GREAT RIVER ENERGY

and

MINNESOTA POWER

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

SAVANNA PROJECT

115 KILOVOLT TRANSMISSION LINE REBUILD
AND
NEW SAVANNA SWITCHING STATION

DOCKET NOS.
ET-2, E015/CN-10-973
ET-2, E015/TL-10-1307

GREAT RIVER ENERGY[SM]
A Touchstone Energy® Cooperative

® minnesota power
AN ALLETE COMPANY

February 10, 2011

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LIST OF ACRONYMS

ACRONYMS	
AC	Alternating current
ACSR	Aluminum conductor steel reinforced
ACSS	Aluminum conductor steel supported
ALJ	Administrative Law Judge
BMPs	Best Management Practices
BNSF	Burlington Northern Santa Fe
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
dBA	Decibel – A weighted
DC	Direct current
DNR	Minnesota Department of Natural Resources
DSM	Demand Side Management
EA	Environmental Assessment
ECE	East Central Energy
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
IMDs	Implantable medical devices
kV	Kilovolt
kV/m	Kilovolts per meter
LCP	Lake Country Power
LHVTL	Large High Voltage Transmission Line
mA	MilliAmperes
mG	Milligauss
MHS	Minnesota Historical Society
MISO	Midwest Independent Transmission System Operator
MLEC	Mille Lacs Energy Cooperative
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MRO	Midwest Reliability Organization
MW	Megawatt
MWh	Megawatt hours
NAC	Noise area classifications
NESC	National Electrical Safety Code

ACRONYMS	
NIEHS	National Institute of Environmental Health Sciences
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OES	Office of Energy Security
PWI	Public Waters Inventory
ROW	Right-of-Way
SHPO	State Historic Preservation Office
SNA	Scientific and Natural Area
SPCC	Spill Prevention Control and Countermeasure
SWPPP	Stormwater Pollution Prevention Plan
USFWS	United States Fish and Wildlife Service
WMA	Wildlife Management Area

1 EXECUTIVE SUMMARY

1.1 Introduction

Great River Energy and Minnesota Power (Applicants) are applying to the Minnesota Public Utilities Commission for a Certificate of Need and a Route Permit to construct the new Savanna 115 kilovolt (kV) Switching Station near Floodwood, Minnesota, and to rebuild approximately 37 total miles of existing 69 kV transmission line to 115 kV specifications between:

- Lake Country Power's existing Cedar Valley Substation and the new Savanna Switching Station, and
- The Savanna Switching Station, Lake Country Power's existing Gowan Substation, and Great River Energy's existing Cromwell Substation.

The Applicants propose to construct the 115 kV lines along the same route as the existing 69 kV line and to construct the new Savanna Switching Station in Section 32 of Van Buren Township, a few miles northeast of Floodwood, Minnesota. The Applicants anticipate start of construction as early as late 2011, completion and energization of the segment between the Cedar Valley Substation and the Savanna Switching Station in 2012, and completion and energization of the rest of the Project by the fourth quarter of 2014.

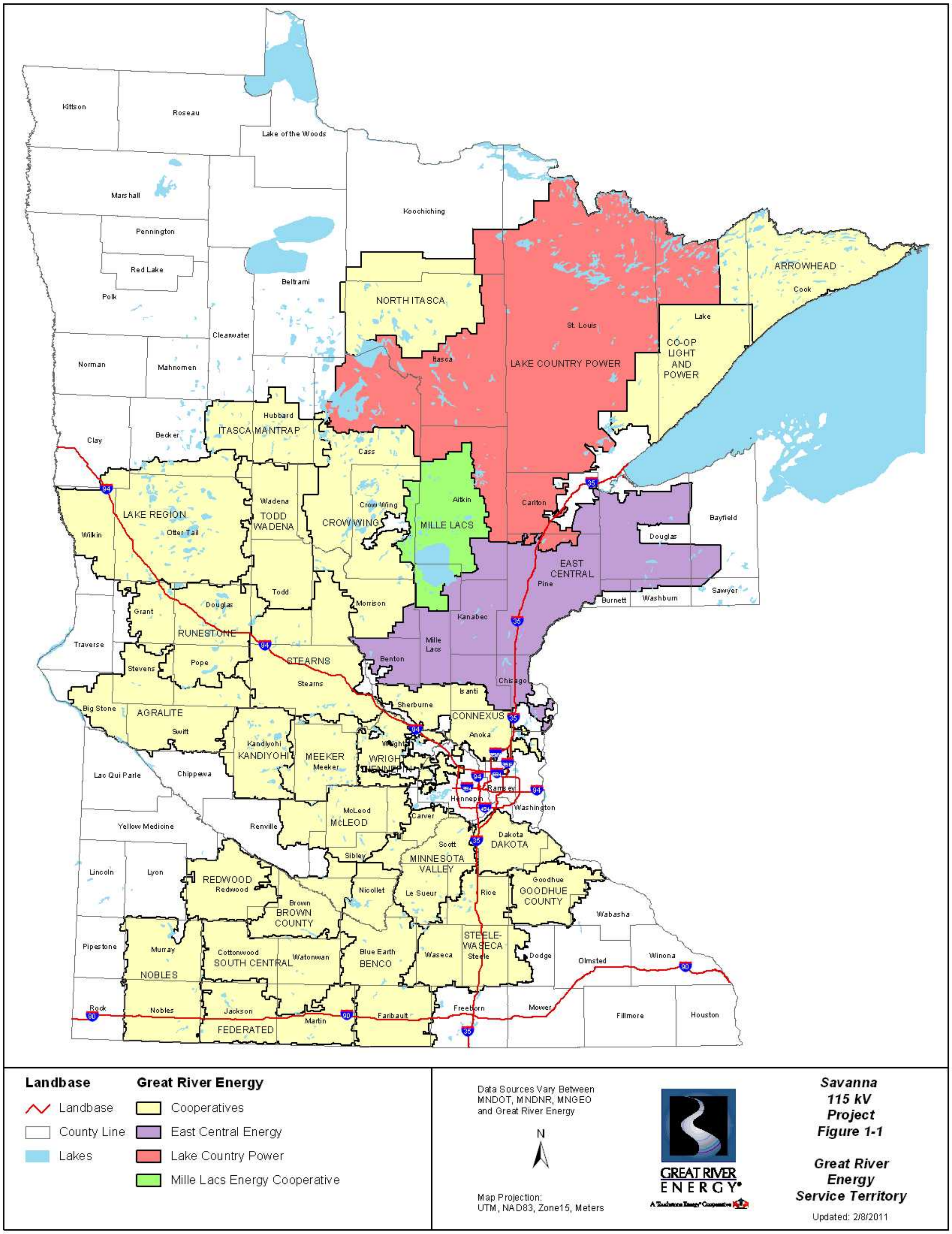
1.2 Great River Energy

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 Lake Country Power, Mille Lacs Energy Cooperative, and East Central Energy, the distribution cooperatives serving the area proposed to be supplied by the new transmission lines (Figure 1-1). Great River Energy's distribution cooperatives, in turn, supply electricity and related services to more than 639,000 residential, commercial, and industrial customers in Minnesota and Wisconsin.

Lake Country Power, Mille Lacs Energy Cooperative, and East Central Energy provide electricity and related services to approximately 112,000 residential, commercial and industrial customers in Minnesota. Over 13,000 residential, commercial and industrial members of these cooperatives would benefit from the proposed high voltage transmission lines.

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 3100 megawatts). Great River Energy owns approximately 4,500 miles of transmission line in Minnesota, North Dakota, South Dakota, and Wisconsin.

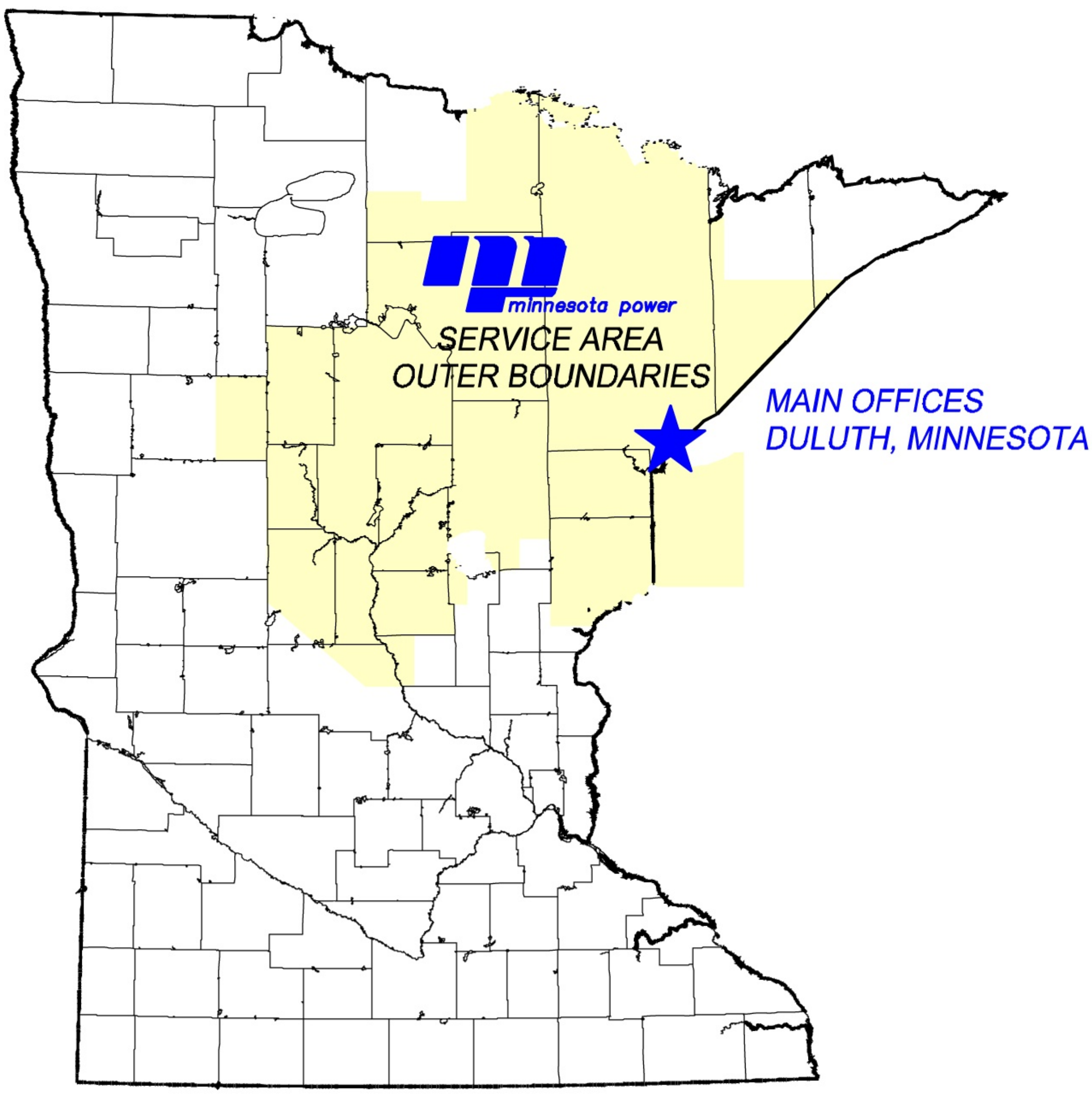
Great River Energy's transmission network is interconnected with the regional transmission grid to promote reliability and Great River Energy is a member of the Midwest Reliability Organization and the Midwest Independent Transmission System Operator.


Kittson
Roseau
Lake of the Woods
Marshall
Koochiching
Pennington
Red Lake
Beltrami
Polk
NORTH ITASCA
ARROWHEAD
Cook
Lake
St. Louis
CO-OP LIGHT AND POWER
Clearwater
Itasca
LAKE COUNTRY POWER
Norman
Mahnomen
Hubbard
ITASCA MANTRAP
Clay
Becker
Cass
Wadena
TODD WADENA
Crow Wing
CROW WING
Aitkin
MILLE LACS
Carlton
Bayfield
Wilkin
LAKE REGION
Otter Tail
Douglas
EAST CENTRAL
Pine
Sawyer
Burnett
Washburn
Todd
Morrison
Grant
Douglas
Kanabec
RUNESTONE
Traverse
Mille Lacs
Benton
Stevens
Pope
STEARNS
Stearns
Chisago
Isanti
Big Stone
AGRALITE
Sherburne
CONNEXUS
Swift
Anoka
Kandiyohi
KANDIYOHI
MEEKER
Meeker
Wright
Lac Qui Parle
Chippewa
Hennepin
Ramsey
Washington
McLeod
McLEOD
Carver
Yellow Medicine
Renville
Dakota
DAKOTA
Scott
Sibley
MINNESOTA VALLEY
Lincoln
Lyon
REDWOOD
Redwood
Goodhue
GOODHUE COUNTY
Nicollet
Le Sueur
Rice
Brown
BROWN COUNTY
Wabasha
Pipestone
Murray
Cottonwood
SOUTH CENTRAL
Watonwan
Blue Earth
BENCO
Waseca
STEELE-WASECA
Steele
Dodge
Olmsted
Winona
NOBLES
Rock
Nobles
Jackson
FEDERATED
Martin
Faribault
Freeborn
Mower
Fillmore
Houston
Landbase
Great River Energy
Landbase
County Line
Lakes
Cooperatives
East Central Energy
Lake Country Power
Mille Lacs Energy Cooperative
Data Sources Vary Between MNDOT, MNDNR, MNGEO and Great River Energy
N
Map Projection: UTM, NAD83, Zone15, Meters
GREAT RIVER ENERGY
Savanna 115 kV Project Figure 1-1
Great River Energy Service Territory
Updated: 2/8/2011

1.3 Minnesota Power

Minnesota Power is an investor-owned public utility headquartered in Duluth, Minnesota. Minnesota Power supplies retail electric service to 136,000 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 Midwest Reliability Organization and the Midwest Independent Transmission System Operator.

Figure 1-2 Minnesota Power Service Territory



1.4 Project Contacts

Contacts for the Savanna Project are:

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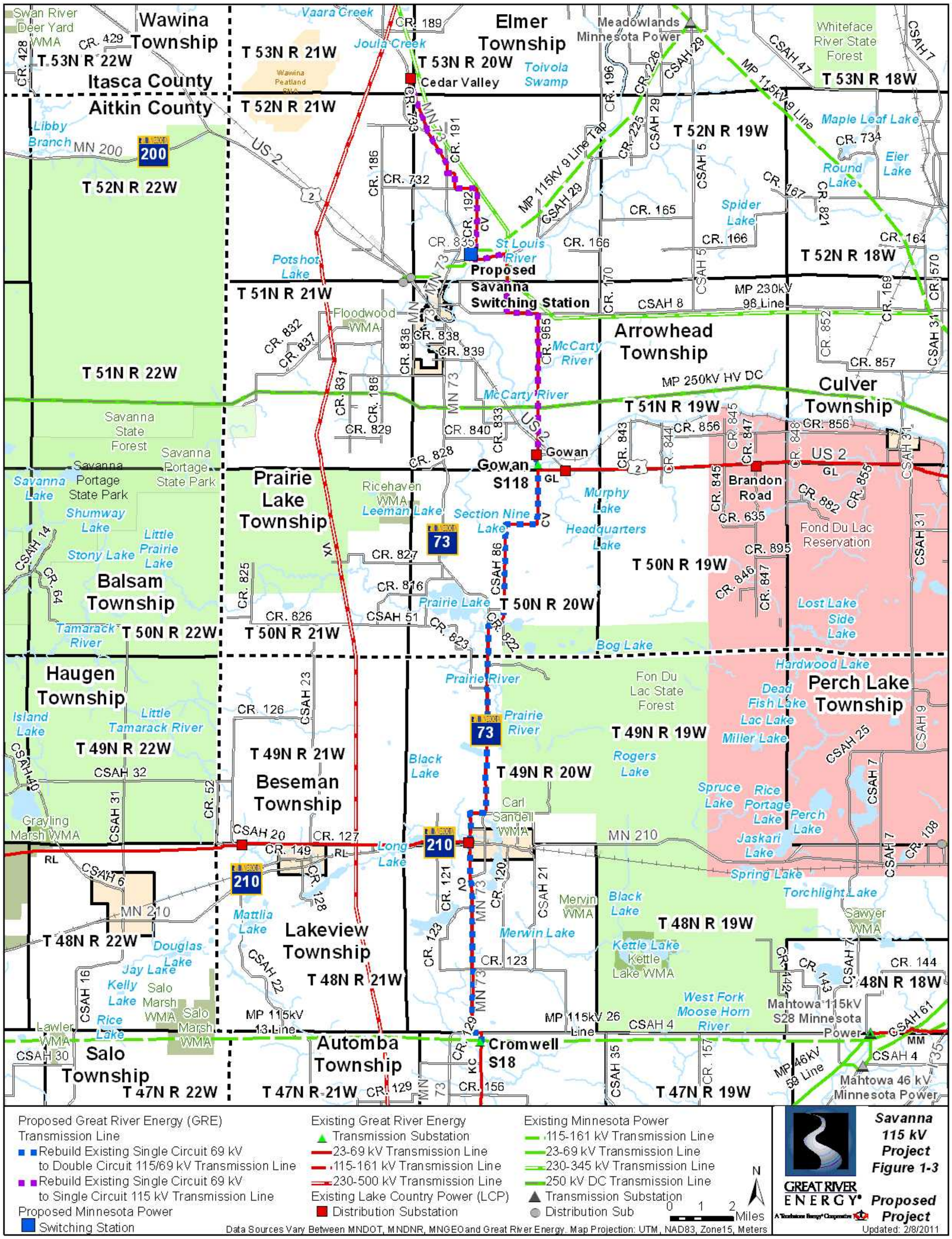
1.5 Proposed Project

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. The corridor studied and the proposed route are shown on Figure 1-3. The proposed plan to address the transmission system voltage issues in the area includes:

- Construct the new Savanna 115 kV Switching Station in Section 32 of Van Buren Township.
- Rebuild approximately seven miles of existing Great River Energy 69 kV transmission line to single circuit 115 kV between Lake Country Power's existing Cedar Valley Substation in Cedar Valley Township and the new Savanna Switching Station.
- Rebuild approximately nine miles of existing Great River Energy 69 kV transmission line to single circuit 115 kV between the new Savanna Switching Station and Lake Country Power's existing Gowan Substation in Floodwood Township.
- Rebuild approximately 21 miles of existing Great River Energy 69 kV transmission line to double circuit 115/69 kV between the Lake Country Power Gowan Substation and Great River Energy's existing Cromwell Substation in Kalevala Township.
- Modify the Lake Country Power Cedar Valley Substation and Great River Energy Cromwell Substation to accommodate the 115 kV transmission lines.


Savanna 115 kV Project
Figure 1-3
Proposed Project
Updated: 2/8/2011
Proposed Great River Energy (GRE) Transmission Line
Rebuild Existing Single Circuit 69 kV to Double Circuit 115/69 kV Transmission Line
Rebuild Existing Single Circuit 69 kV to Single Circuit 115 kV Transmission Line
Proposed Minnesota Power
Switching Station
Existing Great River Energy
Transmission Substation
23-69 kV Transmission Line
115-161 kV Transmission Line
230-500 kV Transmission Line
Existing Lake Country Power (LCP)
Distribution Substation
Existing Minnesota Power
115-161 kV Transmission Line
23-69 kV Transmission Line
230-345 kV Transmission Line
250 kV DC Transmission Line
Transmission Substation
Distribution Sub
0 1 2 Miles
N
GREAT RIVER ENERGY
Data Sources Vary Between MNDOT, MNDNR, MNGEO and Great River Energy. Map Projection: UTM, NAD83, Zone15, Meters
Wawina Township
Itasca County
Aitkin County
Elmer Township
Arrowhead Township
Culver Township
Prairie Lake Township
Balsam Township
Haugen Township
Beseman Township
Perch Lake Township
Lakeview Township
Automba Township
Salo Township
Proposed Savanna Switching Station
Cedar Valley
Gowan
Gowan S118
Brandon Road
Cromwell S18
Meadowlands Minnesota Power
Mahtowa 115kV S28 Minnesota Power
Mahtowa 46 kV Minnesota Power
Fond Du Lac Reservation
Savanna State Forest
Savanna Portage State Park
Fon Du Lac State Forest
Whiteface River State Forest
MP 115kV 9 Line
MP 115kV 9 Line Tap
MP 230kV 98 Line
MP 250kV HV DC
MP 115kV 13 Line
MP 115kV 26 Line
MP 46kV 59 Line
US 2
MN 73
MN 200
MN 210
T 53N R 22W
T 53N R 21W
T 53N R 20W
T 53N R 18W
T 52N R 22W
T 52N R 21W
T 52N R 19W
T 52N R 18W
T 51N R 22W
T 51N R 21W
T 51N R 19W
T 50N R 22W
T 50N R 21W
T 50N R 20W
T 50N R 19W
T 49N R 22W
T 49N R 21W
T 49N R 20W
T 49N R 19W
T 48N R 22W
T 48N R 21W
T 48N R 19W
T 48N R 18W
T 47N R 22W
T 47N R 21W
T 47N R 19W

This Project will result in a new 115 kV line between the proposed Savanna Switching Station and the Cedar Valley Substation, a new 115 kV line between the Savanna Switching Station and the Cromwell Substation, and an upgraded 69 kV line between the Gowan Substation and the Cromwell Substation.

The transmission lines lie entirely in Minnesota in St. Louis and Carlton counties. Single-pole wood structures with horizontal post insulators will be used for most of the rebuild. Laminated wood poles or steel poles may be required in some locations (angle poles or areas where soil conditions are poor and guying is not practical), and two pole H-Frame structures may used in some areas. Typical pole heights will range from 60-85 feet above ground and the average span would be 350 to 400 feet for single pole structures and 600 to 800 feet for H-Frame structures.

Small sections of the existing line near the two St. Louis River crossings have distribution underbuild on them, which would be attached to the new 115 kV transmission line structures. The average span for these structures would be approximately 250 to 350 feet.

The Applicants propose that the majority of the new lines would follow the alignment of the existing 69 kV lines. A 15-foot offset from the existing pole locations may be required in some areas. The necessary easement width is 50 feet on each side of the transmission centerline; however, in areas where the line follows an existing distribution line or roadway, the easement may overlap with existing easements and/or the road right-of-way. Great River Energy has existing easements for the majority of the 69 kV line and anticipates that only minimal additional property will be required for the 115 kV Project. Great River Energy intends to enter into new easements or amendments of the existing easements with landowners to update the language to reflect typical provisions included in today's easements.

The Project will cost approximately $29 million dollars.

1.6 Project Need and Purpose

The region generally bound by Duluth, Grand Rapids, and Brainerd (including the cities and towns of Cromwell, Mahtowa, McGregor, Tamarack, Aitkin, Palisade, Floodwood, Gowan, and Cedar Valley) has experienced moderate growth in electric demand since 2005. This increasing demand is leading to electric reliability concerns to the 69 kV and 115 kV electric transmission systems that serve the area as these systems are reaching their capacity to handle additional loading. Any additional demand placed on these systems, including projected industrial expansion in the City of Floodwood, would exacerbate electrical reliability concerns and could potentially lead to line overloads and inability to maintain adequate voltage.

The North American Electric Reliability Council, which develops standards for implementing secure and safe electrical delivery, mandates that certain levels of service be maintained to ensure that the transmission grid operates efficiently and reliably. In addition, electric utilities like Great River Energy and Minnesota Power are responsible for maintaining power quality at a level that prevents damage to all consumers' electrical equipment. Based on these mandates, transmission improvements have become necessary to maintain the reliability and quality of electric service for this region.

1.7 Proposed Route

The Applicants propose that the new lines follow the same route that the existing Great River Energy 69 kV lines presently follow (Figure 1-3).

On the north end of the Project, the first new 115 kV line begins at the Cedar Valley Substation in Section 36 of Cedar Valley Township. The line follows Highway 73 for approximately four miles, goes cross country east ¼ mile then south ½ mile to County Road (CR) 732, follows CR 732 for ¾ mile, turns south along CR 192 for approximately two miles, then connects into the new Savanna Switching Station. The second new 115 kV line exits the Savanna Switching Station and runs south about ¼ mile to County State Aid Highway (CSAH) 29, follows CSAH 29 east for one mile, then turns south across the St. Louis River to Hill Road. The line follows Hill Road south for two miles, turns east on CSAH 8 for one mile, turns south along CR 965 for approximately 3.5 miles, then continues cross county for about one mile across the St. Louis River and the Burlington Northern Santa Fe railroad tracks to Hingley Road. It follows Hingley Road for about ½ mile to the Lake Country Power Gowan Substation, where double circuit 115/69 kV construction will begin. For this single circuit portion of the Project, the spans will be longer and fewer poles will be required.

The second 115 kV line (now on double circuit structures with the upgraded 69 kV line) continues south past the Lake Country Power Gowan Substation along Hingley Road for 1.75 miles, turns west along CSAH 86 for one mile, then turns south along Hingley Road again for approximately three miles. The line then goes cross country to the southwest for about ¼ mile, goes west along CR 822 for about ½ mile, then turns south along Highway 73 for six miles. The line turns west for ½ mile along CR 122, turns south for two miles (cross country), then follows Highway 73 again south for five miles. The line turns east for ¼ mile along CSAH 4, and then turns south for ½ mile along CR 129 into the Great River Energy Cromwell Substation.

1.8 Alternatives

Great River Energy and Minnesota Power considered several alternatives to the proposed Project, including: 1) a new local generation alternative; 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. Alternatives to the proposed Project are discussed further in Section 6.

1.9 Potential Environmental Effects

The Applicants analyzed the potential environmental effects from the proposed Project. No significant unavoidable impacts will result from upgrading the line to 115 kV specifications or from construction of the new Savanna Switching Station.

No homeowners will be displaced by the transmission line rebuild or the new substation. All agricultural land impacted during construction will be returned to its natural condition as nearly as possible 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 route.

The Department of Commerce, Office of Energy Security will prepare its own Environmental Assessment analyzing potential environmental impacts from the Project.

1.10 Public Involvement

The Applicants held an open house on October 26, 2010, at the Fine Lakes Township Hall to provide information about the Project to the public. Nine members of the public, including governmental officials, attended the open house. Inquiries included whether the transmission line will go through their property, tree removal, Project schedule, and compensation for easements. The Applicants notified tribal and local governmental units of the Project and open house and received no requests for a preapplication consultation meeting. The need for the Project has also been discussed in the Minnesota Biennial Transmission Projects Report since 2003 (Tracking Numbers 2003-NE-N2 and 2003-NE-N8).

The public will have an opportunity to review this application and submit comments to the Commission about the Project. A copy of the application will be available on the Commission e-filings webpage and on the Great River Energy and Minnesota Power webpages at: www.greatriverenergy.com and www.mnpower.com.

A public meeting will be held in the area by the Office of Energy Security within 60 days of acceptance of this application to answer questions about the Project and to solicit public comments and suggestions for matters to examine in the Environmental Assessment. In a few months, after the Environmental Assessment is completed, the Commission will conduct a public hearing in the area at which the Applicants will present evidence and the public will have an opportunity to ask questions and submit comments. The Applicants anticipate that the Commission will hold a joint public hearing on both the Certificate of Need and the Route Permit pursuant to Minn. Stat. § 216B.243, subd. 4.

Persons interested in receiving notices and other announcements about the Project can register their names and addresses with the Commission. Persons can register electronically at: http://energyfacilities.puc.state.mn.us/mailinglist.html.

1.11 Conclusion

The Commission has established criteria in Minn. Rules 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. The Applicants have demonstrated in the Application that Project's proposed transmission upgrades meet all the requirements required to obtain a Certificate of Need. The Project will provide a reliable, cost-effective power supply to customers in the area.

With regard to route selection for high voltage transmission lines, the applicable rules are found in Minn. 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 an existing transmission line corridor.

2 GENERAL INFORMATION

2.1 Certificate of Need Requirement

Minn. Stat. § 216B.243, subd. 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 Minn. Stat. § 216B.2421 subd. 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 kilovolt (kV) transmission lines will be located in Minnesota between Lake Country Power's Cedar Valley Substation, the proposed Savanna Switching Station, and Great River Energy's Cromwell Substation and will be approximately 37 miles long. Because the Project consists of a transmission line in excess of 100 kV and is more than ten miles in length, a Certificate of Need (CON) is required.

The Minnesota Public Utilities Commission (Commission) has adopted rules for the consideration of applications for certificates of need. Minn. Rules chapter 7849. On September 8, 2010, Great River Energy and Minnesota Power (Applicants) filed a Petition for Exemption under Minn. Rules 7849.0200, subp. 6, requesting that the Applicants be exempt from certain filing requirements under chapter 7849. The Commission granted the Petition in an order dated November 2, 2010 (Exemption Order). This Application contains the information required under the chapter 7849 rules, as modified by the Commission in its Exemption Order. A copy of the Commission's Exemption Order is provided in Appendix A.

The Certificate of Need application submittal requirements are listed in Table 2-1 with cross references indicating where information can be found in this Application.

Table 2-1 Certificate of Need Application Completeness Checklist

Authority	Required Information	Section
7849.0120 A	Showing that denial would adversely affect adequacy, reliability and efficiency	
1	Demand forecast for type of energy supplied by proposed facility is accurate	5.6
2	Effects of Applicants' conservation program and state and federal conservation programs	5.8; Appendix E
3	Effects of Applicants' promotional practices on energy demand	5.10
4	Ability of current facilities and facilities not requiring CON to meet future demand	5.1; 6.2
5	Effect of proposed facility in making efficient use of resources	4.1; 5.7
7849.0120 B	A more reasonable and prudent alternative has not been demonstrated	
1	Facility is appropriate size, type and timing compared to reasonable alternatives	4.1; 6
2	Cost of facility and of its energy compared to reasonable alternatives	4.2; 4.3; 6
3	Effects of the proposed facility upon the natural and socio-economic environment compared to the effects of reasonable alternatives	6; 9
4	Expected reliability of facility compared to reasonable alternatives	4.1; 6
7849.0120 C	Project will provide benefit to society:	
1	Relationship of facility to overall state energy needs	5.2
2	Effects of facility on natural and socio-economic environment compared to not building facility	6.5; 9
3	Effects of facility inducing future development	5.1; 8.1.2
4	Socially beneficial uses of the output of the facility, including its uses to protect or enhance environmental quality	5.1; 9
7849.0120 D	Project will comply with relevant policies and regulations of other state and federal agencies and local governments	2.5; 4.6; 8.4
7849.0210	Filing fee	Cover Letter
7849.0230	Draft environmental report	Not required
7849.0240	Need summary and additional considerations	
7849.0240, Subp. 1	Major factors that justify need for facility	5.1

Authority	Required Information	Section
7849.0240, Subp. 2A	Socially beneficial uses of facility output, including uses to protect or enhance environmental quality	5.1; 9
7849.0240, Subp. 2B	Promotional activities that may have given rise to demand	5.10
7849.0240, Subp. 2C	Effects of the facility in inducing future development	5.1; 8.1.2
7849.0260	Proposed LHVTL and alternatives	
7849.0260 A	Type and location of proposed line, including:	
1	Design voltage	4.1
2	Number, sizes and types of conductors	4.1
3	Expected losses under maximum and average loading in lines and terminals or substations	4.5
4	Length of line and portion in Minnesota	4.1
5	Location of DC terminals or AC substations on map	4.1, Appendix D, Figure 1-3
6	List of counties affected by construction and operation	4.1
7849.0260 B	Availability of alternatives, including:	
1	New generation of various technologies, sizes, fuel types	6.2
2	Upgrade of existing lines or generating facilities	6.3
3	Transmission with different voltages or conductor arrays	6.4
4	Transmission lines with different terminals or substations	6.5
5	Double circuiting of existing transmission lines	6.6
6	If facility for DC (AC) transmission, an AC (DC) transmission line	6.7
7	If facility for overhead (underground) transmission, an underground (overhead) transmission line	6.8
8	Any reasonable combination of alternatives (1) – (7)	6
7849.0260 C	For facility and for each alternative, discuss:	
1	Total cost in current dollars	4.2
2	Service life	4.1.1
3	Estimated average annual availability	4.1.1
4	Estimated annual operating and maintenance costs in current dollars	4.2.4; 8.6
5	Estimate of its effect on rates system-wide and in Minnesota	4.3
6	Efficiency	5.7
7	Major assumptions made in sub items (1) – (6)	See above

Authority	Required Information	Section
7849.0260 D	Scaled map showing the system or load center to be served	3.3; 5.4 Figure 3-1
7849.0260 E	Any other relevant information about the proposed facility and each alternative	Seriatim
7849.0270	Peak Demand and Annual Consumption Forecast	
7849.0270, Subp. 1	Pertinent data concerning peak demand and annual electrical consumption	5.5
7849.0270, Subp. 2	Forecast data	5.6
7849.0270, Subp. 3	Detail of the forecast methodology employed in Subp.2	5.6.1
7849.0270, Subp. 4	Discussion of the database used in current forecasting	5.6
7849.0270, Subp. 5	Discussion of each assumption made in forecast preparation	5.6
7849.0270, Subp. 6	Coordination of forecasts	5.6
7849.0280	Description of ability of existing system to meet forecast demand	5.6
7849.0290	Conservation programs	5.8; Appendix E
7849.0300	Consequences of indefinite delay 1, 2, or 3 year postponement	5.9
7849.0310	Environmental information	9; Appendix G
7849.0330	Provide data for each alternative that would require LHVTL construction	6, 7.2
7849.0340	Alternative of no facility	6.9
7849.0340 C	Description of possible methods of reducing environmental impact	9

2.2 Route Permit

Minn. Stat. § 216E.03, subd. 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 Minn. Stat. § 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 transmission line of 115 kV 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 Minn. Rules chapter 7850. Minn. Rules 7850.1900, subps. 2 and 3, set forth the information that must be included in a Route Permit application.

Minn. Stat. § 216E.04, subd. 2(3) provides for an Alternative Review Process for transmission lines between 100 and 200 kilovolts; therefore, this Project qualifies for alternative review. This Alternative Review Process is shorter than the process required for transmission lines over 200 kV. The Applicants notified the Commission on December 29, 2010, pursuant to Minn. Rules 7850.2800, subp. 2 of their intent to utilize the Alternative Review Process and file its Route Permit Application under Minn. Rules 7850.2800 to 7850.3900. A copy of the Applicants' notification letter is provided in Appendix B.

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 Environmental Assessment. 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 submittal requirements are listed in Table 2-2 with cross references indicating where information can be found in this Application.

Table 2-2 Route Permit Application – Alternative Process Completeness Checklist

Authority	Required Information	Section
Minn. R. 7850.2800, Subp. 1(C)	Subpart 1. **Eligible Projects**. An applicant for a site permit or a route permit for one of the following projects may elect to follow the procedures of parts 7850.2800 to 7850.3900 instead of the full permitting procedures in parts 7850.1700 to 7850.2700: **high voltage transmission lines of between 100 and 200 kilovolts**	Appendix B
Minn. R. 7850.2800, Subp. 2.	Subpart 2. **Notice to PUC**. An applicant for a permit for one of the qualifying projects in subpart 1, who intends to follow the procedures of parts 7850.2800 to 7850.3700, shall notify the PUC of such intent, in writing, at least ten days before submitting an application for the project	Appendix B
Minn. R. 7850.3100	**Contents of Application** (alternative permitting process) The applicant shall include in the application the same information required in part 7850.1900, except the applicant need not propose any alternative sites or routes to the preferred site or route. If the applicant has rejected alternative sites or routes, the applicant shall include in the application the identity of the rejected sites or routes and an explanation of the reasons for rejecting them	
Minn. R. 7850.1900, Subp. 2 (applicable per Minn. R. 7850.3100)	**Route Permit for HVTL** A. a statement of proposed ownership of the facility at the time of filing the application and after commercial operation	3.1
	B. the precise name of any person or organization to be initially named as permittee or permittees and the name of any other person to whom the permit may be transferred if transfer of the permit is contemplated	3.1
	C. rejected alternative routes and the reasons for rejecting	7.2
	D. a description of the proposed high voltage transmission line and all associated facilities including the size and type of the high voltage transmission line	4.1
	E. the environmental information required under 7850.1900, Subp. 3	9
	F. identification of land uses and environmental conditions along the proposed routes	9.1; 9.8

Authority	Required Information	Section
	G. the names of each owner whose property is within any of the proposed routes for the high voltage transmission line	Appendix F
	H. United States Geological Survey topographical maps or other maps acceptable to the chair showing the entire length of the high voltage transmission line on all proposed routes	Figure 1-3; Appendix D
	I. identification of existing utility and public rights-of-way along or parallel to the proposed routes that have the potential to share right-of-way with the proposed line	8.2
	J. the engineering and operational design concepts for the proposed high voltage transmission line, including information on the electric and magnetic fields of the transmission line	4.1; 8.7
	K. cost analysis of each route, including the costs of constructing, operating, and maintaining the high voltage transmission line that are dependent on design and route	4.2
	L. a description of possible design options to accommodate expansion of the high voltage transmission line in the future	8.1.2
	M. the procedures and practices proposed for the acquisition and restoration of the right-of-way, construction, and maintenance of the high voltage transmission line	8.3; 8.4; 8.5; 8.6
	N. a listing and brief description of federal, state, and local permits that may be required for the proposed high voltage transmission line	2.5 Table 2-3
	O. a copy of the Certificate of Need or the certified HVTL list containing the proposed high voltage transmission line or documentation that an application for a Certificate of Need has been submitted or is not required	This document
Minn. R. 7850.1900, Subp. 3	**Environmental Information** A. a description of the environmental setting for each site or route	9.1
	B. a description of the effects of construction and operation of the facility on human settlement, including, but not limited to, public health and safety, displacement, noise, aesthetics, socioeconomic impacts, cultural values, recreation, and public services	9.2
	C. a description of the effects of the facility on land-based economies, including, but not limited to,	9.3

Authority	Required Information	Section
	agriculture, forestry, tourism, and mining	
	D. a description of the effects of the facility on archaeological and historic resources	9.4
	E. a description of the effects of the facility on the natural environment, including effects on air and water quality resources and flora and fauna	9.5
	F a description of the effects of the facility on rare and unique natural resources	9.6
	G. identification of human and natural environmental effects that cannot be avoided if the facility is approved at a specific site or route	9
	H. a description of measures that might be implemented to mitigate the potential human and environmental impacts identified in items A to G and the estimated costs of such mitigative measures	9
Minn. R. 7850.2100, Subp. 2 (applicable per Minn. R. 7850.3300)	**Notice of Project** Notification to persons on PUC's general list, to local officials, and to property owners	To be provided
Minn. R. 7850.2100, Subp 4	Publication of notice in a legal newspaper of general circulation in each county in which the route is proposed to be located.	To be published
Minn. R. 7850.2100. Subp. 5	Confirmation of notice by affidavits of mailing and publication with copies of the notices	Submit when available
Minn. R. 7850.4100	**Factors to be Considered in Permitting a HVTL** A. effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation, and public services	9.2
	B. effects on public health and safety	9.2
	C. effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining	9.3
	D. effects on archaeological and historic resources	9.4
	E. effects on the natural environment, including effects on air and water quality resources and flora and fauna	9.5
	F. effects on rare and unique natural resources	9.6
	G. application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity	4.1; 8.1.2

Authority	Required Information	Section
	H. use or paralleling of existing rights-of-way, survey lines, natural division lines, and agricultural field boundaries	4.1; 8.2
	I. use of existing large electric power generating plant sites	Not applicable
	J. use of existing transportation, pipeline, and electrical transmission systems or rights-of-way	8.2
	K. electrical system reliability	5.1; 5.9
	L. costs of constructing, operating, and maintaining the facility which are dependent on design and route	4.2
	M. adverse human and natural environmental effects which cannot be avoided	9
	N. irreversible and irretrievable commitments of resources	4.1; 9
Minn. R. 7850.4300, Subps. 1 and 2	Prohibited Routes **Wilderness areas**. No high voltage transmission line may be routed through state or national wilderness areas **Parks and natural areas**. No high voltage transmission line may be routed through state or national parks or state scientific and natural areas unless the transmission line would not materially damage or impair the purpose for which the area was designated and no feasible and prudent alternative exists. Economic considerations alone do not justify use of these areas for a high voltage transmission line	No wilderness areas or parks are crossed
Minn. Stat. §216E.03, Subd.7 (applicable per Minn. Stat. §216E.04, Subd. 8)	**Considerations in designating sites and routes** (1) Evaluation of research and investigations relating to the effects on land, water and air resources of large electric power generating plants and high voltage transmission lines and the effects of water and air discharges and electric and magnetic fields resulting from such facilities on public health and welfare, vegetation, animals, materials and aesthetic values, including base line studies, predictive modeling, and evaluation of new or improved methods for minimizing adverse impacts of water and air discharges and other matters pertaining to the effects of power plants on the water and air environment	9
	(2) Environmental evaluation of sites and routes proposed for future development and expansion and their relationship to the land, water, air and human	7; 8.1.2

Authority	Required Information	Section
	resources of the state	
	(3) Evaluation of the effects of new electric power generation and transmission technologies and systems related to power plants designed to minimize adverse environmental effects	Not applicable
	(4) Evaluation of the potential for beneficial uses of waste energy from proposed large electric power generating plants	Not Applicable
	(5) Analysis of the direct and indirect economic impact of proposed sites and routes including, but not limited to, productive agricultural land lost or impaired	9.3
	(6) Evaluation of adverse direct and indirect environmental effects that cannot be avoided should the proposed site and route be accepted	9
	(7) Evaluation of alternatives to the applicant's proposed site or route proposed pursuant to subdivisions 1 and 2	7
	(8) Evaluation of potential routes that would use or parallel existing railroad and highway rights-of way	8.2; 9
	(9) Evaluation of governmental survey lines and other natural division lines of agricultural land so as to minimize interference with agricultural operations	8.2; 9.3.1
	(10) Evaluation of the future needs for additional high voltage transmission lines in the same general area as any proposed route, and the advisability of ordering the construction of structures capable of expansion in transmission capacity through multiple circuiting or design modifications	6.2; 8.1.2
	(11) Evaluation of irreversible and irretrievable commitments of resources should the proposed site or route be approved	9
	(12) When appropriate, consideration of problems raised by other state and federal agencies and local entities	Not applicable

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. Minn. Stat. § 216E.02, subd. 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.

The Applicants chose to file for a CON and a Route Permit at the same time and in a single document. Because the preferred route for the proposed transmission line follows an existing transmission line, it was efficient for the Applicants 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. Rules 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 Certificate of Need 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. Rules 7829.2550, subp. 1, requires the applicant for a high voltage transmission line Certificate of Need to submit a proposed plan for providing notice three months prior to the filing of the application. In this matter, Great River Energy and Minnesota Power filed a proposed Notice Plan with the Commission on September 30, 2010. The proposed Notice Plan incorporated the notice requirements of both the Commission's Certificate of Need rules (Minn. Rules 7829.2550) and the Route Permit rules (Minn. Rules 7850.2100) as well as the local units of government notice requirements under Minn. Stat. § 216E.03, subds. 3a and 3b. The Commission approved the Notice Plan on January 19, 2011, and issued its written Order on January 26, 2011. A copy of the Commission's Order is provided in Appendix C.

In accordance with the approved Notice Plan and the Minnesota rules, upon filing this CON and Route Permit Application, the Applicants will mail a notice of the filing and a summary of the Application 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. These are the people and governmental bodies that the Applicants identified in the Notice Plan and are required to receive notice under the applicable rules. In addition, the Applicants will publish notice in a number of local newspapers announcing the filing of the Application.

An electronic version of the Application will be provided to the Commission for posting on its webpage and on the e-dockets register. The Applicants will also post the Application on the Great River Energy (www.greatriverenergy.com/savanna) and Minnesota Power (www.mnpower.com) homepages with a link to the Savanna Project.

Upon submission of an application for a Certificate of Need or a Route Permit, the Department of Commerce – Office of Energy Security (OES) has the obligation to conduct environmental review of the Project. Minn. Rules 7849.1200 and 7850.3700. In this matter, because the Applicants are 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. The OES has the option to elect to combine the environmental review and prepare one document, an Environmental Assessment (EA). Minn. Rules 7849.1900. The 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 the OES must follow in preparing the EA is set forth in Minn. Rules 7850.3700. This process requires the OES to schedule at least one public 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. The Applicants and the OES will both have representatives at the public meeting to answer questions and provide information for the public. The public meeting will be held within 60 days after acceptance of the Application.

Once the public meeting has been held, the OES will issue a Scoping Order describing the issues and alternatives that will be evaluated in the EA. The OES has four months from the time the Application is submitted to complete the environmental review and prepare the EA. Minn. Rules 7849.1400, subp. 9. Upon completion of the EA, the OES 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, www.eqb.state.mn.us/monitor.html, and will mail notice to persons who have registered their names with the OES to receive notices about this Project. Persons wishing to place their names on the mailing list for this Project can do so by contacting the OES directly or electronically on the OES webpage.

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 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. Rules 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 Certificate of Need and the Route Permit. Minn. Rules 7849.1900 and 7850.3800.

Once the hearing is concluded, 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 Certificate of Need 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), but Minn. Rules 7850.2700, subp. 3 prohibits the Commission from making a final decision on a route permit until the CON is approved. Minn. Stat. § 216E.02, subd. 2.

The Applicants anticipate that a final decision on the Certificate of Need and the Route Permit for this Project can be made by fall 2011.

2.4 Public Participation

In accordance with its Notice Plan, the Applicants held a public open house on the Project on October 26, 2010, at the Fine Lakes Township Hall. Nine members of the public, including governmental officials, attended the open house.

The meeting was publicized in two local papers approximately one week prior to the open house, and landowners potentially impacted received a letter of invitation. Tribal and local government officials and resource agencies were also invited by letter. 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, right-of-way (ROW) information, and a post card for questions or comments were available at the open house. A power point presentation describing the need for the Project and the Project benefits was running during the open house.

Inquiries from the public included whether the transmission line will go through their property, tree removal, Project schedule, and compensation for easements. No post cards or written comments have been received on the Project.

The need for the Project has also been discussed in the Minnesota Biennial Transmission Projects Report since 2003. The public participation process associated with the Biennial Transmission Projects Report provided the public and local units of government opportunities to offer comments and suggestions.

2.5 Other Permits/Approvals

In addition to the Certificate of Need and Route Permit sought in this Application, several other permits may be required for the Project depending on the actual route selected and the conditions encountered during construction. These are the same kind of permits utilities have identified in other applications to the Commission for authorization to construct similar high voltage transmission lines and there is nothing unusual about the permits that may be required in this case. See the Tower and Badoura 115 kV Projects, MPUC Docket No. E015/TL-05-867, and the RDO 115 kV Project, MPUC Docket No. ET2/TL-06-468 for reference.

A list of the local, state and federal permits that might be required for this Project is provided in Table 2-3.

Table 2-3 List of Possible Permits

Permit	Jurisdiction
Local Approvals	
Road Crossing/ROW Permits	County, Township, City
Lands Permits, Building Permits	County, Township, City
Overwidth Loads Permits	County, Township, City
Driveway/Access Permits	County, Township, City
Minnesota State Approvals	
Endangered Species Consultation	Minnesota Department of Natural Resources (DNR) – Ecological Services
Licenses to Cross Public Waters and Lands	DNR – Lands and Minerals
Utility Permit	Minnesota Department of Transportation (MnDOT)
Wetland Conservation Act	Board of Water and Soil Resources
National Pollutant Discharge Elimination System (NPDES) Permit	Minnesota Pollution Control Agency (MPCA)
Federal Approvals	
Section 10 Permit	US Army Corps of Engineers (Corps)
Section 404 Permit	Corps
Permit to Cross Federal Aid Highway	Federal Highway Administration
Spill Prevention, Control and Countermeasure (SPCC) Plan	Environmental Protection Agency
United States Fish and Wildlife Service (USFWS)	Endangered Species Consultation
Other Approvals	
Crossing Permit	Burlington Northern Santa Fe (BNSF)
Crossing Permit	Other Utilities such as Pipelines

2.5.1 Local Approvals

The Applicants 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.

Lands Permits

These permits may be required to occupy county, township, and city lands such as park lands, watershed districts, and other properties owned by these entities.

Building Permits

These permits may be required by the local jurisdictions for substation modifications and construction.

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.

2.5.2 State of Minnesota Approvals

Endangered Species Consultation

The Minnesota Department of Natural Resources (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. The Applicants 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 Minn. Stat. § 84.415 and Minn. Rules chapter 6135. The Proposed Project will require licenses for the 10 Public Waters and the Public Lands crossed by the rebuilt transmission line. The Applicants have initiated coordination with the DNR regarding these licenses. The Applicants will file these license applications once the design of the transmission line is complete and will acquire the licenses 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. The Applicants will file for this permit once the design of the transmission line 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 Minn. Rules chapter 8420. The proposed Project may require a permit under these rules if permanent impacts to wetlands are anticipated to result from construction. The Applicants 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 the construction of the switching station or expansion of substations will cause a disturbance of greater than one acre.

2.5.3 Federal Approvals

Section 10 Permit

The US Army Corps of Engineers (Corps) regulates impacts to navigable waters of the United States. There are no rivers in the Savanna 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. The Applicants will apply for this permit once the design of the transmission line is complete.

Spill Prevention, Control and Countermeasure (SPCC) Plan

A SPCC plan is required to prevent discharge of oil into navigable waters of the United States, and is required if the aboveground storage capacity for the substance is greater than 1,320 gallons and there is a reasonable expectation of a discharge into navigable waters of the United States. If necessary, Lake Country Power will modify their existing SPCC plan for the Cedar Valley Substation to reflect the new oil volumes, in accordance with 40 CFR 112.

United States Fish and Wildlife Service (USFWS)

Review of the Project was requested from the USFWS regarding federally listed species or critical habitat. The Applicants 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 the Applicants will adhere to guidance provided.

Other Approvals

Crossing permits will be required from Burlington Northern Santa Fe (BNSF) to cross the railroad and from any utilities who own pipelines crossed by the transmission line.

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3 THE APPLICANTS

3.1 Proposed Ownership

The Applicants anticipate that Great River Energy will be the sole owner of the two proposed 115 kV transmission lines between the Lake Country Power Cedar Valley Substation (located north of Floodwood, Minnesota) and the new Savanna Switching Station (located near Floodwood), and between the new Savanna Switching Station and the Great River Energy Cromwell Substation near Cromwell, Minnesota. Great River Energy will also own the upgraded 69 kV line between the Lake Country Power Gowan Substation (located south of Floodwood, Minnesota) and the Great River Energy Cromwell Substation.

The Applicants anticipate that Minnesota Power will be the sole owner of the new Savanna 115 kV Switching Station near Floodwood, Minnesota.

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 Lake Country Power (LCP), Mille Lacs Energy Cooperative (MLEC), and East Central Energy (ECE), the distribution cooperatives serving the areas that will benefit from the proposed Savanna Project. Great River Energy's distribution cooperatives, in turn, supply electricity and related services to more than 639,000 residential, commercial and industrial customers in Minnesota and Wisconsin.

Great River Energy and its cooperatives' mission is to provide safe, reliable, competitively priced 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 3100 megawatts (MW)). Great River Energy owns approximately 4,500 miles of transmission line in Minnesota, North Dakota, South Dakota, and Wisconsin.

LCP, MLEC, and ECE provide electricity and related services to approximately 112,000 residential, commercial and industrial customers in Minnesota. Over 13,000 residential, commercial and industrial members from these cooperatives would benefit from the proposed Project.

Figure 1-1 shows Great River Energy's service territory and highlights the service areas of LCP, MLEC, and the ECE.

Great River Energy's electric system is interconnected directly with neighboring suppliers. Great River Energy is a member of the Midwest Reliability Organization (MRO) and the Midwest Independent Transmission System Operator (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 136,000 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

The existing transmission system serving the Project area is comprised of several networks operated at the 69 kV and 115 kV levels (Figure 3-1), constructed mainly between 1949 and 1971. Many of the electric facilities in the area are shared facilities with other electric providers. Great River Energy and Minnesota Power as well as the other utilities have used these shared facilities to provide long-term benefit to the electric customers in the area.

3.3.1 69 kV Network

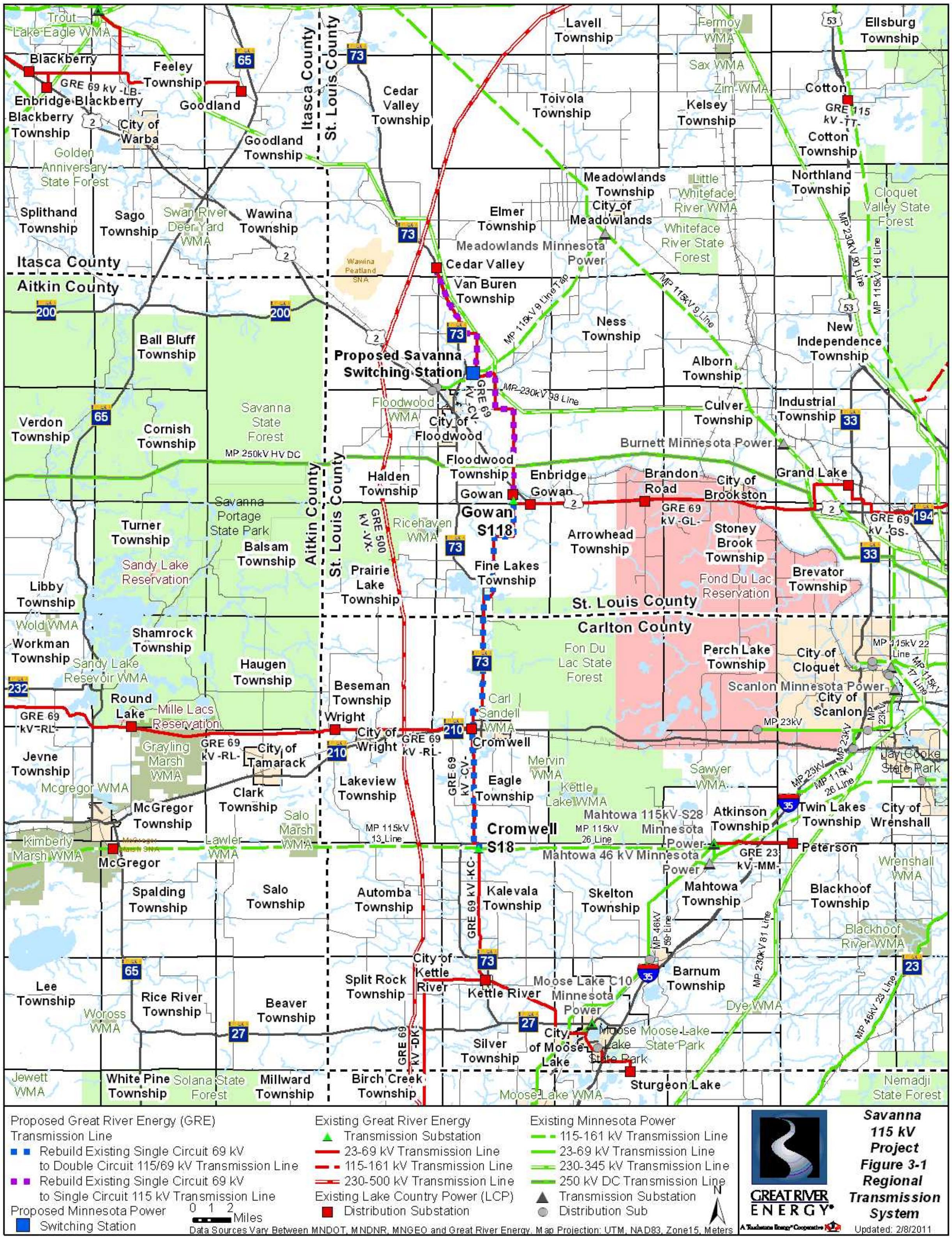
The 69 kV network that serves the area is fed from the 115/69 kV substations at Cromwell and Four Corners (located north of Duluth). There are nearly 100 miles of 69 kV transmission line served between these two substations, including two, long radial feeds: one 16-mile long line serving the Cedar Valley Substation and one nearly 30-mile long line serving the cities of Tamarack, Wright, Palisade, and the Big Sandy Lake area. In all, this system serves Great River Energy member-cooperative loads in the cities and towns of Cromwell, Tamarack, Wright, Palisade, Gowan, Cedar Valley, the Grand Lake area, and rural areas surrounding these locations. The existing 69 kV network in the Project area is owned completely by Great River Energy.

3.3.2 115 kV Networks

The existing 115 kV networks in the Project area are owned completely by Minnesota Power. Great River Energy and Minnesota Power electric customers in the Aitkin, Kimberly, McGregor, Cromwell, Mahtowa, Wrenshall, and surrounding rural areas are supplied by 90 miles of 115 kV line running between substations at Riverton (near Brainerd) and the Thomson Hydroelectric Generating Station (near Duluth). These sources are tied together through the Great River Energy Cromwell 115/69 kV Substation.

Minnesota Power serves a large industrial customer near Floodwood and the cities of Floodwood, Meadowlands, and Cloquet by a 115 kV line fed from the Blackberry 230/115 kV Substation east of Grand Rapids and the Cloquet 115 kV Substation. Over 75 miles of 115 kV transmission line are connected between these substations, including 13 miles of radial 115 kV line serving the Floodwood area.

Though the 69 kV line that serves the Cedar Valley Substation runs near the 115 kV transmission that serves the City of Floodwood, there is no 115/69 kV interconnection in the Floodwood area.


Proposed Savanna Switching Station
Gowan S118
Cromwell S18
St. Louis County
Carlton County
Itasca County
Aitkin County
Proposed Great River Energy (GRE) Transmission Line
Rebuild Existing Single Circuit 69 kV to Double Circuit 115/69 kV Transmission Line
Rebuild Existing Single Circuit 69 kV to Single Circuit 115 kV Transmission Line
Proposed Minnesota Power
Switching Station
Existing Great River Energy
Transmission Substation
23-69 kV Transmission Line
115-161 kV Transmission Line
230-500 kV Transmission Line
Existing Lake Country Power (LCP)
Distribution Substation
Existing Minnesota Power
115-161 kV Transmission Line
23-69 kV Transmission Line
230-345 kV Transmission Line
250 kV DC Transmission Line
Transmission Substation
Distribution Sub
0 1 2 Miles
Data Sources Vary Between MNDOT, MNDNR, MNGEO and Great River Energy. Map Projection: UTM, NAD83, Zone15, Meters
GREAT RIVER ENERGY
Savanna 115 kV Project
Figure 3-1
Regional Transmission System
Updated: 2/8/2011

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4.1 Project Description

Great River Energy proposes to construct two 115 kV transmission lines. The first 115 kV line will run between Lake Country Power's Cedar Valley Substation located north of Floodwood, Minnesota, and a new Savanna 115 kV Switching Station to be located just northeast of Floodwood. The second 115 kV line will run between the new Savanna Switching Station and the Great River Energy Cromwell Substation located south of Cromwell, Minnesota. The total length of these two 115 kV lines is approximately 37 miles.

The Project's 115 kV lines will replace approximately 16 miles of existing 69 kV line between the Cedar Valley and the Gowan substations. Between the Gowan and Cromwell substations, approximately 21 miles of existing Great River Energy 69 kV transmission line will be rebuilt on double circuit structures with the Project's 115 kV line. These transmission lines are located entirely in Minnesota, in St. Louis and Carlton counties.

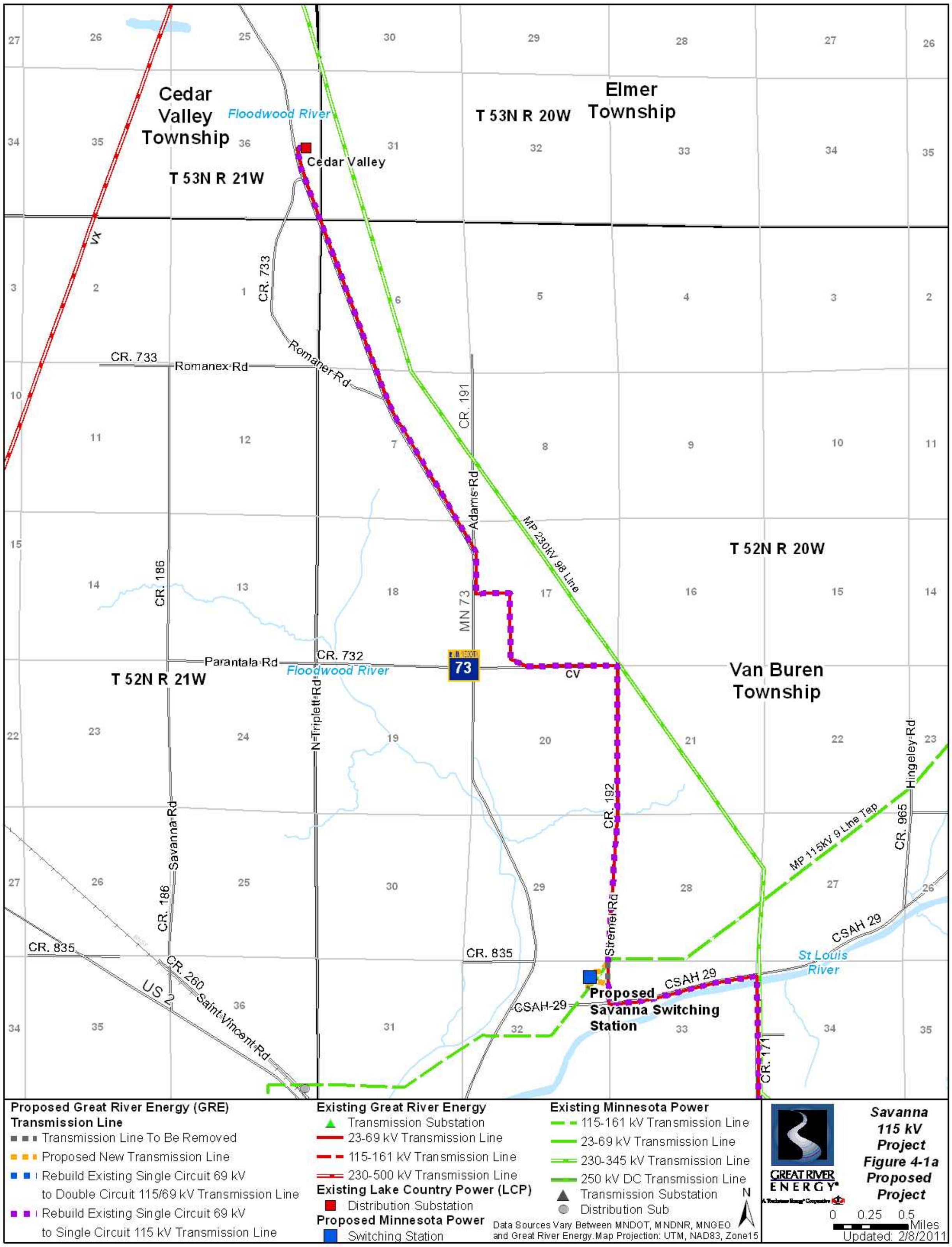
Minnesota Power proposes to construct the new Savanna 115 kV Switching Station in Section 32 of Van Buren Township, a few miles northeast of Floodwood, Minnesota. Modifications to accommodate the new 115 kV lines will be required at Lake Country Power's Cedar Valley Substation and at Great River Energy's Cromwell Substation.

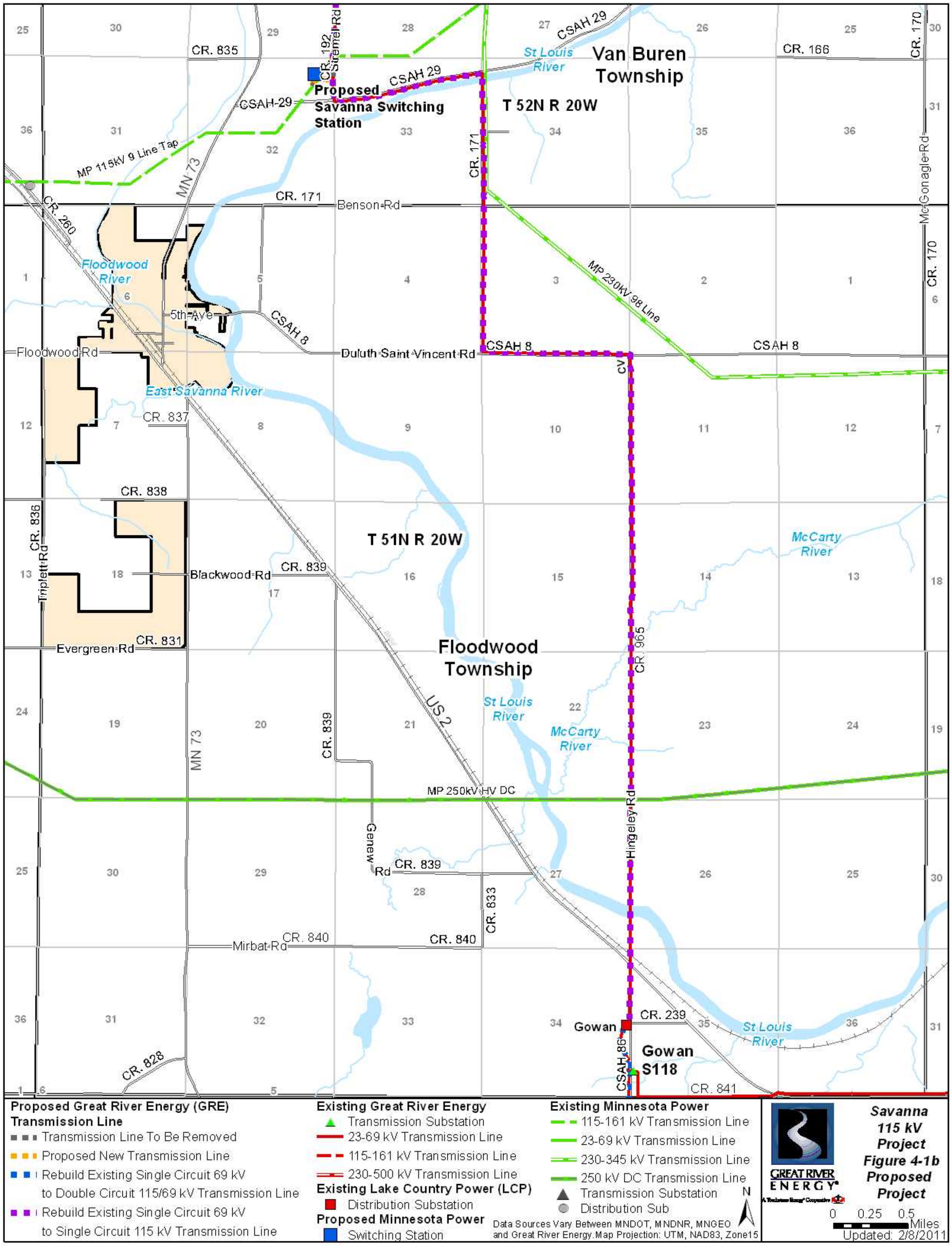
4.1.1 Transmission Lines

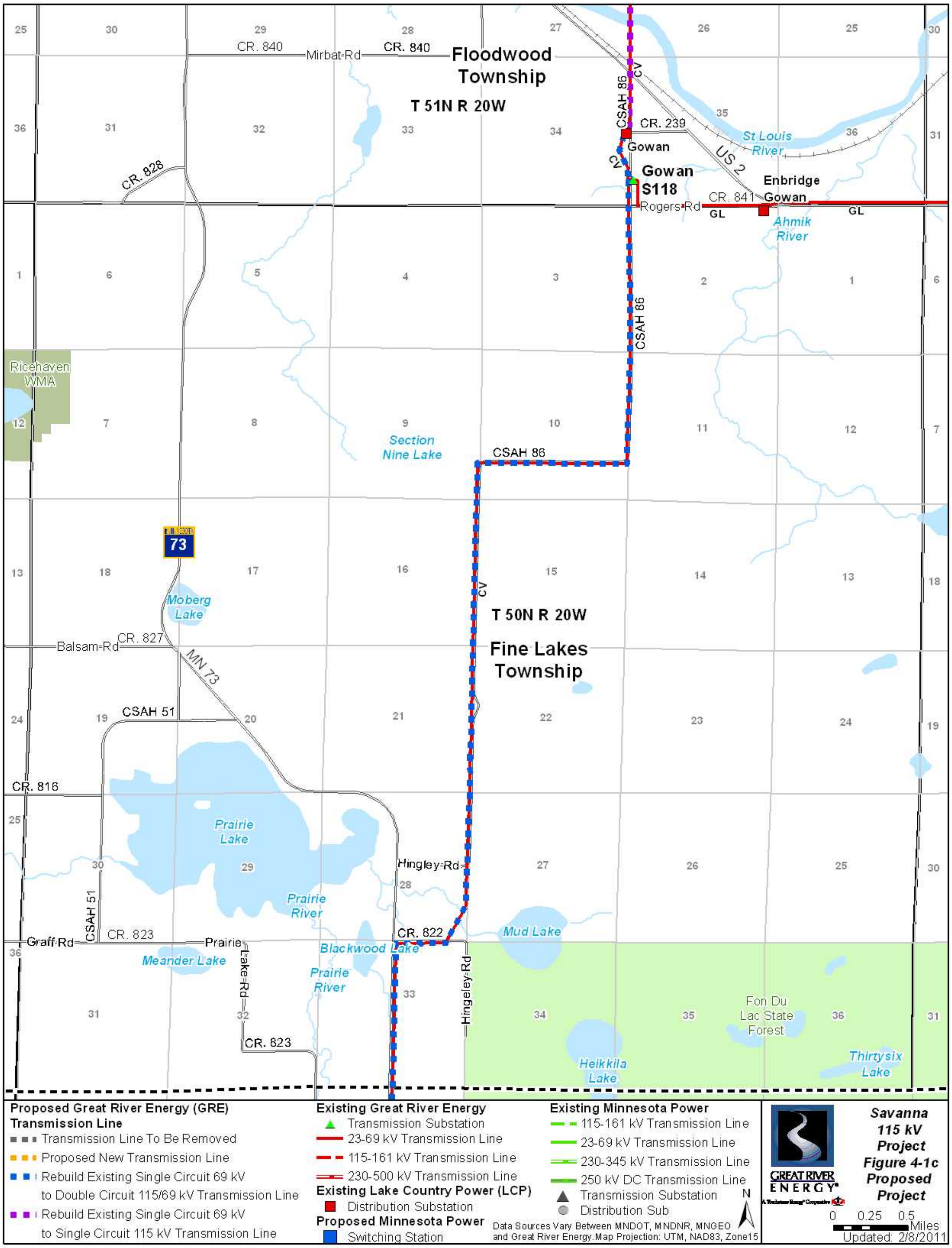
The route preferred by the Applicants is the same route the existing 69 kV lines follow, with 15 foot offsets to accommodate pole placement in some areas. The proposed route is shown in Figures 4-1a to 4-1e. Detailed aerial photos of the entire route are included in Appendix D.

On the north end of the Project, the first new 115 kV line begins at the Cedar Valley Substation in Section 36 of Cedar Valley Township. The line follows Highway 73 for approximately four miles, goes cross country east ¼ mile then south ½ mile to County Road (CR) 732, follows CR 732 for ¾ mile, then turns south along CR 192 for approximately two miles then connects into the new Savanna Switching Station. The second new 115 kV line exits the Savanna Switching Station and runs south about ¼ mile to County State Aid highway (CSAH) 29, follows CSAH 29 east for one mile, then turns south across the St. Louis River to Hill Road. The line follows Hill Road south for two miles, turns east on CSAH 8 for one mile, then turns south along CR 965 for approximately 3.5 miles, continues cross county for about one mile across the St. Louis River and the Burlington Northern Santa Fe railroad tracks to Hingley Road. It follows Hingley Road for about ½ mile to the LCP Gowan Substation, where double circuit 115/69 kV construction will begin. For this single circuit portion of the Project, the spans will be longer and fewer poles will be required.

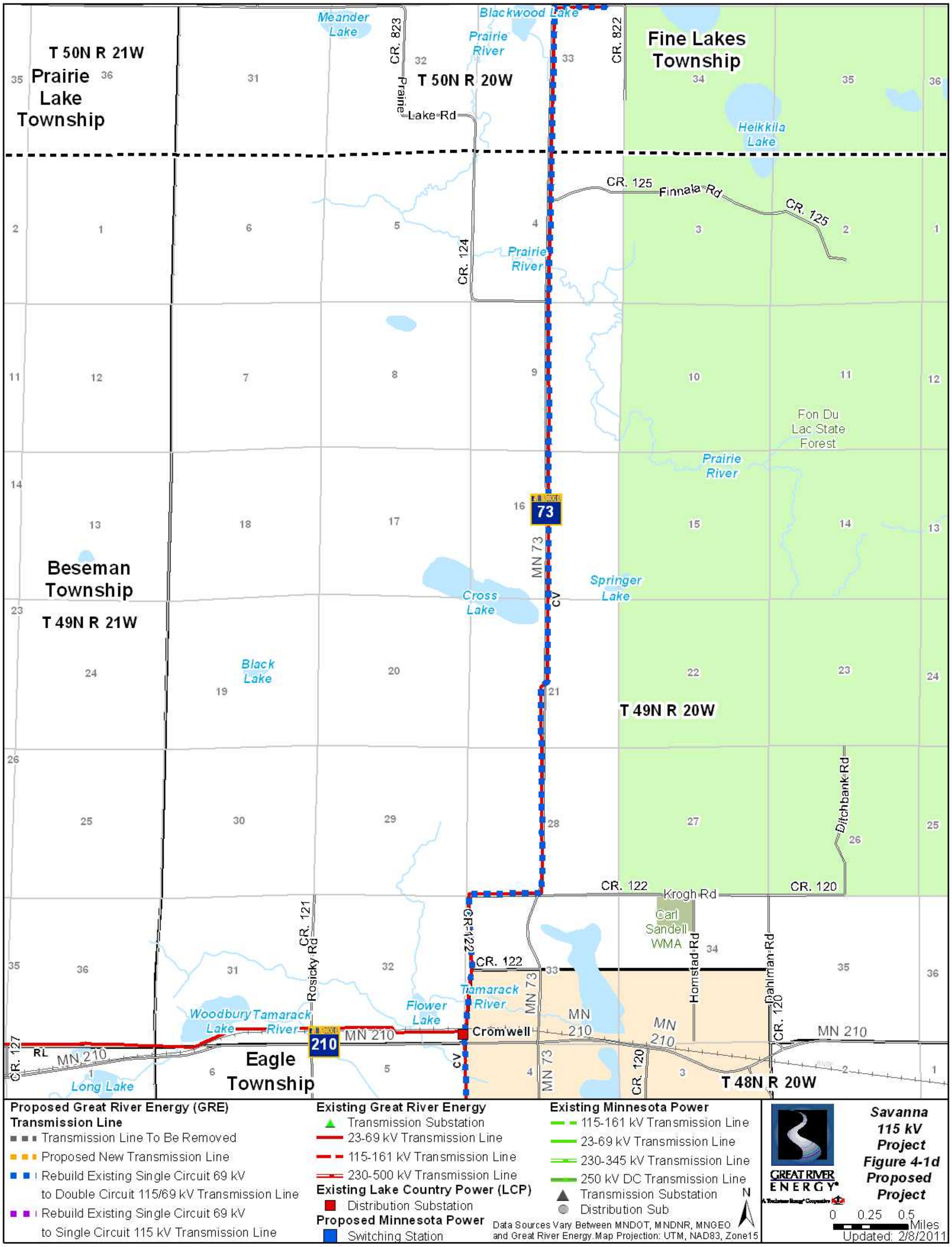
The second 115 kV line (now on double circuit structures with the upgraded 69 kV line) continues south past the LCP Gowan Substation along Hingley Road for 1.75 miles, turns west along CSAH 86 for one mile, then turns south along Hingley Road again for approximately three miles. The line then goes cross country to the southwest for about ¼ mile, goes west along CR 822 for about ½ mile, then turns south along Highway 73 for six miles. Then line turns west for

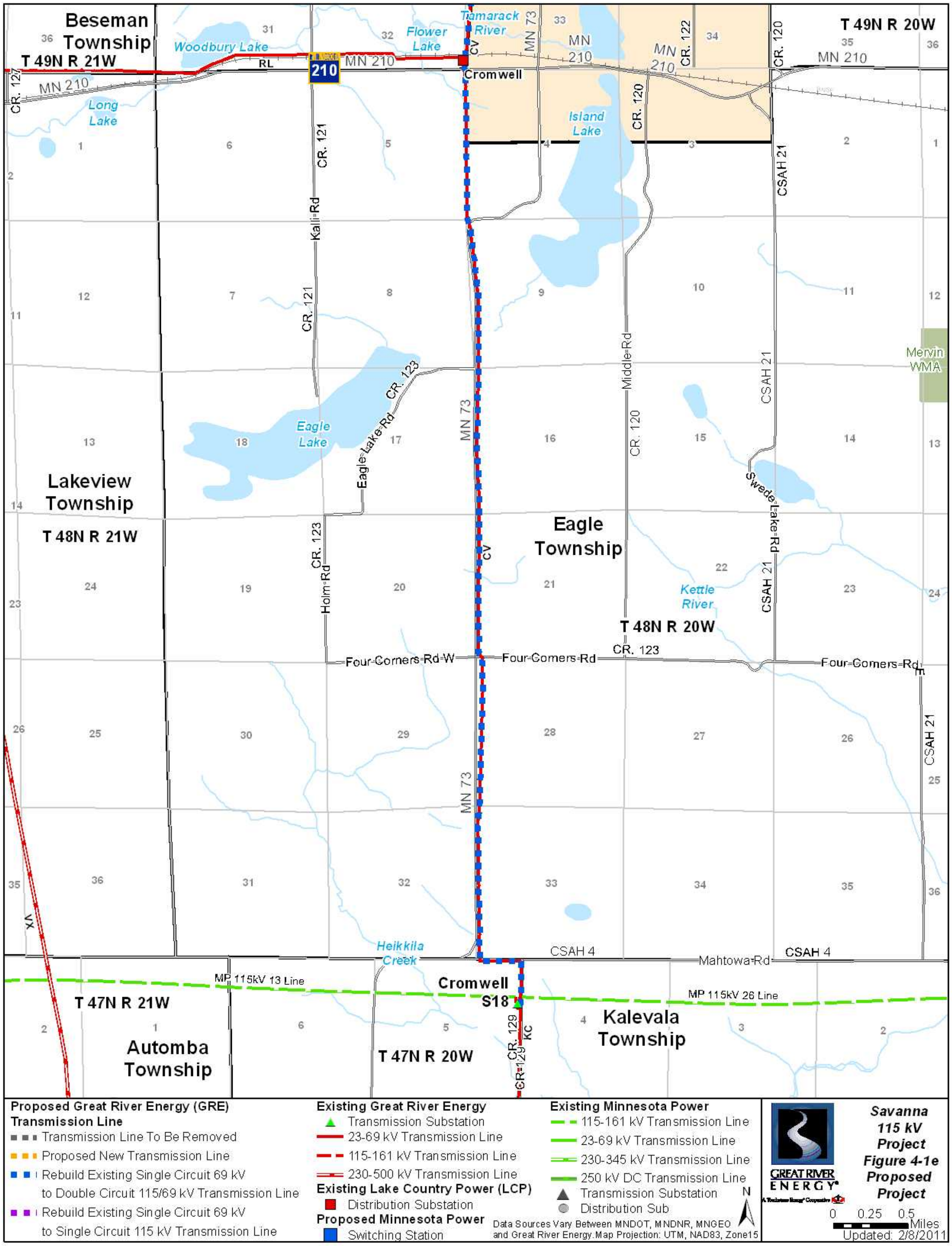

Cedar Valley Township
Elmer Township
Van Buren Township
T 53N R 21W
T 53N R 20W
T 52N R 21W
T 52N R 20W
Floodwood River
Cedar Valley
CR. 733
Romanex Rd
Romaner Rd
CR. 191
Adams Rd
MP 230kV 98 Line
CR. 186
MN 73
Parantala Rd
CR. 732
73
CV
N Triplett Rd
CR. 192
Savanna Rd
MP 115kV 9 Line Tap
CR. 965
Hingeley Rd
Stremer Rd
CSAH 29
St Louis River
CR. 835
CR. 260
US 2
Saint Vincent Rd
CSAH-29
Proposed Savanna Switching Station
CR. 171
Proposed Great River Energy (GRE) Transmission Line
Transmission Line To Be Removed
Proposed New Transmission Line
Rebuild Existing Single Circuit 69 kV to Double Circuit 115/69 kV Transmission Line
Rebuild Existing Single Circuit 69 kV to Single Circuit 115 kV Transmission Line
Existing Great River Energy
Transmission Substation
23-69 kV Transmission Line
115-161 kV Transmission Line
230-500 kV Transmission Line
Existing Lake Country Power (LCP)
Distribution Substation
Proposed Minnesota Power
Switching Station
Existing Minnesota Power
115-161 kV Transmission Line
23-69 kV Transmission Line
230-345 kV Transmission Line
250 kV DC Transmission Line
Transmission Substation
Distribution Sub
Data Sources Vary Between MNDOT, MNDNR, MNGEO and Great River Energy. Map Projection: UTM, NAD83, Zone15
GREAT RIVER ENERGY
Savanna 115 kV Project
Figure 4-1a
Proposed Project
0 0.25 0.5 Miles
Updated: 2/8/2011


Van Buren Township
T 52N R 20W
T 51N R 20W
Floodwood Township
Proposed Savanna Switching Station
Gowan
Gowan S118
St Louis River
Floodwood River
East Savanna River
McCarty River
MP 115kV 9 Line Tap
MP 230kV 98 Line
MP 250kV HV DC
Proposed Great River Energy (GRE) Transmission Line
Transmission Line To Be Removed
Proposed New Transmission Line
Rebuild Existing Single Circuit 69 kV to Double Circuit 115/69 kV Transmission Line
Rebuild Existing Single Circuit 69 kV to Single Circuit 115 kV Transmission Line
Existing Great River Energy
Transmission Substation
23-69 kV Transmission Line
115-161 kV Transmission Line
230-500 kV Transmission Line
Existing Lake Country Power (LCP)
Distribution Substation
Proposed Minnesota Power
Switching Station
Existing Minnesota Power
115-161 kV Transmission Line
23-69 kV Transmission Line
230-345 kV Transmission Line
250 kV DC Transmission Line
Transmission Substation
Distribution Sub
Data Sources Vary Between MNDOT, MNDNR, MNGEO and Great River Energy. Map Projection: UTM, NAD83, Zone15
GREAT RIVER ENERGY
Savanna 115 kV Project
Figure 4-1b
Proposed Project
0 0.25 0.5 Miles
Updated: 2/8/2011



Floodwood Township
T 51N R 20W
T 50N R 20W
Fine Lakes Township
CR. 840
Mirbat Rd
CSAH 86
CR. 239
Gowan
Gowan S118
Enbridge Gowan
CR. 841
Rogers Rd
St Louis River
US 2
Ahmik River
CR. 828
Ricehaven WMA
Section Nine Lake
Moberg Lake
Balsam Rd
CR. 827
MN 73
CSAH 51
CR. 816
Prairie Lake
Hingley Rd
Prairie River
CR. 822
Mud Lake
Graff Rd
CR. 823
Prairie Lake Rd
Blackwood Lake
Meander Lake
Hingeley Rd
Fon Du Lac State Forest
Heikkila Lake
Thirtysix Lake
Proposed Great River Energy (GRE) Transmission Line
Transmission Line To Be Removed
Proposed New Transmission Line
Rebuild Existing Single Circuit 69 kV to Double Circuit 115/69 kV Transmission Line
Rebuild Existing Single Circuit 69 kV to Single Circuit 115 kV Transmission Line
Existing Great River Energy
Transmission Substation
23-69 kV Transmission Line
115-161 kV Transmission Line
230-500 kV Transmission Line
Existing Lake Country Power (LCP)
Distribution Substation
Proposed Minnesota Power
Switching Station
Existing Minnesota Power
115-161 kV Transmission Line
23-69 kV Transmission Line
230-345 kV Transmission Line
250 kV DC Transmission Line
Transmission Substation
Distribution Sub
Data Sources Vary Between MNDOT, MNDNR, MNGEO and Great River Energy. Map Projection: UTM, NAD83, Zone15
Savanna 115 kV Project Figure 4-1c Proposed Project
0 0.25 0.5 Miles
Updated: 2/8/2011


Savanna
115 kV
Project
Figure 4-1d
Proposed
Project
T 50N R 21W
Prairie Lake Township
T 50N R 20W
Fine Lakes Township
Beseman Township
T 49N R 21W
T 49N R 20W
Eagle Township
T 48N R 20W
Meander Lake
Blackwood Lake
Prairie River
Heikkila Lake
Cross Lake
Springer Lake
Black Lake
Woodbury Lake
Tamarack River
Flower Lake
Long Lake
Fon Du Lac State Forest
Carl Sandell WMA
Cromwell
CR. 823
CR. 822
Prairie Lake Rd
CR. 125
Finnala Rd
CR. 124
MN 73
CR. 122
Krogh Rd
CR. 120
Ditchbank Rd
CR. 121
Rosicky Rd
Homstad Rd
Dahlman Rd
MN 210
CR. 127
Proposed Great River Energy (GRE) Transmission Line
Transmission Line To Be Removed
Proposed New Transmission Line
Rebuild Existing Single Circuit 69 kV to Double Circuit 115/69 kV Transmission Line
Rebuild Existing Single Circuit 69 kV to Single Circuit 115 kV Transmission Line
Existing Great River Energy
Transmission Substation
23-69 kV Transmission Line
115-161 kV Transmission Line
230-500 kV Transmission Line
Existing Lake Country Power (LCP)
Distribution Substation
Proposed Minnesota Power
Switching Station
Existing Minnesota Power
115-161 kV Transmission Line
23-69 kV Transmission Line
230-345 kV Transmission Line
250 kV DC Transmission Line
Transmission Substation
Distribution Sub
Data Sources Vary Between MNDOT, MNDNR, MNGEO and Great River Energy. Map Projection: UTM, NAD83, Zone15
GREAT RIVER ENERGY
0 0.25 0.5 Miles
Updated: 2/8/2011


Beseman Township
T 49N R 21W
T 49N R 20W
Woodbury Lake
Flower Lake
Tamarack River
Long Lake
Island Lake
Cromwell
MN 210
MN 73
CR. 122
CR. 120
CR. 121
CR. 127
CSAH 21
Kalli Rd
Middle Rd
Mervin WMA
CR. 123
Eagle Lake
Eagle Lake Rd
Lakeview Township
T 48N R 21W
Eagle Township
T 48N R 20W
Swede Lake Rd
Kettle River
Holm Rd
Four Corners Rd W
Four Corners Rd
Four Corners Rd E
Heikkila Creek
CSAH 4
Mahtowa Rd
MP 115kV 13 Line
MP 115kV 26 Line
Cromwell S18
T 47N R 21W
Automba Township
T 47N R 20W
Kalevala Township
CR. 129
Proposed Great River Energy (GRE) Transmission Line
Transmission Line To Be Removed
Proposed New Transmission Line
Rebuild Existing Single Circuit 69 kV to Double Circuit 115/69 kV Transmission Line
Rebuild Existing Single Circuit 69 kV to Single Circuit 115 kV Transmission Line
Existing Great River Energy
Transmission Substation
23-69 kV Transmission Line
115-161 kV Transmission Line
230-500 kV Transmission Line
Existing Lake Country Power (LCP)
Distribution Substation
Proposed Minnesota Power
Switching Station
Existing Minnesota Power
115-161 kV Transmission Line
23-69 kV Transmission Line
230-345 kV Transmission Line
250 kV DC Transmission Line
Transmission Substation
Distribution Sub
Data Sources Vary Between MNDOT, MNDNR, MNGEO and Great River Energy. Map Projection: UTM, NAD83, Zone15
GREAT RIVER ENERGY
Savanna 115 kV Project
Figure 4-1e
Proposed Project
0 0.25 0.5 Miles
Updated: 2/8/2011

½ mile along CR 122, turns south for two miles (cross country), then follows Highway 73 again south for five miles. The line turns east for ¼ mile along CSAH 4, then turns south for ½ mile along CR 129 into the Great River Energy Cromwell Substation.

The Savanna to Cromwell line will cross the St. Louis River northeast of Floodwood and north of Gowan in the same locations that the existing 69 kV line presently crosses the river. These overhead crossings do not interfere with recreational and other benefits associated with the river.

While the proposed route for the 115 kV lines is the same as the route the existing 69 kV lines presently follow, the structures may need to be installed in slightly different locations (15-foot offset) in some areas. The Applicants are requesting that the Commission authorize a route that is 300 feet in width, 150 feet either side of the centerline of the existing transmission line. Designating a route 300 feet in width will provide the Applicants with flexibility to accommodate features on the route, such as vegetation and structures, along with existing and proposed road rights-of-way that may have changed since the line was originally constructed. A route wider than the required ROW affords the Applicants flexibility to move structures from the existing centerline and within the permitted corridor if there is a logical and reasonable alternative location for the new transmission centerline.

The Applicants request a width of 1040 feet in the vicinity of the Savanna Switching Station location to accommodate the lines in and out of the station. This width includes the existing 69 kV line ROW, the entire switching station property, and a 200 foot buffer on the north, east, and south sides of the property. The additional ROW is required to allow for some flexibility in the final design of the switching station and in how the transmission lines enter the station.

Right-of-Way

The actual easement required for the line is typically 50 feet on each side of the transmission line centerline. A portion of the easement may overlap with existing distribution line easements, and/or where the line parallels a road, the road ROW. The Applicants have worked closely with the local, state and federal agencies and landowners regarding the Project. The majority of the Project has existing easements, which are adequate if the line remains in its present location. However, the Applicants anticipate negotiating new easements with the landowners to bring the easements into conformance with present day provisions.

Structures

The majority of the two new 115 kV lines will consist of single-pole wood structures spaced approximately 350 to 400 feet apart. For the single circuit portion of the project (Cedar Valley Substation to Savanna Switching Station and Savanna Switching Station to LCP Gowan Substation), the 115 kV spans will be longer than the existing 69 kV spans, therefore fewer poles will be required. The structures will typically range in height from 60 to 85 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.

Small sections of the existing line near the two St. Louis River crossings have distribution underbuild, which would be attached to new 115 kV transmission line structures spaced 250 to 350 feet apart.

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 85 feet 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 underbuild, double circuit and H-Frame) are shown in Figure 4-2.

Conductors

The single circuit structures will have three single conductor phase wires and one shield wire, and the double circuit structures will have six single conductor phase wires and one shield wire.

It is anticipated that the phase wires will be 477 thousand circular mil aluminum conductor steel reinforced (ACSR) with seven steel core strands and 26 outer aluminum strands on the 115 kV line between the Cedar Valley Substation and the Savanna Switching Station, and on the upgraded 69 kV line on the 115/69 kV double circuit structures between the LCP Gowan Substation and the Great River Energy Cromwell Substation.

It is anticipated that the phase wires will be 477 thousand circular mil aluminum conductor steel supported (ACSS) with seven steel core strands and 26 outer aluminum strands on both the single circuit and double circuit segments of the 115 kV line from the Savanna Switching Station to the Great River Energy Cromwell Substation.

The shield wire will be 0.528 optical ground wire for all transmission line segments.

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.

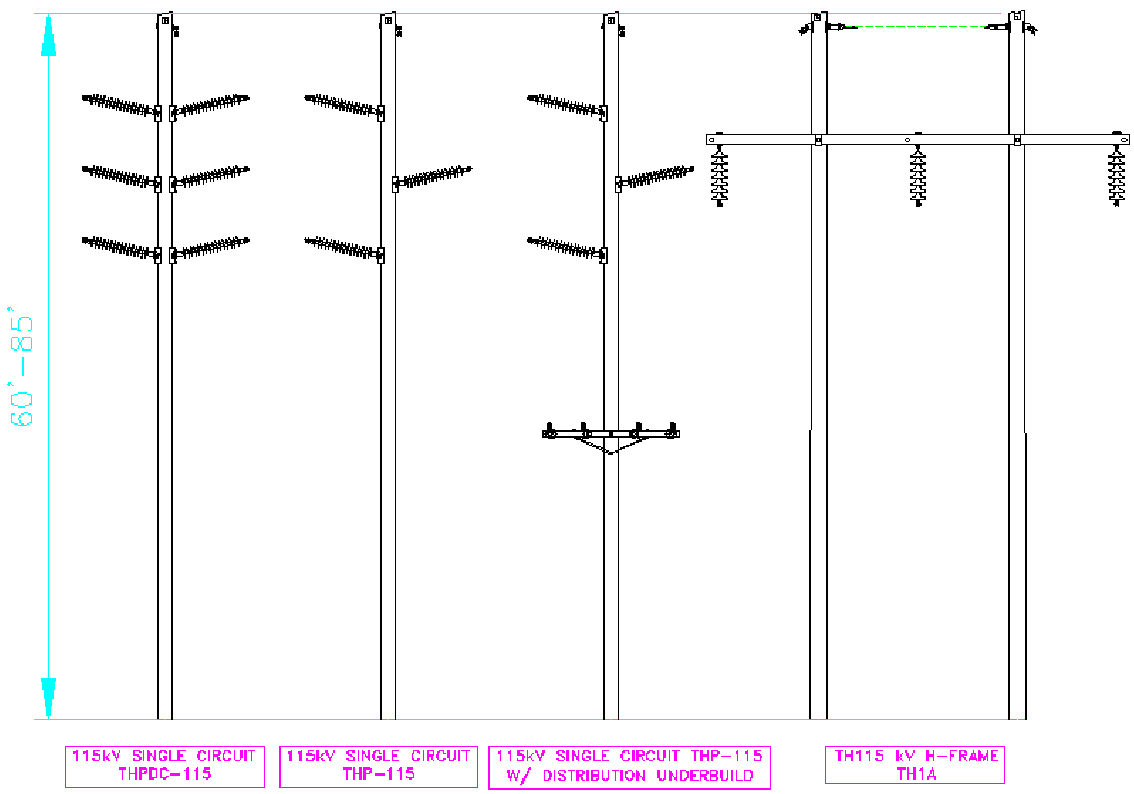
Annual Availability

An average new 115 kV transmission line is expected to be available approximately 99.9 percent of the year. The 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 includes a new Savanna 115 kV Switching Station and minor modifications to the LCP Cedar Valley Substation and the Great River Energy Cromwell Substation. Upgrades on the Minnesota Power 9 Line Floodwood Tap will also be required in conjunction with the Project to accommodate increased power flows.

Figure 4-2 Typical Transmission Structure Types



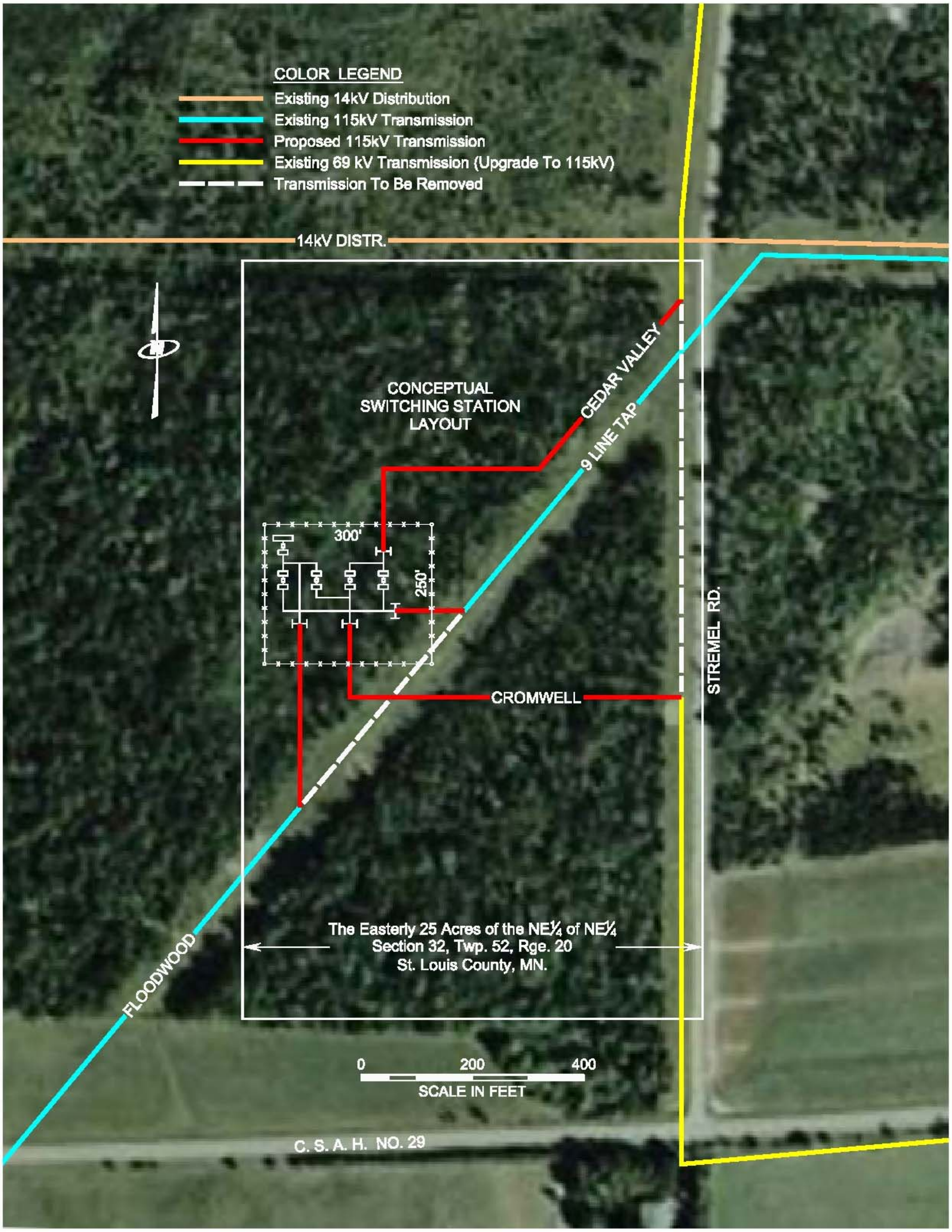
Savanna Switching Station

Minnesota Power proposes to construct the new Savanna 115 kV Switching Station near Floodwood, MN. Minnesota Power has an option to purchase 25 acres of land in the NE ¼ of the NE ¼ of Section 32 of Van Buren Township (Figure 4-3), and would own all common facilities associated with the switching station (land, fence, etc.). It is anticipated that the fenced-in area of the 115 kV switching station will be approximately 250 feet by 300 feet.

The facilities at the Savanna Switching Station will include:

- Four 115 kV, SF6 Circuit Breakers
- One 115kV, 27 MVAR Capacitor Bank

Figure 4-3 Savanna Switching Station Conceptual Layout



- 115 kV Switches
- Electrical Equipment Enclosure
- Structural Steel
- Bus work and fittings
- SCADA/Relay/Control Equipment
- Conduit
- Grounding

Lake Country Power Cedar Valley Substation

The Cedar Valley Substation was recently rebuilt and can accommodate a 115 kV circuit. LCP will only need to change out the substation transformer to allow operation of the substation at 115 kV.

Great River Energy Cromwell Substation

Great River Energy will provide a 115 kV line termination at the existing Cromwell Substation to accommodate the 115 kV line from Savanna.

Minnesota Power 9 Line Floodwood Tap

Once the Project is complete, the addition of the Savanna Switching Station and the Savanna to Cromwell 115 kV line will cause approximately 10 miles of Minnesota Power's 115 kV 9 Line Floodwood Tap (9 Line Tap) to become a networked transmission facility. This network connection will greatly improve the reliability and transmission capacity to the Floodwood area 115 kV system, effectively providing a second 115 kV source into the area; however, it also creates a through-flow path on the 9 Line Tap. In its existing configuration, the 9 Line Tap is a radial line, meaning that the only power flowing on it is that needed to serve the loads in the Floodwood area. When the Project is implemented and the 9 Line Tap becomes a network facility, the power flow on the 10 mile segment between the new Savanna Switching Station and the existing 9 Line Tap switches (located near Meadowlands) will increase significantly under certain system conditions. This is because the power flowing on the line will no longer be limited simply to what is needed for the Floodwood area because power needed to support the area transmission system may also flow on the line. To accommodate the increased power flow, this segment of the 9 Line Tap will need to be upgraded so that it has adequate capacity. The upgrade will involve replacing or modifying some structures to increase conductor clearance, which would increase capacity by allowing the line to operate at a higher thermal limit. Alternatively, reconductoring this 10 mile segment of the 9 Line Tap may be a more cost-effective solution. Either way, all the work will be done within the existing ROW.

Because the voltage of the line will not change, a permit from the Commission for this upgrade is not required. As per Minn. Rules 7850.1500, subp. 3, Minnesota Power will notify the Commission in writing at least 30 days before work begins on the upgrade.

4.2 Estimated Costs

Estimated costs for the proposed Project are divided into pre- and post-construction costs, construction costs, and operation and maintenance costs. Pre- and post-construction costs include expenditures for permitting, surveying (land and cultural resources), ROW acquisition, ROW clearing and ROW restoration. Construction costs include substation and transmission line construction. Great River Energy and Minnesota Power also evaluate the operation and maintenance costs associated with the Project after it is placed in service.

The estimated Project costs are summarized in Table 4-1 and discussed in more detail below.

Table 4-1 Estimated Project Costs (2010 Dollars)

Estimated Pre- and Post-Construction Costs	Estimated Construction Costs – 115 kV Transmission Lines	Estimated Switching Station Costs	Estimated Substation Modification Costs	Total Estimated Project Cost
$4,640,000	$20,720,000	$2,600,000	$1,075,000	**$29,035,000**

All capital costs for the proposed transmission lines and modifications at the Great River Energy Cromwell Substation will be borne by Great River Energy. The proposed Savanna Switching Station and Minnesota Power 9 Line Tap capital costs will be borne by Minnesota Power.

4.2.1 Pre- and Post-Construction Costs

Preconstruction costs include labor and expenses for preparation and approval of the Application, public information meetings, public hearings, cultural resource surveys if required, licensing or permitting fees, easement and land acquisition for approximately 37 miles of transmission line ROW and 25 acres for the substation, and the cost of ROW clearing. Post-construction costs include the restoration and revegetation of disturbed soils after construction of the Project is complete.

4.2.2 Transmission Line Construction Costs

Transmission line costs vary depending on the structure type, the number of structures per mile (i.e. span length), the height and diameter of the wood poles, labor and hardware costs. The line construction costs include the cost of structures, insulators, conductor, bird flight diverters where necessary and labor as well as any costs of equipment that will be used to construct the new line and substation.

Single pole construction costs are approximately $386,000 per mile. H-Frame construction costs are approximately $350,000 per mile and the double circuit construction costs are approximately $608,000 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.

The cost to upgrade Minnesota Power 9 Line tap is dependent on the number of structures that will need to be modified or replaced to achieve the required capacity. Based on a preliminary review of the as-built plan and profile, it is anticipated that 70 spans will require modification or replacement at an estimated cost of $1.5 million.

4.2.3 Switching Station and Substation Modification Construction Costs

The estimated cost for construction of the Savanna Switching Station is $2,600,000. The cost to modify the Lake Country Power Cedar Valley Substation is estimated at $500,000 and the cost to modify the Great River Energy Cromwell Substation is estimated at $575,000.

4.2.4 Operation and Maintenance Costs

Once constructed, operation and maintenance costs associated with the proposed Savanna 115 kV Switching Station will be minimal, other than weed control inside the substation.

The estimated annual cost of ROW maintenance is between $500 and $750 per mile of transmission line.

In addition to these ROW maintenance costs, annual operating and maintenance costs associated with 115 kV transmission lines in Minnesota currently average about $600 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. This requirement presumes that a single utility proposes to construct, own, and operate the project, and therefore the utility provides an estimate of the impact on ratepayers by calculating the annual revenue requirements for the project against a forecast of sales as though the cost of the project will be borne primarily by retail customers. The Commission's Order of November 2, 2010, granting exemptions allowed that effect on rates be described in the format as set forth below.

The model for determining the impacts on ratepayers has changed due to implementation of MISO Attachment FF to the Transmission Energy Market Tariff (FERC Docket No. ER06-18), which now allocates and recovers costs associated with new transmission projects and system upgrades within the MISO system on a regional basis, using provisions developed by the Regional Expansion Criteria and Benefits Task Force. Where a project has been determined to be a Baseline Reliability Project below 345 kV but above 100 kV, its total cost is recovered through a "subregional" allocation based on an analysis of the line outage distribution factor impacts of the project.

Great River Energy and Minnesota Power have submitted the Savanna Project for consideration as part of the MISO Midwest Transmission Expansion Plan 11 (MTEP11) process. This process will take much of 2011 to complete, with final approval by the MISO Board of Directors expected in December 2011. Any sharing of revenue requirements with other MISO members will not be known until that time. Any sharing of revenue requirements will help reduce transmission rates to the customers of both Great River Energy and Minnesota Power.

4.4 Project Schedule

Provided the Applicants obtain a Certificate of Need and a Route Permit by fall 2011, the Applicants plan to commence construction of the Savanna Switching Station as early as late 2011 and complete it in late 2012. Construction of the first 115 kV transmission line may begin as early as late 2011 on the north end with the rebuild of approximately seven miles of existing 69 kV line to single circuit 115 kV between the Cedar Valley Substation and the Savanna Switching Station. Construction of the second 115 kV transmission line will begin with the rebuild of approximately 21 miles of existing 69 kV line to double circuit 115/69 kV between the Gowan Substation and the Cromwell Substation in 2012-2013. Construction of the second 115 kV transmission line will continue with the rebuild of approximately nine miles of existing 69 kV line to single circuit 115 kV between the Savanna Switching Station and the Gowan Substation in 2013-2014.

The Applicants anticipate that construction will take approximately three years and that the entire Project will be energized sometime in the fourth quarter of 2014. Portions of the Project may be energized while work continues on other portions.

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 amount of losses that occur is 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 the 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 the Applicants considered a significantly larger area served by a number of utilities to determine the resulting effect of the Project's transmission upgrades.

The Applicants have calculated the losses at peak demand based on the projected 2014-2015 winter peak loadings, as this is when the Project is scheduled to be energized. The results are shown below in Table 4-2.

Table 4-2 Summary of Line Losses

Scenario	System Losses (MW)
Existing System	480.0
System with Savanna Project Transmission	479.2
Difference	-0.8

The table shows that the Project's proposed transmission infrastructure reduces the losses on the electrical system. Under winter peak demand conditions, the losses incurred are 0.8 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 based on the following formulas[1]:

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

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

Based on Minnesota Power and Great River Energy historic data, the average load factor for the Project area is 58.17 percent. Using the method described above and the calculated loss savings at peak demand (given in Table 4-2), the Project will reduce average transmission losses by an estimated 2880 megawatt hours (MWh) annually.

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

4.6 Construction Practices

The Applicants intend to employ normal construction practices in the installation of the new switching station and rebuild of the transmission lines. No unusual or difficult features are expected along the route. The 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 Vehicles, pickup truck, or by aerial means. These inspections will be limited to the acquired ROW and areas where obstructions or terrain require access off the easement. 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 operation of the transmission lines. Frequency of vegetation maintenance is on a three to seven year cycle. ROW practices include a combination of mechanical and hand clearing, along with an application of herbicides where allowed.

Minnesota Power will perform periodic inspections, maintain equipment, and make repairs over the life of the switching station. Routine maintenance will be conducted as required to remove undesired vegetation that may interfere with the safe and reliable operation of the switching station.

4.8 Work Force Required

During construction, there will be minimal positive impacts to community services, hotels and restaurants to support the utility personnel and contractors. It is estimated that 15 to 20 workers 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.

5 PROJECT NEED AND PURPOSE

5.1 Summary of Need

The proposed upgrade of the area transmission network is required to address three concerns; low voltage conditions on the 69 and 115 kV systems under certain outages, excessive miles of exposure of the 115 kV line in the Floodwood area, and the age of the 69 kV system that was constructed in the 1950s. If voltage is not maintained within acceptable limits, electric appliances and lighting will not perform as expected and could potentially be damaged. Excessive exposure on the 115 kV system increases the chances of having an outage of all consumers served from the line, as a fault condition anywhere along the line results in an outage of all substations being fed from the 115 kV system. Serving consumers from an older 69 kV system results in higher likelihood of outages and lower reliability. The need for the upgrade is driven by increased electrical demand in the area that has grown at an average of six percent annually since 2005. With the significant industrial load growth projected for the area, a second transmission feed is necessary to maintain reliable electric service.

As described in Section 3.3, this area is served by a 69 kV network and two 115 kV networks.

The Four Corners-Cromwell 69 kV line serves Great River Energy consumers between Grand Lake, Gowan, and Cromwell. Outage of the Four Corners-Solway 69 kV line, the Four Corners 115/69 kV transformer, the Great River Energy Cromwell-Lake Country Power Cromwell 69 kV line, or the Cromwell 115/69 kV transformer will lead to unacceptably low voltages under peak system demand conditions.

The Riverton-Cromwell-Thomson 115 kV line serves both Great River Energy and Minnesota Power consumers between Brainerd and Duluth. Under peak demand conditions, outage of the Thomson-Wrenshall 115 kV line is leading to unacceptably low voltages.

The Blackberry-Cloquet 115 kV line serves Minnesota Power consumers between Grand Rapids, Meadowlands, Floodwood, and Cloquet. Due to industrial expansion in the Floodwood area, this network will no longer be adequate to serve the customers in the surrounding area due to the large amounts of reactive power and inrush current required by the expanding load. Additionally, reliability in the Floodwood area is becoming a greater concern. Due to the long line length of this circuit (approximately 75 miles) and the fact that the Floodwood area is served by a radial 115 kV tap (the 9 Line Tap), an outage anywhere on the line will cause an outage in the Floodwood area until switching can be done to restore service.

5.2 Relationship Between Proposed Project and Overall State Energy Needs

The need for this Project has been discussed in the Minnesota Biennial Transmission Projects Report since 2003 (Tracking Numbers 2003-NE-N2 and 2003-NE-N8). In addition, the Applicants held a voluntary public meeting in the Project area and notified tribal and local government units of the Project and its need. This provided an opportunity for the public, local governments and state agencies to become involved in the transmission planning process consistent with the Minnesota Energy Security and Reliability Act.

The proposed Project is a baseline reliability project that will insure a continuous supply of secure and reliable electric energy. Locations benefited by the proposed Project include Floodwood, Meadowlands, Cedar Valley, Gowan, Grand Lake, Cromwell, Wright, Tamarack, Palisade, the Big Sandy Lake area, Aitkin, McGregor, Mahtowa, Barnum, Wrenshall, and all areas in between these locations. 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 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 as load continues to grow, 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's, so doing nothing would not be consistent with the energy policies of the State.

5.3 Data Exemptions

On September 8, 2010, the Applicants submitted a Petition for Exemption to the Commission requesting that the 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 October 28, 2010, and issued its written Order on November 2, 2010. A copy of the Order is attached as Appendix A. In its Order, the Commission relieved the 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.

The Applicants have included in this Application the information relating to the need for this transmission upgrade 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. Rules 7849.0260, subps. A(3) and C(6). The Commission granted the Applicants' request for an exemption from certain portions of Minn. Rules 7849.0260 requiring information on estimated line losses. The Commission authorized the Applicants to provide line loss data for the system as a whole, rather than line loss data specific to the individual transmission lines.

Minn. Rules 7849.0270, subps. 1 and 2. The Commission granted the Applicants' request for an exemption from certain portions of Minn. Rules 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 two-county area surrounding the lines, the Commission authorized the Applicants to provide the requested data only for the affected load area. Peak demand forecast will be based on historical loading by substation in the affected load area.

The Commission also exempted the Applicants from providing data on forecasted consumption and peak demand by customer class (Minn. Rules 7849.0270, subps. 2(B) and 2(C)). Instead, the Applicants will provide aggregate data on an annual coincident peak basis for the affected load area.

In lieu of providing the estimated annual revenue requirement per kilowatt hour for the system in current dollars (Minn. Rules 7849.0270, subp. 2(E)), the Commission granted the Applicants' request to provide: 1) a description of how MISO spreads wholesale electricity costs among users of the transmission grid, and 2) general estimates of how the cost of the Savanna Project would affect ratepayers of Great River Energy and Minnesota Power.

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

Minn. Rules 7849.0280. The Commission exempted the Applicants from the requirements of paragraphs B through G and I, as those sections apply to generators, not transmission proposals. The Commission also granted the Applicants' request that the remaining requirements of Minn. Rules 7849.0280, subps. A and H, apply to the applicable load area.

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

5.4 Affected Load Centers

The customers that will benefit from the Savanna Project are primarily in St. Louis, Carlton, and Aitkin counties.

Great River Energy has three member cooperatives serving load in the Project area. Lake Country Power serves members in the Cedar Valley, Gowan, Grand Lake, Cromwell, Wright, Tamarack, and Big Sandy areas while Mille Lacs Energy serves members in the Palisade, McGregor, and Aitkin areas. East Central Energy serves members in the rural areas east of Mahtowa.

Minnesota Power serves wholesale municipal and industrial customers as well as retail customers in the Floodwood, Meadowlands, Wrenshall, Mahtowa, Barnum and Aitkin areas.

5.5 Peak Demand and Annual Electrical Consumption

Minnesota Rules 7849.0270 requires an applicant for a Certificate of Need 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 the Applicants from providing this information for its entire system and authorized the Applicants to provide the data only for the Affected Load Centers. Also, because there are small numbers of customers in the Affected Load Centers, the Commission agreed with the Applicants that it was not necessary to provide the data for the various consumer classes served. 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 Centers for the previous five years is shown by month in Table 5-1.

Table 5-1 Historical Monthly Peak Demand (MW)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2005	92.3	82.5	81.4	66.6	67.3	74.4	88.8	82.8	72.2	67.3	84.9	92.5
2006	89.7	106.0	83.7	71.2	80.9	76.9	90.4	74.4	68.1	75.7	88.8	97.6
2007	112.9	125.0	94.6	83.6	70.7	81.5	87.4	91.0	78.9	75.5	95.7	101.8
2008	110.8	107.5	100.1	80.1	76.9	78.4	81.2	80.3	79.3	79.4	109.8	112.8
2009	122.4	108.9	109.2	81.5	75.2	83.2	80.5	90.1	75.5	81.9	84.3	105.6
2010	113.1	104.3	89.9	75.0	78.0	82.4						

5.5.2 Annual Electrical Consumption

The annual electrical consumption in megawatt hours (MWh) for Great River Energy and Minnesota Power load in the Affected Load Centers for the previous five years is shown by month in Table 5-2.

5.6 Forecasts

Minn. Rules 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 A, 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 load forecast methodology for Great River Energy and Minnesota Power are the same as the most recent Integrated Resource Plan filings.

5.6.1 Methodology

In developing a long-range load forecast, both Great River Energy and Minnesota Power utilized multiple scenarios and assumptions regarding, among other things, weather, demographic trends and macroeconomics.

Great River Energy and Minnesota Power utilized econometric energy models of energy sales for the total system load center, using historical data on monthly sales, economic activity, and weather conditions. Monthly sales forecasting models were estimated as a function of these explanatory variables, plus month-specific variables to capture any seasonal patterns that are not related to the other explanatory variables.

Great River Energy coordinates creating a load forecast for each of its 28 members. For the purposes of this filing, the forecasts for LCP, MLEC and ECE were used to provide energy and demand growth rates. These growth rates were applied to the historic load for the respective cooperatives in the study area. The Minnesota Power system load forecast was applied to the Minnesota Power load in the study area. Expected industrial load expansion not included in the load forecasts was added to the substation where the load is expected to be located.

Table 5-2 Historical Consumption

Area Historic Monthly Energy Usage (MWh)

Year	Jan.	Feb.	March	April	May	June	July	August	Sept.	October	Nov.	Dec.	Total
2005	55,729	45,555	47,611	39,039	39,473	38,450	43,942	40,658	37,801	40,240	47,092	56,601	**532,191**
2006	53,300	51,234	48,364	40,489	41,071	39,975	48,502	42,123	38,978	43,621	48,473	55,442	**551,572**
2007	58,405	56,639	50,061	43,620	40,941	40,738	46,905	44,644	41,902	44,350	51,743	62,340	**582,288**
2008	63,358	57,831	54,318	45,445	42,141	41,356	45,588	45,109	41,151	45,566	53,253	66,364	**601,480**
2009	66,944	54,185	53,935	44,809	42,343	42,251	44,855	45,219	43,358	48,725	48,372	62,248	**597,244**
2010	63,496	53,447	49,268	42,260	44,691	34,049							

As shown by the 2005-2010 historic monthly peak demands, the winter peak demands are 10-15% higher than summer peak demands for each year. This finding provides the basis of creating the winter peak forecast for the area, and that there isn't value in creating a projection for the summer season or by month.

The peak demand projection was made for the winter season using the historic peak for the winter 2009-2010 season as the starting point. Projection of the peak demand was made using the growth rates from the corresponding system load forecasts, and a coincidence factor that corrects the demand from the area projection to the system coincident value.

Specifically, the area winter seasonal maximum peak demand was calculated for the substations in the study area using the January 2005 to June 2010 hourly substation load data. The substation demand at the time of each system (LCP, MLEC, ECE, and Minnesota Power) was compared to the peak demand of each substation at the time of the area peak. This comparison results in a coincidence factor for each substation. There was also a coincidence factor calculated for a subsection of the Great River Energy 69 kV substations to show the maximum loading in the area served by the 69 kV transmission system.

Because the system load forecasts were developed on a system coincident basis, the system growth rates were applied by substation and then converted to the area coincident peak demand using the coincidence factor. Winter area coincident peak demand projections were made for the Winter 2011-12 through Winter 2024-25.

5.6.2 Demand Forecast Results

Table 5-3 shows the Applicants' results of forecasting peak demand in the Project's Affected Load Centers through the 2024-25 winter season.

Table 5-3 Winter Season Forecast Demand (MW per Month)

Winter Season	Peak Demand	Annual Growth Rate
2008-2009	122.4	
2009-2010	113.1	-7.6%
2010-2011	123.1	8.8%
2011-2012	120.3	-2.3%
2012-2013	123.5	2.6%
2013-2014	131.1	6.2%
2014-2015	143.3	9.3%
2015-2016	145.2	1.3%
2016-2017	147.1	1.3%
2017-2018	148.8	1.2%
2018-2019	150.7	1.3%
2019-2020	152.4	1.2%
2020-2021	154.2	1.1%
2021-2022	155.9	1.1%
2022-2023	157.6	1.1%
2023-2024	159.3	1.1%
2024-2025	161.1	1.1%

5.6.3 Consumption Forecast Results

Table 5-4 shows the Applicants' results of forecasting energy consumption in the Project's Affected Load Centers from 2010 through 2024.

Table 5-4 Forecasted Energy Consumption

Year	Energy (MWh)	Annual Growth Rate
2010	598,668	1.02%
2011	604,755	1.22%
2012	612,108	1.40%
2013	620,698	1.40%
2014	629,399	1.51%
2015	638,872	1.44%
2016	648,074	1.36%
2017	656,899	1.44%
2018	666,366	1.36%
2019	675,413	1.27%
2020	684,012	1.29%
2021	692,854	1.28%
2022	701,707	1.27%
2023	710,617	1.29%
2024	719,779	1.02%

5.6.4 System Capacity

Minn. Rules 7849.0280 provides that an applicant for a Certificate of Need must provide information about the ability of the existing system to meet the demand for energy predicted to occur in upcoming years. The 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 the Applicant must respond to are subpart A (relating to planning programs) and subpart H (relating to net demand and net capability), and those discussions are provided below.

5.6.5 Transmission Planning

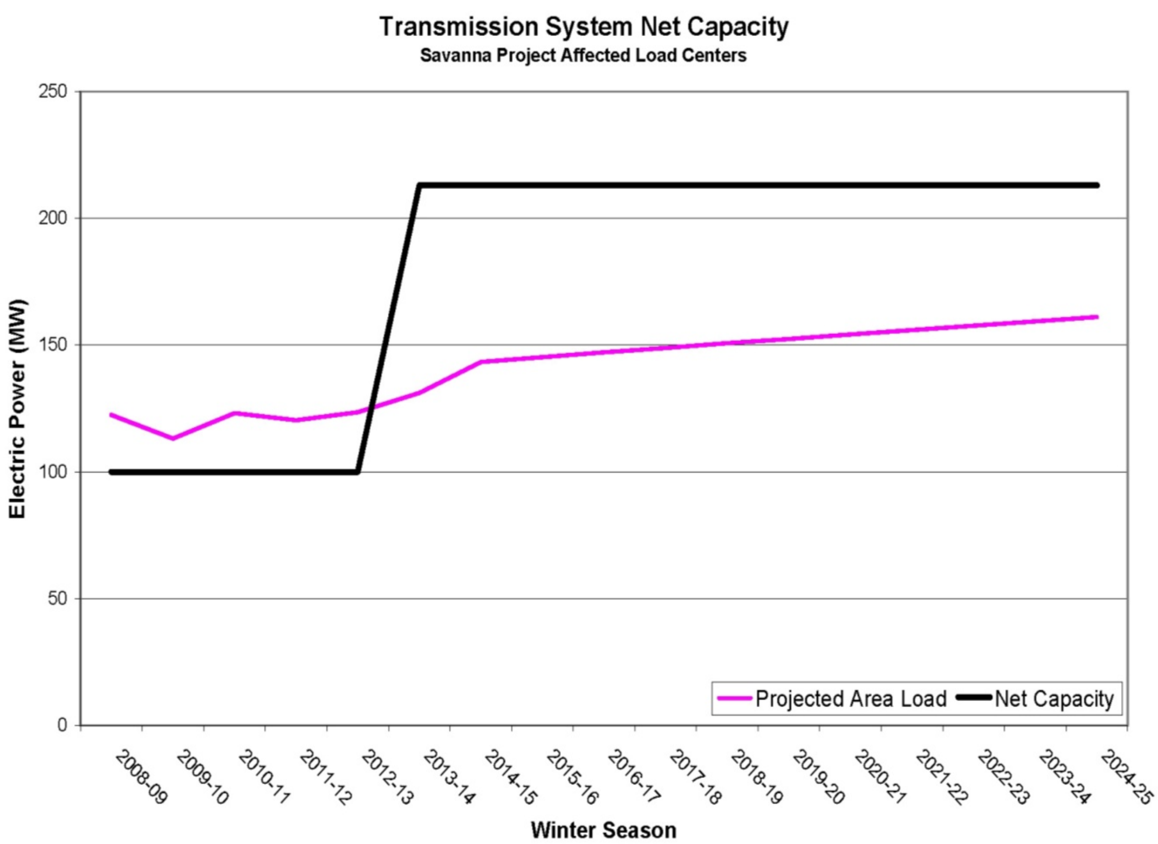
The Applicants were both part of the Minnesota Transmission Owners that prepared the 2009 Biennial Transmission Projects Report, which was approved by the Commission on May 28, 2010. MPUC Docket No. E-999/TL-09-602. Section 6.3.2 of the 2009 Biennial Transmission Projects Report describes the inadequacy driving the need for this Project as well as a summary of the alternatives considered for addressing this inadequacy (tracking number 2003-NE-N2). This inadequacy was also discussed in previous Biennial Transmission Projects Report filings starting with the 2003 report (tracking numbers 2003-NE-N2 and 2003-NE-N8).

The Applicants 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 115 kV connection between a new switching station in the Floodwood area and the existing Cromwell Substation, combined with the conversion of the Cedar Valley Substation to 115 kV operation, would provide adequate and reliable service in the area for well over 20 years, given anticipated growth levels.

5.6.6 Net Demand and Net Capability

With the Project's 115 kV transmission lines and the Savanna Switching Station, the area transmission system can provide reliable electric service to the Affected Load Centers at over 212 MW of demand (a growth of nearly 100 MW from 2009-10 winter peak levels), even during one of the critical contingencies currently driving the need for the Project. That is enough capacity to serve the Affected Load Centers well beyond the 2024-25 winter season, given the projected growth levels. The Applicants have determined the present and future adjusted net demand and net capability of its system as shown on Figure 5-1.

Figure 5-1 Transmission System Net Capacity



5.7 Increased Efficiency

As explained in Section 4.5, for a given amount of power transfer, transmission networks operated at higher voltages (i.e. 115 kV) are more efficient due to lower current levels compared to lower voltage networks (i.e. 69 kV). Higher voltage transmission systems have lower system line losses due to lower current flows. Power losses on the transmission system are proportional to the square of the current flow. The proposed Project reduces loading on other area 115 kV lines, reducing system losses and increasing efficiency. The rebuild of the Cromwell to Gowan 69 kV line with larger conductors will reduce the losses associated with that line. Furthermore, serving load in Cedar Valley with a 115 kV system, rather than a 69 kV system reduces losses by delivering the same amount of power using less current. The resistance of the lines serving the load will also be lower due to a shorter route and a larger, lower resistance conductor, which results in greater efficiency and lower losses. The combined impact of these factors results in line losses decreasing by 0.8 MW with the proposed Project as compared to existing system configurations under winter peak conditions. As shown in Section 4.5, this results in an estimated average annual energy savings of 2880 MWh.

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 Minnesota Power DSM activities include the Conservation Improvement Program (CIP) along with Dual Fuel, Controlled Access, and Interruptible Rates.

Current Great River Energy DSM activities include interruptible demand programs, off-peak storage programs and 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% of maximum seasonal peak demand (360 MW summer/320 MW winter).

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 The

Next Generation Energy Act of 2007. In 2010, Great River Energy invested approximately $10 million in the energy efficiency, conservation and demand side management programs.

Great River Energy and its member owners not only provide rebates to meet the Next Generation Energy Act 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 E.

Minnesota Power

As referenced above, Minnesota Power has instituted a CIP as part of its Resource Plan. CIP programs focus on increased efficiencies that reduce the amount of energy needed for certain uses. 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%, an energy-saving goal of 1.5% of gross annual retail electric energy sales by 2010. In May of 2007, an abbreviated filing (Docket No. E015/CIP-07-479) was submitted and subsequently approved, allowing the continuation of Minnesota Power's 2006-2007 CIP biennial (Docket No. E015/CIP-05-797) and related goals for one additional year, through 2008.

In November of 2008, Minnesota Power's 2009-2010 CIP biennial (Docket No. E015/CIP-08-610) was approved and in November of 2010, Minnesota Power's 2011 – 2013 CIP triennial (Docket No. E015/CIP-10-526) was approved. Minnesota Power's anticipated CIP investment for 2011 will be $5.8 million with anticipated annual program savings of 51,658,518 kWh, representing 1.58% energy savings. Minnesota Power's CIP investment goal was $4.6 million for 2010, $4.7 million for 2009, ($3.2 million for 2008, $3.2 million for 2007; $3.2 million for 2006; $3.2 million for 2005; $3.1 million for 2004), with actual spending of $5.5 million in 2009, ($4,826,410 million in 2008, $3.9 million in 2007; $3.8 million in 2006; $3.6 million in 2005; $3.1 million in 2004).

Energy savings and spending under the commercial (PowerGrant) program within Minnesota Power's CIP specific to the Savanna Project area from 2003 – 2010 are provided in Table 5-5 (towns include Floodwood, Alborn, Brookston, Wrenshall, Mahtowa, Meadowlands, Barnum, Willow River, Sturgeon Lake, Finlayson, Askov, Bruno, Kerrick, Denham, Sandstone and Hinckley).

Table 5-5 Minnesota Power - CIP Projects in the Savanna Project Area

City	# of Projects	Year	kWh Saved	kW Saved	Rebate
Hinckley	3	2003	369,326	1.08	$ 13,939.96
Floodwood	14	2003	671,597	60.35	$ 21,895.32
Finlayson	6	2003	115,627	33.27	$ 16,519.84
Saginaw	1	2003	17,784	6.84	$ 1,368.00
Bruno	1	2003	42,625	0	$ 2,484.00
Sandstone	8	2004	624,946	14.41	$ 23,127.00
Askov	1	2004	1,500	.6	$ 78.00
Finlayson	1	2004	12,500	5	$ 1,000.00
Saginaw	1	2005	13,414	4.2	$ 838.00
Sawyer	8	2005	443,319	36.44	$ 19,985.00
Floodwood	2	2006	2,327	1.77	$ 405.00
Sawyer	5	2006	30,913	2.35	$ 1,535.00
Sandstone	3	2006	100,142	28.4	$ 5,664.00
Sandstone	8	2007	300,289	31.44	$ 10,063.00
Hinckley	1	2007	2,375	.95	$ 155.00
Willow River	1	2007	52,139	0	$ 1,825.00
Saginaw	1	2007	36,527	6.7	$ 1,280.00
Floodwood	1	2007	16,507	4.5	$ 909.00
Wrenshall	1	2007	30,950	11.9	$ 3,571.00
Sandstone	3	2008	50,026	13	$ 2,922.00
Barnum	1	2008	13,099	6	$ 1,119.60
Willow River	6	2008	175,233	16	$ 6,358.00
Hinckley	2	2009	76,707	0	$ 2,684.73
Barnum	3	2009	54,450	9.4	$ 3,371.60
Finlayson	4	2009	76,909	21.7	$ 3,384.75
Hinckley	2	2010	507,978	4	$ 22,075.12
Willow River	3	2010	123,097	5.7	$ 4,791.43
Barnum	4	2010	32,809	4.1	$ 1,394.09
Floodwood	1	2010	4,750	.9	$ 375.00
Wrenshall	1	2010	482,604	25.5	$ 16,891.13
Total	**97**		**4,482,469**	**356.5**	**$ 192,009.57**

5.8.3 Conclusion

The load levels shown in Table 5-3 assume Great River Energy and Minnesota Power will be successful in reaching the DSM and CIP energy savings objectives in their respective Resource Plans. As shown in Figure 5-1, near-term winter peak load levels are already exceeding the capacity of the system to reliably serve all load in the Affected Load Centers without remedial actions like switching operations to shift load off the system. Thus 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 Centers. 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 Centers.

5.9 Delay of the Project

Minn. Rules 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 2014-15 winter has been designated as the in-service date for the Project; therefore a One Year Delay translates to a 2015-16 winter date. Because this Project will solve the electrical network deficiencies for three separate systems, each of these systems is analyzed individually to show the effects of delay.

5.9.1 Blackberry-Cloquet 115 kV System

The deficiencies on the Blackberry-Cloquet 115 kV system are tied to industrial load growth in the Floodwood area. The projected industrial load growth would involve the installation of several large motors, which require vast amounts of reactive power and inrush current in order to start. It is unlikely that the existing 115 kV system serving the Floodwood area could provide the support needed to start these large motors without adverse impacts to nearby customers. Delay of the Project, therefore, would inhibit the industrial customer's ability to operate the expanded plant or result in unacceptable power quality impacts to other customers in the Floodwood area. Additionally, because of the configuration of Minnesota Power 9 Line and the 9 Line Tap to Floodwood, an outage anywhere on the line would cause an outage in the Floodwood area until switching is done to restore service. Because the line is more than 75 miles long, there is significant exposure for the Floodwood area to outages caused by natural events or maintenance taking place far away from the load center. As long as the existing configuration of the 9 Line Tap to Floodwood remains unchanged, this excessive line exposure will pose a reliability risk to the operations of the large industrial customer in the Floodwood area.

5.9.2 Thomson-Riverton 115 kV and Four Corners-Cromwell 69 kV Systems

The demand served from the Thomson-Riverton 115 kV system and the Four Corners-Cromwell 69 kV system is expected to exceed critical loading limits by the time the Project is placed in service as shown in Tables 5-6 and 5-7.

Table 5-6 Thomson-Riverton 115 kV Critical Demand Analysis

Scenario	2014-15 Winter Forecast	One Year Delay	Two Year Delay	Three Year Delay	Infinite Delay[2]
# Hours above Critical Demand	1350	1508	1732	2030	4128
Curtailed Demand in MW[3]	16.6	17.4	18.3	19.4	26.2
% of Local Demand Curtailed	29.3	30.3	31.3	32.6	39.6
Annual # of Days at Risk[1]	170	186	197	210	309

[1] Based on 2009 load curve
[2] Based on 2024-2025 demand projections
[3] Curtailment assumes no remedial actions (switching)

Table 5-7 Four Corners-Cromwell 69 kV Critical Demand Analysis

Scenario	2014-15 Winter Forecast	One Year Delay	Two Year Delay	Three Year Delay	Infinite Delay[2]
# Hours above Critical Demand	26	43	65	92	563
Curtailed Demand in MW[3]	2.5	3.33	4.06	4.71	9.48
% of Local Demand Curtailed	7.5	9.6	11.5	13.1	23.3
Annual # of Days at Risk[1]	7	10	17	22	70

[1] Based on 2009 load curve
[2] Based on 2024-2025 demand projections
[3] Curtailment assumes no remedial actions (switching)

At present, a loss of the Thomson-Wrenshall 115 kV line under area coincident peak loading conditions would require manual adjustments by system operators to maintain acceptable voltage at Wrenshall. While these manual adjustments are a feasible short-term solution, their ability to restore the system to acceptable conditions will eventually be exhausted. If a more robust long-term solution is not implemented other remedial actions would need to be taken to ensure adequate service to area consumers, including curtailing system demand.

For the Four Corners-Cromwell 69 kV system, demand levels are projected to exceed what the system can reliably deliver, and curtailing demand would be necessary to ensure the safe, integrated operation of the electrical network. Initially, the risk of having to perform curtailment is projected to be low as there are few hours during the year where the projected system demand would be above critical levels. However, as demand grows, more hours above critical levels could be expected and the chance that corrective actions, including curtailments, would need to be implemented would increase.

For both systems, any delay in the proposed Project would result in more hours of the year where the systems would be at risk. Although this risk may be small because electrical facilities are very reliable with a low probability of the critical outage actually occurring, the possibility does exist and North American Electric Reliability Council standards require the Applicants to correct the problem.

Tables 5-6 and 5-7 highlight the transmission concerns indicating approximate annual hours that the demand would be above the critical level, the amount of demand that would have to be curtailed to bring the system back within acceptable limits if permanent outage is realized, the percentage of local demand curtailed, and the number of days at risk of experiencing curtailment based on the 2009 load curve.

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. The Applicants have not engaged in any promotional practices to encourage the use of more power. Just the opposite, as described in Section 5.8, the 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 Certificate of Need proceeding on a proposed transmission line project, an applicant is required to consider various alternatives to the proposed project. Minn. Stat. § 216B.243, subd. 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 Certificate of Need must discuss in the application the possibility of a number of alternatives. Minn. Rules 7849.0260 states:

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 subitems (1) to (7).

Minn. Rules 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 Great River Energy and Minnesota Power are discussed. These alternatives include: 1) a new local generation alternative; 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 for each alternative focuses on why that alternative is unacceptable or inferior to the proposed Project.

6.2 Generation Alternative

Generation and distributed generation were considered as an alternative to the new transmission of the proposed Project. Because the Project is designed to address localized inadequacies in three different areas of the transmission system (Floodwood area, Cromwell-Gowan-Four Corners 69 kV loop, and Cromwell-Mahtowa-Wrenshall area), a comparable generation solution must also address the issues in each of these project areas. However, the sort of small generators that could reasonably be considered for such an alternative (typically 1.5 or 2 MW diesel or natural gas-fueled generators) would not be sufficient to meet the need in the Floodwood area, as the main load in that area is an industrial load consisting of a number of large electric motors. To start these large motors, large amounts of reactive power and inrush current are required. This phenomenon is due to the physics behind an electric motor. When the motor is stationary, it looks like a short circuit (very low impedance to ground), so that when it is initially switched in, it will immediately draw a large amount of current (up to 7 times its steady state current). This is called "inrush current." As the motor runs, the current decreases to a much lower steady state value. Reactive power is the power required to charge the electric and magnetic fields that surround any current-carrying conductor; reactive power requirements increase exponentially with increasing current. When a motor is switched in and draws a large inrush current, that large current has large reactive power requirements. Because small generators alone are simply not capable of supplying reactive power and current on the order required by such large electric motors, distributed generation cannot eliminate the need for new transmission such as that provided by the proposed Project.

6.3 Upgrade of Existing Facilities

The proposed Project involves an upgrade of the existing 69 kV lines between Cedar Valley, Gowan, and Cromwell. The rebuild of an existing line would utilize existing ROW corridors and upgrade aging infrastructure. To provide the new endpoint required for the Project, the existing Minnesota Power Floodwood distribution substation would require a significant and costly expansion to be comparable to the proposed Savanna Switching Station in terms of reliability. Therefore, rather than upgrading the existing facility, it makes more sense to build a new facility in a more ideal location for similar or less cost. The new Savanna Switching Station will, however, be designed with space for a distribution transformer to serve the customers in Floodwood when the existing distribution station reaches the end of its useful life.

6.4 Alternative Voltages

Great River Energy and Minnesota Power considered the possibility of resolving the inadequacies in the Affected Load Centers by implementing a solution of a different voltage level. Because transmission in the Project area is so sparse and spread out, a lower voltage solution is not feasible. Beyond the Cromwell to Four Corners 69 kV system, there is no other transmission or sub-transmission level voltage lower than 115 kV in the area between Cromwell and Floodwood. Even if there was, a lower voltage solution would not provide the same quality of voltage support to the 115 and 69 kV systems as the proposed 115 kV solution.

Because a higher voltage solution would provide superior voltage support, a new Floodwood-area 230 kV interconnection was considered as an alternative to the proposed Project. If a new Floodwood-area 230/115 kV substation were to be developed, it would look much like the proposed Savanna 115 kV Switching Station, with 115 kV transmission lines to loads at Cedar Valley and Floodwood, and another 115 kV line to Cromwell. The 230 kV interconnection would eliminate the need for the existing 115 kV 9 Line Floodwood Tap, so that approximately 10 miles of this 115 kV line could be removed and partially replaced by one or both of the two short segments of 230 kV line that would be required to interconnect the existing Minnesota

Power Line #98 to the substation. The existing 230 kV line would be broken into two segments at the new substation, with each segment on a separate breaker. Because this solution would require practically the same 115 kV transmission to be built as the proposed Project and the 115 kV transmission by itself is enough to resolve the transmission inadequacies in the area for many years to come, the additional cost of the 230 kV solution cannot be justified at this time. However, the proposed Project is being designed to minimize, to a reasonable extent, the amount of additional work required to implement the 230 kV solution in the future, when load growth in the area dictates a need for it.

6.5 Alternative Endpoints

Before settling on the proposed Project's 115 kV endpoints at the Great River Energy Cromwell 115/69 kV Substation, the new Minnesota Power Savanna 115 kV Switching Station, and the LCP Cedar Valley Substation, Great River Energy and Minnesota Power considered a number of other possible 115 kV solutions. While some of the alternative endpoints may appear to be more or less effective for addressing the inadequacy in a particular part of the Affected Load Centers, the endpoints ultimately selected were the best for providing a single solution for all the inadequacies identified in the entire Affected Load Centers. The following discussion of alternative 115 kV endpoints focuses on three alternative ways of addressing the Affected Load Centers' inadequacies and why each of these alternatives is inferior to the proposed Project.

6.5.1 New Floodwood-Area 115/69 kV Source

An alternative way to address the inadequacies caused by load growth on the Cromwell to Four Corners 69 kV system is to add a new 115/69 kV source to the 69 kV network. The source would require development of a new 115/69 kV substation that is in close proximity to the existing 69 kV and 115 kV transmission. The one area that has both of these transmission voltages available is the Floodwood area. Other locations for the substation would require 115 kV transmission to be developed.

Though it would be an effective solution for strengthening the voltage on the 69 kV system in the area, the installation of a new 115/69 kV transformer in a new substation would be more expensive than the proposed 115 kV conversion of the Cedar Valley Substation, as the 69 kV line serving the Cedar Valley Substation needs to be rebuilt due to age and condition regardless of whether or not it is upgraded to 115 kV.

Additionally, this solution does not address the 115 kV system deficiencies in the Floodwood and Cromwell-Mahtowa-Wrenshall areas. In fact, if implemented with no additional 115 kV transmission, it would further degrade system performance in the Floodwood area. A likely 115 kV project to correct these deficiencies would be to connect the Cromwell Substation to the new 115/69 kV substation and the existing Minnesota Power 115 kV 9 Line Tap near Floodwood, similar to the proposed Project. Should the route for this 115 kV circuit follow the existing 69 kV circuit serving the Cedar Valley area, the 115 kV and 69 kV circuits would likely be double circuited to efficiently use existing ROWs. However, compared to the proposed Project, this would not significantly change the reliability and would be a more expensive option.

6.5.2 Development of the Mahtowa 115 kV Substation

Besides the Cromwell 115/69 kV transformer load, the main load in the Cromwell-Mahtowa-Wrenshall Area is at the Mahtowa 115/46/24 kV Substation. The 46 kV system originating at Mahtowa serves loads between there and Sandstone, and is becoming increasingly stressed during peak conditions when the Mahtowa source is out of service. Minnesota Power is addressing this issue for the time being by installing a capacitor bank at the Barnum 46 kV Substation; however, if load continues to grow something will need to be done to improve the reliability of the Mahtowa Substation. Currently, the substation is served by a very short radial tap off of Minnesota Power's 115 kV Line #26. Similar to the Floodwood Area, an outage anywhere on this nearly 30-mile line will cut off the 115 kV source to the Mahtowa Substation until switching can be done to restore the system.

Because reliability improvements would be desirable at Mahtowa, Great River Energy and Minnesota Power considered the Mahtowa Substation as an alternative to the Cromwell Substation endpoint for the proposed 115 kV transmission line. Significant upgrades would be required at the Mahtowa Substation to develop it into a substation with three 115 kV lines and adequate protection. Because it is further from the Floodwood area than is Cromwell, the Mahtowa endpoint would require approximately 10 miles of additional 115 kV transmission. A significant amount of new ROW would also be required for the Mahtowa to Savanna 115 kV line because there is no existing lower voltage line running north out of Mahtowa, as there is in Cromwell. Transmission system analysis showed that significant improvements in reliability and performance could be achieved at Mahtowa by bringing the new 115 kV line into Cromwell (rather than Mahtowa) and developing the Mahtowa Substation when load on the 46 kV system it serves dictates the need. A high level cost analysis showed that the savings realized by building a shorter transmission line on existing ROW to the more-developed Cromwell Substation would likely be enough to pay for the future development of the Mahtowa Substation, when it becomes necessary.

6.5.3 Interconnecting at the Cloquet 115 kV Substation

Another alternative endpoint for the Project is the Cloquet 115 kV Substation. Because Mahtowa is closer to Cloquet than Cromwell, the Cloquet endpoint would most likely be paired with the Mahtowa endpoint, resulting in 115 kV lines from Mahtowa to Cloquet to Floodwood. These 115 kV lines would be significantly longer than the proposed 115 kV Cromwell to Savanna line and would require almost entirely new ROW, resulting in dramatic increases in environmental and human impacts as well as cost. All of the costs associated with developing the Mahtowa Substation would be incurred along with the cost of expanding the Cloquet Substation, which is not currently designed to accommodate two additional 115 kV transmission lines. This solution also does little by itself to address the inadequacies on the Cromwell – Four Corners 69 kV system, so Cedar Valley or some other 69 kV distribution substation would still need to be converted to 115 kV service. Although the 115 kV system around Cloquet is stronger than the existing 115 kV system in the Cromwell and Floodwood areas, building new transmission out of Cloquet to address the inadequacies in the Affected Load Centers is significantly more expensive than the proposed Project, and the benefits do not outweigh the additional cost and environmental impacts.

6.6 Double Circuiting

Double circuiting is the construction of two separate circuits on the same structures. The proposed Project includes approximately 21 miles of potential double circuit 115/69 kV line between Gowan and Cromwell. From a reliability perspective, double circuiting is typically avoided because a common structure failure could result in the loss of both lines. In this case the two lines would be the existing Cromwell to Gowan 69 kV line and the proposed Cromwell to Savanna 115 kV line. For this particular situation, the system diversity is great enough that a simultaneous outage of both of the lines is not significantly worse than an individual outage of one or the other. Double circuiting also happens to be a cost-effective solution in this particular case because the aging Cromwell to Gowan 69 kV line is in need of replacement regardless of what happens with the Project. Therefore, Great River Energy and Minnesota Power intend to double circuit the proposed 115 kV line with the existing 69 kV line to the fullest extent practical.

6.7 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 an AC line. A HVDC line is not a reasonable alternative to the proposed Project. The Project is being proposed 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 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.

6.8 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 cost of building an underground line instead of 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 results in increased impact to wetland areas due to the likely need to install an access road 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.

Due to the construction, maintenance, reliability, and cost drawbacks of high voltage underground transmission lines, Great River Energy and Minnesota Power believe that undergrounding is not a viable alternative for any segment of the proposed 115 kV transmission lines.

6.9 No-Build Alternative

Before proposing a transmission or generation solution, Great River Energy and Minnesota Power 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 Centers strained by load growth and vulnerable to localized voltage collapses. The following discussion of the no-build alternative focuses on two different ways that the inadequacies in the Affected Load Centers might be addressed without building new transmission or generation.

6.9.1 Demand Side Management and Conservation

As documented in Section 5.8 and Appendix E, effective conservation measures in the Affected Load Centers have deferred but cannot eliminate the need for additional voltage support and reliability improvements. Conservation is particularly inadequate in the Floodwood area, where the load growth driving the need for the Project is due to a large industrial expansion and not solely increased residential or commercial demand. Conservation programs will continue to be implemented in the Affected Load Centers to maximize efficient use of electricity; however, these programs cannot slow load growth sufficiently to mitigate the projected inadequacies in the transmission system.

6.9.2 Reactive Power Supply

One fairly common method of addressing voltage inadequacies is to install equipment, such as capacitor banks, that will supply the needed reactive power locally. In fact, capacitor banks have already been installed at nearly every substation on the 69 kV system between Cromwell and Four Corners. Though these capacitors delayed the need for more significant system upgrades in the area for a time, their ability to provide adequate reactive support is quickly eroding. Due to capacitor switching control issues, the installation of additional capacitors to further delay the need for significant system upgrades on this 69 kV system is not feasible. A more robust long-term solution is required.

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7 ALTERNATIVE ROUTES

7.1 Alternative Requirement

Under the alternative review process, which is applicable in this case, an applicant for a Route Permit is not required to identify and evaluate an alternative route to the preferred route, as is required for transmission lines above 200 kilovolts. Because the preferred route in this case is an existing route, there is little likelihood that another route would be preferable to the preferred route. However, Minn. Stat. § 216E.04, subd. 3 and Minn. Rules 7850.3100 require an applicant to identify any alternative routes that were considered and rejected.

7.2 Rejected Route Alternatives

Because the preferred route follows an existing route, there were no readily apparent alternative routes to consider to determine whether they offered any benefits over the preferred route.

To date, the Applicants have received suggestions from two landowners who have both distribution line and the existing 69 kV line on their properties. One suggested (in a phone call to Minnesota Power staff) that the transmission line be moved to the opposite side of the road from his house. The other mentioned (at the open house on October 26, 2010) that in Section 28 of Fine Lakes Township, the transmission line could be moved from its existing location westerly to Ylinen Road.

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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. A schematic of typical structures is provided in Figure 4-2.

8.1.2 Design Options to Accommodate Future Expansion

A number of design features are being built into the Project to accommodate future expansion. The first of these is the design of the Savanna Switching Station. In addition to being located near existing 115 kV and 69 kV facilities, the switching station will also be physically close to a 230 kV circuit (Minnesota Power Line #98). This affords the future opportunity to provide a 230 kV connection to the Savanna Switching Station with a relatively minimal amount of additional work and human and environmental impact. The future 230 kV connection at the Savanna Switching Station would provide even greater capability to serve the areas affected by the Project. Therefore, the Savanna Switching Station is being located and designed to accommodate a future 230 kV connection, which will be considered when load growth in the area dictates a need for it.

A second feature of the Savanna Switching Station that is being designed with the future in mind is the capability for installation of a 115/14 kV transformer. The existing 115/14 kV transformer that Minnesota Power uses to serve the City of Floodwood is over 80 years old and will eventually need to be replaced. At that time, the aging distribution substation in which it is located would also need to be rebuilt. Designing the Savanna Switching Station to accommodate a future 115/14 kV transformer and locating it near an existing 14 kV distribution circuit will allow the Floodwood distribution station to be retired.

Another feature of the Project that is being designed to accommodate future expansion is the use of ACSS conductor for the proposed transmission line. The Applicants plan to use 477 ACSS conductor on the proposed Savanna-Cromwell 115 kV circuit to provide additional capacity above that allowable on a similar sized ACSR conductor. This will ensure that the Project will be viable into the future and will not have to be rebuilt as electrical demand increases or changes in the electrical network configuration are made.

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

The existing 69 kV lines parallel existing ROW for nearly their entire length, as discussed in the sections below. The proposed route for the new lines follows this same ROW, with some possible minor offsets of approximately 15-20 feet from the existing transmission centerline for constructability purposes, such as to allow the new line to be constructed while the existing line remains energized. Offsets may also be utilized as necessary to provide additional setback from structures on the ROW or to incorporate requests from landowners and/or agencies.

There are existing transmission line easements for approximately 33 of the 37 miles of the route preferred by the Applicants, although generally prescriptive easement rights exist for the approximately four miles of existing line without easements. Existing easements may be amended or replaced with new easements and new easements will be obtained where prescriptive easements currently exist that will describe the new transmission centerline on the property and have provisions that are typical of today's easements.

8.2.1 Utility Rights-of-Way

The transmission line is located parallel and on the same side of the road as existing Lake Country Power distribution lines for a portion of the Project. Approximately two miles of Lake Country Power distribution lines are underbuilt on the existing transmission line structures. Great River Energy does not propose to change either of these existing configurations.

8.2.2 Public Rights-of-Way

The transmission line will parallel road ROW for the majority (approximately 28 miles or 76 percent) of the route.

8.3 Right-of-Way Acquisition Procedures

8.3.1 Transmission Lines

Although Great River Energy has existing easements for approximately 89% of the route (and prescriptive easement rights for the remainder), the intent is to amend the existing easement or enter into new easements with the landowners to update the language to reflect typical provisions included in today's easements. In the event the Commission should authorize a different route requiring new ROW, the Applicants will be required to obtain new easements. Great River Energy will have a ROW agent or title specialist complete a search of the public records of all lands involved in the Project. This search will result in a title report to determine the legal description of the property, the owner(s) of record of the property, and other information regarding easements, liens, restrictions, encumbrances, and other conditions of record. Once this information has been verified and the easement and parcel exhibit has been prepared, a ROW agent will contact the property owners or their representative to provide information about the Project and discuss the easement and how it may affect their property. The Applicants did notify by mail and invite all landowners of record to the open house held on October 26, 2010. The Applicants will notify the landowners again when this Application is filed, therefore it should not be new information when the ROW agent contacts the landowner.

Great River Energy will complete the preliminary survey work of the existing transmission line after landowner notification. Soil investigations will be performed after the owner has granted permission. As the design of the transmission line nears completion, the survey crews will stake the transmission centerline.

The ROW agent will begin the negotiating process by presenting the parcel specific documents and Project information, including the easement and parcel exhibit, along with an offer of compensation for the easement rights requested. The property owner will be allowed a reasonable amount of time in which to consider the offer and to present material to Great River Energy that the owner believes is relevant to determining the value of the property.

During easement negotiations, Great River Energy will also discuss ingress and egress to and from the transmission line during construction, tree and vegetation removal, potential damage and its mitigation and the Project schedule. The offer of compensation will include reasonable compensation for trees and/or vegetation that needs to be removed for the Project.

The ROW agent will work with the landowner to negotiate the terms of a new easement that are acceptable to the landowner and Great River Energy. If Great River Energy cannot come to terms on a new easement, then Great River Energy may continue to exercise its rights that it already has from the previous easement. In the event that Great River Energy and the landowner cannot come to agreement on the terms of an easement, then Great River Energy would consider exercising its rights of eminent domain under Minnesota Statutes Chapter 117.

8.3.2 Switching Station

Minnesota Power has entered into a Purchase Agreement for the east twenty-five acres of the NE¼-NE¼ of Section 32, Township 52N, Range 20W, St. Louis County, Minnesota, located approximately 1.75 miles northeast of Floodwood, Minnesota. The Purchase Agreement is contingent on a final route permit and land use and environmental approvals for the site. Minnesota Power will request surveys and soil investigations to determine whether the site meets its substation criteria and will then develop a more site-specific design.

During the switching station construction phase, any affected property owners will be advised of construction schedules and needed access to the site. To construct, operate and maintain the proposed switching station, all vegetation will be cleared from the station's footprint area, from the station's driveway area and from a buffer area outside the station's fence. Vegetation on the property outside of the switching station footprint, driveway, and buffer will be left undisturbed, except where it must be impacted to allow for transmission line access to the switching station.

8.4 Construction Procedures

Procedures to be used for construction of the transmission lines and switching station are discussed below. Substation upgrades involve replacing existing equipment with new equipment or adding more equipment to an existing site, all occurring within the existing substation property.

8.4.1 Transmission Lines

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 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”) will be removed or trimmed to eliminate the hazard as shown in Figure 8-1, as allowed by the terms in the existing or the new easement that is acquired. Danger trees generally are those that are dead, 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.

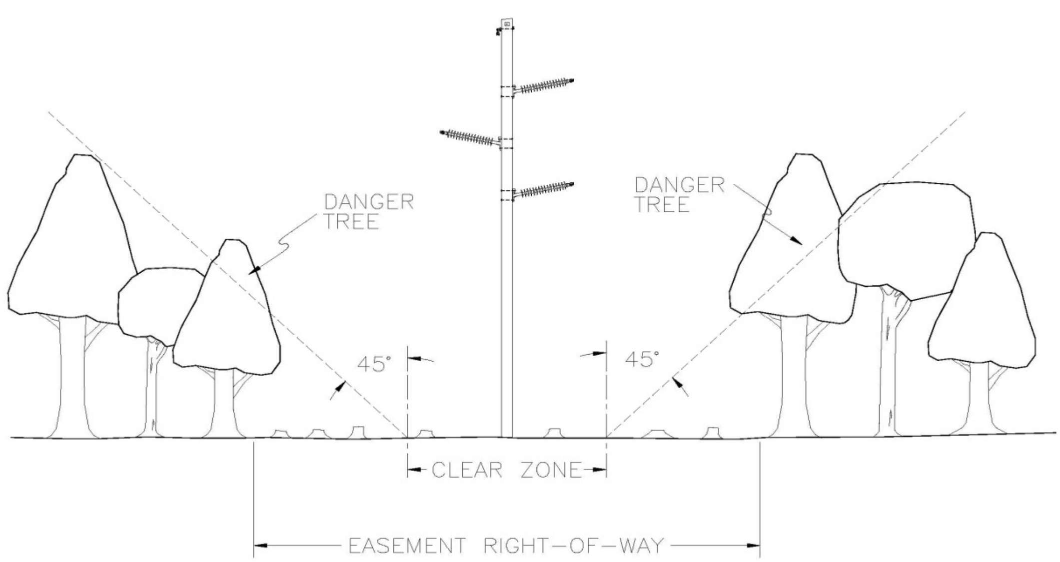
All materials resulting from the clearing operations will be either chipped on site and spread on the ROW, stacked in the ROW for use by the property owner, or removed and disposed of otherwise as agreed to with the property owner during easement negotiations.

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 the 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.

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 clearance, 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 construction that will assist in minimizing impacts for sensitive environments. Any contractors involved in construction of the transmission line will be advised of these BMP requirements.

Actual line construction will begin with removal of existing structures closest to the location of the new structures, unless an off-set is necessary so the existing transmission line can remain energized, whereas it would be left in place. The new structures are installed directly in the ground, by augering or excavating a hole typically 7 to 10 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. In poor soil conditions, a galvanized steel culvert is sometimes installed vertically with the structure set inside. Great River Energy does not expect to use concrete foundations, but if it were to be required, the size of the hole for concrete foundations depends largely on soil type. Based on the known soil types in northeastern Minnesota, it is anticipated that the average structure depth of a typical 65 foot long pole would be approximately 8.5 feet deep. 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 static 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 to the insulators or to install shield wire clamps once 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 a number of wetlands and will span the St. Louis River in two places. Great River Energy intends to place structures in generally the same location along the road ROW to cross the St. Louis River. In addition, 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.

8.4.2 Switching Station

Once the final design is complete and necessary property is acquired, construction will begin on the switching station. A detailed construction schedule will be developed based upon availability of crews, outage restrictions for any transmission lines that may be affected, weather conditions, spring load restrictions on roads, and any restrictions placed on certain areas for minimizing permanent impacts from construction.

Construction of a new facility begins with site preparation work, which involves clearing, grading and leveling the site with heavy equipment to prepare the site to support electrical equipment and associated facilities. This may or may not include replacement of site soils depending on existing soil conditions found and those identified in the Soil Exploration Report or Geotechnical Investigation. Topsoil will be removed, stockpiled and re-spread onsite. Any excess soil will be offered to the adjacent landowners or removed from the site. Once the site is graded, a perimeter fence, typically chain link, is installed to secure the site. All switching station equipment will be contained within the fenced area. Concrete foundations are placed throughout the switching station to support the switching station equipment. An electrical equipment enclosure will be installed to house protective relaying and control equipment. Erection of steel structures follows the foundation installation. These structures are built using rolled I-beams and/or tubular steel materials. Beams are used for mounting electrical conductors, disconnects and equipment. Bare copper conductor is buried around the perimeter of the fence and within the fence to properly ground all of the equipment and provide safety of personnel. Large high-voltage equipment, such as circuit breakers and associated control cables, are installed following completion of these steel structures. The final step is to properly test and commission each electrical device.

Minnesota Power will utilize erosion control methods to minimize runoff during construction of the switching station. A SWPPP will be prepared and implemented in compliance with the NPDES.

The proposed switching station will be constructed in compliance with the applicable codes, the Occupational Safety and Health Act, and local regulations. Utility workers and contractors will be committed to safe working practices. The switching station will be reviewed for local conditions and will include provisions in design beyond the minimum provisions for safety established in the various regulatory codes, where warranted. The switching station design will allow future maintenance to be accomplished with a minimum impact on switching station operation and allow adequate clearance to work safely.

8.5 Restoration Procedures

8.5.1 Transmission Lines

During construction, limited ground disturbance at the structure sites may occur. Staging areas for temporary storage of materials and equipment are established under agreements with the property owner or agency. 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 laydown 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 laydown 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 uses various methods to alleviate the compaction, or as negotiated with landowners.

The ROW agent contacts the landowners once construction is completed to determine if the clean-up measures have been to their satisfaction and if any other damage may have occurred. If damage has occurred to crops, fences or the property, the Applicants will compensate the landowner. In some cases, an outside contractor may be hired to restore the damaged property as near as possible to its original condition.

8.5.2 Switching Station

Upon completion of construction activities, Minnesota Power will restore the remainder of the site. Post-construction reclamation activities include the removing and disposing of debris, dismantling all temporary facilities (including staging areas), employing appropriate erosion control measures and reseeding areas disturbed by construction activities with vegetation similar to that which was removed as appropriate.

8.6 Operation and Maintenance

8.6.1 Transmission Lines

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, the Applicants will inspect the transmission lines at least once every other year. Inspections will be limited to the ROW and to areas where obstructions or terrain may require off-ROW access. If problems are found during inspection, repairs will be performed and damage restoration will occur 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 of the transmission line will be allowed to reestablish in the ROW. The Applicants' practice 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. Noxious weed control with herbicides will be conducted on a two-year cycle around structures and anchors.

Operating and maintenance costs associated with these transmission lines are estimated to be on the order of $50,000 per year. Actual transmission line specific maintenance costs will depend on 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.

8.6.2 Switching Station

Over the life of the switching station, annual inspections will be performed for safety, and quarterly inspections will be performed to maintain equipment and make necessary repairs. Routine maintenance will be conducted as required to remove undesired vegetation that may interfere with the safe and reliable operation of the switching station.

8.7 Electric and Magnetic Fields (EMF)

As it pertains to the Project, the term "EMF" refers to the extremely low frequency decoupled electric and magnetic fields that are present around any electrical device 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. Among other places, energized conductors with associated electric and magnetic fields can be found in transmission lines, local distribution lines, substation transformers, household electrical wiring, and common household appliances.

8.7.1 Health and Environmental Effects

Considerable research has been conducted in recent decades to determine whether exposure to power-frequency (60 hertz) electric and magnetic fields 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 EMF 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.[2]

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.[3]

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.[4]

Based on findings like those of the Working Group and NIEHS, the Minnesota Public Utilities Commission has consistently found that "there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects."[5] This conclusion was further justified in the recent 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

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

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

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

[5] 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)

parties both provided expert evidence on the potential impacts of electric and magnetic fields on human health. The administrative law judge (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 [EMF] exposure."[6] The Commission adopted this finding on July 15, 2010.[7]

8.7.2 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 to other nearby objects, such as the ground, towers, vegetation, buildings, and vehicles. The intensity of transmission line electric fields is measured in kilovolts per meter (kV/m), and the magnitude of the electric field rapidly decreases with distance from the transmission line conductors. The presence of trees, buildings, or other solid structures nearby 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 each of the proposed configurations, regardless of the power flowing on the line.

Although there is no state or federal standard for transmission line electric field exposures, the EQB has developed a standard of a maximum electric field limit of 8 kV/m at one meter above ground. The Applicants have calculated the approximate electric field for the Project's transmission configurations and expect the peak magnitude of electric field density among all possible configurations to be approximately 1.40 kV/m underneath the conductors, one meter (3.28 feet) above ground. Table 8-1 summarizes the electric fields calculated for the proposed single and double circuit transmission lines on the Savanna Project. These electric field calculations are also shown graphically in Figures 8-2 through 8-4.

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[6] *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)

[7] *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)

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'
115/69 kV Double Circuit (Figure 8-2)	121/72.5	0.003	0.01	0.02	0.06	0.47	0.96	0.14	0.04	0.02	0.01	0.003
115 kV Single Circuit Savanna to Cromwell (Figure 8-3)	121	0.01	0.02	0.06	0.21	0.46	1.29	0.63	0.19	0.07	0.02	0.01
115 kV Single Circuit Savanna to Cedar Valley (Figure 8-4)	121	0.01	0.02	0.06	0.21	0.49	1.40	0.65	0.19	0.07	0.02	0.01

Figure 8-2   115/69 kV Double Circuit Savanna to Cromwell Line
Electric Field Profile (kV/M)

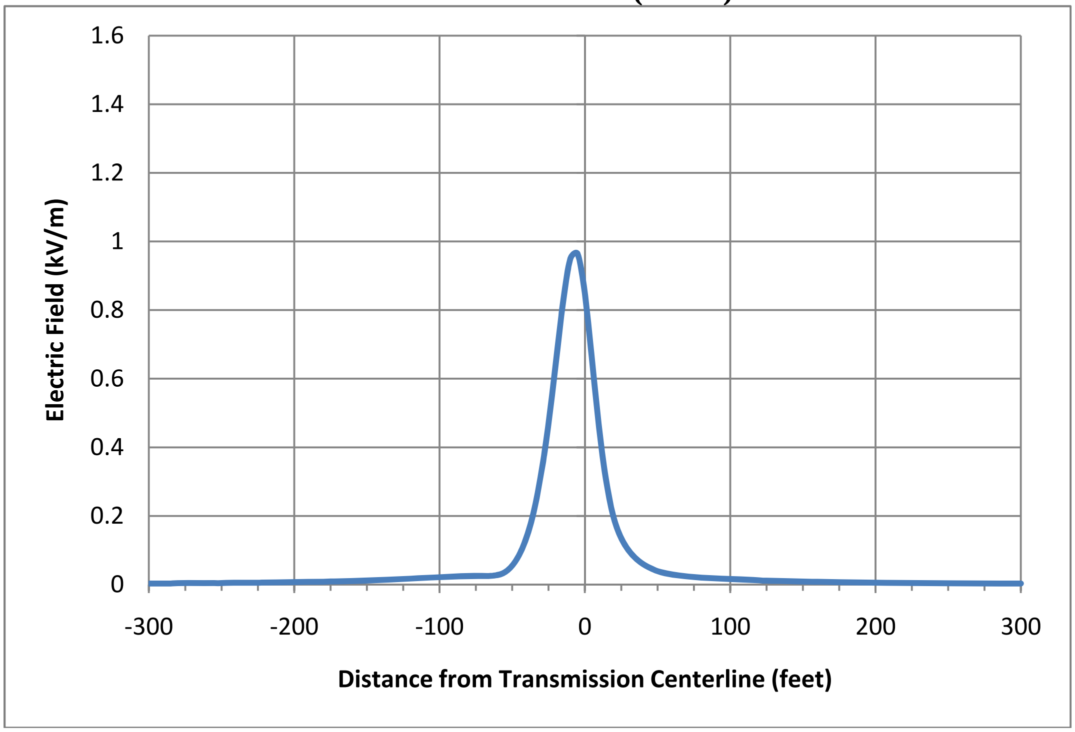


Figure 8-3   115 kV Single Circuit Savanna to Cromwell Line
Electric Field Profile (kV/M)

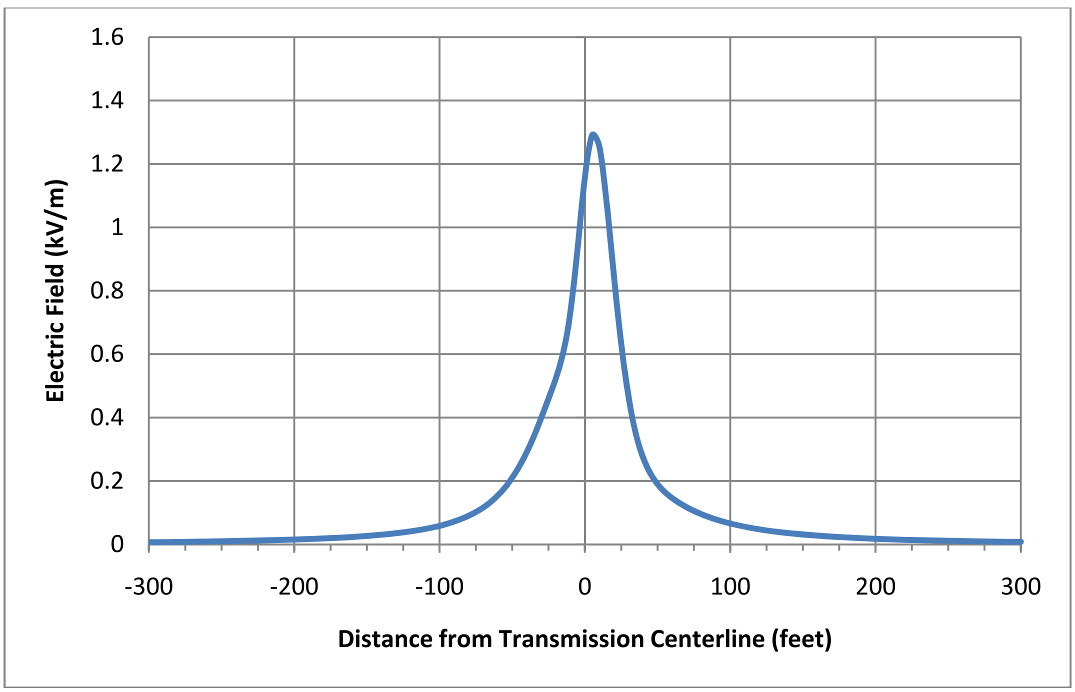
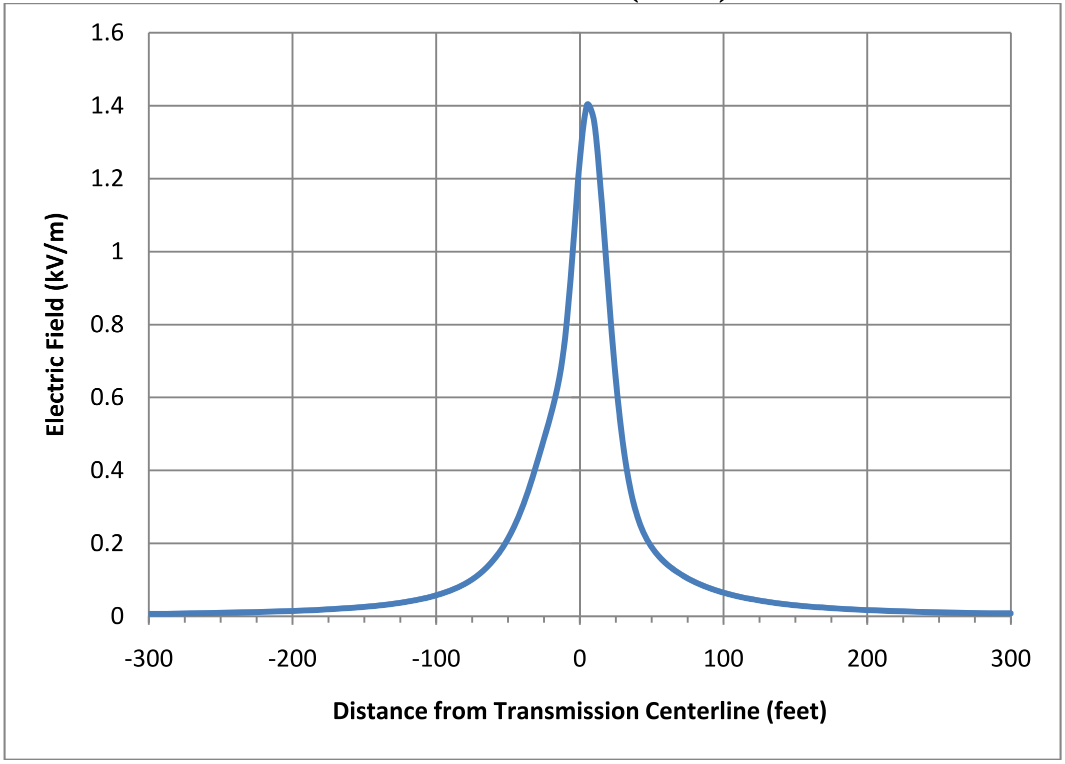


Figure 8-4 115 kV Single Circuit Savanna to Cedar Valley Line Electric Field Profile (kV/M)



<u>Induced Voltage</u>

When an electric field reaches a nearby conductive object, such as a vehicle or a metal fence, it induces 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 the weather conditions. If the object is insulated or semi-insulated from the ground and a person touches it, a small current would 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 (mA). The Applicants used computer modeling to estimate the spark discharge from a typical school bus (40' long × 8.5' wide × 12.75' high) stopped at mid-span under a typical 115/69 kV double circuit line. The modeling showed that the spark discharge would be less than 2 mA under worst-case conditions. This is less than the 5 mA NESC limit, and unlikely to register even as an annoyance. The Applicants would also 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 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 was in electric fields ranging from 1.2 to 1.7 kV/meter.

Table 8-1 and Figures 8-2 through 8-4 show 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 inhibition of 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.

8.7.3 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 from the energized conductors to other nearby objects. 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 value of the magnetic field density is expressed in the unit of gauss (G) or milligauss (mG).

[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.

There are no federal or Minnesota exposure standards for magnetic fields. The EQB and the Commission have recognized that Florida (a 150 mG limit) and New York (a 200 mG limit) are the only two state standards in the country. 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.

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 single and double circuit transmission line configurations with power flow at expected 2014-15 winter peak loading and at the line's thermal limit. The magnetic field calculations are also shown graphically in Figures 8-5 through 8-7. Because none of the Project's transmission lines will ever be loaded beyond its thermal limit, those results represent the maximum possible magnetic field associated with each line. Out of all the possible transmission line configurations, the maximum possible magnetic field is 167.96 mG. However, the actual loading of the transmission line will be far below the thermal limit of the line, resulting in a maximum magnetic field under expected peak demand conditions of 9.13 mG, which is well below most of 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 is expected to be well below the calculated intensity at the expected peak loading.

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[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/.

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

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'
115/69 kV Double Circuit Peak Load (Figure 8-5)	121/72.5	115 kV: 68.8 69 kV: 45.2	0.03	0.07	0.33	1.27	3.15	4.85	2.00	0.67	0.17	0.05	0.02
115/69 kV Double Circuit Conductor Limit (Figure 8-5)	121/72.5	115 kV: 1266 69 kV: 950	0.44	1.09	5.11	20.80	53.54	85.86	36.03	11.45	2.36	0.597	0.288
115 kV Single Circuit Savanna to Cromwell Line Peak Load (Figure 8-6)	121	68.8	0.08	0.18	0.67	2.12	4.76	9.13	5.60	2.41	0.73	0.19	0.09
115 kV Single Circuit Savanna to Cromwell Line Conductor Limit (Figure 8-6)	121	1266	1.52	3.36	12.40	39.04	87.57	167.96	102.95	44.04	13.42	3.51	1.57
115 kV Single Circuit Savanna to Cedar Valley Line Peak Load (Figure 8-7)	121	12.1	0.02	0.03	0.12	0.38	0.87	1.74	1.03	0.43	0.13	0.03	0.02
115 kV Single Circuit Savanna to Cedar Valley Line Conductor Limit (Figure 8-7)	121	950	1.14	2.53	9.36	29.82	68.41	136.47	80.99	34.00	10.14	2.64	1.18

Figure 8-5 115/69 kV Double Circuit Savanna to Cromwell Line Magnetic Field Profile (mG)

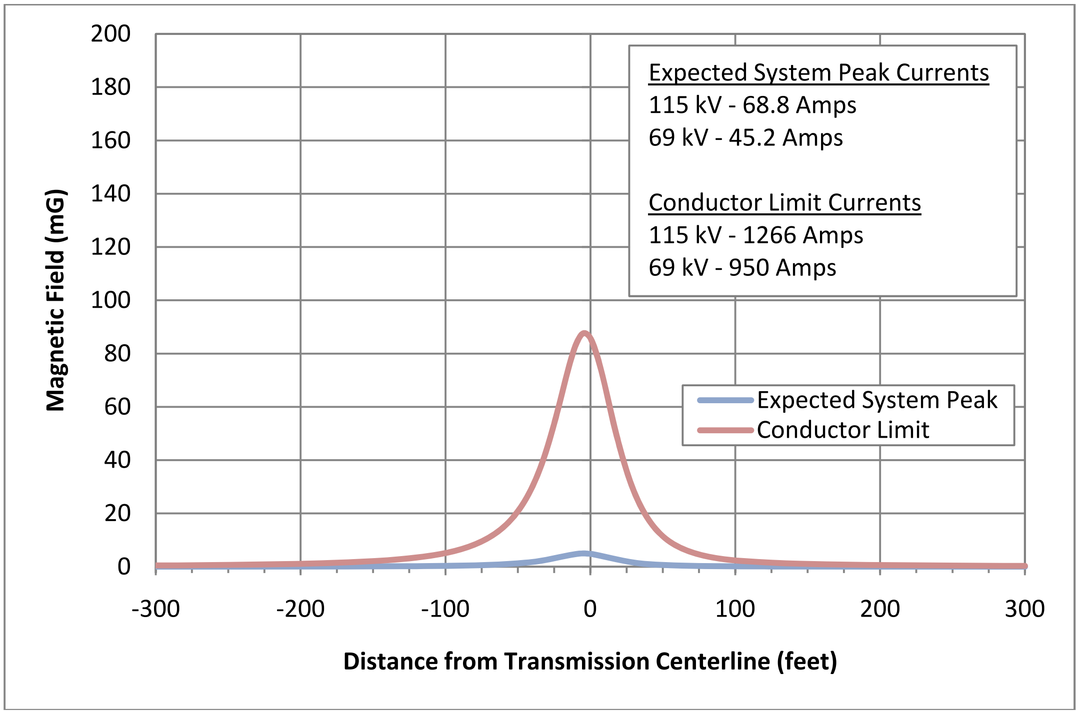


Figure 8-6 115 kV Single Circuit Savanna to Cromwell Line Magnetic Field Profile (mG)

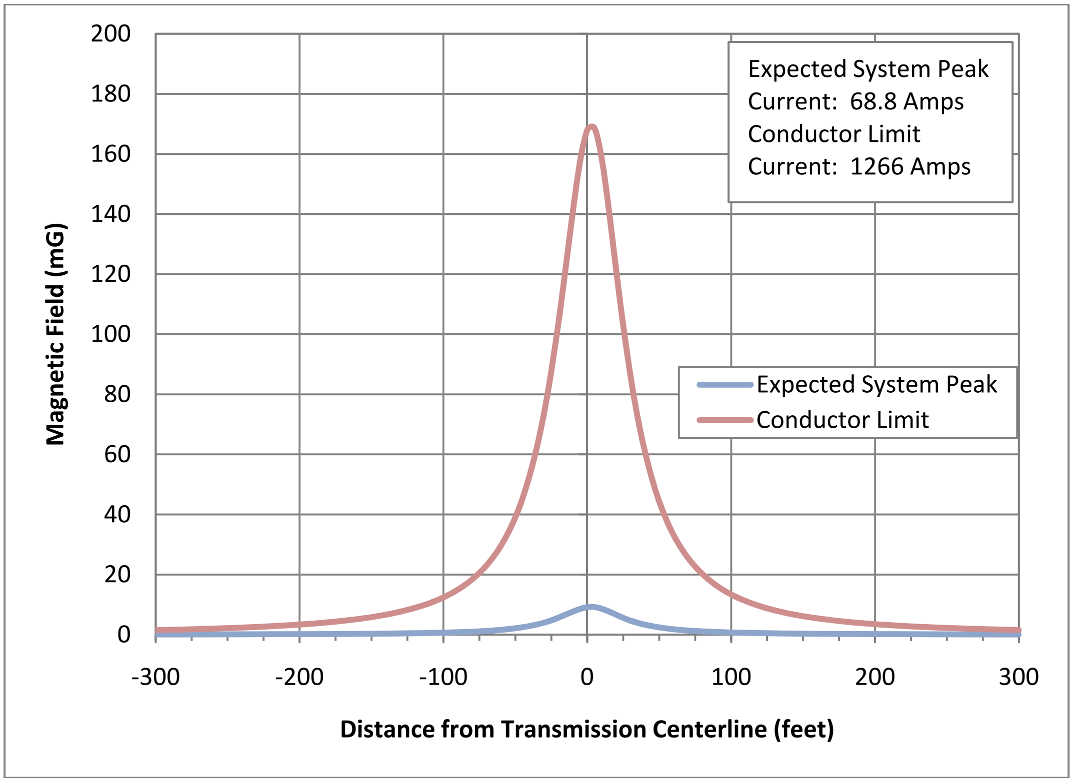
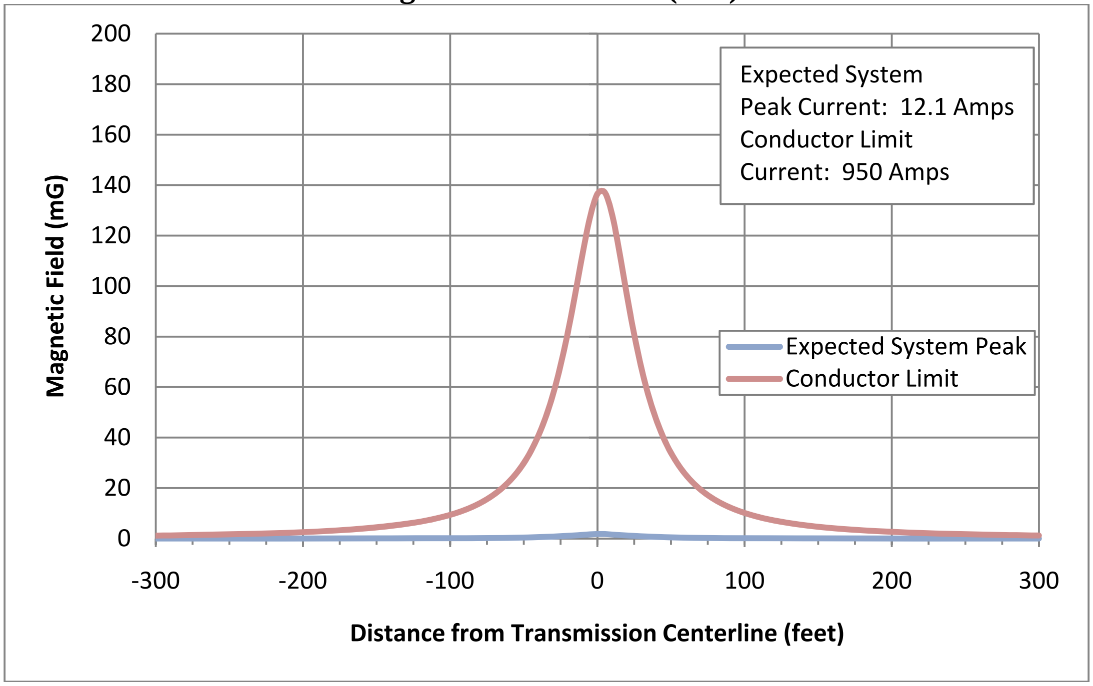


Figure 8-7 115 kV Single Circuit Savanna to Cedar Valley Line Magnetic Field Profile (mG)



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 stray voltage on a distribution circuit that is parallel and immediately under the transmission line. Appropriate measures would be taken to prevent stray voltage problems when the proposed Project parallels or crosses distributions lines.

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 the formation of audible noise and radio frequency noise. If the discharges are excessive, the audible noise can reach annoyance levels 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 8.7.2.

8.9.1 Radio and Television Interference

Because the likelihood of significant corona formation on the Project's 69 kV and 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 Applicants are unaware of any complaints related to radio or television interference resulting from the operation of existing 69 kV and 115 kV facilities in the Project area (Cedar Valley, Floodwood, and Cromwell areas) and do not expect radio and television interference to be an issue along the proposed corridor.

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 9.2.3.

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 which 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 Applicants expect ozone and nitrogen oxide concentrations associated with the Project to be negligible, and well below all federal and state standards.

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