates paid under the commercial program specific to the Motley Project area from 2006 – 2015 are provided in Table 5-14 (the towns around the Project are Motley and Pillager).

Table 5-14. Minnesota Power - CIP Projects in the Menahga Project Area

City	# of Projects	Year	kWh Saved	kW Saved	Rebate
Motley	1	2006	30,625	7.00	$1,398
Motley	2	2007	621,988	102.10	$0
Motley	4	2009	1,581,850	116.50	$62,215
Motley	9	2010	834,580	38.40	$29,673
Motley	5	2011	2,292,579	114.10	$59,013
Motley	13	2012	1,025,160	320.40	$36,997
Motley	10	2013	816,298	54.40	$30,456
Motley	4	2014	859,533	91.90	$30,084
Pillager	2	2009	900	0.30	$72
Pillager	3	2010	13,141	5.30	$1,422
Pillager	2	2011	11,653	3.30	$830
Pillager	9	2012	447,792	58.80	$22,971
Pillager	1	2013	1,840	0.50	$94
Pillager	2	2014	10,193	2.20	$403
Pillager	1	2015	5,717	1.20	$233
TOTAL	**68**		**8,553,849**	**916.4**	**$275,860**

5.8.3 Conclusion

The load levels shown in **Table 5-11** assume Applicants will be successful in reaching the DSM and CIP energy savings objectives in their Resource Plans. As shown in **Figure 5-11**, near-term winter peak load levels are already exceeding the capacity of the system to reliably serve all load in the affected load area without remedial actions such as switching operations to shift load off the system. For DSM or CIP to be feasible alternatives to the Project, these programs would not only need to meet their objectives, they would also have to provide additional reductions in demand to offset projected load growth in the affected load area. Based on historic DSM and CIP savings as well as forecasted load growth, it is not realistic to expect that DSM and conservation measures can achieve the level of reduction necessary within the affected load area.

5.9 Delay of the Project

Minnesota Rule 7849.0300 requires a discussion of anticipated consequences to its system, neighboring systems, and the power pool should the Project be delayed one, two, and three years, or postponed indefinitely. The 2016/17 winter peak has been designated as the in-service date for the Project; therefore, a one year delay translates to a 2017/18 winter date.

The inadequacy in the affected load area is low voltage. As discussed in **Section 5.6**, the affected load area has shown growth in the past ten years. A robust transmission system is required to address the deficiencies in the existing system and provide service to new loads that come to the affected load area, such as the MPL pump station load.

The analysis using the historical load data shows that the loads in the affected load area have grown above the maximum load serving capability of the transmission system. Delay of the Project worsens thermal overload concerns. Maintenance of the transmission lines would also be more difficult as the Project is delayed. As discussed in **Section 5.6** and shown in the duration curve, the number of hours that the affected load area is vulnerable to inadequacies increases. To bring the transmission system within the proper operating conditions, curtailment of loads in the affected load area is required. This would result in an unavailability of power to a significant portion of consumers in the affected load area. The critical demand analysis in **Table 5-15** summarizes the duration at which load is at risk and the magnitude of the load that needs to be curtailed to bring the system in to normal operating conditions.

Table 5-15. Critical Demand Analysis

Scenario	2016/17 Winter Forecast	One Year Delay	Two Year Delay	Three Year Delay	Infinite Delay[2]
# Hours above Critical Demand	63	85	105	126	147
Curtailed Demand in MW[3]	2.05	2.25	2.49	2.74	2.98
% of Local Demand Curtailed	9.27	10.17	11.26	12.39	13.47
Annual # of Days at Risk[1]	5	7	9	11	12

[1] Based on 2012-13 load curve
[2] Based on 2023 demand projections
[3] Curtailment assumes no remedial actions (switching)

5.10 Effect of Promotional Practices

The growth in demand in the Project service area is a result of the growth in the number of customers and in the energy that each customer is consuming. Applicants have not engaged in any promotional practices to encourage the use of more power. Just the opposite, as described in **Section 5.8,** Applicants have spent significant sums of money promoting conservation and demand side management.

6 ALTERNATIVES TO THE PROJECT

6.1 Analysis of Alternatives

In any CON proceeding for a proposed transmission line project, an applicant is required to consider various alternatives to the proposed project. Minnesota Statutes Section 216B.243, subdivision 3(6) provides that in assessing need, the Commission will evaluate "possible alternatives for satisfying the energy demand or transmission needs." The Commission has also provided in its rules that an applicant for a CON must discuss in the application the possibility of a number of alternatives. Minnesota Rule 7849.0260 provides:

Each application for a proposed large high voltage transmission line (LHVTL) must include:

B. a discussion of the availability of alternatives to the facility, including but not limited to:

1. new generation of various technologies, sizes, and fuel types;
2. upgrading of existing transmission lines or existing generating facilities;
3. transmission lines with different design voltages or with different numbers, sizes, and types of conductors;
4. transmission lines with different terminals or substations;
5. double circuiting of existing transmission lines;
6. if the proposed facility is for DC (AC) transmission, an AC (DC) transmission line;
7. if the proposed facility is for overhead (underground) transmission, an underground (overhead) transmission line; and
8. any reasonable combinations of the alternatives listed in sub items (1) to (7).

Minnesota Rule 7849.0340 also requires an applicant to consider the option of not building the proposed facility.

In this section, the various alternatives to the proposed Project that were considered by Applicants are discussed. These alternatives include: 1) various generation options including peaking generation, distributed generation, and renewable (solar and wind) generation; 2) various transmission solutions, including upgrading other existing facilities, different voltage levels and different endpoints; and 3) a no-build alternative focusing on reactive power supply improvements and demand side management. Discussion of each alternative focuses on why that alternative is unacceptable or inferior to the Project.

6.2 Generation Alternative

6.2.1 Peaking Generation

Generation and distributed generation were considered as an alternative to the new transmission of the proposed Project. Peaking generation typically takes the form of 1.5- or 2-MW diesel or natural gas-fueled generators. This type of small generator would not be sufficient to meet the need in the Dog Lake-Baxter 34.5 kV system because the large pump station load cannot be served via the 34.5 kV system. If the Motley substation were converted to 115 kV system, generation in lieu of interconnecting to the existing "24 Line" 115 kV system is a viable option that is discussed further in this section.

The Project is proposed to address inadequacies in the 34.5 kV Dog Lake-Baxter system. The Project will provide approximately 13.25 MW of incremental load-serving capability beyond the 2017 load level. For comparison purposes, the generation solution must address the existing inadequacies of these systems and provide an equivalent level of load-serving capability.

A study was performed and showed that the equivalent load-serving capability could be achieved by operating multiple gas-fired or diesel generators for a total of 13.25 MW at the Motley Pump Station. The use of generation to address the needs of this Project was not selected for the following reasons:

1. Capital investment to install generation of this type is significantly higher than the Project. With a typical estimate of $1,000/kW, installation of 14 MW of diesel generators is estimated to cost approximately $14,000,000.

2. Operation and maintenance costs associated with generation units are significantly higher than that of transmission systems.

3. Reliability of peak generation is less than that of transmission lines. Installation of redundant generation would be necessary for equivalent reliability to be achieved.

4. Addition of generation would not improve transmission system reliability of the existing 34.5 kV infrastructure at issue in the Project area.

5. Operation of these generators to address system inadequacies at non-peak hours may be required, resulting in higher energy costs than what the transmission system could provide.

6.2.2 Distributed Generation

A distributed generation alternative was analyzed. Distributed generation, however, is not a viable alternative to address the proposed pump station load or the inadequacies identified in the existing transmission system. Due to the size of the pump station load, the affected load area and the performance achievable by the proposed Project, a large number of distributed generation units (1.5 to 2 MW each) would be required to address the load-serving performance achievable by the Project. This option was not selected for the following reasons:

1. Installation of the number of generators of this scale to address the pump station load and the inadequacies in the area and provide equivalent incremental load-serving capability is much more costly than the proposed Project.

2. Operation and maintenance cost of these generators is high.

3. The area also serves industrial loads that consist of large motors. Motors such as these require a large amount of power at startup. Distributed generators are not capable of providing the large amount of power that may be needed by these motors. The proposed Fish Trap Pump Station will incorporate three new 4500-horsepower electric motors.

4. Reliability of generators, in general, is less than that of transmission.

5. Distributed generation would not eliminate the need for new 115 kV transmission lines. New 115 kV transmission lines would still need to be built to deliver the power from the generators to the Fish Trap Pump Station.

6.2.3 Renewable Generation

A system solution is needed that will provide reliable and effective power for the proposed pump station and the affected load area. Renewable generation is dependent on natural events, such as sunlight or wind speed. Neither wind generation nor solar generation is considered a reasonable alternative to the Project. Energy from these resources is not necessarily available at the times when they are most necessary to serve customers. Residential loads peak between 4 p.m. and 6 p.m., when people are returning to their homes after being away for the day. Solar energy output and wind energy output typically decrease during these hours of the day. Sufficient energy from these renewable sources may not be available for the pump station if it is needed at this same time. Because renewable sources cannot adjust for sudden power demands such as motor starts, voltage drops upon motor starts at the pump station could damage other electrical components on the system (see **Section 5.1.2**).

This option was not selected for the following reasons:

1. Unpredictable sources of energy and inability to make use of resources when power is demanded for the pump station and within the affected load area.

2. Installation costs of both wind and solar generation resources are significantly higher than those of the proposed Project.

3. Insufficient voltage support for motor starts.

6.3 Upgrade of Existing Facilities

The voltage of the existing transmission system in the area (34.5 kV) is not robust enough to serve the proposed pump station. Even if the 34.5 kV system were to be rebuilt with a larger conductor, the voltage drop created from starting the electric motors at the pump station will be too great, creating low voltage issues on the system. Rebuilding the 34.5 kV system from Dog Lake-Baxter is 29.8 miles of line, which would cost about $11.5 million. The 115/34.5 kV transformer at Dog Lake would also need to be replaced with a higher output capacity transformer costing approximately $2 million. Thus the total estimated cost of upgrading the existing facilities is $13.5 million, compared to the proposed Projects estimated cost of $16 to $17 million.

Upgrading the existing 34.5 kV facilities still would not support the Project goals. An upgraded system would still collapse on contingency. Simply stated, the 34.5 kV system cannot support a large industrial load such as the proposed pump station. Thus, some level of a higher voltage system would still need to be constructed to support the Fish Trap Pump Station.

This option was not selected for the following reasons:

1. Upgrading the existing 34.5 kV is inadequate to support the Fish Trap Pump Station and continue to provide a reliable system for all load served by the system.

2. To adequately support the Fish Trap Pump Station and protect the reliability of service to all those served by the existing 34.5 kV system, the Project would still need to be constructed.

6.4 Alternative Voltages

Applicants are proposing to build a new 115 kV circuit that interconnects to the “24 Line” (Dog Lake-Baxter) to reliably serve the proposed MPL Fish Trap pump station and the Motley substation. However, Applicants considered the possibility of resolving the inadequacies in the Project area and affected load area by implementing a solution of a different voltage level as discussed below.

6.4.1 Distribution Voltage

Using distribution voltage to address the system inadequacies was analyzed as an alternative to the Project. Transferring load between distribution systems is feasible to solve transmission issues when the receiving distribution system is served from an independent transmission network. Loads in the affected load area are from a single, and lengthy, 34.5 kV sub-transmission system. Loads can only be transferred between Substations, but remain on the same 34.5 kV sub-transmission network throughout the Dog Lake-Baxter system. This will not improve loading or low voltage concerns on the Dog Lake-Baxter system. Substations served by a transmission system separate from the Dog Lake-Baxter system are not located in close proximity. To use an independent distribution system to provide support to the Dog Lake-Baxter

system would require constructing lengthy distribution lines to transfer loads. This transfer would, overall, result in weaker voltage and increased loss on a high impedance distribution system. For these reasons, this alternative is not considered a reasonable alternative to the Project.

6.4.2 Higher Voltages

A higher voltage solution above 115 kV was not investigated at this time because Applicants determined that a 115 kV solution in the Project area would provide adequate and necessary support to the proposed pump station and the affected load area for the foreseeable planning horizon. Voltage solutions higher than 115 kV are typically implemented to facilitate the transfer of electricity over long distances. The Dog Lake-Baxter system does not contain any 161 kV transmission lines, and construction of these facilities in this area would be non-standard. This transmission system is the backbone of the 115 kV transmission network, upon which the 34.5 kV network serving the affected load area is dependent. A 230 kV transmission system is not a load-serving system and was therefore not considered further as an alternative to the Project.

6.5 Different Conductor

Great River Energy uses several types of conductors for system transmission lines. The standard bare aluminum overhead transmission conductors, ACSR and aluminum conductor steel supported (ACSS), offer known reliable power performance, operating at temperatures up to 100°C and 200°C, respectively. At these temperatures, for each of the 115 kV lines proposed for the Project, 477 ACSR would provide 141.6 MVA of capacity and 477 ACSS would provide 226.5 MVA of capacity. ACSS typically costs approximately 10 percent more than ACSR conductor.

Two-composite conductor alternatives can offer substantial increases in capacity and the ability to span greater distances between poles by use of innovative modern composites, but at a significantly increased cost and lower efficiency. The modern materials and manufacturing process required for these composite conductors result in a material cost that is 300-500 percent higher compared to standard ACSR and ACSS. Composite conductors also experience higher losses because they are operated at higher temperatures. As a result, this type of conductor is used only in special circumstances, where long spans are required. In the case of this Project, circumstances do not warrant the use of this type of conductor. The Applicants chose the ACSR conductor because the line is radial in nature without future plans to loop it and the ACSR conductor will meet the existing and future loading demands while maintaining margin in the capacity of the transmission line. Use of an ACSS conductor would create more capacity that is estimated to not be needed.

6.6 Alternative Endpoints

The proposed Project, with endpoints at a new interconnection to the “24 Line” and Fish Trap Substation, was ultimately selected because it was the least cost alternative and its system performance addressed many system needs, not only in the affected load area but also in the Project area, which had experienced operational issues under certain contingencies. The endpoints of the Project were selected to facilitate serving the pump station and to provide

additional incremental load-serving capability to serve future load growth in the affected load and Project areas.

However, during its analysis of how to address the pump station load and the operational concerns on the Dog Lake-Baxter 34.5 kV System, Great River Energy did analyze one additional project with alternative endpoints. A discussion of this alternative project and why it was deemed inferior to the proposed Project is provided below.

6.6.1 "47 Line" Interconnection

Great River Energy analyzed interconnecting to Minnesota Power's "47 Line" (Wing River – Long Prairie 115 kV) using a route that extends west to east, converting Todd-Wadena and Crow Wing Power's Ward substation to 115 kV and continuing east and south to the Fish Trap substation. This route option was rejected, which is discussed further in **Section 7**.

6.7 Double Circuiting

Double circuiting is the method of attaching two independent circuits (three phase conductors per circuit) on a single common structure. With the exception of several segments where existing Crow Wing Power distribution and Minnesota Power sub-transmission lines will be attached as underbuild, there are no other opportunities for double circuit transmission line construction within the Project area.

6.8 Direct Current Alternative

High voltage direct current (HVDC) lines are typically proposed for transmitting large amounts of electricity over long distances because line losses are significantly less over long distances on a HVDC line than on an alternative current (AC) line. A HVDC line is not a reasonable alternative to the proposed Project. The Project is being proposed to serve a proposed pump station and for local load-serving purposes, whereas HVDC lines are typically proposed for regional transmission projects. The Project must be readily tapped now and in the future to serve customers in the Project area. HVDC lines require expensive conversion stations at each delivery point because the direct current (DC) power must be converted to AC power before it can be used by customers. Such conversion stations would add significantly to the cost of the Project. There is no justification – in terms of reliability, economy, performance, or otherwise – for a HVDC line in this case.

6.9 Undergrounding

Undergrounding is an alternative that is seldom used for high voltage transmission lines such as those proposed for the Project. One of the primary reasons underground high voltage transmission lines are seldom used is that they are significantly more expensive than overhead lines. The cost range depends on the design voltage, the type of underground cable required, the extent of underground obstructions such as rock formations, the thermal capability of the soil, the number of river crossings, and other factors, but the construction cost of locating the entire length of the Project's proposed transmission underground is estimated to be as much as 8 to 10 times greater per mile than if it were to be constructed overhead as proposed. This cost does not

include the large reactors that would likely be required at each substation to counteract the large line charging currents present on underground high voltage lines. In addition, there are increased line losses and additional maintenance expenses incurred throughout the useful life of an underground high voltage line that further increase the total additional costs of building and operating an underground line versus an overhead line.

A common argument in favor of implementing underground lines is that they will minimize the human and environmental impacts above ground. However, there are still human and environmental impacts both during and after construction. The predominant environmental impact from the construction, operation, and maintenance of underground transmission lines arises from the need to obtain and maintain completely cleared ROWs. While construction activities for overhead transmission lines are typically concentrated around the line's structures, leaving areas between structures relatively undisturbed apart from some vegetation removal, construction of underground transmission lines requires the entire ROW to be completely cleared and utilized for construction activities. This can result in greater wetland impacts from needing to construct access roads capable of supporting the heavy construction equipment required for trenching activities, and cable installation. After construction, the ROW needs to be maintained free of woody vegetation to reduce soil moisture loss, because high voltage underground conductors make use of soil moisture for conductor cooling. A permanent road must also be maintained along the ROW for maintenance and repair.

Underground lines can also be more challenging to operate and maintain. While overhead lines are typically subject to more frequent outages than underground cables, service can usually be quickly restored. This is accomplished by automatic reclosing of circuit breakers, which results in only a momentary outage of the line. Because circuit breakers on underground lines are typically not reclosed until it can be verified that a fault has not occurred on the underground cable, the smaller number of outages is typically offset by their increased duration. A faulted underground line takes much longer to restore because of the difficulty in locating the fault and accessing the site to make repairs. If the fault is due to a failure in the cable, the segment of failed cable must typically be replaced. This usually involves completely replacing the failed cable between two man-hole splice points, which are ordinarily located every 1,500 to 2,000 feet along the line. To replace a failed cable, it must be possible to bring heavy equipment, including cable reels weighing 30,000 to 40,000 pounds, into the ROW during all seasons of the year. If the fault occurs in a wetland area where all-season roads are not maintained, restoration can be delayed due to the need to install wetland matting to gain access to the manholes involved in replacing the failed cable. Additionally, specialized equipment is often required to repair 115 kV underground transmission facilities and, as Great River Energy has no 115 kV underground facilities on its transmission system, this specialized equipment is not readily available in case of an outage.

Due to the construction, maintenance, reliability, and cost drawbacks of high voltage underground transmission lines, Applicants believe that undergrounding is not a viable alternative for any segment of the proposed Project.

6.10 No-Build Alternative

Before proposing a transmission or generation solution, Applicants considered the viability of managing the existing system such that building additional facilities could be avoided. As discussed in **Section 5.9**, a true "do-nothing" alternative would leave the transmission system in the affected load area and Project area strained by load growth and vulnerable to localized voltage collapses, and unable to serve the proposed pump station. Specifically, as shown in **Figure 5-11**, the affected load area peak demand already exceeds system capacity. The following discussion of the no-build alternative focuses on two different ways the pump station load might be served and inadequacies in the affected load area and Project area might be addressed without building new transmission or generation.

6.10.1 Demand Side Management and Conservation

As documented in **Section 5.8** and **Appendix H**, effective conservation measures in the affected load area have helped to defer the need for additional reliability improvements. However, the proposed Project is largely driven by the addition of a new large, high load factor electric load, in particular a proposed new pump station. This load is not only subject to modern energy efficiency standards for motors, but is typically designed to be as efficient as possible. Such an addition is also a clear target for enhanced efficiency due to its size and long run hours, so the ability to drive additional efficiency is limited. As such, conservation and energy efficiency is particularly inadequate in the Dog Lake-Baxter system and Project area, where the addition of a highly efficient large industrial load is a large driver for the need for the Project. Additionally, peak demand in the affected load area already exceeds system capacity. Although conservation programs will continue to be implemented in the affected load area and the Project area to maximize efficient use of electricity, these programs are insufficient to mitigate the projected inadequacies in the transmission system.

6.10.2 Reactive Power Supply

The Dog Lake-Baxter 34.5 kV system has many capacitor banks already installed. There is a limit to how much reactive power supply can be added to a system and the Dog Lake-Baxter 34.5 KV system has reached that level. Installing additional reactive power supplies to the Dog Lake-Baxter 34.5 kV system could not sufficiently serve the pump station load.

7 ALTERNATIVE ROUTES CONSIDERED

7.1 Alternative Requirement

Under the alternative review process, under which this Application was submitted, an applicant for a Route Permit is not required to identify and evaluate an alternative route to the preferred route, as is under the full review process. However, Minnesota Statutes Section 216E.04, subdivision 3 and Minnesota Rule 7850.3100 require an applicant to identify any alternative routes that were considered and rejected. Applicants evaluated and rejected three alternative routes (**Figure 7-1**) for the new transmission line. These routes are described below, along with the reasons they were rejected.

7.2 Rejected Route Alternatives

7.2.1 Dog Lake Substation–Fish Trap Lake Substation

This route would be approximately 15.5 miles in length extending from Minnesota Power's existing Dog Lake Substation to the proposed Fish Trap Lake Substation. This route extends straight south from the Dog Lake Substation a distance of 4.5 miles, crossing over the Crow Wing River and U.S. Highway 10 while following the alignment of the existing Minnesota Power "503" 34.5 kV line. The route then extends easterly for a distance of 2.5 miles while continuing to follow the alignment of Minnesota Power's 34.5 kV "503 Line" to Minnesota Power's existing Motley Substation located in a developed urbanized area along U.S. Highway 10 in the southern portion of the City of Motley. This route turns south along U.S. Highway 10 a distance of 8.5 miles to the proposed Fish Trap Lake Substation. This same route segment would follow and overtake approximately 1.25 miles of Minnesota Power's existing 34.5 kV "534 Line" located north of Azalea Road. This route segment also necessitates crossing the Long Prairie River.

This route was rejected by the Applicant because portions of it impact existing and proposed urban development in the City of Motley, it necessitates a second river crossing, and because of the operational challenges to obtain an extended outage on Minnesota Power's existing 34.5 kV "503 Line" to facilitate the construction of the new 115 kV transmission line. Lastly, this route was also rejected because it does not facilitate the upgrade of Crow Wing Power's Motley Substation from 34.5 kV to 115 kV.

7.2.2 Dog Lake Substation–Ward Substation–Fish Trap Lake Substation

This route would be approximately 23 miles in length extending from Minnesota Power's Dog Lake Substation to Todd-Wadena Cooperative's Ward Substation and continuing to the proposed Fish Trap Lake Substation. Like the previous rejected route, this route extends straight south from the Dog Lake Substation a distance of 4.5 miles. It continues westerly a distance of 3.1 miles overtaking Minnesota Power's existing 34.5 kV "29 Line" to its intersection with the

common corridor of Todd County Road 7 and the Burlington Northern Santa Fe (BNSF) railroad. The route then extends southeasterly and southerly a distance of 8.1 miles following the existing Great River Energy "TW-WAT" 34.5 kV sub-transmission line to Todd-Wadena Cooperative's existing Ward Substation located in Moran Township. The route then continues easterly along Todd County Roads 26 and 7 a distance of 6.4 miles to its intersection with U.S. Highway 10, where it then continues southerly along U.S. Highway 10 a distance of 0.7 miles to Holt Road. The route extends 0.2 miles easterly along Holt Road and terminates at the Fish Trap Lake Substation.

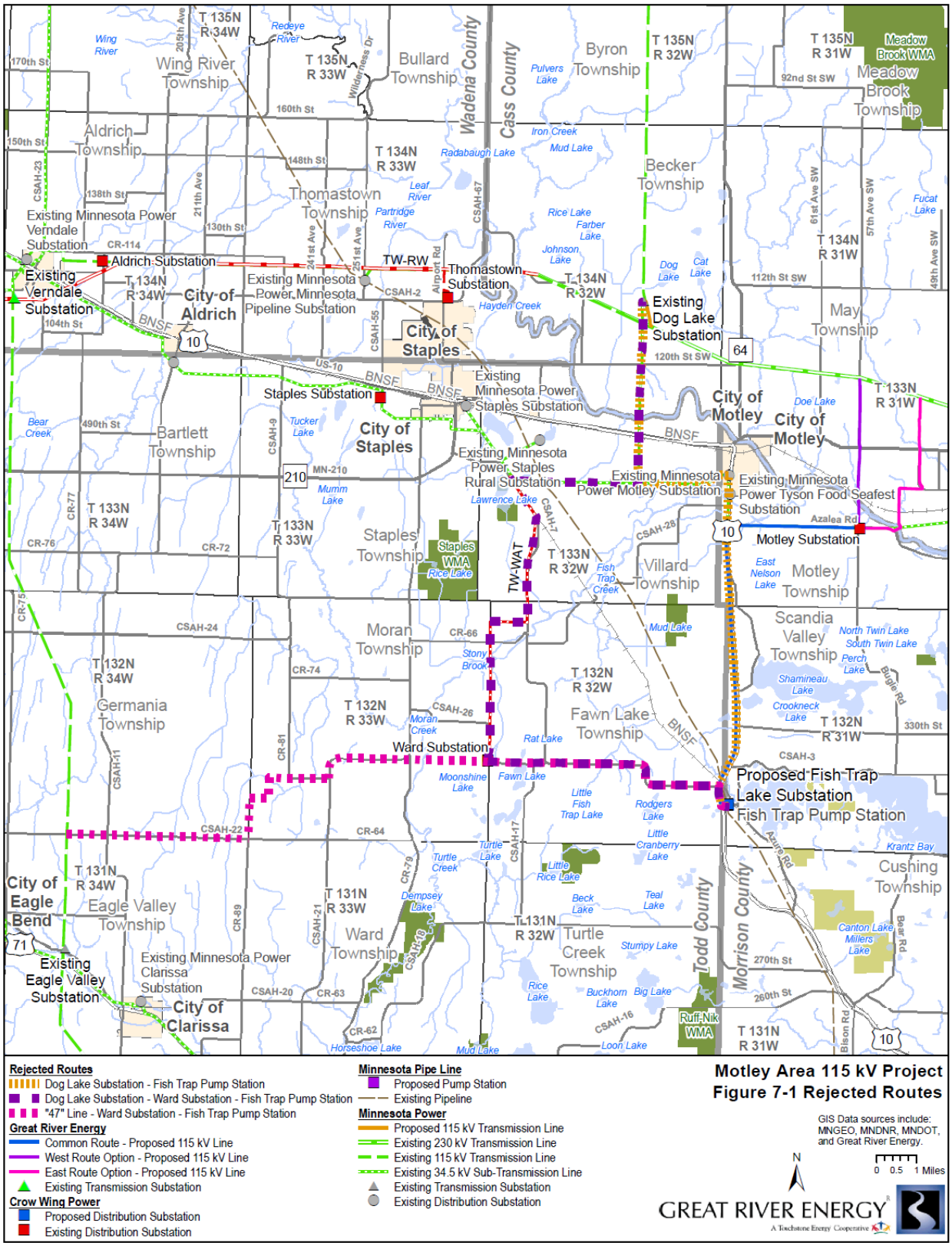
This route was rejected by the Applicant because of its additional length resulting in more cost. Additional cost would also result from the need to underbuild nearly 16 miles of 34.5 kV 3-phase transmission line. This route also necessitates a second river crossing, the Long Prairie River. This route was also rejected because it does not facilitate the upgrade of Crow Wing Power's Motley Substation from 34.5 kV to 115 kV or the construction of the future Shamineau Substation.

7.2.3 "47" Transmission Line–Ward Substation–Fish Trap Lake Substation

This route would be approximately 20 miles extending from Minnesota Power's "47 Line" 115 kV transmission line located in the northernmost part of Section 5 in Eagle Valley Township, Todd County, to the proposed Fish Trap Lake Substation. From the point of interconnection with Minnesota Power's "47 Line", this route would extend easterly 4.5 miles along Todd County Road 22, then continue north a distance of 1.0 mile along Todd County Road 89 (225th Avenue). The route would then turn east a distance of 0.5 miles along 400th Street, then extend north 0.5 miles along 231st Avenue. The route would then extend east a distance of 1.5 miles along Todd County Road 81 (404th Avenue) before turning north 0.5 miles following along Todd County Road 21. The route would then extend east 4.0 miles to Todd-Wadena's Ward Substation. The west half of this four-mile route segment would follow Todd County Road 21, and the remaining east half of this route segment would be cross-country extending across the Long Prairie River. The route then continues easterly along Todd County Roads 26 and 7 a distance of 6.4 miles to its intersection with U.S. Highway 10, where it then continues southerly along U.S. Highway 10 a distance of 0.7 miles to Holt Road. The route extends 0.2 miles easterly along Holt Road and terminates at the Fish Trap Lake Substation.

This route was rejected by the Applicant due to its additional length and resultant additional cost. Additional cost would also result from the need to underbuild nearly 12 miles of 34.5 kV 3-phase sub-transmission. This route also necessitates a second river crossing, the Long Prairie River. This route was also rejected because it does not facilitate the upgrade of Crow Wing Power's Motley Substation from 34.5 kV to 115 kV or the construction of the future Shamineau Substation.

Figure 7-1. Rejected Routes



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8 ENGINEERING, DESIGN, CONSTRUCTION AND RIGHT-OF-WAY ACQUISITION

8.1 Transmission Line Engineering and Operation Design

8.1.1 Transmission Structure Design and Right-of-Way Requirements

Transmission structure design and the ROW requirements are discussed in **Section 4.1.1**. Typical structures are depicted in **Figures 4-2 and 4-3**.

8.1.2 Design Options to Accommodate Future Expansion

The new sections of the transmission line will be designed and constructed to 115 kV standards. The existing 34.5 kV tap switches for the Substation will also be replaced with 115 kV switches. The 115 kV design will allow for future loading requirements.

The Project will also support the construction of a future potential Shamineau Substation that has been discussed in the Regional Transmission Projects Report since 2009, but which is currently on hold due to a reduction in load growth following the economic recession.

The new sections of the transmission line will utilize 477 ACSR conductor. These design considerations will maximize longevity and are consistent with good utility practices.

8.2 Identification of Existing Utility and Public Rights-of-Way

The proposed transmission line alignment parallels existing road ROW for the vast majority of its length. The West Route Option would parallel existing road ROW for all but 0.75 miles of its length. Of the 0.75 mile portion that does not parallel road ROW, all of it with the exception of the approximately 1000-foot-long crossing of the Crow Wing River would overtake Crow Wing Power's existing three-phase distribution line extending north-south between the Motley Substation and the Crow Wing River. The East Route Option would parallel existing road ROW for nearly its entire length and would also overtake Minnesota Power's 34.5 kV sub-transmission line crossing of the Crow Wing River and nearly 0.8 miles along Morrison County Road 28 (Azalea Road). The proposed Common Route segment parallels Azalea Road ROW and U.S. Highway 10 ROW for nearly its entire length, while also overtaking approximately four miles of Minnesota Power's existing 34.5 kV sub-transmission line located on the south side of Azalea Road. Depending on which side of the road the Project is constructed on, low voltage distribution lines may be overtaken by the proposed 115 kV transmission line at various locations throughout the route. For the proposed alignments (see **Appendix F**), the West Route Option would have approximately 5.8 miles of underbuild and the East Route Option would have approximately 6.2 miles of underbuild.

Generally, the new transmission line poles would be constructed approximately two to five feet outside of road ROW. However, in some areas where there are variations in the width of the existing road ROW, the Applicant may propose an alignment farther outside of road ROW or within the road ROW to minimize deflections and provide consistency in the transmission alignment.

Additional setbacks may be utilized to incorporate specific needs of landowners and/or regulatory agencies. Existing distribution lines that are overtaken by Great River Energy may be temporarily leaned or moved to allow construction of the new transmission line if they are to be removed once the Project is energized. Great River Energy will closely coordinate its construction practices with the owners of distribution lines that must remain in service after the Project is complete. These distribution lines may be relocated, buried, and/or attached to the new transmission line poles as underbuild.

8.3 Transmission Line Right-of-Way Acquisition Procedures

Great River Energy will obtain new easements for the entire length of the Project except for the new transmission line segment from the Dog Lake Substation to the existing "24 Line" transmission line, which will be obtained by Minnesota Power. There may be existing easements held by Minnesota Power or Crow Wing Power in areas where transmission and distribution lines may be overtaken by the proposed line.

Once a Route Permit is issued by the Commission, land rights acquisition would commence immediately following the preliminary development of the transmission alignment and associated survey activities. Land rights acquisition activities primarily consist of negotiating and securing a permanent easement for the transmission line. As a general practice, landowners will be contacted by phone or by U.S. mail whereby the Applicant's representative would request a meeting to provide information pertaining to the easement and to share Project details with the property owner(s).

During the acquisition phase of the Project, the Applicant's representative will provide landowners a copy of the Route Permit (including complaint procedures), easement document and associated exhibits, a written offer of easement compensation, and specific information pertaining to the Project schedule, construction practices, vegetation removal, and damage settlement. Additional information would also be given to each landowner that shows preliminary pole placement (if available), structure design or photos, and power line safety.

In addition to permanent easements necessary for the construction of the line, marshalling yard agreements may be obtained from certain landowners for temporary construction or staging areas for temporary storage of poles, vehicles, or other related items. Landowners will be notified in the event access is needed for soil borings that are needed to determine if special transmission design is necessary due to existing soils characteristics.

If the direct purchase of an easement cannot be successfully negotiated with a landowner, Great River Energy and Minnesota Power each have the right to exercise an eminent domain (condemnation) action to obtain the necessary easement rights pursuant to Minnesota Statute Chapter 117. If a condemnation action is initiated by either Great River Energy or Minnesota

Power, the Court determines the fair compensation award to be paid to the landowner for the value of the easement. The amount of fair compensation is determined by three impartial Court-appointed commissioners. In some cases, the landowner would also be entitled to receive reimbursement for certain appraisal and legal costs that may be incurred by the landowner.

8.4 Construction Procedures

Procedures to be used for construction of the transmission lines are discussed below.

After land rights have been secured, landowners will be notified prior to the start of the construction phase of the Project, including an update on the Project schedule and other related construction activities.

The first phase of construction activities will involve survey staking of the transmission line centerline and/or pole locations, followed by removal of trees and other vegetation from the ROW. As a general practice, low-growing brush or tree species are allowable at the outer limits of the easement area. Taller tree species that endanger the safe and reliable operation of the transmission facility will be removed. In developed areas and to the extent practical, existing low-growing vegetation that will not pose a threat to the transmission facility or impede construction or maintenance may remain in the easement area, as agreed to during easement negotiations.

The NESC states that "vegetation that may damage ungrounded supply conductors should be pruned or removed." Trees beyond the easement area that are in danger of falling into the energized transmission line ("danger trees") as shown in **Figure 8-1** will be removed or trimmed to eliminate the hazard, in accordance with the terms of the existing or the new easement that is acquired. Danger trees generally are those that are dead, diseased, weak or leaning towards the energized conductors. In special circumstances, tree trimming agreements may be possible to minimize tree removal based on negotiations with individual landowners.

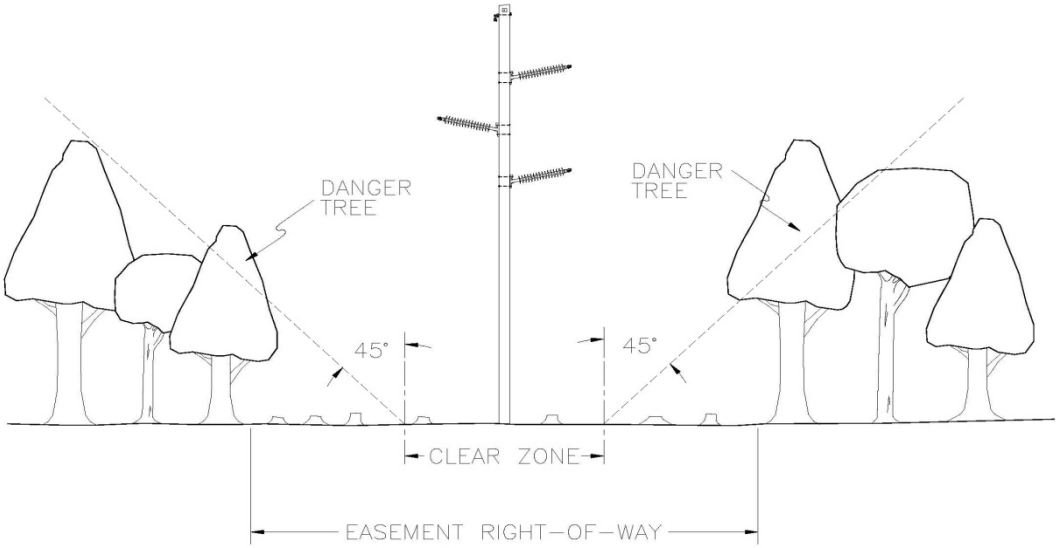
All materials resulting from the clearing operations will be either chipped on site and spread on the ROW, stacked in the ROW for use by the property owner, or removed and disposed of otherwise as agreed to with the property owner during easement negotiations.

The final survey staking of pole locations may again occur after the vegetation has been removed and just prior to the structure installation.

The second phase of construction will involve structure installation and stringing of conductor wire. During this phase, underground utilities are identified through the required One Call process to minimize conflicts with existing utilities along the routes.

If temporary removal or relocation of fences is necessary, installation of temporary or permanent gates would be coordinated with the landowner. The ROW agent may work with the property owner for early harvest of crops, where possible, with compensation to be paid for any actual crop losses. During the construction process, it may be necessary for the property owner to remove or relocate equipment and livestock from the ROW. Compensation related to these activities will be discussed with the landowner during easement negotiations.

Figure 8-1. Standard Tree Removal Practices



Transmission line structures are generally designed for installation at existing grades. Therefore, structure sites will not be graded or leveled unless it is necessary to provide a reasonably level area for construction access and activities. For example, if vehicle or installation equipment cannot safely access or perform construction operations properly near the structure, minor grading of the immediate terrain may be necessary.

Great River Energy will employ standard construction and mitigation practices that were developed from experience with past projects as well as industry-specific BMPs. BMPs address ROW clearing, erecting transmission line structures and stringing transmission lines. BMPs for each specific project are based on the proposed schedules for activities, prohibitions, maintenance guidelines, inspection procedures and other practices. In some cases these activities, such as schedules, are modified to incorporate BMP installation that will assist in minimizing impacts to sensitive environments. Any contractors involved in construction of the transmission line will be advised of these BMP requirements.

New structures are installed directly in the ground, by augering or excavating a hole typically at least 7 feet deep and 2 to 3 feet in diameter for each pole. Any excess soil from the excavation will be spread and leveled near the structure or removed from the site, if requested by the property owner or regulatory agency.

The new structures will then be set and the holes back-filled with the excavated material, native soil, or crushed rock. Based on the known soil types in Minnesota, it is anticipated that the average structure depth of a typical 70-foot long pole would be approximately 9 feet deep. In poor soil conditions, a galvanized steel culvert is sometimes installed vertically with the structure

set inside. Drilled pier concrete foundations may be necessary in special cases. Drilled pier foundations may vary from 4 to 8 feet in diameter. Concrete trucks are normally used to bring the concrete in from a local concrete batch plant.

After a number of new structures have been erected, Great River Energy will begin to install the new shield wire by establishing stringing setup areas within the ROW. These stringing setup areas are usually located every two miles along a project route and occupy approximately 15,000 square feet of land. Conductor stringing operations require brief access to each structure to secure the conductor wire and shield wire once the final sag is established. Temporary guard or clearance structures are installed, as needed, over existing distribution or communication lines, streets, roads, highways, railways or other obstructions after any necessary notifications are made or permits obtained. This ensures that conductors will not obstruct traffic or contact existing energized conductors or other cables. In addition, the conductors are protected from damage.

Crossing of rivers, streams and wetlands will require particular attention during construction. The transmission lines will cross some wetlands and will span four or five Public Water Inventory rivers or creeks (see **Section 9.6.2**). Great River Energy will not allow construction equipment to be driven across waterways except under special circumstances and only after discussion with the appropriate resource agency. Where waterways must be crossed to pull in the new conductors and shield wires, workers may walk across, use boats, or drive equipment across ice in the winter. In areas where construction occurs close to waterways, BMPs help prevent soil erosion and ensure that equipment fueling and lubricating occur at a distance from waterways.

8.5 Restoration Procedures

During construction, limited ground disturbance at the structure sites will occur. Marshalling yard agreements will be obtained from property owner(s) or agency(ies) for temporary storage of materials and equipment. Typically, a previously-disturbed or developed area is used, and includes sufficient space to lay down material and pre-assemble some structural components or hardware and store construction equipment. Portions of the ROW or property immediately adjacent to the ROW may be used for structure lay down and framing prior to structure installation. Additionally, stringing setup areas are used to store conductors and equipment necessary for stringing operations. Disturbed areas are restored to their original condition to the maximum extent practicable, or as negotiated with the landowner.

Post-construction reclamation activities will include removing and disposing of debris, removing all temporary facilities (including staging and lay down areas), employing appropriate erosion control measures, reseeding areas disturbed by construction activities with vegetation similar to that which was removed with a seed mixture certified as free of noxious or invasive weeds, and restoring the areas to their original condition to the extent possible. In cases where soil compaction has occurred, the construction crew or a restoration contractor will use industry-accepted methods to alleviate the compaction, or as negotiated with landowners.

An Applicant’s representative will contact landowners after construction is completed to determine if the clean-up measures have been completed to their satisfaction and if any other damage may have occurred. If damage has occurred to crops, fences or other personal property,

Great River Energy would offer compensation to the owner of the damaged property for the value of the loss. In some cases, an outside contractor may be hired to restore the damaged property as near as possible to its original condition.

8.6 Operation and Maintenance

Access to the ROW of a completed transmission line is required to perform periodic inspections, conduct maintenance and repair damage. Regular maintenance and inspections will be performed during the life of the transmission line to ensure its continued integrity. Generally, Great River Energy will inspect the transmission lines once per year. Inspections will be limited to the ROW and to areas where off-ROW access is required due to ROW obstructions or terrain impediments. If problems are found during inspection, repairs will be performed and property restoration will be completed or the landowner will be provided reasonable compensation for any damage to the property.

The ROW will be managed to remove vegetation that interferes with the operation and maintenance of the transmission line. Native shrubs that will not interfere with the safe operation or accessing and traversing the ROW of the transmission line will be allowed to reestablish in the ROW. Great River Energy's practice generally provides for the inspection of 115 kV transmission lines every two years to determine if clearing is required. ROW clearing practices include a combination of mechanical and hand clearing, along with herbicide application (where allowed), to remove or control vegetation growth.

The estimated annual cost of ROW maintenance and operation and maintenance of Great River Energy's transmission lines (69 kV to 500 kV) in Minnesota currently average about $2,000 per mile. Actual transmission line specific maintenance costs will depend on the environmental setting, the amount of vegetation management necessary, storm damage occurrences, structure types, age of the line, etc. The Project facilities will primarily be routed along road ROW, which will minimize tree maintenance required.

8.7 Electric and Magnetic Fields (EMF)

As it pertains to the Project, the term "EMF" refers to the extremely low frequency (ELF) decoupled electric and magnetic fields that are present around any electrical device or conductor and can occur indoors or outdoors. Electric fields are the result of electric charge, or voltage, on a conductor. The intensity of an electric field is related to the magnitude of the voltage on the conductor. Magnetic fields are the result of the flow of electricity, or current, traveling through a conductor. The intensity of a magnetic field is related to magnitude of the current flow through the conductor. Electric and magnetic fields can be found in association with transmission lines, local distribution lines, substation transformers, household electrical wiring, and common household appliances.

8.7.1 Electric Fields

Voltage on a wire produces an electric field in the area surrounding the wire. The voltage on the conductors of a transmission line generates an electric field extending from the energized conductors. The intensity of transmission line electric fields is measured in kilovolts per meter

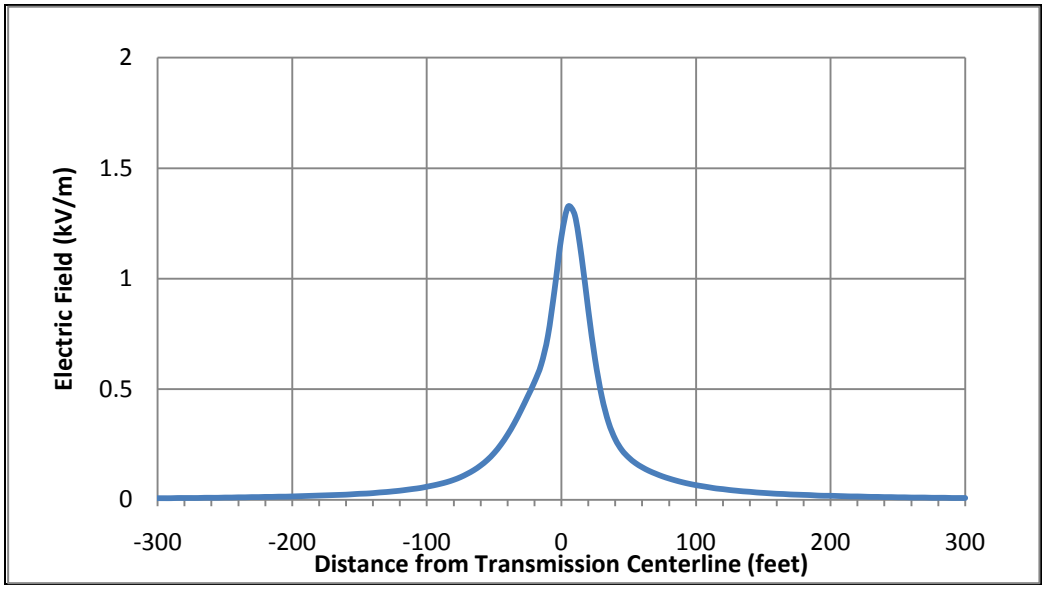
(kV/m). The magnitude of the electric field rapidly decreases with distance from the transmission line conductors. The presence of trees, buildings, or other solid structures in the path of the field can also significantly reduce the magnitude of the electric field. Because the magnitude of the voltage on a transmission line is near-constant (ideally within ±5 percent of nominal), the magnitude of the electric field will be near-constant for a given conductor configuration, regardless of the power flowing on the line.

Although there is no Minnesota or federal standard for transmission line electric field exposures, the EQB developed a standard of a maximum electric field limit of 8 kV/m at one meter above ground. This standard has been adopted by the Commission. The Applicants have calculated the approximate electric field for the Project's transmission conductor configurations and determined the peak magnitude of electric field density among all proposed configurations to be well below the EQB standard at approximately 1.33 kV/m underneath the conductors, one meter (3.28 feet) above ground. **Table 8-1** summarizes the electric fields calculated for the proposed single circuit transmission lines on the Project. These electric field calculations are also shown graphically in **Figures 8-2** through **8-4**.

Table 8-1. Calculated Electric Fields (kV/M) for Proposed Transmission Line Designs (One meter (3.28 feet) above ground)

Scenario	Max. Operating Voltage (kV)	Distance to Proposed Centerline										
		-300'	-200'	-100'	-50'	-25'	Max.	25'	50'	100'	200'	300'
115 kV Single Circuit (Figure 8-2)	121	0.007	0.015	0.059	0.211	0.468	1.327	0.636	0.191	0.066	0.018	0.008

Figure 8-2. 115 kV Single Circuit Line Electric Field Profile



Induced Voltage

When an electric field reaches a nearby conductive object, such as a vehicle or a metal fence, it can induce a voltage on the object. The magnitude of this voltage is dependent on many factors, including the object's capacitance, shape, size, orientation and location, resistance with respect to ground, and weather conditions. If the object is insulated or semi-insulated from the ground and a person touches it, a small current could pass through the person's body to the ground. This might be accompanied by a spark discharge and mild shock, similar to what can occur when a person walks across a carpet and touches an object or person.

The main concern with induced voltage is not the magnitude of the voltage induced, but the current that would flow through a person to the ground should the person touch the object. To ensure the safety of persons in the proximity of high voltage transmission lines, the NESC requires that any discharge be less than five (5) milliAmperes root mean square (mA rms). The magnitude of a discharge from any conductive object can be mitigated by providing the object with good electrical grounding. The Applicant would ensure that any fixed conductive object in close proximity or parallel to the Project, such as a fence or other permanent conductive fixture, would be grounded so any discharge would be less than the 5 mA rms NESC limit.

Implantable Medical Devices

High intensity EMF can have adverse impacts on the operation of implantable medical devices (IMDs) such as pacemakers and defibrillators. While research has shown that the magnetic fields associated with high voltage transmission lines do not reach levels at which they could cause interference with such devices, it is possible that the electric fields associated with some high voltage transmission lines could reach levels high enough to induce sufficient body currents to cause interference. However, modern "bipolar" cardiac devices are much less susceptible to interactions with electric fields. Medtronic and Guidant, manufacturers of pacemakers and other IMDs have indicated that electric fields below 6 kV/m are unlikely to cause interactions affecting operation of most of their devices. The older "unipolar" designs of cardiac devices are more susceptible to interference from electric fields. Research from the early 1990s indicates that the earliest evidence of interference with these types of IMDs could occur in electric fields ranging from 1.2 to 1.7 kV/meter. **Table 8-1** shows that the electric fields for all of the Project's structure alternatives are well below levels at which modern bipolar devices are susceptible to interaction with the fields. For older style unipolar designs, the electric fields do exceed levels that research from the 1990s has indicated may produce interference. However, recent research conducted in 2005 concluded that the risk of interference to unipolar cardiac devices from high voltage power lines in everyday life is small. In 2007, Minnesota Power and Xcel Energy conducted studies with Medtronic, Inc. under 115 kV, 230 kV, 345 kV, and 500 kV transmission lines to confirm these 2005 findings. The analysis was based on real life public exposure levels under actual transmission lines in Minnesota and found no adverse interaction with pacemakers or IMDs. The

analysis concluded that although interference may be possible in unique situations, device interference as a result of typical public exposure would be rare.[8]

In the unlikely event that a pacemaker is impacted, the effect is typically a temporary asynchronous pacing (commonly referred to as reversion mode or fixed rate pacing). The pacemaker would return to its normal operation when the person moves away from the source of the interference.

8.7.2 Magnetic Fields

Current passing through any conductor, including a wire, produces a magnetic field in the area around the wire. The current flowing through the conductors of a transmission line generates a magnetic field that, in similar fashion to the electric field, extends outward from the energized conductors. The intensity of the magnetic field associated with a transmission line is proportional to the amount of current flowing through the line's conductors, and the magnitude of the magnetic field rapidly decreases with the distance from the conductors. Unlike electric fields, magnetic fields are not significantly affected by the presence of trees, buildings, or other solid structures nearby. The intensity of the magnetic field density is expressed in the unit of gauss (G) or milliGauss (mG).

There are no federal or Minnesota exposure standards for magnetic fields. The EQB and the Commission have recognized Florida (a 150-mG limit) and New York (a 200-mG limit) state standards. Both state standards are to be considered at the edge of ROW. Recent studies of the health effects from power frequency fields conclude that the evidence of health risk is weak.[9] The general standard is one of prudent avoidance.

Magnetic field levels associated with some common electric appliances are provided in **Table 8-2.**

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[8] 2007 Minnesota Power Systems Conference Proceedings (University of Minnesota), *Electromagnetic Compatibility of Active Implantable Medical Devices (AIMD) and Their Interaction with High Voltage Power Lines*, at 23.

[9] Minnesota Department of Health. *EMF White Paper on Electric and Magnetic Field* (EMF) Policy and Mitigation Options. 2002; National Research Council. *Possible Health Effects of Exposure to Residential Electric and Magnetic Fields*. 1997; www.niehs.nih.gov/health/topics/agents/emf/.

Table 8-2. Magnetic Fields of Common Electric Appliances (mG) [10]

Appliance	Distance from Source		
	6 inches	1 foot	2 feet
Hair Dryer	300	1	--
Electric Shaver	100	20	--
Can Opener	600	150	20
Electric Stove	30	8	2
Television	NA	7	2
Portable Heater	100	20	4
Vacuum Cleaner	300	60	10
Copy Machine	90	20	7
Computer	14	5	2

Table 8-3 summarizes the magnetic fields calculated for each of the Project's proposed transmission line configurations with power flow at peak loading and at the average loading. The magnetic field calculations are also shown graphically in **Figures 8-5** through **8-7.** Out of all the possible transmission line configurations, the maximum magnetic field under expected peak demand conditions is 13.0 mG, which is well below the Florida and New York standards, as well as the levels shown in **Table 8-2**.

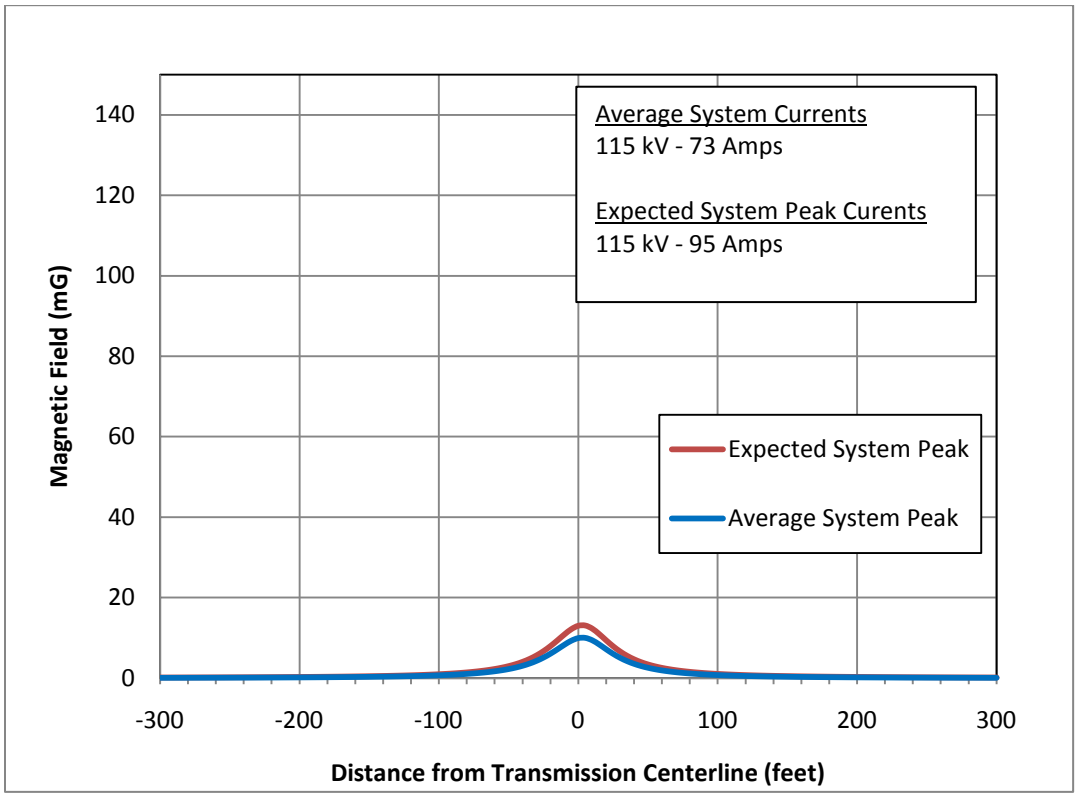
Because the actual power flow on a transmission line could potentially vary widely throughout the day depending on electric demand, the actual magnetic field level could also vary widely from hour to hour. In any case, the typical magnitude of the magnetic field associated with the Project's transmission lines will be less than the calculated intensity at the expected peak loading.

Table 8-3. Calculated Magnetic Fields (mG) for Proposed Transmission Line Designs (One meter (3.28 feet) above ground)

Scenario	Max. Operating Voltage (kV)	Line Current (Amps)	Distance to Proposed Centerline										
			-300'	-200'	-100'	-50'	-25'	Max.	25'	50'	100'	200'	300'
115 kV Single Circuit Line Peak Load (Figure 8-3)	121	95	0.11	0.25	0.93	2.95	6.67	13.04	7.86	3.36	1.01	0.26	0.12
115 kV Single Circuit Line Average Load (Figure 8-3)	121	73	0.09	0.19	0.72	2.27	5.13	10.02	6.04	2.58	0.78	0.20	0.09

[10] *EMF In Your Environment* (EPA 1992)

Figure 8-3. 115 kV Single Circuit Line Magnetic Field Profile



8.8 Stray Voltage

"Stray voltage" is a condition that can occur on the electric service entrances to structures from distribution lines. More precisely, stray voltage is a voltage that exists between the neutral wire of the service entrance and grounded objects in buildings such as barns and milking parlors.

Transmission lines do not, by themselves, create stray voltage because they do not connect to businesses and residences. Transmission lines can, however, induce a current on a distribution circuit that is parallel and immediately under the transmission line. Appropriate measures would be taken to mitigate problems associated with induced currents on distribution circuits when the proposed Project parallels or crosses distributions lines.

If a landowner has stray voltage concerns on their property, Applicants would suggest that they contact their electric service provider to discuss the situation with technical staff, including the possibility of an on-site investigation.

8.9 Corona

Under certain conditions, the localized electric fields near an energized transmission line conductor can produce small electric discharges, ionizing nearby air. This is commonly referred to as the "corona" effect. Most often, corona formation is related to some sort of irregularities on the conductor, such as scratches or nicks, dust buildup, or water droplets. The air ionization

caused by corona discharges can result in audible noise and radio frequency noise. While the magnitude of the noise is not likely to exceed Minnesota's noise standards, some may characterize frequent audible noise as an annoyance, and the radio frequency discharges can cause interference with radio and television reception. The potential for radio and television signal interference, however, is largely dependent on the magnitude of the corona-induced radio frequency noise *relative to* the strength of the broadcast signals.

Corona formation is a function of the conductor radius, surface condition, line geometry, weather condition, and most importantly, the line's operating voltage. Corona-induced audible noise and radio and television interference are typically not a concern for power lines with operating voltages below 161 kV, because the electric field intensity is too low to produce significant corona. The expected electric field intensity due to the Project's transmission lines is provided in **Section 8.7.1**.

8.9.1 Radio and Television Interference

Because the likelihood of significant corona formation on the Project's 115 kV lines is minimal, the likelihood of radio and television interference due to corona discharges associated with the Project's transmission is also minimal. The Applicant is unaware of any complaints related to radio or television interference resulting from the operation of existing 115 kV facilities in the Project area and does not expect radio and television interference to be an issue along the proposed route.

8.9.2 Audible Noise

Transmission lines can cause audible noise due to corona discharges from the conductors. This noise, which resembles a crackling sound, is typically only within the threshold of human hearing during rainy or foggy conditions, and even then is largely imperceptible due to background noise. The impacts and mitigation of audible noise due to the Project are discussed further in **Section 9.2.4**.

8.9.3 Ozone and Nitrogen Oxide Emissions

In addition to potentially causing audible and radio frequency noise, corona can also produce ozone and oxides of nitrogen in the air surrounding the conductor. Ozone is a very reactive form of oxygen molecule that combines readily with other elements and compounds in the atmosphere, making it relatively short lived. Ozone forms naturally in the lower atmosphere from lightning discharges and from reactions between solar ultraviolet radiation and air pollutants such as hydrocarbons from auto emissions. The natural production rate of ozone is directly proportional to temperature and sunlight, and inversely proportional to humidity. Thus the conditions that are most likely to cause corona formation on a transmission line – humid, rainy, or foggy conditions – actually inhibit the production of ozone.

Like audible and radio frequency noise, corona-induced ozone and nitrogen oxides are typically not a concern for power lines with operating voltages below 161 kV, because the electric field intensity is too low to produce significant corona. Therefore, the Applicant expects ozone and nitrogen oxide concentrations associated with the Project to be negligible, and well below all federal and state standards.

9 ENVIRONMENTAL ANALYSIS OF ROUTES

This portion of the Application provides a description of the land use and environmental resources in the Project area, potential impacts and proposed mitigative measures.

The name of each landowner whose property is within the proposed route is provided in **Appendix J**.

The Project has been reviewed by a number of state and federal agencies. All environmental review correspondence related to the proposed Project is provided in **Appendix K**.

9.1 Environmental Setting

The Project lies in the Pine Moraines and Outwash Plains Subsection of the Laurentian Mixed Forest Province, according to the DNR Ecological Classification Systems[11].

The Laurentian Mixed Forest Province is characterized by broad areas of conifer forest, mixed hardwood and conifer forests, and conifer bogs and swamps. The landscape ranges from rugged lake-dotted terrain with thin glacial deposits over bedrock, to hummocky or undulating plains with deep glacial drift, to large, flat, poorly drained peatlands.

The Pine Moraines and Outwash Plains Subsection is a mix of outwash plains, end moraines, till plains, and drumlin fields.

The Project area is dominated by forested land, lakes, and wetlands, with some areas of agricultural land. The closest communities near the Project include the city of Motley, and the town of Lincoln.

The environmental setting of the Project area includes hydrologic features such as rivers, creeks, ditches, wetlands and riparian areas. A mix of groundcover is present along the proposed routes. The physiographic features (topography, soils, geology and farmland) are typical of this area and do not preclude the development of this Project. Wildlife habitat exists in pockets throughout the Project area.

Land use in the Project area includes a mix of public, residential, business, open space, forested lands and agricultural lands. The residential areas within the Project area are primarily single-family low-density homes. Open space areas include forested areas, grassland, shrub land, wetlands, and some areas of cultivated land.

[11] http://www.dnr.state.mn.us/ecs/212Nc/index.html

Impacts and Mitigation

To minimize impacts to the environmental settings of the Project area, Applicants identified a proposed route that predominantly uses existing transmission line and road corridors where the environmental settings have already been altered.

9.2 Human Settlement

9.2.1 Public Health and Safety

Proper safeguards would be implemented for construction and operation of the transmission facilities. The Project will be designed in compliance with local, state, NESC, and Great River Energy standards regarding clearance to the ground, clearance to crossing utilities, strength of materials and ROW widths. Construction crews and/or contract crews would comply with local, state, and NESC standards regarding installation of facilities and standard construction practices. Great River Energy's established safety procedures, as well as industry safety procedures, would be followed during and after installation of the transmission lines, including clear signage during all construction activities.

The Project would be equipped with protective devices to safeguard the public if an accident occurs and a structure or conductor falls to the ground. The existing substations are already equipped with breakers and relays located where existing transmission lines connect to the substations. The protective equipment is designed to de-energize the transmission lines should such an event occur.

Electric and Magnetic Fields

Considerable research has been conducted since the 1970s to determine whether exposure to power-frequency, commonly referred to as "extremely-low frequency" or "ELF" (60 hertz), electric fields (EF) and magnetic fields (MF) can cause biological responses and adverse health effects. The multitude of epidemiological and toxicological studies has shown, at most, a weak association (*i.e.*, no statistically significant association) between ELF-MF exposure and health risks and no association between ELF-EF exposure and health risks.

In 1999, the National Institute of Environmental Health Sciences (NIEHS) issued its final report on "Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields" in response to the Energy Policy Act of 1992. In the report, the NIEHS concluded that the scientific evidence linking EMF exposures with health risks is weak and that this finding does not warrant aggressive regulatory concern. However, in light of the weak scientific evidence supporting some association between EMF and health effects and the fact that exposure to electricity is common in the United States, the NIEHS stated that passive regulatory action, such as providing public education on reducing exposures, is warranted.[12]

[12] Report is available at http://www.niehs.nih.gov/health/topics/agents/emf/

The United States Environmental Protection Agency (EPA) seems to have come to a similar conclusion about the link between adverse health effects, specifically childhood leukemia, and power-frequency EMF exposure. On its website, the EPA states:

> Many people are concerned about potential adverse health effects. Much of the research about power lines and potential health effects is inconclusive. Despite more than two decades of research to determine whether elevated EMF exposure, principally to magnetic fields, is related to an increased risk of childhood leukemia, there is still no definitive answer. The general scientific consensus is that, thus far, the evidence available is weak and is not sufficient to establish a definitive cause-effect relationship.[13]

Minnesota, California, and Wisconsin have each conducted their own literature reviews or research to examine this issue. In 2002, Minnesota formed an Interagency Working Group to evaluate the research and develop policy recommendations to protect the public health from any potential problems arising from EMF effects associated with HVTLs. The Minnesota Department of Health published the Working Group's findings in *A White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options*. The Working Group summarized its findings as follows:

> Research on the health effects of EMF has been carried out since the 1970s. Epidemiological studies have mixed results – some have shown no statistically significant association between exposure to EMF and health effects, some have shown a weak association. More recently, laboratory studies have failed to show such an association, or to establish a biological mechanism for how magnetic fields may cause cancer. A number of scientific panels convened by national and international health agencies and the United States Congress have reviewed the research carried out to date. Most researchers concluded that there is insufficient evidence to prove an association between EMF and health effects; however many of them also concluded that there is insufficient evidence to prove that EMF exposure is safe.[14]

In 2007, the World Health Organization (WHO) conducted an intensive review of the health implications of ELF-MFs. WHO concluded that "virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level ELF magnetic fields and changes in biological function or disease status."[15] Based on its review, WHO did not recommend exposure limits but provided that "[t]he best source of guidance for both exposure levels and the principles of scientific review are international guidelines."[16] The guidelines

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[13] http://www.epa.gov/radtown/power-lines.html

[14] Minnesota Department of Health. 2002. *A White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options*

[15] World Health Organization. 2007. *Environmental Health Criteria Volume No. 238 on Extremely Low Frequency Fields* at 12.

[16] *Id*. at 12-13.

referred to by WHO are those of the International Commission on Non-Ionizing Radiation Protection (ICNIRP)[17] and the Institute of Electrical and Electronic Engineers (IEEE) exposure limit guidelines.[18] At the time WHO completed its review, the ICNIRP continuous general public exposure guideline was 833 mG and the IEEE continuous general public exposure guideline was 9,040 mG. In 2010, ICNIRP revised its continuous general public exposure guideline to 2,000 mG. The WHO has not provided any analysis of the 2010 ICNIRP continuous general public exposure guideline to date.

Based on findings like those of the Working Group and NIEHS, the Commission has consistently found that "there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects."[19] This conclusion was further justified in the Route Permit proceedings for the Brookings County – Hampton 345 kV Project ("Brookings Project"). In the Brookings Project Route Permit proceedings, the Applicants (Great River Energy and Xcel Energy) and one of the intervening parties both provided expert evidence on the potential impacts of ELF-EF and ELF-MF, including the WHO findings. The ALJ in that proceeding evaluated written submissions and a day-and-a-half of testimony from the two expert witnesses. The ALJ concluded: "there is no demonstrated impact on human health and safety that is not adequately addressed by the existing State standards for [EF and MF] exposure."[20] The Commission adopted this finding on July 15, 2010.[21]

Impacts and Mitigation

No impacts to public health and safety are anticipated as a result of the Project. The Project will be designed in compliance with local, state, NESC, and Great River Energy standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way widths. The proposed transmission lines will be equipped with protective devices to safeguard the public from the transmission line if an accident occurs, such as a structure or conductor falling to the ground.

Great River Energy will ensure that safety requirements are met during the construction and operation of the facilities. Additionally, when crossing roads or railroads during stringing operations, guard structures will be utilized to eliminate traffic delays and provide safeguards for

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[17] ICNIRP is a non-governmental organization in formal relations with WHO.

[18] *Id.*

[19] See, for example, *In the Matter of the Application for a HVTL Route Permit for the Tower Transmission Line Project*, Docket No. ET-2, E015/TL-06-1624, Findings of Fact, Conclusions of Law and Order Issuing a Route Permit to Minnesota Power and Great River Energy for the Tower Transmission Line Project and Associated Facilities (August 1, 2007)

[20] *In the Matter of the Route Permit Application by Great River Energy and Xcel Energy for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota*, Docket No. ET-2/TL-08-1474, ALJ Findings of Fact, Conclusions and Recommendation at Finding 216 (April 22, 2010 and amended April 30, 2010)

[21] *In the Matter of the Route Permit Application by Great River Energy and Xcel Energy for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota*, Docket No. ET-2/TL-08-1474, Order Granting Route Permit (September 14, 2010)

the public. With implementation of these safeguards and protective measures, no additional mitigation is proposed.

9.2.2 Displacement

No displacement of residential homes, structures or businesses will occur as a result of this Project. The NESC and Great River Energy standards require certain clearances between transmission lines and buildings or structures within the ROW for safe operation of the proposed transmission line. Displacement of residential homes, structures or businesses in the ROW would occur only if a transmission line alignment and design could not accomplish these necessary clearances. Applicants believe the proposed Project route provides sufficient design flexibility and distances from existing homes, structures and businesses for a transmission line design that achieves the requisite clearances.

Proximity of the proposed transmission centerline to commercial/industrial properties and residences (and non-residential buildings) along the route is summarized in **Table 9-1** and shown on the detailed route maps in **Appendix F**. Distances to commercial/industrial properties and residences were measured from the proposed alignment.

There are 17 to 21 homes within 50-150 feet of the proposed centerline. An additional six to ten residences are set back a distance of 150 feet or more from the proposed centerline.

Table 9-1. Proximity of Homes and Businesses to Proposed Transmission Line Centerline

Transmission Line Segment	Number of Residences within Various Distances of Either Side of Transmission Line Centerline					
	0-50’	50-100’	100-150’	150-200’	200-250’	Total
Dog Lake Substation and Tap Line to “115” Transmission Line	0	0	0	0	0	0
West Option, “115” transmission line – Motley Substation	0	2	2	2	2	8
East Option, “115” transmission line – Motley Substation	0	1	7	3	5	16
Motley Substation – Fish Trap Lake Substation	4	6	3	0	2	15

Impacts and Mitigation

The Project will be designed in compliance with local, state, NESC, and Great River Energy standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way widths. The proposed transmission line will be equipped with protective devices to safeguard the public from the transmission line if an accident occurs, such as a structure or conductor falling to the ground.

Applicants will work with landowners to adjust the alignment or pole placement, as necessary to achieve requisite clearances. If there are other structures (e.g., farm buildings) within the ROW, it may be possible to meet clearance requirements by installing taller transmission line structures, placing all conductors on one side of the transmission line pole away from the structure, or placing the transmission line on the other side of the road.

9.2.3 Noise

Noise will be created during the construction phase of the project, from operation of the transmission line, and from operations at the substation.

Because human hearing is not equally sensitive to all frequencies of sound, the most noticeable frequencies of sound are given more "weight" in most measurement schemes. The A-weighted scale corresponds to the sensitivity range for human hearing. Noise levels capable of being heard by humans are measured in dBA, which is the A-weighted sound level recorded in units of decibels.

A noise level change of 3 dBA is barely perceptible to human hearing. A 5 dBA change in noise level, however, is clearly noticeable. A 10 dBA change in noise level is perceived as a doubling of noise loudness, while a 20 dBA change is considered a dramatic change in loudness. **Table 9-2** shows noise levels associated with common, everyday sources.

Table 9-2. Common Noise Sources and Levels

Sound Pressure Level (dBA)	Noise Source
140	Jet Engine (at 25 meters)
130	Jet Aircraft (at 100 meters)
120	Rock and Roll Concert
110	Pneumatic Chipper
100	Jointer/Planer
90	Chainsaw
80	Heavy Truck Traffic
70	Business Office
60	Conversational Speech
50	Library
40	Bedroom
30	Secluded Woods
20	Whisper

Source: Minnesota Pollution Control Agency (2008)

The MPCA established daytime and nighttime noise standards by Noise Area Classifications (NAC) are provided in **Table 9-3**. The standards are expressed as a range of permissible dBA within a one hour period; L_{50} is the dBA that may be exceeded 50 percent of the time (30

minutes) within an hour, while L_{10} is the dBA that may be exceeded 10 percent of the time (6 minutes) within the hour.

Land areas, such as picnic areas, churches, or commercial spaces, are assigned a NAC based on the type of activities or use occurring in the area and the sensitivity of the activities to noises. The NAC is listed in the MPCA noise regulations to distinguish the categories. Residential areas, churches, and similar type land use activities are included in NAC 1; commercial-type land use activities are included in NAC 2; and industrial-type land use activities are included in NAC 3.

Typically the most noise-sensitive receptors along the routes will include residences, businesses, churches, and schools. Current average noise levels in these areas are typically in the 30 to 40 dBA range and are considered acceptable for residential land use activities. Ambient noise in rural areas is commonly made up of rustling vegetation and infrequent vehicle pass-bys. Higher ambient noise levels, typically 50 to 60 dBA, will be expected near roadways, urban areas and commercial and industrial properties in the Project area.

Table 9-3. MPCA Noise Limits by Noise Area Classification (dBA)

Noise Area Classification	Daytime		Nighttime	
	L_{50}	L_{10}	L_{50}	L_{10}
1 Residential-type Land Use Activities	60	65	50	55
2 Commercial-type Land Use Activities	65	70	65	70
3 Industrial-type Land Use Activities	75	80	75	80

Construction Related Noise

Construction noise is expected to occur during daytime hours as the result of heavy equipment operation and increased vehicle traffic associated with the transport of construction personnel and materials to and from the work area. Noise associated with transportation and equipment operation will be temporary in nature.

Transmission Line Related Noise

Operational noise levels produced by a 115 kV transmission line are generally less than outdoor background levels and are therefore not usually perceivable. Proper design and construction of the transmission line and substations in accordance with industry standards will help to ensure that noise impacts are not problematic. Noise associated with operation of the transmission facilities is discussed further below.

Transmission lines can generate a small amount of sound energy during corona activity where a small electrical discharge caused by the localized electric field near energized components and conductors ionizes the surrounding air molecules. Corona is the physical manifestation of energy loss and can transform discharge energy into very small amounts of sound, radio noise, heat, and chemical reactions of the air components. Several factors, including conductor voltage, shape and diameter, and surface irregularities such as scratches, nicks, dust, or water drops can affect a conductor's electrical surface gradient and its corona performance.

Noise emission from a transmission line occurs during certain weather conditions. In foggy, damp, or rainy weather, power lines can create a crackling sound due to the small amount of electricity ionizing the moist air near the wires. During heavy rain, the background noise level of the rain is usually greater than the noise from the transmission line. As a result, people do not normally hear noise from a transmission line during heavy rain.

Table 9-4. Anticipated Noise Levels with Heavy Rain

L_5	L_{50}	Location
17.7 dBA	14.2 dBA	edge of right-of-way
18.8 dBA	15.3 dBA	directly under line

The worst-case scenario is when the transmission line is exposed to heavy rain conditions (one inch per hour). Anticipated noise levels for heavy rain conditions for a typical 115 kV line based on the results from the Bonneville Power Administration Corona and Field Effects Program version 3 (U.S. Department of Energy, Bonneville Power Administration (BPA), Undated) are listed in **Table 9-4**.

Substation Related Noise

Noise associated with substations includes the operation of transformers and switchgear. The transformers produce a constant low-frequency humming noise while the switchgear produces an impulsive or short duration noise during infrequent activation of the circuit breakers. Due to the infrequent operation of the switchgear, the noise generated would be considered temporary in nature and not predicted to exceed the MPCA Noise Limits.

The proposed new Fish Trap Lake Substation and the modified Motley Substation will be designed to comply with Minnesota Noise standards (Minnesota Rules part 7030). The controlling limit for substations is the nighttime Noise Area 1 Classification (Table 4-2). Under this classification, noise levels are limited to 50 dBA during nighttime hours at the nearest location where a person is reasonably expected to sleep.

Typical noise levels from the type of transformers that will be used in the Fish Trap Lake and Motley Substations are 70 dBA when the transformer cooling fans are not running and 73 dBA when the fans are running. To conservatively predict future noise levels and compliance with the 50-dBA limit, the 73 dBA noise levels were treated as a point source at the transformers and modeled to determine the distance where the noise levels would be reduced to 50 dBA.

A simplified, conservative model[22] was used to determine the distance at which the noise would attenuate to 50 dBA. Noise propagation through the outdoor atmosphere typically decreases in level with increasing distance between the source and the receiver. The noise attenuation is the result of several mechanisms, including geometrical spreading of the sound waves, shielding provided by physical structures, atmospheric absorption of the acoustic energy and ground effects on the sound waves. In general, the noise or sound pressure levels emitted from the substation will decrease approximately 6 dB for each doubling of distance from the source to the receiver. The simplified model was prepared based on this 6-dB reduction with a doubling of distance. The model is conservative in that it does not factor in any attenuation from shielding or ground effects.

The noise levels at a distance greater than 40 feet from the transformer should comply with the 50 dBA state noise standard. The noise levels at the residences nearest the substations will be well below the 50 dBA noise standard. For the Motley Substation, the predicted noise level at the nearest residence (approximately 500 feet) is 29 dBA. For the Fish Trap Lake Substation, the predicted noise level at the nearest residence (approximately 30 feet) is 33 dBA.

Impacts and Mitigation

Noise related to the Project is associated with both the construction and operation of the energy transmission system.

Noise associated with construction activities will be temporary in nature. To mitigate noise impacts associated with construction activities, work will be limited to daytime hours between 7 a.m. and 10 p.m. weekdays. Occasionally there may be construction outside of these hours or on a weekend if the Applicant has to work around customer schedules, line outages, or if the schedule has been significantly impacted due to permitting delays or other factors. Heavy equipment will also be equipped with sound attenuation devices such as mufflers to minimize the daytime noise levels.

Operational noise levels are expected to be well below the state noise limits, therefore no mitigation is proposed.

9.2.4 Aesthetics

The transmission line and the Fish Trap Lake Substation will be new features visible along the route. The structures for the circuit portions of the Project without distribution underbuild will be wood poles approximately 60 to 90 feet above ground with spans between poles ranging from 250 to 400 feet. The structures for the circuit portions of the Project with distribution underbuild will be wood poles approximately 60 to 90 feet above ground with spans between poles ranging from 250 to 350 feet. A maximum span will be used between the structures as necessary while

[22] The simplified model is based off the following formula: S2 = S1 - 20 * Log(d2/d1). S2 = Noise level at distance d2 (dBA), S1 = Measured sound level at d1 (dBA), D1 = Distance from noise source to S1 noise measurement (ft), and D2 = Distance from noise source at which S2 is calculated (ft).

still keeping the conductor within the ROW under blowout conditions. The typical ROW required for 115 kV structures is 100 feet wide.

The new infrastructure will be visible in the general area of the Project. The landscape in the Project area is a mix of rural residential development, forested land, agricultural land, recreational areas, open space, and commercial development along U.S. Highway 10. The visual effect will depend largely on the perceptions of the observers across these various landscapes. The visual contrast added by the transmission structures and lines may be perceived as a visual disruption or as points of visual interest. The transmission lines, distribution lines, substations and general development that already exist in the vicinity of the proposed Project will limit the extent to which the new infrastructure viewed as a disruption to the area's scenic integrity. The West Route Option has the potential for greater visual impacts than the East Route Option because the West Route Option would include a new crossing of the Crow Wing River in a relatively undisturbed segment of the river. The East Route Option would overtake and realign the existing Minnesota Power 34.5 kV sub-transmission line crossing of the river.

Impacts and Mitigation

To minimize impacts to the aesthetics and visual character of the Project area, Applicants identified a proposed route that predominantly uses existing transmission line and road corridors and avoids residences and businesses to the greatest extent practicable.

Great River Energy will work with landowners to identify concerns related to the transmission lines and aesthetics. In general, mitigation includes enhancing positive effects as well as minimizing or eliminating negative effects. Potential mitigation measures include:

- Location of structures, ROW, and other disturbed areas will be determined by considering input from landowners or land management agencies to minimize visual impacts.
- Care shall be used to preserve the natural landscape. Construction and operation shall be conducted to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work.
- Landowners will be compensated for the removal of trees and vegetation, either through easement negotiations or on a separate basis.
- Structures will be placed at the maximum feasible distance from highway, trail, and water crossings, within limits of structure design.
- To the extent practicable, rivers shall be crossed in the same location as existing transmission lines.

9.2.5 Socioeconomic

The Project is located primarily within Morrison and Cass counties with a small portion in Todd County in north central Minnesota.

The socioeconomic setting of the proposed Project area was evaluated on a regional basis, comparing data for the area along the Project route with average data for Cass, Morrison and Todd counties and the state of Minnesota. Data were compiled from the 2000 and 2010 U.S. Census. **Table 9-5** summarizes the socioeconomic characteristics within the Project area.

Impacts and Mitigation

Constructing the new substations and transmission line will result in some short and long term economic impacts for the surrounding communities. Long term benefits will result from the new utility infrastructure and will include improved utility service, which supports local economies.

Increasing the transmission outlet capability within the Project area will benefit the surrounding communities in general. Upgrading the utility lines will serve the growing demand of the region, including the proposed MPL pump station.

Short term impacts will result from the activities associated with construction. Impacts to social services would be unlikely because of the short-term nature of the construction project. In the short-term, revenue would likely increase for some local businesses, such as hotels, restaurants, gas stations, and grocery stores, due to workers associated with construction of the Project.

Because impacts to socioeconomics will be generally short-term and beneficial, no mitigation is proposed.

9.2.6 Cultural Values

Cultural values include those perceived community beliefs or attitudes in a given area, which provide a framework for community unity. The populations of Cass, Morrison and Todd counties derive from a diverse ethnic heritage. According to the Morrison County Historical Society[23], 12 different nationalities have settled within the County during the mid- to late-1800s, with Norwegian, English and Swedish nationalities settling in the vicinity of the project. Similar nationalities could be expected in neighboring counties impacted by the project. Cultural representation in community events appears to be more closely tied to geographic features, seasonal events, national holidays, and municipal events than to those based in ethnic heritage.

Construction of the proposed Project is not expected to conflict with the cultural values of the area.

Impacts and Mitigation

The construction of the proposed transmission facilities will provide the region with a stable power supply. The available power supplied by Project will provide essential support and contribute to a stable economic environment in which to live and work. In addition, opportunities presented by the diverse economy may continue to encourage civic pride, and tourism may benefit from this unity as well.

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[23] http://morrisoncountyhistory.org/?page_id=298

Because no adverse impacts to cultural values are anticipated, no mitigation is proposed.

9.2.7 Recreation

There are a number of existing recreational resources within the Project vicinity, including parks, trails, rivers, and lakes. Popular activities include camping, fishing, hunting, bird watching, canoeing/kayaking, boating, swimming, golfing, biking, hiking, cross country skiing and riding ATVs and snowmobiles. Recreational resources in the vicinity of the Project are shown on **Figures 9-1A through 9-1C.**

DNR managed lands in the area provide opportunities for viewing wildlife and intact ecosystems. There are no DNR lands in close proximity to the Project. The Phillbrook Wildlife Management Area (WMA) is over one mile west of the transmission line segment adjacent to U.S. Hwy. 10 in Township 132N, Range 32W, Section 2. A portion of the Lake Alexander Woods Scientific and Natural Area (SNA) is approximately two miles east of the proposed Fish Trap Lake Substation in Township 132N, Range 31W, Sections 28, 29, and 33. The WMA and SNA are shown on **Figure 4-1C**.

The Pine Ridge Golf Course is located on the east side of U.S. Highway 10 at approximately three to four miles south of Azalea Road.

Impacts and Mitigation

The Project is not located in close proximity to any WMAs. The Project does not cross state forest lands, WMAs or SNAs (**Figures 9-1A through 9-1C**).

Clearing vegetation underneath the utility lines may alter the wildlife habitat within the immediate vicinity, potentially impacting viewing opportunities for the short term. Permanent disturbance of wildlife habitat will be minimized, to avoid impacts to hunting and wildlife observation. The proposed Project routes are located adjacent to existing corridors to the greatest extent possible, minimizing the impact to previously undisturbed habitats.

Great River Energy will coordinate with the DNR, USFWS, and other resource agencies to ensure utility line construction will not impact the surrounding natural resources.

The transmission line is adjacent to the Pine Ridge Golf Course; however, Applicants have proposed to build the line on the west side of U.S. Highway 10 to mitigate impacts to the golf course.

The Project is not in close proximity to local recreational resources such as museums, city parks, or campgrounds, and as such, no impacts will occur.

Figure 9-1A. Recreation Areas - Dog Lake Substation

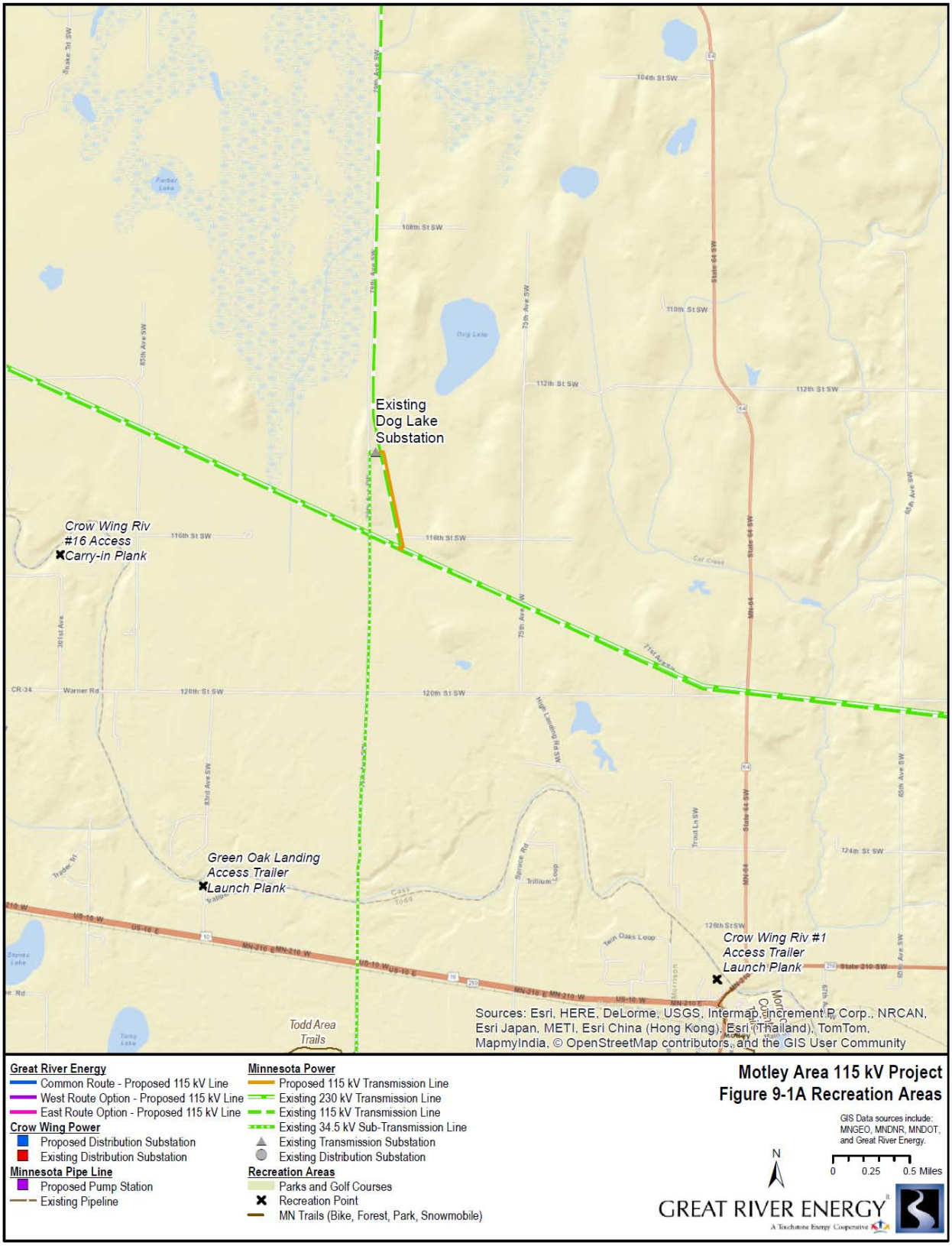

Figure 9-1B. Recreation Areas – North

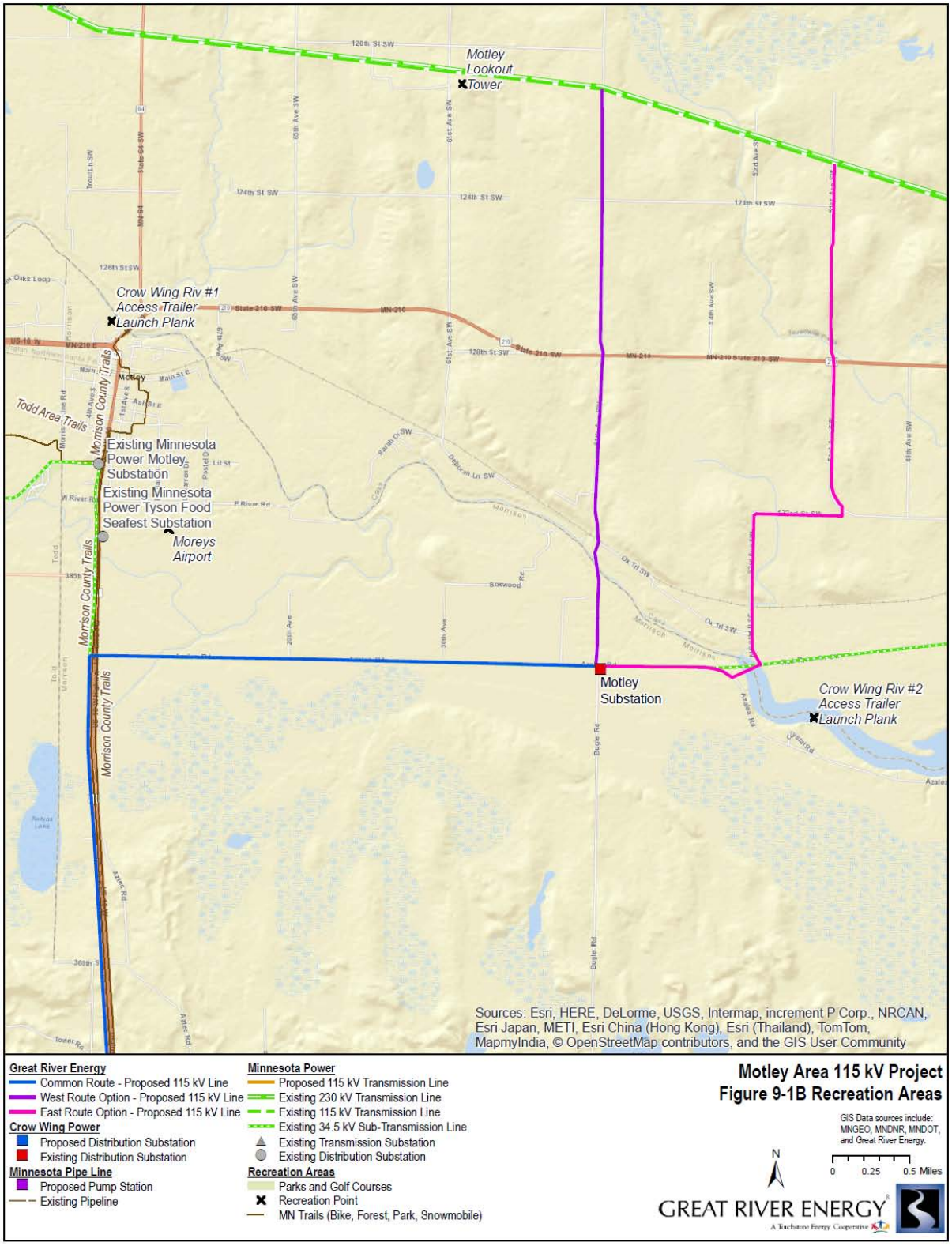

Figure 9-1C. Recreation Area – South

9.2.8 Public Services and Transportation

The Project is located in rural areas with typical public services (police, fire protection, waste collection, natural gas, wells, septic systems, cable television, electricity, telephone, etc.).

Underground services will be located during the Project surveying activities. Such services typically can include gas/oil pipelines, telecommunication lines and electric distribution lines, as well as site improvements such as septic systems and wells.

The proposed route follows existing utility and/or road ROWs for nearly the entire route. The majority of the proposed transmission line and poles will be located outside of road and other utility easements.

The proposed Project is three-fourths of a mile from the Moreys Seafood Airport in Motley, MN. The MnDOT Office of Aeronautics was contacted[24] requesting information on the possible effects of the proposed Project on airports or airstrips in the Project area. In an email[25] dated October 7, 2014 (**Appendix K**), MnDOT indicated that the project description Early Notification Memo was received and reviewed by the Office of Aeronautics, and determined the Project would have no significant effect on operations at the Morey's Seafood Airport.

Impacts and Mitigation

Based on the location of other existing utilities and site improvements that are identified during survey activities, the transmission line will be designed to meet or exceed required clearances, and pole locations will be designed to be outside of existing utility easements, with the exception of Crow Wing Power distribution lines and the MP "355" 34.5 kV sub-transmission line. Great River Energy will work with Crow Wing Power to modify or co-locate the existing distribution system that is on the proposed route.

Because the route follows existing utility and road ROWs, and the majority of transmission poles will be located outside of existing utility easements and road ROW, no impacts to public services are anticipated and therefore no mitigation is proposed.

The proposed Project is not anticipated to affect any ongoing or future road projects within the Project area. Great River Energy will coordinate with and obtain approval from road authorities if it were necessary to locate any poles for the proposed transmission line within road ROW.

Temporary access for construction of the transmission line would be along the existing transmission line ROW or by short spur trails from the existing road network to the ROW. Temporary guard structures would be used to string conductor over existing roads and railroads. The structures typically consist of directly-imbedded poles with a horizontal cross piece to

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[24] Letter from Mark Strohfus, Great River Energy to Cathy Huebsch, MnDOT. September 16, 2014. *See* Appendix K.

[25] Email from Debra Sorenson-MnDOT Aeronautics, to Mark Strohfus, Great River Energy. October 7, 2014. *See* Appendix K.

support the conductor at sufficient height above traffic. Temporary traffic impacts associated with equipment are material delivery and worker transportation.

Short-term localized traffic delays are anticipated. Impacts resulting from construction and operation of the proposed transmission line would be minimal for transportation.

When appropriate, pilot vehicles will accompany the movement of heavy equipment. Traffic control barriers and warning devices will be used when appropriate. All necessary provisions will be made to conform to safety requirements for maintaining the flow of public traffic. Construction operations will be conducted to offer the least possible obstruction and inconvenience to the traveling public. The construction contractor would be required to plan and execute delivery of heavy equipment in such a manner that would avoid traffic congestion and reduce likelihood of dangerous situations along local roadways.

9.3 Land Use/Zoning

The Project covers a variety of land use patterns in rural environments. Land use along the route is a mix of forest, cropland, shrub land, grassland, and wetlands and waters (**Figures 9-2A through 9-2C**).

Zoning information for the Project area is provided in **Figures 9-3A through 9-3C**.

Cass County

The portion of the Project located in southern Cass County is dominated by croplands, with some forest areas, grassland and some shrub land (**Figure 9-2A and B**).

Zoning in the vicinity of the Dog Lake Substation includes Commercial/Industrial/Public Utility, Agricultural, Rural Vacant, and Residential Homestead (**Figure 9-3A and B**).

Morrison County

The portion of the Project in Morrison County is also dominated by forested areas with some shrub lands, grass lands, cropland and wetlands/water (**Figure 9-2B and Figure 9-2C**).

Zoning (**Figure 9-3B and C**) along the proposed route is predominantly agricultural (2A) with some residential (1A), seasonal recreational (4C12) and commercial (3A).

Todd County

The portion of Todd County that is adjacent to the Project is dominated by forested areas with some shrub land and grassland (**Figure 9-2C**) and is zoned agricultural (**Figure 9-3C**).

Figure 9-2A. Land Use-Dog Lake Substation

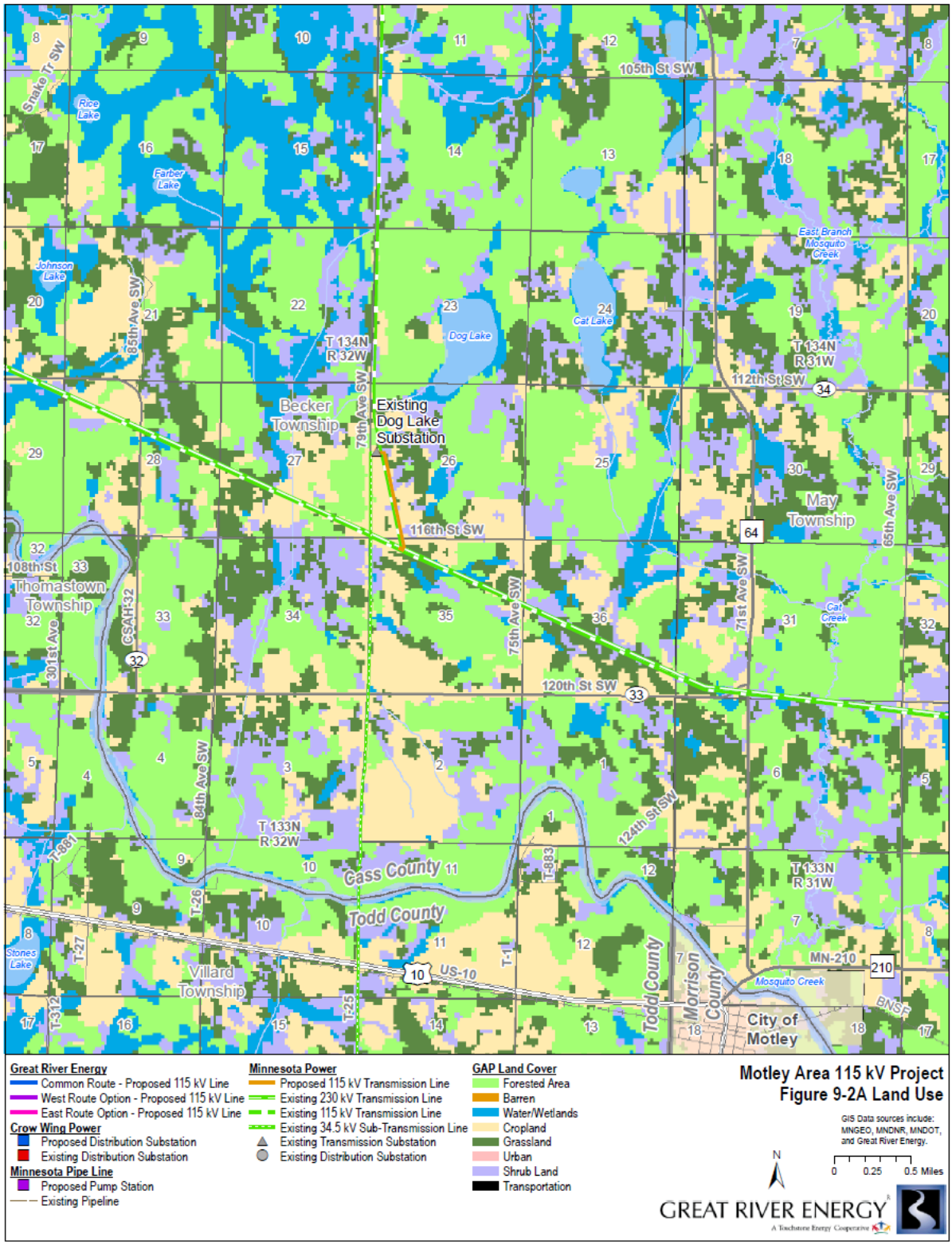


Figure 9-2B. Land Use-North

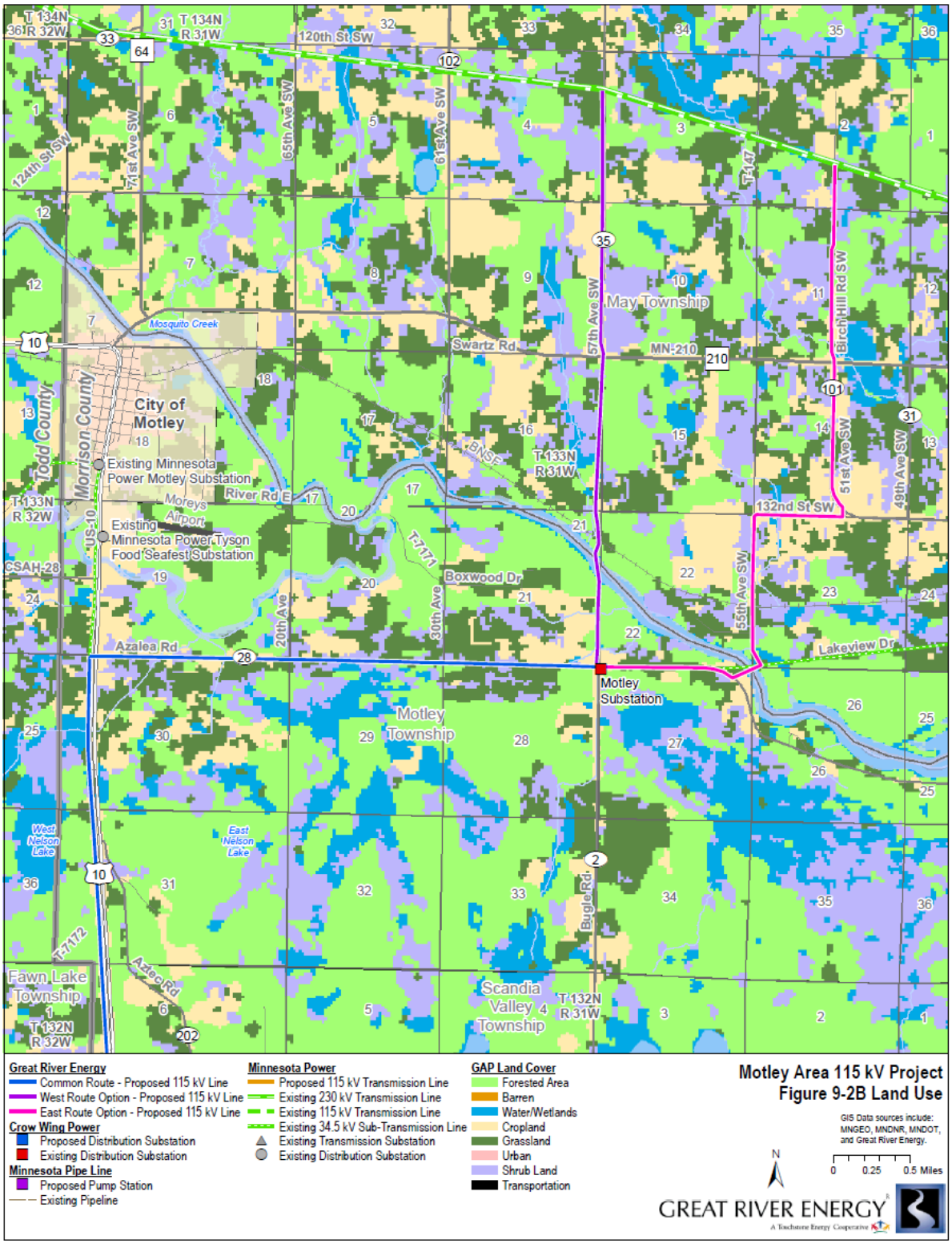


Figure 9-2C. Land Use-South

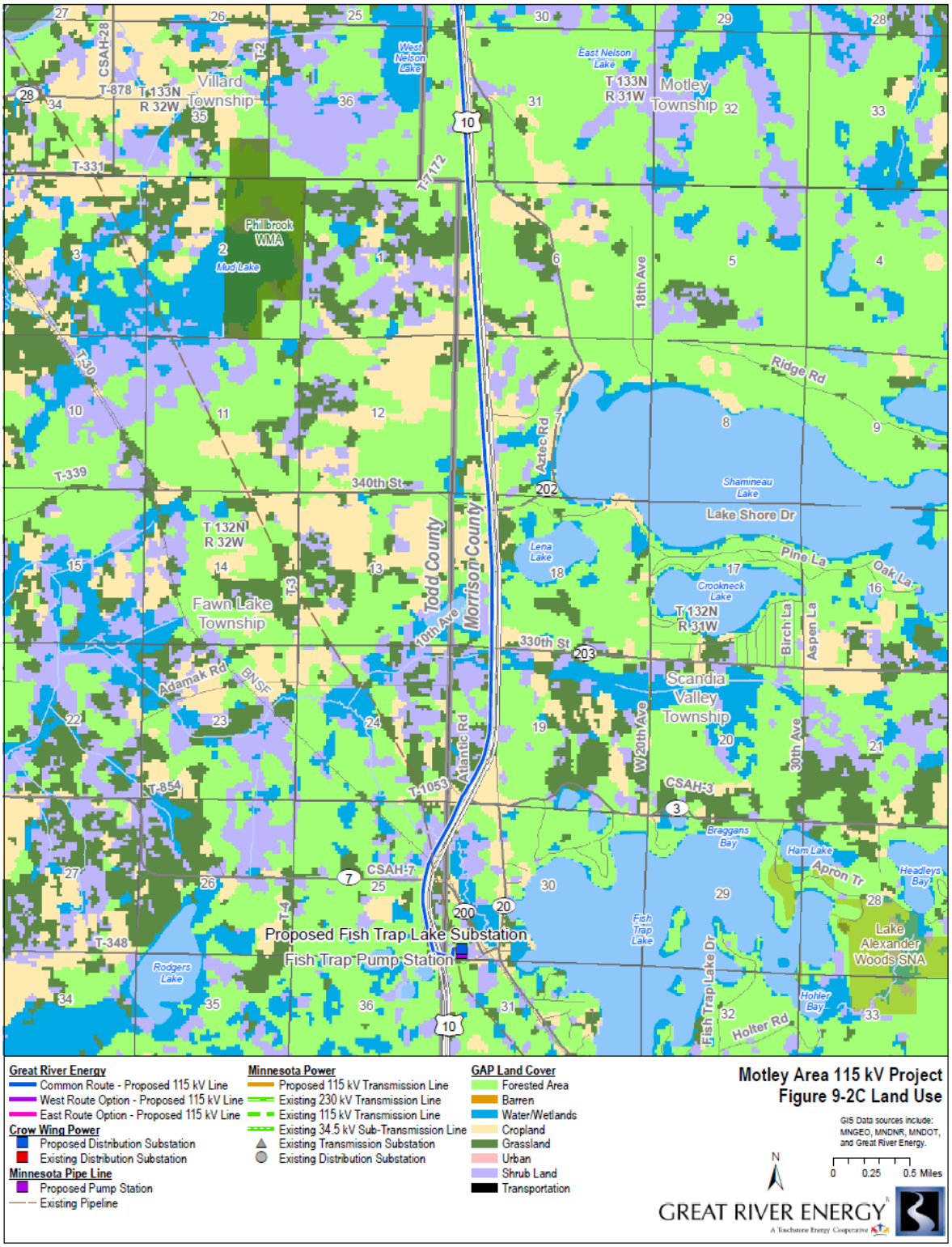


Figure 9-3A. Zoning-Dog Lake Substation

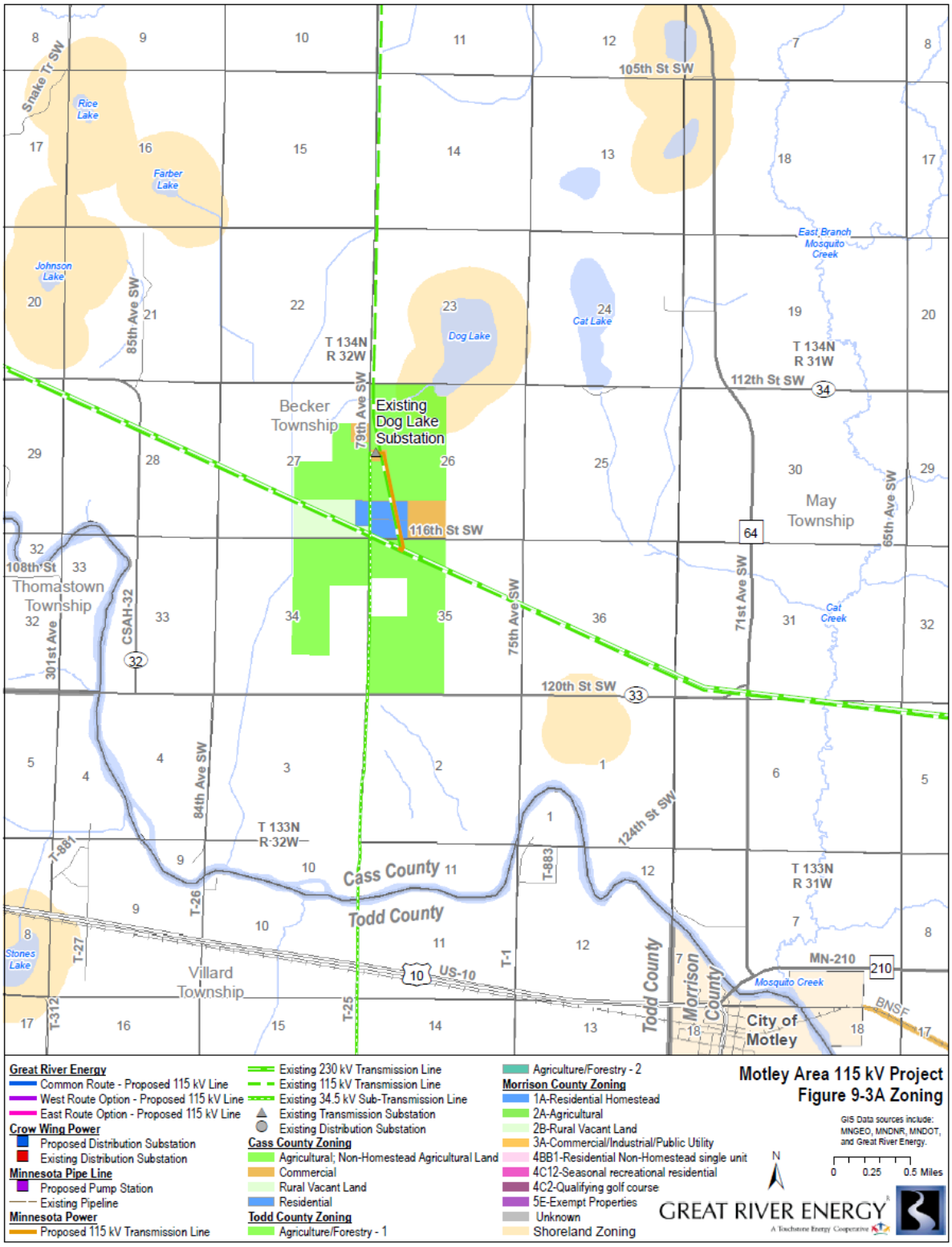


Figure 9-3B. Zoning-North

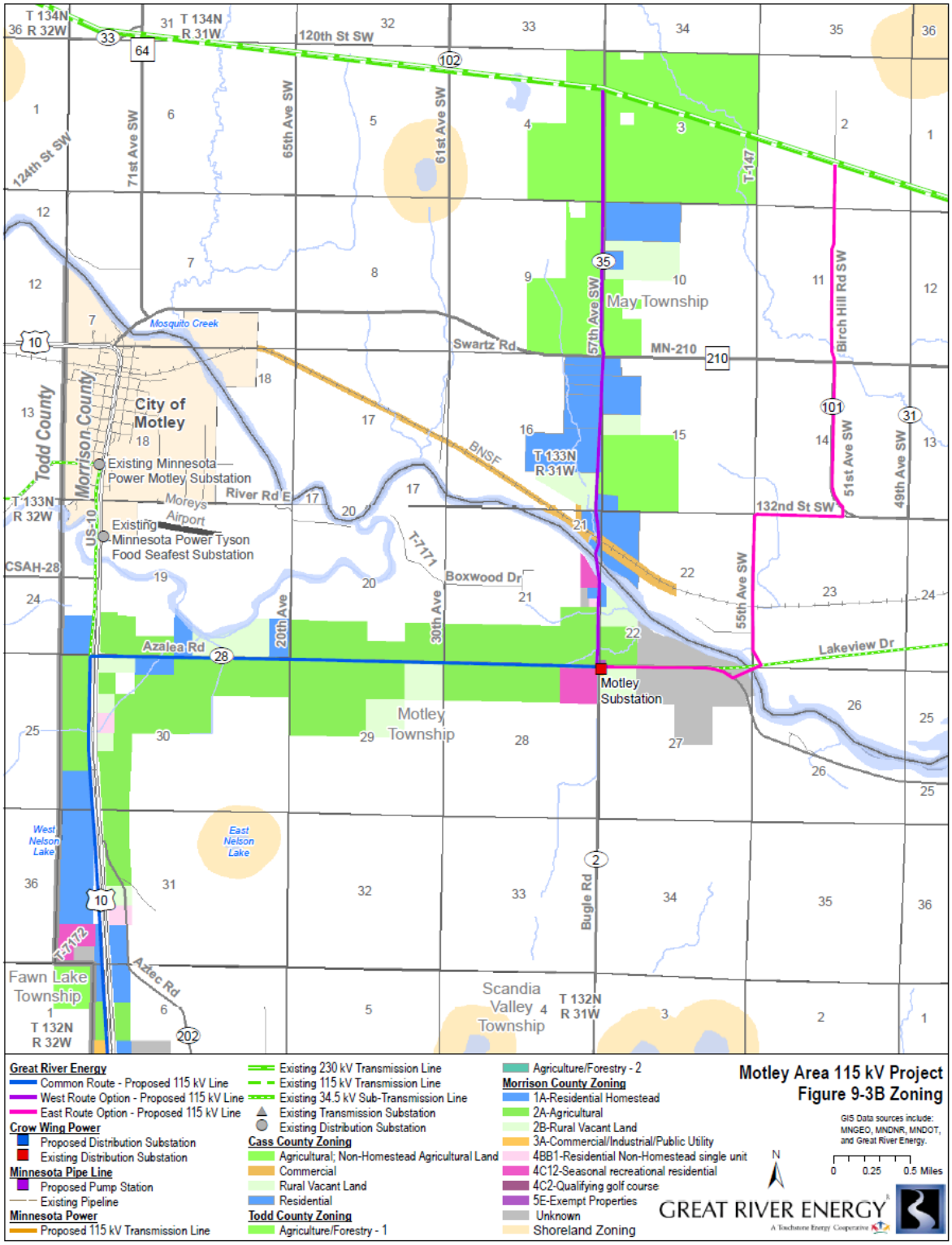
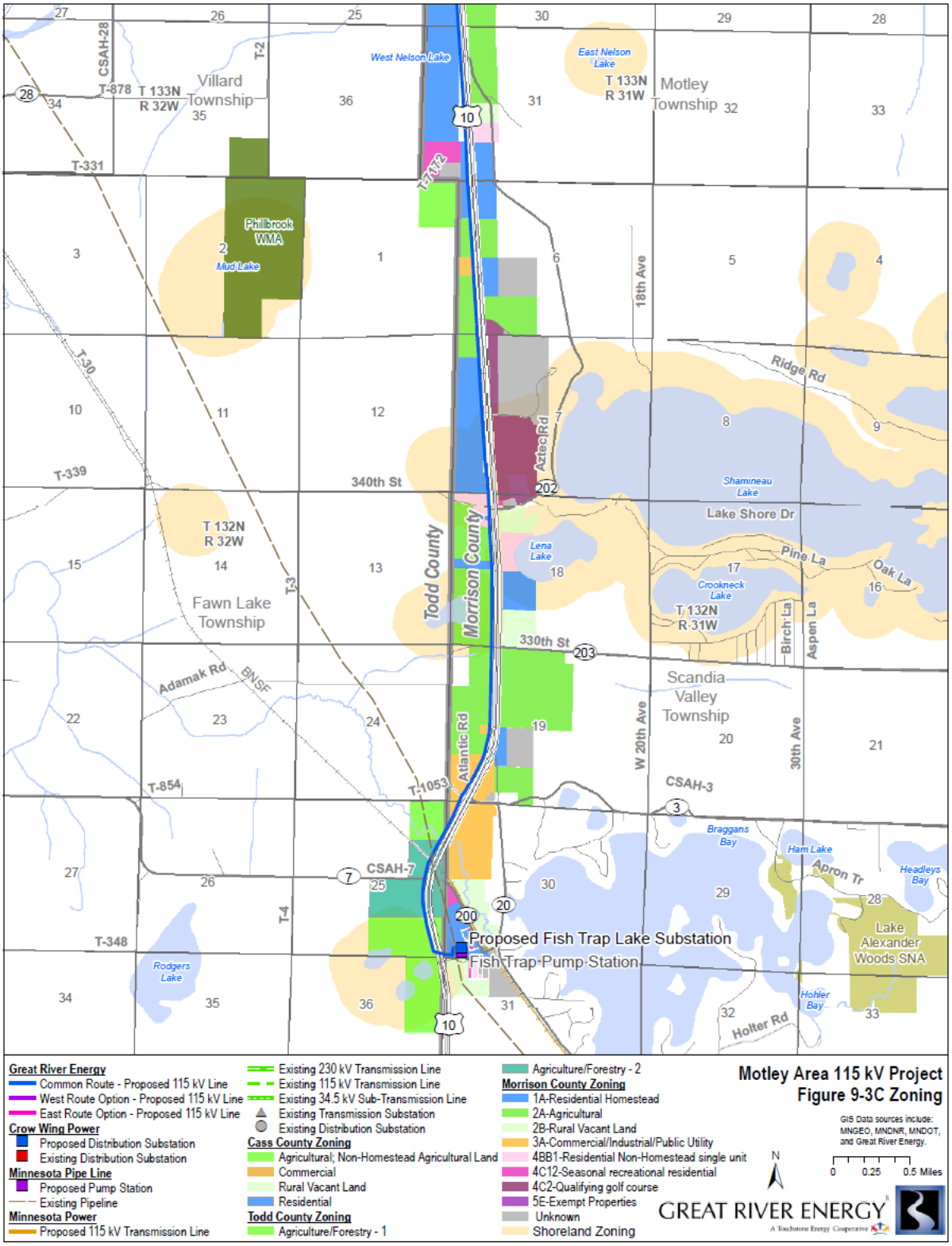


Figure 9-3C. Zoning-South



Impacts and Mitigation

Impacts to land use as a result of the Project are expected to be minimal. Construction and operation of the Project will not alter the possible land uses. No impacts to residential or commercial/industrial land uses are anticipated; therefore no mitigation is proposed.

As discussed in **Section 9.4.1**, some temporary agricultural impacts (rutting, compaction) may occur during construction, as equipment accesses the ROW to install the structures and to string conductor. Permanent agricultural impacts will be the footprint of the pole and the area immediately surrounding it (about 4 square feet), although the majority of the ROW easement will be available for agricultural cultivation. Great River Energy will work with landowners to minimize impacts to all farming operations along the route, and will compensate landowners for any crop damage and soil compaction that may occur during construction.

9.4 Land-based Economies

9.4.1 Agriculture

2012 United States Department of Agriculture (USDA) Census of Agriculture data for the state and affected counties is provided in **Table 9-5**.

Table 9-5. Agriculture Statistics within the Project Area[26]

STATISTIC	MINNESOTA	MORRISON COUNTY	CASS COUNTY	TODD COUNTY
Number of Farms	74,542	1,957	546	1,931
Total Land in Farms (acres)	26,035,838	436,536	157,215	393,890
Average Farm Size (acres)	349	223	288	204
Market Value of Products ($1000)	21,280,184	429,935	35,153	241,011
Average Per Farm ($100)	285,479	219,691	69,878	124,811

Agricultural lands within the Project area include cropland and pasture. Of the proposed 15.5-16.5 miles of new transmission line, approximately 6.5 miles of agricultural lands will be crossed by the proposed alignments.

[26] State and County-Level Data at http://agcensus.usda.gov/Publications/2012/.

Impacts and Mitigation

Some agricultural land will be temporarily removed from production during transmission line construction, but permanent agricultural land conversion associated with the transmission line poles will be minimal.

Determination of temporary agricultural impacts that will result from construction is dependent upon final engineering design. The acreage anticipated to be included in temporary construction access points is composed of numerous small agricultural properties in the vicinity of the Proposed Route. Construction of new transmission structures (and removal of existing distribution and sub-transmission structures) will require repeated access to structure locations to install the structures and to string conductor. Equipment used in the construction process includes backhoes, cranes, boom trucks and assorted small vehicles. Operation of these vehicles on adjoining farm fields can cause rutting and compaction, particularly during springtime and otherwise wet conditions.

Permanent agricultural impacts will occur as a result of structure placement along the Project centerline. The area of impact will be the footprint of the pole itself and the area immediately surrounding the pole (approximately four square feet per pole), although the majority of the ROW easement will be available for agricultural cultivation.

Great River Energy will work with landowners to minimize impacts to all farming operations along the routes, and will compensate landowners for any crop damage and soil compaction that may occur during construction. Areas disturbed during construction will be repaired and restored to pre-construction contours as required so that all surfaces drain naturally, blend with the natural terrain and are left in a condition that will facilitate natural revegetation, provide for proper drainage and prevent erosion.

Specific mitigation measures to be implemented include:

- Movement of crews and equipment will be limited to the ROW to the greatest extent possible, including access to the routes. Contractors employed by Great River Energy will limit movement on the ROW to minimize damage to grazing land, crops, or property. If movement outside of the ROW is necessary during construction, permission will be obtained and any crop damage will be paid to the landowner.

- When weather and ground conditions permit, deep ruts that are hazardous to farming operations will be repaired or compensation will be provided as an alternative if the landowner desires. Such ruts will be leveled, filled and graded or otherwise eliminated in an approved manner. In hay meadows, alfalfa fields, pastures and cultivated productive lands, compacted soils will be loosened and ruts will be leveled by scarifying, harrowing, disking, or by other approved methods. Damage to ditches, tile drains, terraces, roads, and other features of the land will be corrected using approved methods and indigenous plants where necessary. The land and facilities will be restored as nearly as practicable to their original conditions.

- The transmission line will be designed to accommodate existing or proposed center pivot irrigation systems, with transmission poles located as near as practicable to the outer edge of the road ROW and the placement of pole locations to avoid the maximum radius of the system as it passes along the road ROW. Irrigation stops or electrical supply apparatus are allowable in the easement area and appropriate grounding requirements will be discussed with the landowners.

- ROW easements will be purchased through negotiations with each landowner affected by the Project. Restoration or compensation will subsequently be made for reasonable crop damages or other property damage that occurs during construction or maintenance as negotiated.

- Construction will be scheduled during periods when agricultural activities will be minimally affected to the extent possible or the landowner will be compensated accordingly.

- Fences, gates and similar improvements that are removed or damaged will be promptly repaired or replaced.

Some temporary construction space will be needed for the Project. For temporary marshalling yards, which will provide space to store material and equipment, Great River Energy will lease the space by agreement with the respective landowner(s), remove and properly dispose of all material and debris, and repair all damages and perform restoration, as necessary. It is anticipated that minimal temporary construction space on property immediately adjacent to the ROW and on private property will be needed, with the exception of limited equipment access.

9.4.2 Forestry

According to the USDA Forest Service[27], total acreage of forest inventory for the affected counties is as follows:

- Cass County – approximately 833,000 acres

- Morrison County – approximately 218,000 acres

- Todd County – approximately 149,000 acres

Forested areas in the Project area are shown on **Figures 9-2A to 9-2C.** The Project ROW would impact approximately 24 acres of forested land with the West Route Option or 14 acres with the East Route Option. Forests in the Project area have routinely been logged for the forest industry and personal use, such as for firewood for heating, and it is expected that this practice will continue into the future. Some of the forests in the Project area provide windbreak to fields or home sites.

[27] Standard reports available at http://apps.fs.fed.us/fia/fido/index.html

Impacts and Mitigation

The entire width of the ROW would need to be cleared of vegetation to ensure the safe and reliable operation of the transmission line. Because the proposed alignment primarily follows existing utility and road ROWs, additional forest impacts due to additional ROW acquisition and subsequent clearing will be reduced.

Mitigation measures for potential impacts to forest resources would be as follows:

- Compensation for the removal of vegetation in the ROW will be offered to landowners during easement negotiations.
- If possible, windbreaks comprised of compatible (maturing to a height of 15 feet or less) vegetation may be allowed in the outer edges of the ROW, to be determined through negotiation with individual landowners.

9.4.3 Tourism

Tourist destinations within the Project vicinity include parks, trails, rivers, and State WMAs and SNAs. Popular activities include camping, fishing, hunting, bird watching, canoeing/kayaking, boating, golfing, swimming, biking, hiking, golfing, skiing, riding ATVs and snowmobiles. The WMAs, SNAs and state and county forests within the Project area provide opportunities for viewing wildlife and intact ecosystems. Historic areas provide the chance to learn about the regional and local history.

Impacts and Mitigation

The proposed route avoids many of the areas in the Project vicinity that would be considered tourist destinations, and the Project would not preclude tourism activities or appreciably diminish the use or experience at tourist destinations. Although some tree clearing will be required, it will be along the edge of existing ROWs and should not affect wildlife viewing opportunities.

As no impacts on tourism are expected, no mitigation is proposed.

9.4.4 Mining

There are no mining activities within the vicinity of the Project.

Impacts and Mitigation

As no impacts on mining are expected, no mitigation is proposed.

9.5 Archaeological and Historic Resources

A cultural resource literature review of the proposed transmission line and a one-mile buffer was conducted online and at the Minnesota State Historic Preservation Office (SHPO) located at the Minnesota History Center in St. Paul, Minnesota. Current topographic maps and aerial photographs, historic maps and documents, original land survey maps and original land patent

records were examined. The archaeological and architectural site files were examined to obtain a list of all previously recorded archaeological sites and architectural properties in the Project's study area, defined as a one mile buffer around the route.

9.5.1 Previously Recorded Archaeological Sites

There are eight previously recorded archaeological sites within the study area (**Table 9-8**). Many of the sites are associated with the Crow Wing River. The proposed transmission line would cross the Crow Wing River via either the West Route Option or the East Route Option. One site is directly adjacent to the West Route Option.

Eleven of the archaeological sites are in Cass County. Twelve of the archaeological sites are in Morrison County, and one is in Todd County. Twenty sites are situated along the river within Sections 21, 22, 23 and 26, in both Cass and Morrison counties on either side of the Crow Wing River. The West Route Option of the Project may intersect 1 of these sites (21CA0247) or be very near its recorded location.

The available information suggests that the locales crossed by the proposed Project, in particular the crossing options of the Crow Wing River, have a high potential to intersect currently non-recorded pre-contact archaeological sites, including artifact scatters and earthworks. Such resources are general considered to have a greater potential to be significant; in addition, pre-contact earthworks are almost always protected under the Minnesota Private Cemeteries Act (MN 307.08). Extant sites are also more likely in areas not disturbed by historic and modern (non-agricultural) development.

Table 9-6. Previously Recorded Archeological Resources in Project Vicinity

Site Number/Site Name/Site Type	County, Location (TRS)	Site Significance	Location Relative to Project
21CA0239/John and Lina Nygren Farm, a.k.a. Deer Site East/Pre-contact Lithic Scatter and Historic Foundations	Cass, 133N/31W/26	Unevaluated	Southeast of East Route Option
21CA0240/Deer Site West/ Pre-contact Lithic Scatter and Historic Artifact Scatter	Cass, 133N/31W/26	Unevaluated	Southeast of East Route Option
21CA0241/Fisherman's Pines/Pre-contact Artifact Scatter	Cass, 133N/31W/26	Unevaluated	East of East Route Option
21CA0242/Access Ford/Pre-contact Lithic Scatter	Cass, 133N/31W/23	Unevaluated	East of East Route Option
21CA0243/Turn-Around/Pre-contact Artifact Scatter	Cass, 133N/31W/23	Unevaluated	East of East Route Option
21CA0244/Lot 3, Wheelock Shores/Pre-contact artifact scatter	Cass, 133N/31W/22	Unknown	North and West of East Route Option
21CA0245/Lot 7, Wheelock Shores/Pre-contact lithic scatter	Cass, 133N/31W/22	Unknown	North and West of East Route Option
21CA0246/Siesta Islands/Pre-contact lithic scatter, earthworks	Cass, 133N/31W/22	Unknown	Between West and East Route Options
21CA0247/Donahue Find Spot II/Pre-contact single artifact	Cass, 133N/31W/21	Unknown	West Route Option may intersect
21CA0248/Creek Crossing/Pre-contact lithic	Cass,	Unknown	West of West Route Option

Site Number/Site Name/Site Type	County, Location (TRS)	Site Significance	Location Relative to Project
scatter	133N/31W/21		
21CA0249/Belden/Pre-contact lithic scatter	Cass, 133N/31W/21	Unknown	West of West Route Option
21MO0013/Morey/Pre-contact artifact scatter, earthworks	Morrison, 133N/31W/20	Unknown	North of project
21MO0015/Steinbrecher/Pre-contact Lithic Scatter and Historic Artifact Scatter	Morrison, 133N/31W/20	Unknown	North and West of Project
21MO0104/unnamed/Earthwork	Morrison, 133N/31W/20	Unknown	North and West of Project
21MO0129/Twin Pines/Pre-contact lithic scatter	Morrison, 133N/31W/21	Unknown	West of West Route Option
21MO0130/Pre-contact single artifact	Morrison, 133N/31W/21	Unknown	West of West Route Option
21MO0131/Peterson/Pre-contact artifact scatter	Morrison, 133N/31W/21&22	Unknown	East of West Route Option
21MO0132/Brad Macheel/Pre-contact lithic scatter	Morrison, 133N/31W/22	Unknown	East of West Route Option
21MO0133/Shay's Camp/Pre-contact and historic-period artifact scatters	Morrison, 133N/31W/22	Unknown	North and West of East Route Option
21MO0134/Pepin Point/Pre-contact Artifact Scatter	Morrison, 133N/31W/26	Unknown	Southeast of East Route Option
21MO0135/Rohl/Pre-contact Lithic Scatter	Morrison, 133N/31W/26	Unknown	Southeast of East Route Option
21MO0136/unnamed/Pre-contact Lithic Scatter	Morrison, 133N/31W/26	Unknown	North of proposed Fish Trap Lake Substation
21MOw/Historic-period structural ruin	Morrison, 133N/31W/21	Unknown	North of proposed Fish Trap Lake Substation
21TO0031/unnamed/Pre-contact Lithic Find Spot	Todd, 132N/32W/25	Ineligible	North of proposed Fish Trap Lake Substation

9.5.2 Previously Recorded Standing Historic Structures

There are four previously recorded standing historic structures in the study area (**Table 9-9).** Only one of the sites is in close enough proximity to the Project to cause any potential impacts, structure MO-MOT-00, the District 120 School House and Motley Town Hall building. This structure was inventoried during a 1985 county survey. Its current status is not clear but has likely not been evaluated for National Register eligibility.

Table 9-7. Previously Recorded Standing Historic Structures in Project Vicinity

SiteNumber/Site Name/ Site Type	County, Location (TRS)	Site Significance	Location Relative to Project
CA-MAY-002/Fort Ripley Military Road	Cass, 133N/31W/24	Unevaluated	East of Project
CA-MAY-003/Fort Ripley Military Road	Cass, 133N/31W/23	Ineligible	East of Project
MO-MOT-001/District 120 School, Motley Town Hall	Morrison, 133N/31W/22	Unknown	Project may intersect
TO-FAW-005/ Northern Pacific Railway	Todd, 132N/32W/25	Ineligible	West of Project

Impacts and Mitigation

Given public and private development over the almost 30-year period since the 1985 survey, Applicants believe it is unlikely that additional historic structures would be identified near the proposed transmission facilities and feel that no further architectural review is warranted for the Project.

Applicants do not believe there will be any adverse impact on known or suspected archaeological resources as a result of this Project. However, if a Corps permit is required and Section 106 consultation is initiated, given the relatively high site density along the Crow Wing River, Great River Energy anticipates conducting a Phase I archaeological reconnaissance survey of the Project ROW in the vicinity of the river once the route is well defined.

The Minnesota Historical Society (MHS) was contacted[28] requesting information on the possible effects of the proposed Project on historic properties in the Project area. In a letter dated October 16, 2014[29], MHS concurred that a Phase I archaeological survey should be completed (Appendix K).

If any archaeological sites are identified during placement of the poles along the permitted route, construction work will be stopped and MHS staff consulted as to how to proceed. If human remains are encountered during construction activities, all ground disturbing activity will cease and local law enforcement will be notified per MN 307.08.

Great River Energy will make every effort to avoid impacts to identified archaeological and architectural resources. In the event that an impact would occur, Great River Energy will consult with the appropriate reviewing agency to determine the necessary steps regarding treatment of the resource. While avoidance of the resource would be a preferred action, mitigation for Project-related impacts on archaeological and architectural resources eligible for the National Register of Historic Places may include an effort to minimize Project impacts on the resource and/or additional documentation through data recovery.

[28] Letter from Mark Strohfus, Great River Energy to Sarah Beimers, MHS. September 16, 2014. Appendix K.

[29] Letter from Sarah Beimers, MHS to Mark Strohfus, Great River Energy. October 16, 2014. Appendix K.

9.6 Natural Environment

9.6.1 Air Quality

The only potential air emissions from a transmission line result from corona, which may produce ozone and oxides of nitrogen. This can occur when the electric field intensity exceeds the breakdown strength of the air. For a 115 kV transmission line, the conductor surface gradient is typically below the air breakdown level. As such, it is unlikely that any measurable emissions would occur from the conductor surface.

Impacts and Mitigation

No impacts to air quality are anticipated due to the operation of the transmission line.

Temporary and localized air quality impacts caused by construction vehicle emissions and fugitive dust from ROW clearing and construction are expected to occur. Exhaust emissions from diesel equipment will vary during construction, but will be minimal and temporary. The magnitude of emissions is influenced heavily by weather conditions and the specific construction activity taking place. Appropriate dust control measures will be implemented.

9.6.2 Water Resources

Hydrologic features in the Project area and along the proposed route are shown in **Figures 9-2A through 9-2C**. Hydrologic features, such as wetlands, lakes, rivers and floodplains perform several important functions within a landscape, including flood attenuation, groundwater recharge, water quality protection and wildlife habitat production.

The Project lies within the Crow Wing River watershed, in the north central portion of the Upper Mississippi River Basin.[30]

Ground Water

The DNR divides Minnesota into six groundwater provinces. Morrison, Cass and Todd counties fall into the Central Province, which is described as sand aquifers in generally thick sandy and clayey glacial drift overlying Precambrian and Cretaceous bedrock.[31]

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[30] http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/basins/upper-mississippi-river-basin/index.html

[31] http://www.dnr.state.mn.us/groundwater/provinces/index.html

Figure 9-5A. **Hydrologic Features-Dog Lake Substation**

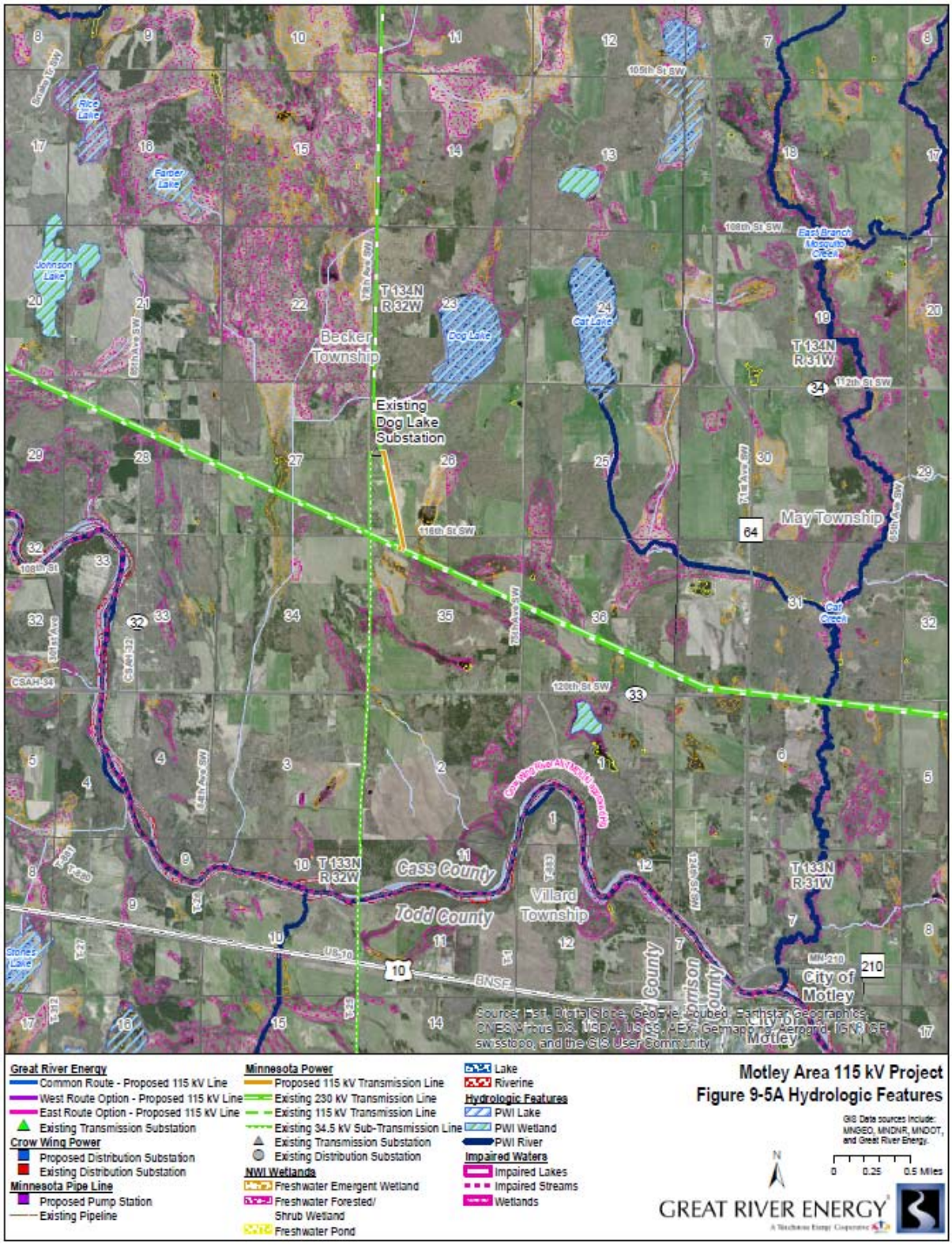


Figure 9-5B. Hydrologic Features-North

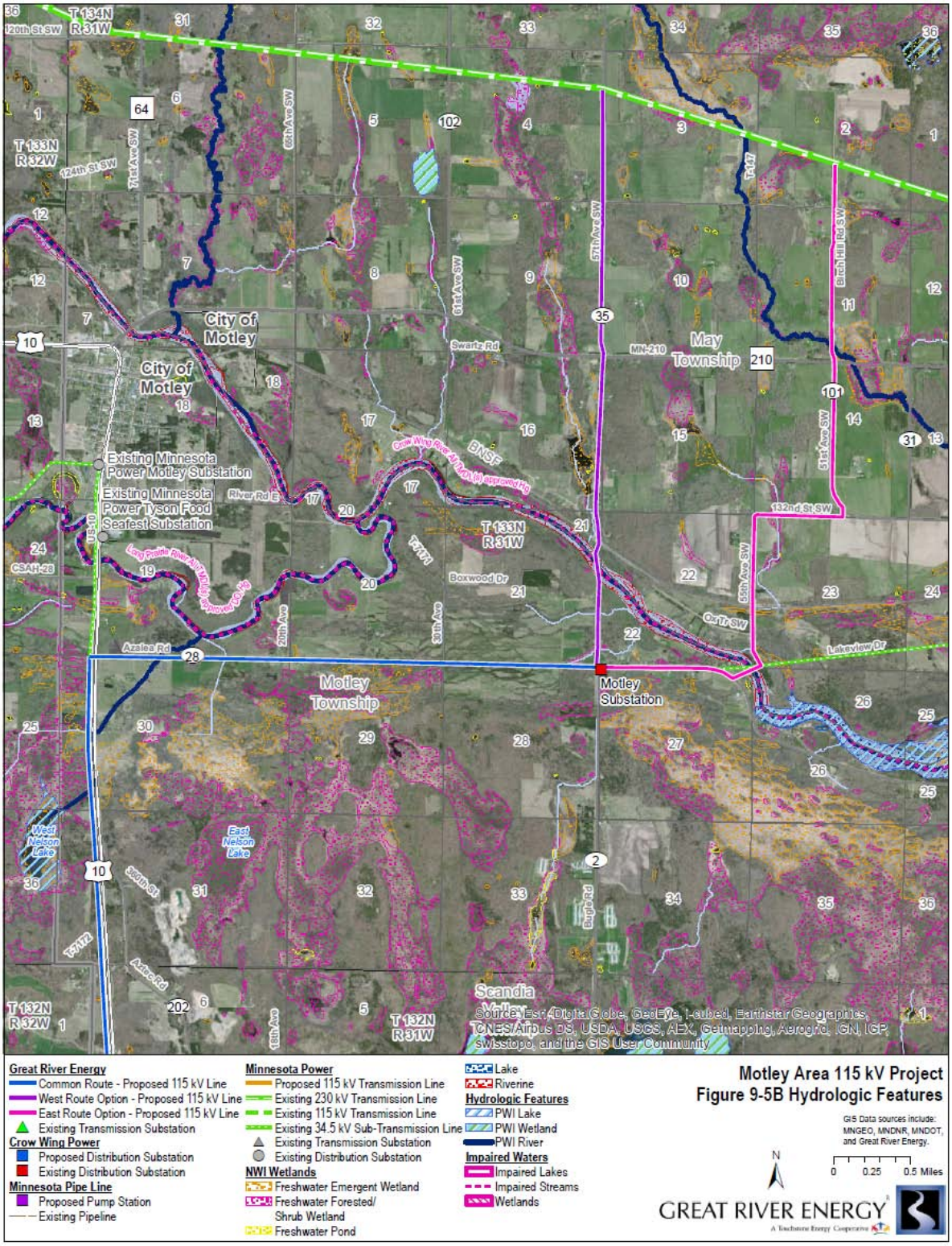
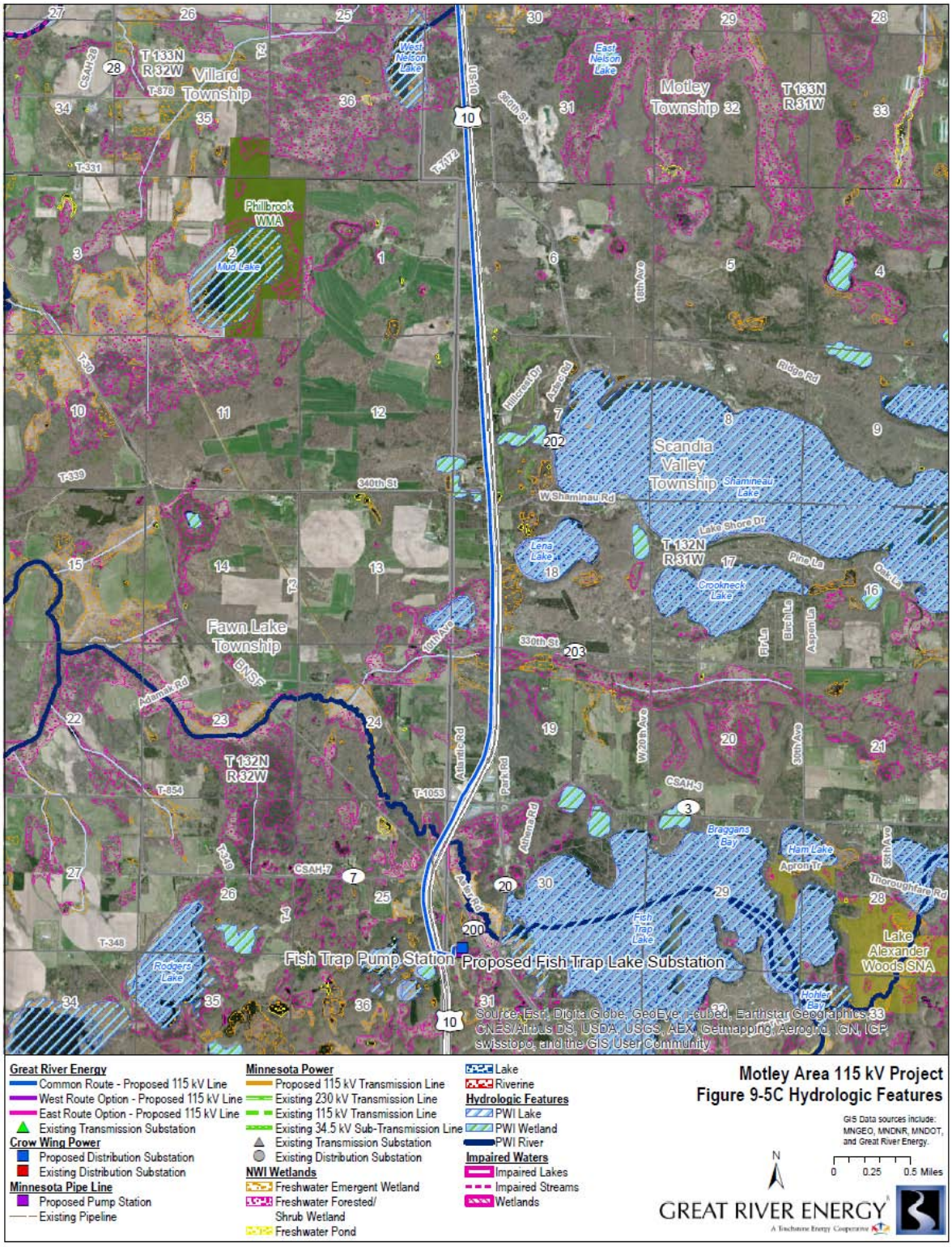


Figure 9-5C. Hydrologic Features-South



Lakes

Lakes in the distant Project area include Dog Lake (108 acres), Shamineau Lake (1,356 acres), Lena Lake (85 acres), and Fish Trap Lake (1,118 acres)[32] (**Figures 9-2A to C**). The route is closest to an unnamed lake in Township 132N, Range 32W, Section 13 at approximately 600 feet from open water.

Rivers and Streams

There are a number of rivers and streams in the Project area, including the Seven Mile Creek, Crow Wing River, Fish Trap Creek and a tributary to the Long Prairie River (**Figures 9-2B to C**). The East Route Option would cross Seven mile Creek. The West Route Option and the East Route Option would cross the Crow Wing River. The Common Transmission Line Segment would cross the unnamed tributary twice and Fish Trap Creek.

Floodplains

The transmission line would cross the floodplains of the rivers listed above.

Riparian Areas

Riparian areas are ecosystems that occur along watercourses or at the fringe of water bodies. For purposes of this Application, the riparian areas are defined as the land within 300 feet of streams and within 1,000 feet of lakes. These distances were selected because they are consistent with the definition of shoreland in the DNR Statewide Standards. These statewide standards set guidelines for the use and development of shoreland (riparian) property around all lakes greater than 25 acres (10 acres in municipalities) and rivers with a drainage area of two miles or greater.

The proposed route crosses riparian areas associated with the rivers and streams listed above.

Public Waters

Public Waters are wetlands, water basins and watercourses of significant recreational or natural resource value in Minnesota as defined in Minnesota Statutes Section 103G.005. The DNR has regulatory jurisdiction over these waters, which are identified on the DNR Public Waters Inventory (PWI) maps.

The proposed transmission line would cross three to four Public Waters in Cass and Morrison counties. The Public Waters are shown on **Figures 9-2A through 9-2C** and listed in **Table 9-10**.

[32] http://www.dnr.state.mn.us/lakefind/index.html

Table 9-8. PWI Waters (Cass and Wadena Counties)

Name	Type	Location
Seven Mile Creek	Creek	T133N, R31W, Section 11
Crow Wing River	River	T133N, R31W, Section 21 or 26 & 27
Unnamed Tributary to Long Prairie River	Creek	T133, R31W, Section 30 (twice)
Fish Trap Creek	Creek	T132N, R32W, Section 25

Impaired Waters

Section 303(D) of the Federal Clean Water Act requires states to publish, every two years, a list of streams and lakes that are not meeting their designated uses because of excess pollutants (impaired waters). The list, known as the 303(d) list, is based on violations of water quality standards. None of the crossed waters are listed as impaired (**Figures 9-2A through 9-2C**).

Wetlands

Wetlands are important resources for flood abatement, wildlife habitat, and water quality. Wetlands that are hydrologically connected to the nation's navigable rivers are protected federally under Section 404 of the Clean Water Act. In Minnesota, wetlands are also protected under the Wetland Conservation Act.

The USFWS produced maps of wetlands based on aerial photographs and NRCS soil surveys starting in the 1970s. These wetlands are known as the National Wetland Inventory (NWI). Wetlands listed on the NWI may be inconsistent with current wetland conditions; however, NWIs are the most accurate and readily available database of wetland resources within the Project area and were therefore used to identify wetlands along the existing and proposed routes.

Wetland types and lengths within the proposed route are provided in **Table 9-11.**

Impacts and Mitigation

No impacts to groundwater in the Project area are anticipated.

The transmission line does not cross any of the lakes in the area, and no navigable waters will be affected by the Project.

Because all rivers and streams will be spanned by transmission structures, no structures will be located within these features and no direct impacts to rivers or streams are anticipated. Indirect impacts could include sedimentation reaching surface waters during construction due to ground disturbance by excavation, grading, construction traffic, and dewatering of holes drilled for transmission structures. This could temporarily degrade water quality due to turbidity. These impacts will be avoided or minimized using appropriate sediment control practices and BMPs.

Once the Project is completed, there would be no significant impact on surface water quality because wetland impacts will be minimized and mitigated, disturbed soil will be restored to previous conditions or better, and the amount of land area converted to an impervious surface will be small.

The transmission line would cross three to four DNR Public Waters. Great River Energy will apply for a license to cross these waters once design details are available and will follow any recommendations to minimize erosion and other impacts.

Table 9-9. Wetland Types Intersected by Proposed Transmission Line Centerline (NWI)

Cowardin Type[1]	No. of Basins	Area inside of 100-ft ROW (acres)	Length of Crossing (feet)
Dog Lake Substation			
PEMC	1	0.54	247
PSS1C	1	0.18	87
Total		**0.72**	**334**
West Route Option			
PSS1C	1	0.71	404
PSS1Cd	1	0.53	233
R2UBH	1	3.96	1,746
Total		**5.20**	**2,383**
East Route Segment			
PEM/SS1C	1	0.02	0
PSS1C	1	0.87	380
R2UBH	1	1.69	740
Total		**2.58**	**1,120**
Common Route Segment			
PEMC	8	1.63	698
PEMCb	1	0.70	309
PEMF	1	0.06	0
PFO1C	2	1.04	471
PSS1C	8	7.96	3,768
Total		**11.39**	**5,246**

[1]Cowardin et. al. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Department of the Interior, USFWS, Washington D.C.

The Project should have no impact on the impairment status of the waters in the Project area. There is potential to increase turbidity due to sedimentation from construction activities; however, appropriate erosion and sediment control measures will be implemented to avoid or minimize such impacts.

Potential impacts to riparian areas along the routes would be limited to ground disturbances due to pole placement. Due to the flexibility to avoid placing poles in sensitive areas, the anticipated impacts to the riparian areas along the routes are minimal.

Construction of the transmission lines is not expected to alter existing water drainage patterns or floodplain elevations due to the small cross section per pole and their relatively wide spacing. The small area of impermeable surfaces created by the pole structures will not cause an increase in susceptibility of flooding in the region.

The wetland type was classified using the Cowardin system that defines the habitat system, vegetative and sediment class and water regime. The wetland classification system is hierarchical, with wetlands and deepwater habitats divided among five major systems at the broadest level. The five systems include Marine (open ocean and associated coastline), Estuarine (salt marshes and brackish tidal water), Riverine (rivers, creeks, and streams), Lacustrine (lakes and deep ponds), and Palustrine (shallow ponds, marshes, swamps, sloughs). Systems are further subdivided into subsystems that reflect hydrologic conditions. Below the subsystem is the class that describes the appearance of the wetland in terms of vegetation or substrate. Each class is further subdivided into subclasses; vegetated subclasses are described in terms of life form, and substrate subclasses in terms of composition. The classification system also includes modifiers to describe hydrology (water regime), soils, water chemistry (pH and salinity), and special modifiers relating to man's activities (e.g., impounded, partly drained).

Some common symbols used in the wetland classification system include:

SYSTEM:	P – Palustrine	L - Lacustrine
CLASS:	RB - Rock Bottom	UB - Unconsolidated Bottom
	EM – Emergent	SS - Scrub-Shrub
	FO – Forested	OW - Open Water
MODIFIERS:	A - Temporarily flooded	B - Saturated
	C - Seasonally flooded	D - Seasonally well drained
	E - Seasonally saturated	F - Semipermanently flooded
	G - Intermittently flooded	H - Permanently flooded
SPECIAL MODIFIERS:	b – beaver	d - partially drained/ditched
	f – farmed	s - spoil
	x – excavated	

Temporary impacts to wetlands may occur if they need to be crossed during construction of the transmission line. No staging or stringing setup areas will be placed within or adjacent to water resources, as practicable. Wetland impact avoidance measures that will be implemented during design and construction of the transmission lines include spacing and placing the power poles at

variable distances to span and avoid wetlands, where possible. When it is not possible to span the wetland, several measures will be utilized to minimize impacts during construction:

- When possible, construction will be scheduled during frozen ground conditions.
- Construction crews will attempt to access the wetland with the least amount of physical impact to the wetland (*i.e.*, shortest route) and will access poles near/in wetlands from roadways whenever possible to minimize travel through wetland areas.
- The structures will be assembled on upland areas before they are brought to the site for installation, when practicable.
- When construction during winter is not possible, construction mats (wooden mats or the Dura-Base Composite Mat System) will be used to protect wetland vegetation. Additionally, all-terrain construction vehicles may be used, which are designed to minimize impact to soils in damp areas.

Permanent impacts to wetlands occur where structures must be located within wetland boundaries (approximately 20 square feet of permanent impacts per structure). Wetland vegetation would be restored in the disturbed areas following construction.

It is not anticipated that a Regional General Permit under Section 404 of the Clean Water Act from the Corps will be required for the Project. If one is determined to be needed, Great River Energy will apply for a permit once design details are available, restore the wetlands as required by the Corps, and comply with the requirements of the Wetland Conservation Act.

Vegetation maintenance procedures under transmission lines prohibit trees from establishing. Existing trees must be removed throughout the entire ROW, including forested wetlands. These forested wetlands would undergo permanent vegetative changes within the ROW, and mitigation for the conversion of forested wetlands to emergent and shrub/scrub wetlands may be required by the Corps.

In the event that impacts to hydrologic features are unavoidable, Great River Energy will work with the jurisdictional agencies to determine the best ways to minimize the impacts and create appropriate mitigation measures.

9.6.3 Flora and Fauna

<u>Flora</u>

Presettlement vegetation in the area consisted of jack pine, northern pin oak, aspen-birch and mixed red and white pine. The primary present day land uses in the Project area are forest management, agriculture, and recreation and tourism.

These resources provide potential habitat for native vegetation, wildlife and rare and unique resources.

Fauna

The USFWS website[33] for threatened and endangered species includes the northern long-eared bat (proposed as endangered) and the gray wolf (threatened) in Morrison, Cass and Todd counties, and the Canada lynx (threatened) in Cass County. Great River Energy does not believe the proposed transmission project will affect these species.

The USFWS was contacted by letter[34], and in their email response of October 15, 2014[35], they concurred that the northern long-eared bat is proposed to be listed in Morrison, Cass and Todd counties. There are no known occurrence records in close proximity to the proposed action area; however, summer roosting habitat may be present. If removal of suitable habitat is anticipated after final listing and between April 1 and September 30, consultation with USFWS may be necessary. The email did not address the Canada lynx or the gray wolf, which was listed after the response was written.

The recent northern long-eared listing proposal by the U.S. FWS (January 16, 2015 *Federal Register*) proposes tree clearing restrictions only from June 1 to July 31, rather than the longer restriction period of April 1 to September 30.

The forested areas, shrub lands and water features in the vicinity of the Project provide habitat for a variety of animal species, including birds, deer, small game and waterfowl. There are no USFWS Waterfowl Production Areas in the Project area.

Impacts and Mitigation

No impacts to native vegetation are anticipated. The proposed transmission line will follow existing transmission ROW for one-third of the Project, minimizing impacts to previously-undisturbed vegetation in that area.

There is minimal potential for the displacement of wildlife and loss of habitat from construction of the Project. Wildlife that inhabit natural areas could be impacted in the short-term within the immediate area of construction. The distance that animals will be displaced will depend on the species. Additionally, these animals will be typical of those found in agricultural and forested settings and should not incur population level effects due to construction.

Raptors, waterfowl and other bird species may be affected by the construction and placement of the transmission lines. Avian collisions are a possibility after the completion of the transmission lines. Waterfowl are typically more susceptible to transmission line collision, especially if the

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[33] U.S. Fish and Wildlife Webpage Endangered Species.
http://www.fws.gov/Midwest/Endangered/LISTS/minnesot-cty.html

[34] Letter from Mark Strohfus, Great River Energy to Andrew Horton, U.S. Fish and Wildlife Service. September 16, 2014. *See* Appendix K.

[35] Email from Andrew Horton, U.S. Fish and Wildlife Service to Mark Strohfus, Great River Energy. October 15, 2014. *See* Appendix K.

transmission line is placed between agricultural fields that serve as feeding areas, or between wetlands and open water, which serve as resting areas.

Great River Energy will address avian issues by working with the DNR and USFWS to identify any areas that may require marking transmission line shield wires and/or to use alternate structures to reduce the likelihood of collisions.

9.6.4 Invasive Species Management

The movement of construction equipment to, from, and between various work sites has the potential to introduce and/or spread invasive species. Such species include reed canary grass, common buckthorn, purple loosestrife, and leafy spurge, in addition to various invasive aquatic species.

Impacts and Mitigation

Invasive aquatic species, including Eurasian water-milfoil, flowering rush, and zebra mussels, are not expected to a significant issue for construction of the Project. Great River Energy anticipates a construction schedule that would allow for stringing of conductor over potentially-infested waters during winter months over the ice. To minimize the potential for the introduction or spread of invasive species, Great River Energy proposes to follow BMPs during Project construction:

- All disturbed areas will be re-vegetated using weed-free seed mixes. If practicable, native plant species will be used to re-vegetate disturbed areas. Weed-free straw or hay will be used for erosion control;

- Herbicidal or manual vegetation removal may be implemented to minimize the spread of invasive species where such removal is consistent with easement conditions or landowner restrictions;

- Construction vehicles will be cleaned and inspected to remove dirt, mud, plants, and debris from vehicles and equipment prior to arriving at, and leaving from, construction sites; and

- The Construction Field Representative will oversee BMP installation and effectiveness.

After detailed design for the Project is complete, Great River Energy will coordinate with the DNR to determine if any additional invasive species mitigation measures are required on DNR lands or across DNR waterways.

9.7 Rare and Unique Natural Resources

The DNR was contacted[36] requesting information on the possible effects of the proposed Project on rare and unique features in the Project area. In an email dated September 22, 2014, the DNR encouraged an assessment of potential effects to rare features prior to the determination of a final route.[37] [Application for DNR review was filed Feb 3, 2015]

A desktop review of the Natural Heritage Inventory System database provided by the DNR indicates no rare features within the proposed route. The database indicates the presence of other resources of special concern within one mile of the Project. These resources are listed in **Table 9-12** and shown on **Figures 9-3A through 9-3C**.

Table 9-10. Rare and Unique Resources in the Vicinity of the Project

Common Name	Scientific Name	Number of Occurrences	Federal Status	MN Status*	Habitat
Bald Eagle	*Haliaeetus leucocephalus*	1	None	Special Concern	Fire Dependent Forest, Mesic Hardwood Forest, Lake Shore, River Shore, Floodplain Forest, Wet Forest, Small Rivers and Streams, Medium Rivers and Streams, Large Rivers, Littoral Zone of Lake, Deep Water Zone of Lake, Savanna
Red Shouldered Hawk	*Buteo lineatus*	3	None	Special Concern	Fire Dependent Forest, Mesic Hardwood Forest, Floodplain Forest, Wet Forest
Northern Barrens Tiger Beetle	*Cicindela patruela patruela*	1	None	Special Concern	Savanna
American Bittern	*Botaurus lentiginosus*	1	None	Special Concern	Freshwater marshes
Least Darter	*Etheostoma microperca*	2	None	Special Concern	Small rivers and streams
Beach Heather	*Hudsonia tomentosa*	1	None	Special Concern	Sand dunes
Drummond's Campion	*Silene drummundii*	1	None	Special Concern	Wet meadow, Swamp

** END – Endangered; THR – Threatened; SPC – Special Concern; NON – no legal status, data being gathered for possible future listing; None – Terrestrial communities do not have assigned status, but are considered important ecologically.*
Source: Minnesota Natural Heritage Information System: Rare Features Database through License Agreement #LA6471. Data current as of December 2014.

[36] Letter from Mark Strohfus, Great River Energy to Lisa Joyal, Minnesota Department of Natural Resources. September 16, *See* Appendix K.

[37] Email from Lisa Joyal, Minnesota Department of Natural Resources to Mark Strohfus, Great River Energy. September 22, 2014. *See* Appendix K.

There is one DNR sites of moderate biodiversity that would be transected by the West Route Option. One area of high biodiversity and one area of moderate biodiversity are located adjacent to the Common Route Segment. Because the proposed route follows existing road ROWs in these areas, the Project's impact to these areas is expected to be minimal.

All of the occurrences listed in **Table 9-12** except one are located outside of the proposed route.

Impacts and Mitigation

Constructing along existing road ROWs will avoid impacting undisturbed habitat in this area to the extent practicable. Great River Energy will continue to coordinate with the DNR and USFWS to ensure that sensitive species in the Project area are not impacted by construction of the Project.

The following measures will be used to help avoid or minimize impacts to area wildlife and rare natural resources during and after the completion of the proposed transmission line:

- Minimize tree felling and shrub removal that are important to area wildlife.
- Utilize BMPs to prevent erosion of the soils in the areas of impact.
- Implement sound water and soil conservation practices during construction and operation of the Project to protect topsoil and adjacent water resources and minimize soil erosion. Practices may include containing excavated material, protecting exposed soil, and stabilizing restored soil.
- Re-vegetate disturbed areas with native species and wildlife conservation species where applicable.
- Implement raptor protection measures, including placement of bird flight diverters on the line at water crossings after consultation with local wildlife management staff.

Figure 9-6A. Rare Features-Dog Lake Substation

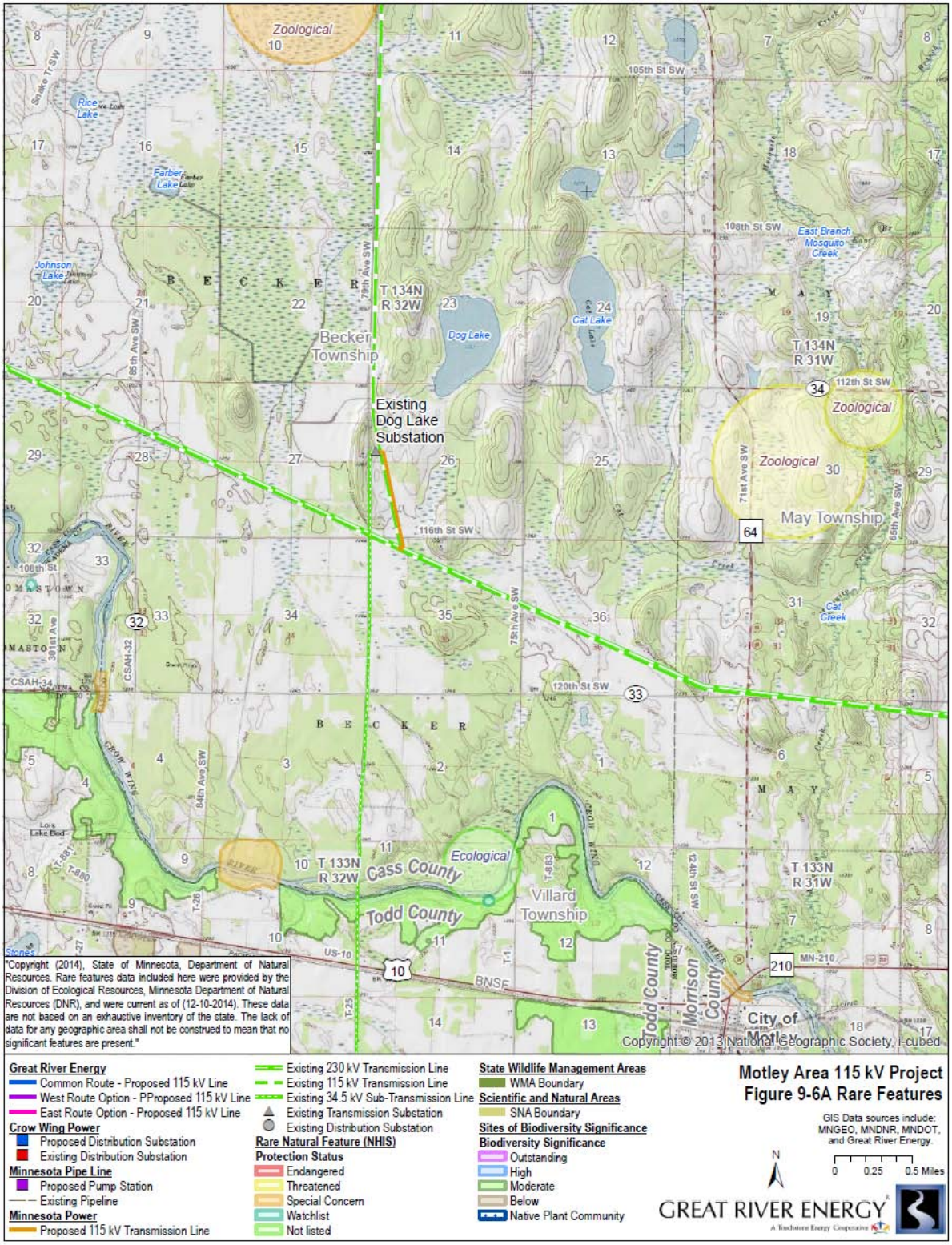


Figure 9-6B. Rare Features-North

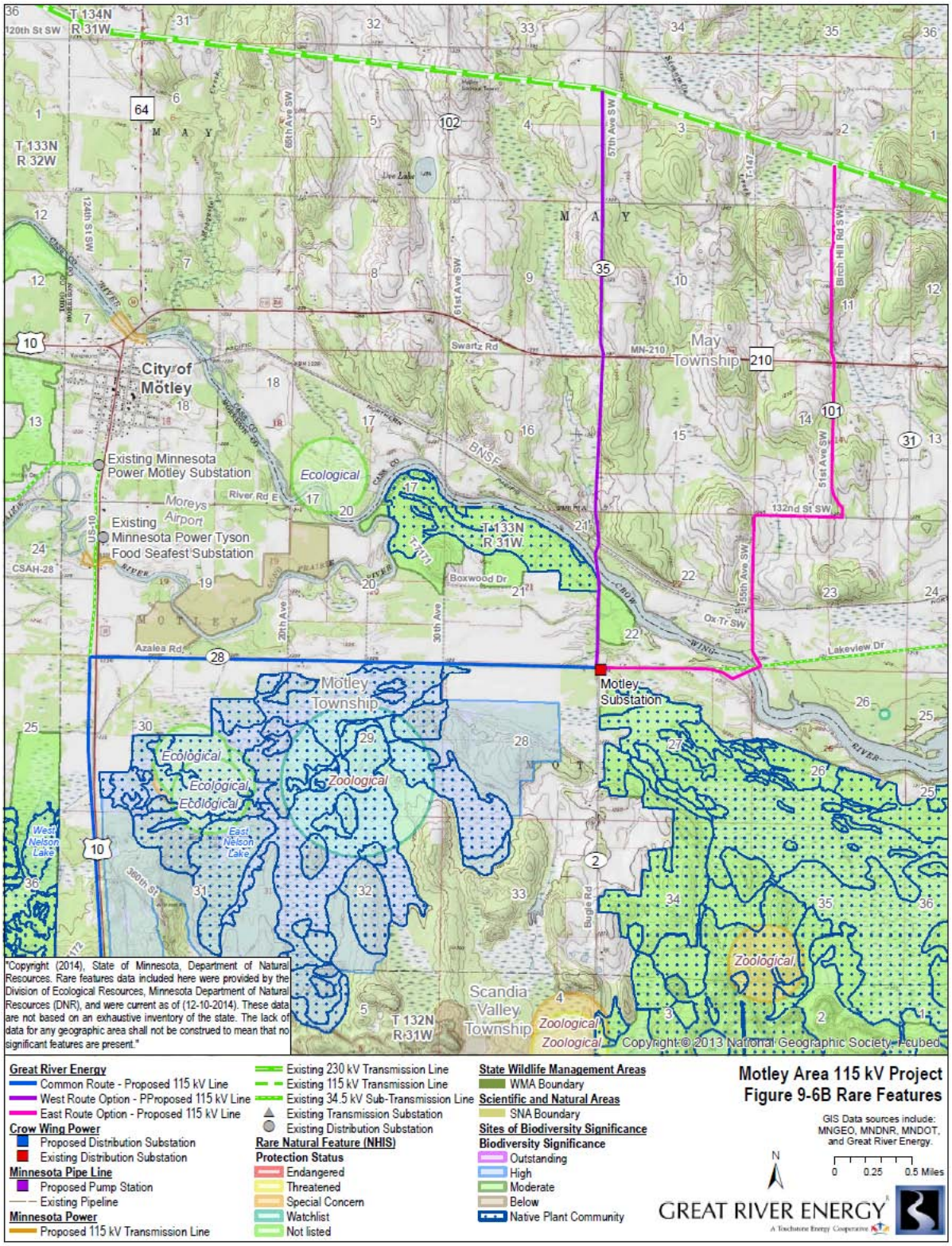
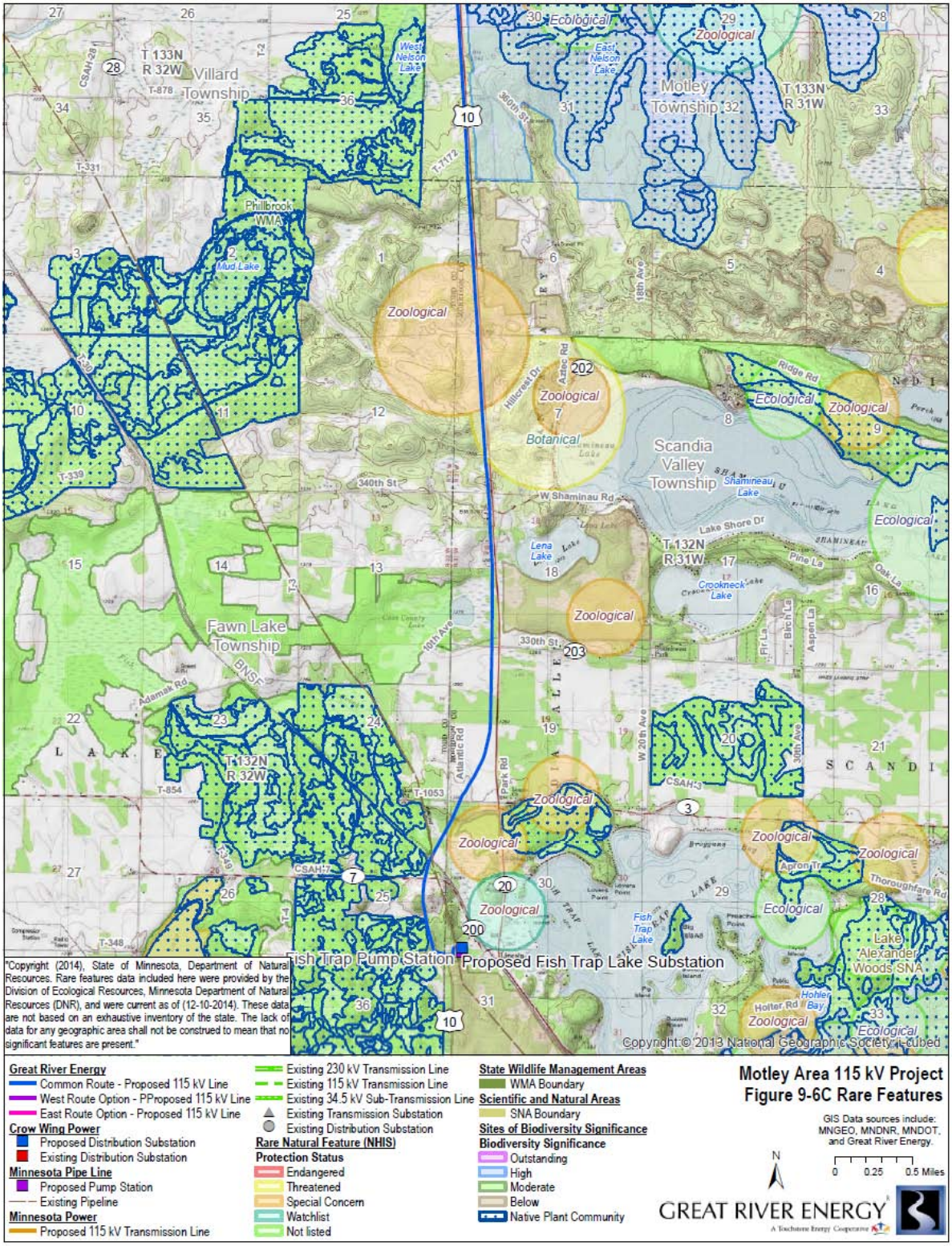


Figure 9-6C. Rare Features-South



9.8 Physiographic Features

9.8.1 Topography

The proposed Project lies within the Pine Moraines and Outwash Plains Subsection of the Laurentian Mixed Forest Province under the DNR Ecological Classification Systems.

The Laurentian Mixed Forest Province is characterized by broad areas of conifer forest, mixed hardwood and conifer forests, and conifer bogs and swamps. The landscape ranges from rugged lake-dotted terrain with thin glacial deposits over bedrock, to hummocky or undulating plains with deep glacial drift, to large, flat, poorly drained peatlands.

The Pine Moraines and Outwash Plains Subsection is a mix of outwash plains, end moraines, till plains, and drumlin fields.

The topography of the proposed routes is nearly level to rolling.

Impacts and Mitigation

Construction of the Project will not alter the topography along the routes; therefore, no mitigation is proposed.

9.8.2 Geology

Depth of glacial drift over bedrock in the Pine Moraines and Outwash Plains Subsection varies from 200 to over 600 feet, with the greatest depths in the southwestern portion of the subsection. Underlying bedrock is a variety of Precambrian rock. There are some localized cretaceous marine shale, sandstone and variegated shale in the southwestern portion of the subsection.

Impacts and Mitigation

Few geological constraints on design, construction, or operation are anticipated in the Project area. If dewatering is found to be necessary during construction (i.e., during pole embedding), the effects on water tables would be localized and short term, and would not affect geologic resources. Construction of the Project will not alter the geology along the routes; therefore, no mitigation is proposed.

9.8.3 Soils

USDA data were reviewed to describe the soil resources in the vicinity of the Project. Soils are generally grouped into categories known as “associations.” A soil association has a distinctive pattern of soils, relief and drainage, and is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. There are six soil associations along the proposed route. These soil associations are listed in **Table 9-13** and shown in **Figures 9-4A through 9-4C**.

Table 9-11. Soil Associations in the Vicinity of the Project

Soil Association
Menahga-Mahtomedi
Staples-Menahga-Huntersville
Menahga-Markey-Hubbard
Meehan-Markey
Zimmerman-Sartell-Rifle-Lino-Isanti
Mahtomedi-DeMontreville-Cushing

The U.S. Department of Agriculture describes these soil types as follows[38]:

https://soilseries.sc.egov.usda.gov/osdnamequery.asp

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed [02/23/2015].

> *The **Menahga** series consists of very deep, excessively drained to well drained soils that formed in sandy glacial outwash sediments on outwash plains, valley trains, and some moraines and drumlins. These soils have rapid permeability. Their slopes range from 0 to 55 percent. Mean annual precipitation is about 26 inches. Mean annual air temperature is about 42 degrees F.*
>
> *The **Mahtomedi** series consists of very deep, excessively drained, rapidly permeable soils formed in sandy outwash of Late Wisconsinan Age on glacial moraines and outwash plains. These upland soils have slopes ranging from 0 to 45 percent. Mean annual temperature is about 41 degrees F. Mean annual precipitation is about 28 inches.*
>
> *The **Staples** series consists of very deep, poorly drained soils formed in sandy glacial outwash and underlying a dense sandy loam till. It is deep to a densic contact. These soils are on glacial drumlins and ground moraines. They have rapid permeability in the upper part and very slow permeability in the dense underlying till. Slopes range from 0 to 2 percent. Mean annual air temperature is about 42 degrees F. Mean annual precipitation is about 22 inches.*
>
> *The **Huntersville** series consists of very deep, moderately well drained soils formed in sandy glacial outwash and underlying dense sandy loam till. It is deep to dense till-densic contact. These soils are on drumlins and moraines. They have rapid permeability in the sandy upper part and slow or very slow permeability in the dense underlying till. Slopes range from 1 to 6 percent. Mean annual air temperature is about 41 degrees F. Mean annual precipitation is about 27 inches.*

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[38] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed 02/23/2015. https://soilseries.sc.egov.usda.gov/osdnamequery.asp

*The **Markey** series consists of very deep, very poorly drained organic soils. They formed in herbaceous organic material 40 to 130 centimeters thick overlying sandy deposits in depressions on outwash plains, lake plains, flood plains, river terraces, valley trains, and moraines. Saturated hydraulic conductivity is moderately slow to moderately rapid in the organic layers and rapid or very rapid in the sandy material. Slopes range from 0 to 2 percent. Mean annual precipitation is about 760 millimeters. Mean annual air temperature is about 6 degrees C.*

*The **Hubbard** series consists of very deep, excessively and well drained soils that formed in sandy glacial outwash or sandy alluvial sediments of the Late Wisconsin glaciation. These soils are on slightly concave to convex slopes on outwash plains, valley trains and stream terraces. Slope ranges from 0 to 35 percent. Mean annual precipitation is about 730 millimeters. Mean annual air temperature is about 6 degrees C.*

*The **Meehan** series consists of very deep, somewhat poorly drained soils formed in sandy alluvium on outwash plains, stream terraces, beach ridges, and glacial lake plains. Permeability is rapid or very rapid. Saturated hydraulic conductivity is high or very high. Slopes range from 0 to 3 percent. Mean annual precipitation is about 30 inches near the type location. Mean annual air temperature is about 42 degrees F.*

*The **Zimmerman** series consists of very deep, excessively drained soils that formed in sandy glacial outwash or eolian sediments on glacial outwash plains, stream terraces, deltas, lake terraces, dunes, beach deposits and valley trains. These soils have rapid permeability. Their slopes range from 0 to 60 percent. Mean annual precipitation is about 28 inches. Mean annual air temperature is about 41 degrees F.*

*The **Sartell** series consists of very deep, excessively drained soils that formed in sandy eolian or glacial outwash sediments on outwash plains and valley trains. These soils have rapid permeability. Slope ranges from 0 to 25 percent. Mean annual precipitation is about 27 inches. Mean annual air temperature is about 43 degrees F.*

*The **Rifle** series consists of very deep, very poorly drained soils formed in organic deposits more than 51 inches thick in bogs and depressional areas within ground moraines, end moraines, outwash plains, and lake plains. These soils have moderately rapid permeability. Slopes range from 0 to 2 percent. Mean annual precipitation is about 30 inches and the mean annual temperature is about 42 degrees F.*

*The **Lino** series consists of very deep, somewhat poorly drained soils that formed in sandy glacial outwash or eolian sediments on outwash plains and valley trains. These soils have rapid permeability. Slopes range from 0 to 3 percent. Mean annual precipitation is about 26 inches. Mean annual air temperature is about 44 degrees F.*

*The **Isanti** series consists of very deep, poorly and very poorly drained soils that formed in sandy glacial outwash or eolian sediments on outwash plains and valley trains. These soils have moderately rapid or rapid permeability in the upper part and rapid permeability in the lower part. Slopes range from 0 to 2 percent. Mean annual precipitation is about 26 inches. Mean annual air temperature is about 44 degrees F.*

*The **DeMontreville** series consists of very deep, well drained and moderately well drained soils formed in a moderately thick sandy mantle of aeolian or glacial lacustrine or outwash sediments and the underlying loamy glacial till on glacial moraines. Permeability is rapid in the sandy mantle and moderately slow in the rest of the soil. These upland soils have slopes ranging from 1 to 45 percent. Mean annual temperature is about 41 degrees F. Mean annual precipitation is about 29 inches.*

*The **Cushing** series consists of very deep, well drained soils that formed in loamy calcareous till on ground moraines. These soils have moderate permeability in the solum and moderately slow in the underlying till. Slopes range from 20 to 35 percent. Mean annual precipitation is about 30inches. Mean annual air temperature is about 43 degrees F.*

Impacts and Mitigation

Potential impacts of construction are compaction of the soil and exposing the soils to wind and water erosion. Impacts to physiographic features should be minimal during and after installation of the transmission line structures, and these impacts will be short term. There should be no long-term impacts resulting from this Project.

Soils will be revegetated as soon as possible to minimize erosion or some other method used during construction to prevent soil erosion.

If over an acre of soil will be disturbed during the construction of the transmission line, Great River Energy will obtain a NPDES construction stormwater permit from the MPCA and will prepare a SWPPP. Erosion control methods and BMPs will be utilized to minimize runoff during line construction.

Figure 9-7A. Soils-Dog Lake Substation

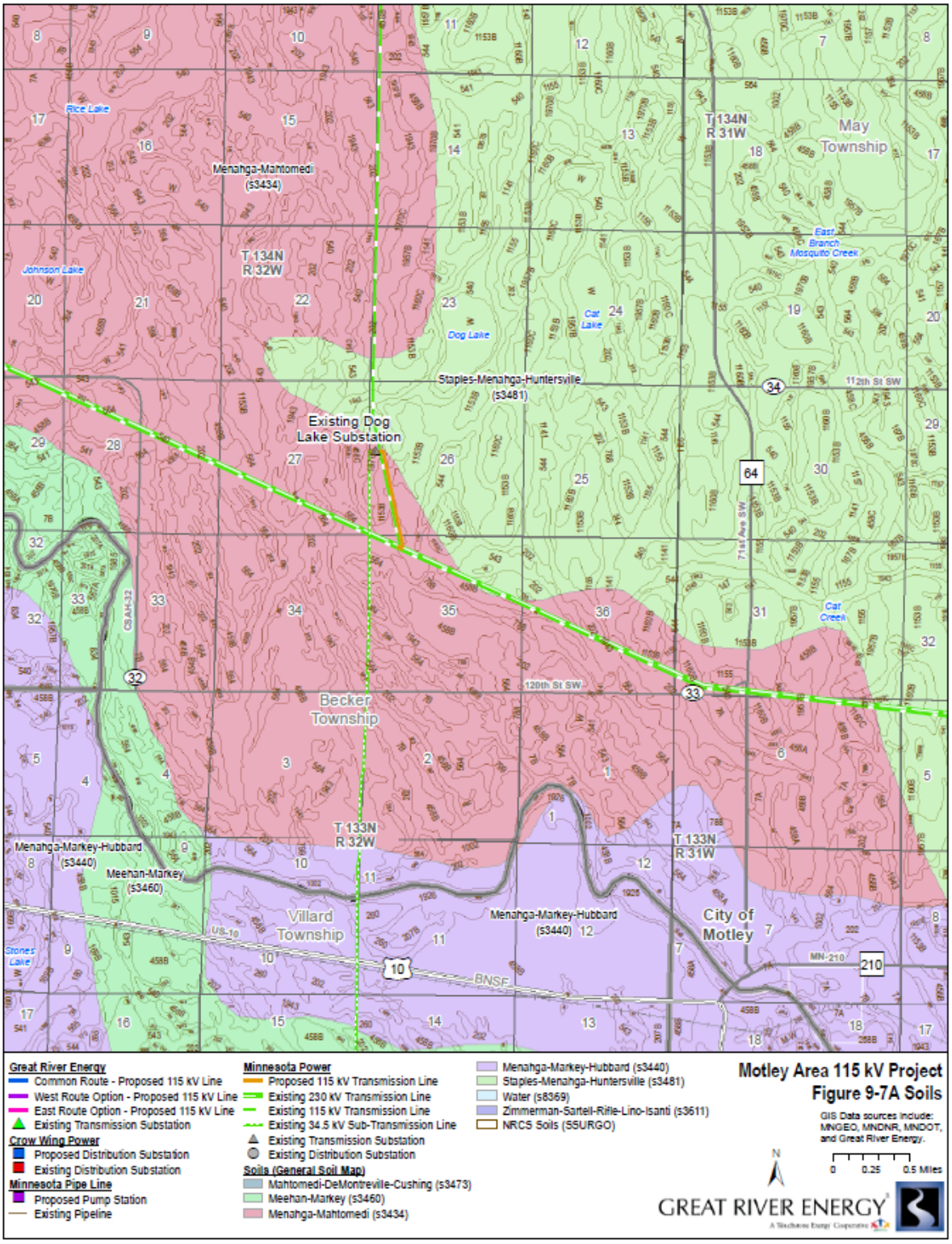


Figure 9-7B. Soils-North

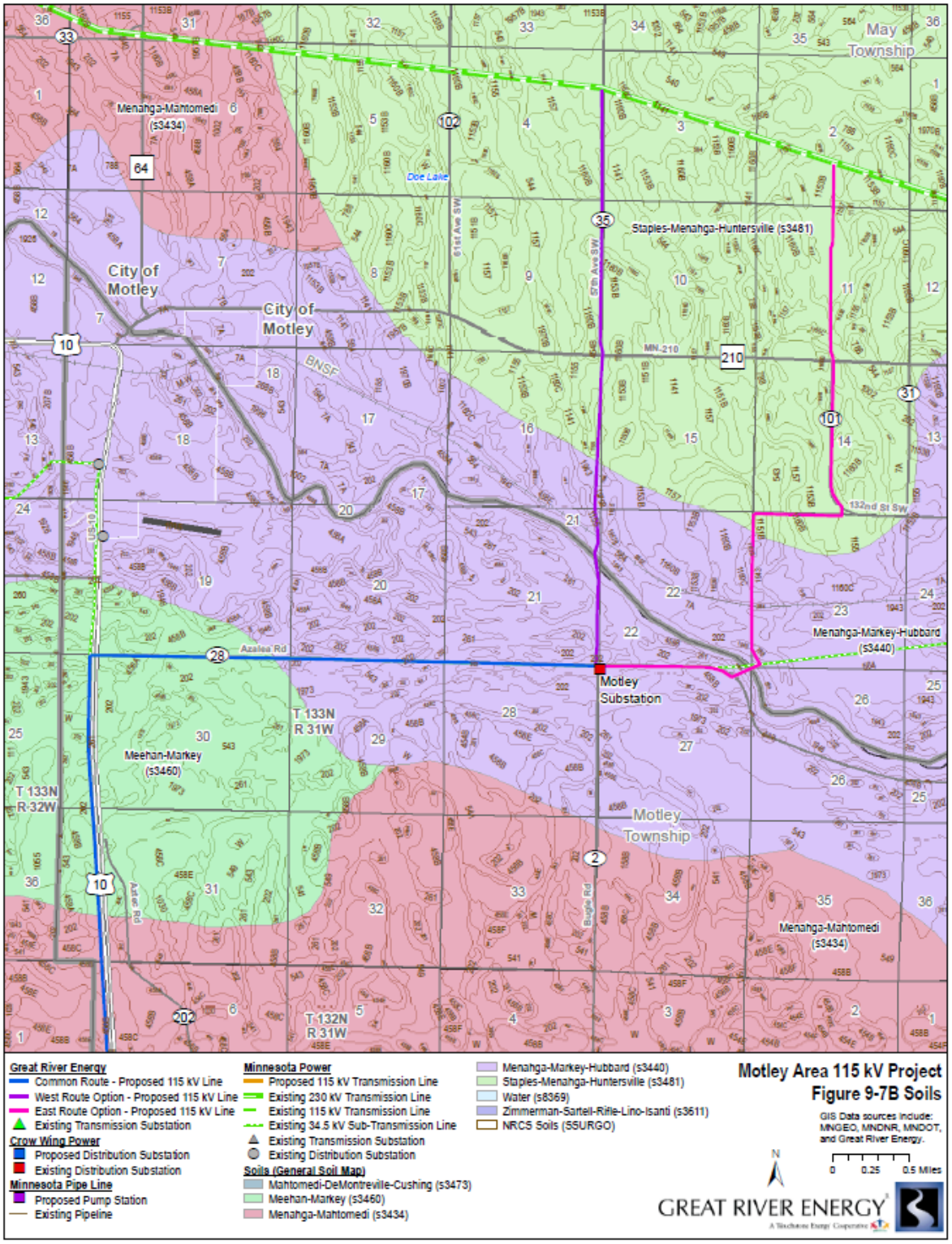
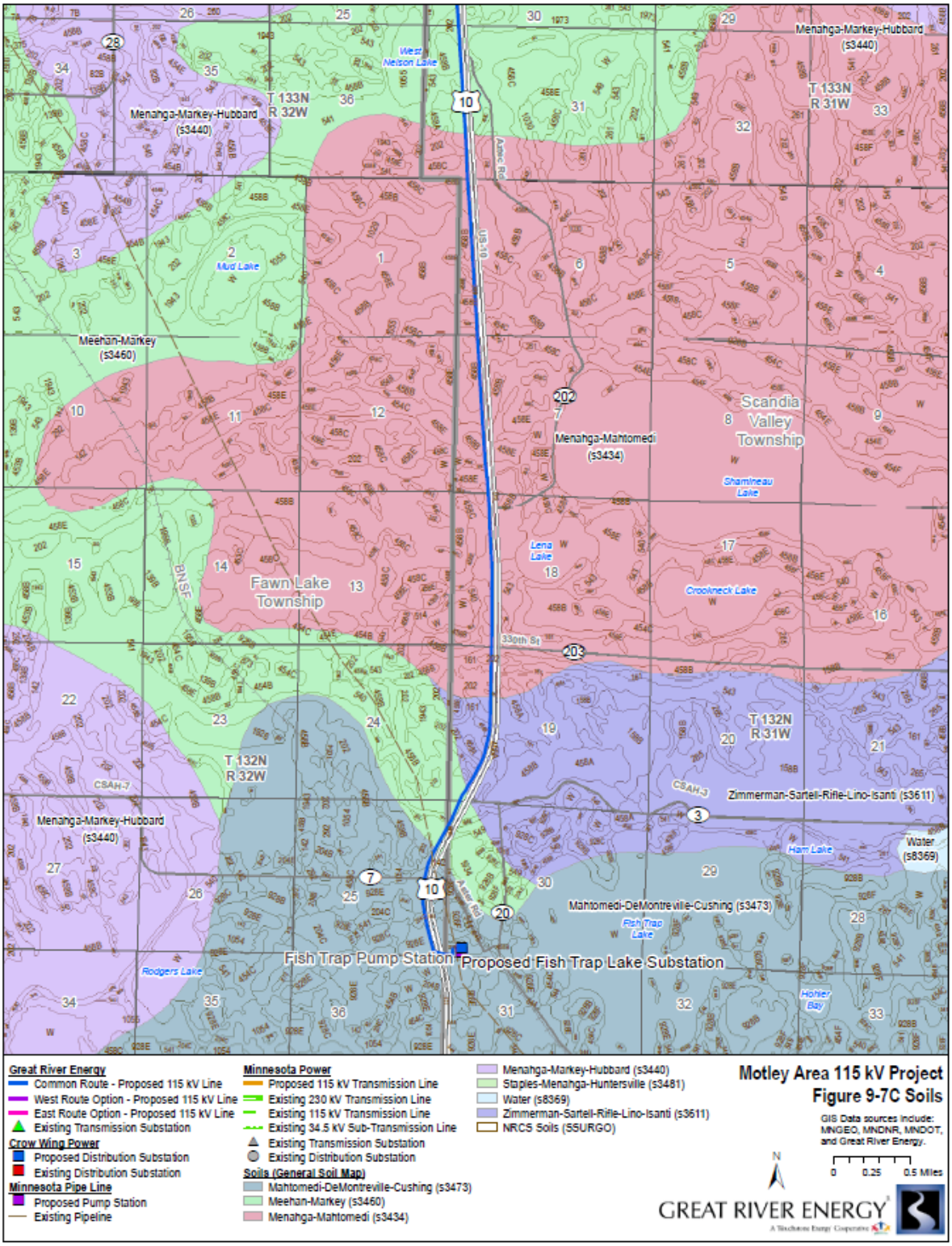


Figure 9-7C. Soils-South



9.9 Unavoidable Impacts

Construction of the Motley Area 115 kV Project will have nominal unavoidable impacts.

The significant ROW sharing (utility and road) associated with the Project would mitigate the direct impacts associated with the new line construction.

The Project will require only minimal commitments of resources that are irreversible and irretrievable. Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible commitments of resources are those that result from the use or destruction of a specific resource that cannot be replaced within a reasonable time frame. Irretrievable resource commitments are those that result from the loss in value of a resource that cannot be restored after the action.

Those commitments that do exist are primarily related to construction. Construction resources include aggregate resources, concrete, steel, and hydrocarbon fuel. During construction, vehicles necessary for these activities would be deployed on site and would need to travel to and from the construction area, consuming hydrocarbon fuels. Other resources would be used in pole construction, pole placement, and other construction activities.

10 APPLICATION OF RULE CRITERIA

10.1 Certificate of Need

The Commission has established in its rules (Minn. R. 7849.0120) the criteria that it will apply to determine whether an applicant has established that a new proposed large energy facility is needed. Great River Energy and Minnesota Power have described in this Application the reasons why a CON should be granted to build the Motley Area Project. Those reasons are summarized below.

10.1.1 Denial Would Adversely Affect the Energy Supply

The proposed Project is required to serve the proposed new MPL Fish Trap pump station (10 MW load) and to address low system voltages in the affected load area near Motley, Minnesota.

MPL Pump Station

The existing Dog Lake-Baxter 34.5 kV system does not have the capacity to serve 10 MW of new electrical demand. Although transition of Great River Energy's Motley load from the 34.5 kV system to a new 115 kV system creates capacity on the Hubbard-Verndale 34.5 kV system, it is not nearly enough capacity to serve the proposed MPL pump station load; therefore, a larger voltage source (115 kV) is needed to provide reliable electric service to the pump station.

The Project as proposed will provide a reliable source of electricity to the proposed MPL Fish Trap pump station. Denial of the Project would prevent MPL from meeting the objective of their MPL Reliability Project, which is to increase the pump capacity on MPL Line 4 to maintain reliable crude oil supplies to Minnesota refineries.

System Overloads

System overload concerns in the Motley area are due to the growth of the peak electrical demand that has surpassed the level that can be served, and the age of the 34.5 kV transmission lines combined with the overall length of the 34.5 kV network. The load area served from the Dog Lake-Baxter 34.5 kV system has shown modest growth in the past ten years. As discussed in **Section 5.6**, the load area is growing at a weighted annual average rate of about one percent.

Transmission line and transformer overloads concerns relate to the amount of current operating through the conductor. Electrical equipment requires sufficient current to function properly. Conductors are rated to allow a certain amount of current to be carried. As electrical demand grows or when additional equipment is connected to the system, the conductor continues to supply the required current until the conductor reaches its maximum rating. An overload situation occurs when the conductor transfers current above its rating. In an overload situation, a

conductor can heat up and begin to sag. Similarly, a transformer can overload and cause loss of life and/or fail catastrophically. If the overload condition is great enough or prolonged enough, the conductor can break. A break in a conductor can cause service interruption, equipment damage, or other system concerns.

Load growth is occurring in the affected load area, which is not the result of promotional activities by Applicants. Forecasts modeled by Applicants are reasonable and supported by both the historic data and load forecasts; there is a demonstrated need for improved service in the area.

The proposed Project is designed to address the low voltage issues, and denial of the Project would adversely affect the reliable electric service to the affected load area.

10.1.2 There is No Reasonable and Prudent Alternative

Applicants have proposed the most efficient and cost effective way to provide electrical service for a new pump station load and to address transmission low system voltages in the affected load area. As discussed in this application, the 34.5 kV system is not a robust enough voltage to serve the existing native load along with the 10 MW pump station. A complete rebuild of the Dog Lake-Baxter 34.5 kV system still would not achieve the end goal of serving the pump station; therefore, the proposed Project is the most cost effective way to serve both the native load growth and the large industrial MPL pump station.

Applicants considered a number of alternatives to the Project, including various generation options, different transmission scenarios, and a no-build alternative focusing on reactive power supply improvements and conservation/demand side management. Applicants deemed all of these alternatives inferior to the proposed Project as discussed in **Chapter 6**.

10.1.3 The Project will Protect the Environment and Provide Benefits

With the exception of the crossing of Crow Wing River under the West Route Option, the entirety of the Project overtakes or is adjacent to existing road ROW or electric sub-transmission and distribution lines. Further, the Project is located in a rural setting with a low density of residential and commercial development. Given the Project route relies heavily on existing corridor developments and the low density for of other human developments, impacts should be minimal. Applicants are working with the DNR, USFWS, Corps and other agencies to ensure that natural resources are protected.

The Project will be a reliable solution for the pump station and the affected load area because the lines will operate nearly continuously for decades. There can be no doubt that the Project will benefit customers in the service area by ensuring an adequate power supply for years to come.

10.1.4 The Project will Comply with All Applicable Requirements

Applicants have identified other permits and approvals that may be required for the Project in **Section 2.5**. Applicants have demonstrated that they will comply with all applicable requirements and obtain all necessary permits.

10.2 Route Permit

According to Minnesota Statutes Section 216E.02, subd. 1, it is the policy of the state of Minnesota to locate high voltage transmission lines in an orderly manner that minimizes adverse human and environmental impacts and ensures continuing electric power system reliability and integrity. The Commission has promulgated standards and criteria for issuing route permits (Minn. R. 7850.4000). That rule provides that the Commission shall issue route permits for high voltage transmission lines that are consistent with state goals to conserve resources, minimize environmental impacts and impacts to human settlement, minimize land use conflicts, and ensure the state's electric energy security through efficient, cost-effective transmission infrastructure.

The 115 kV transmission proposed for the Motley Area Project satisfies all the criteria that are applied in evaluating a new transmission line project. Following an existing distribution lines and road ROW for the majority of the Project conserves resources and minimizes environmental impacts and other impacts. Constructing the lines at 115 kV capability helps ensure a reliable and secure power source in the area served by these lines. It is less expensive and less intrusive than other alternatives.

For all the reasons described in this Application, and summarized in **Section 10.1** regarding the reasons why a CON should be issued, the Commission should also issue a Route Permit.

10.3 Conclusion

Great River Energy and Minnesota Power respectfully request that the Commission issue a Certificate of Need authorizing construction of approximately 15.5 to 16.5 total miles of 115 kV transmission line between the existing Minnesota Power 115 kV "24 Line" and the new Fish Trap Substation, construction of the new Fish Trap Substation, modifications to the existing Dog Lake Substation, conversion of the Motley Substation 34.5 kV to 115 kV, and installation of a switch to accommodate a future Shamineau Substation.

In addition, Great River Energy and Minnesota Power request that the Commission issue a Route Permit at the same time that designates the route for the 115 kV transmission line and sites for the new Fish Trap Lake Substation. Applicants request that the Commission designate a route wider than the necessary ROW for the Project, to allow flexibility in determining the precise location of the transmission centerline and structures.

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