# ENVIRONMENTAL REPORT

## BUFFALO RIDGE INCREMENTAL GENERATION OUTLET TRANSMISSION LINES

Proposed by Xcel Energy

MPUC Docket E002/CN-06-154
OAH Docket 15-2500-17838-2

ISSUED
April 24, 2007

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# ABSTRACT

On December 4, 2006, Xcel Energy applied for a Certificate of Need (CON) from the Minnesota Public Utilities Commission (PUC) to build the proposed Buffalo Ridge Incremental Generation Outlet (BRIGO Project) transmission line project. The Project includes three separate 115,000 volt (115 kV) high voltage transmission lines (HVTL), each between 10 and 20 miles long in the southwestern Minnesota counties of Murray, Lincoln, Nobles, and Lyon.

The Project is a Large HVTL as defined by Minnesota Statutes 216B.243 and requires a CON from the Minnesota Public Utilities Commission. The Project(s) also will require designation of a transmission line route(s), which will be reviewed by the PUC or local government in a separate, future routing proceeding.

An Environmental Report (ER) is required for the CON. On March 22, 2007, Department of Commerce Commissioner Glenn Wilson issued the scoping decision determining alternatives and items to be addressed in the ER. The Scoping Order is available in Appendix A.

Public and evidentiary hearings will be held by Administrative Law Judge Beverly Heydinger in southwestern Minnesota and in St. Paul. Details about the hearings are listed below:

**PUBLIC HEARINGS**

| | | |
|---|---|---|
| **May 16, 2007** | **May 17, 2007** | **May 17, 2007** |
| **7:00 p.m.** | **1:00 p.m.** | **7:00 p.m.** |
| **Murray County Govt Ctr** | **Lincoln County Courthouse** | **Marshall Municipal** |
| **Courts Bldg Meeting Room** | **Assembly Room** | **Utilities** |
| **2848 Broadway** | **319 North Rebecca Street** | **113 South 4th Street** |
| **Slayton, MN** | **Ivanhoe, MN** | **Marshall, MN** |

## EVIDENTIARY HEARING

**May 22, 2007**
**9:00 a.m.**
**Public Utilities Commission**
**121 7th Place E., Suite 350**
**Saint Paul, MN 55101**

Persons interested in receiving additional information regarding the environmental review in this matter can register their names on the Project Docket webpage at http://energyfacilities.puc.state.mn.us/Docket.html?Id=18664, by contacting Adam Sokolski, Energy Facilities Permitting, 85 7th Place East, Suite 500, St. Paul, Minnesota 55101, phone (651) 296-2096, e-mail: adam.sokolski@state.mn.us , or by contacting PUC staff person David Jacobsen, Public Utilities Commission, 121 7th Place East, Suite 350, St. Paul, MN 55101, (651) 201-2238.

# 1.0 INTRODUCTION

On December 4, 2006, Xcel Energy applied for a Certificate of Need (CON) from the Minnesota Public Utilities Commission (PUC) for the proposed Buffalo Ridge Incremental Generation Outlet (BRIGO Project) transmission line project. This Project is part of a series of measures intended to increase transmission capacity to export wind energy generated on the Buffalo Ridge to Xcel Energy's customers. Xcel indicates that the three proposed transmission lines will increase the transmission outlet capacity on the Buffalo Ridge from approximately 825 megawatts (MW) to approximately 1,175 MW and resolve electric reliability issues in the city of Marshall.

The Minnesota Department of Commerce (DOC) is the responsible governmental unit required to prepare an Environmental Report (ER) on large energy projects for which a CON is required from the PUC. Minnesota Rules parts 4410.7010 – 4410.7070.

DOC staff has followed the process for preparing an ER outlined in Minnesota Rule 4410.7030. Interested persons were notified of the project by mail and a project page was constructed on the PUC's Energy Facilities website. DOC EFP staff noticed and held public meetings in Slayton, Ivanhoe, and Marshall about the Project on February 21 and 22, 2007 to provide the public with an opportunity to ask questions, present comments, and suggest alternatives and possible impacts to be evaluated in the ER. Minnesota Rule 4410.7030, subp. 3. The public comment period closed on March 14, 2007. No written public comments were received during the comment period.

On March 22, 2007, Department of Commerce Commissioner Glenn Wilson issued the scoping decision determining alternatives and items to be addressed in the ER. Minnesota Rule 4410.7030, subp. 7. The Scoping Order is available in Appendix A.

The DOC is required to perform environmental review on CON applications to inform the final decisions made by the PUC. This ER covers the environmental review required for the CON application.

Chapter 1 and 2 provide background on the proposed project and the regulatory process. Chapter 3 describes the alternatives to the proposed BRIGO Project that attempt to reduce, mitigate or eliminate the need for the proposed transmission lines. Chapters 4 through 8 analyze the environmental, human, economic impacts and feasibility of the alternatives to the proposed BRIGO Project. Analysis of alternatives is required by

Minnesota Rule 7849.0230 and 4410.7035 for the CON application. Chapter 9 describes the additional permits required for the Project.

Much of the information contained within this document was provided by the Xcel Energy in the company's CON Application. Other information sources include previous Environmental Impact Statements and Reports prepared by the DOC, Energy Facilities Permitting staff on other transmission line projects, and certificate of need and route permit applications to the PUC for similar projects in the area. First hand information was gathered by DOC EFP staff and review of aerial photography along the proposed corridors.

Additional sources of information include:

- Minnesota Pollution Control Agency (http://www.pca.state.mn.us/)
- Minnesota Department of Natural Resources (http://www.dnr.state.mn.us/index.html)
- Minnesota Department of Health (http://www.health.state.mn.us/)
- Minnesota Department of Administration, State Demographic Center (http://www.demography.state.mn.us/)
- United States Census Bureau, QuickFacts, (http://quickfacts.census.gov/qfd/states/27000.html)

# 2.0 PROJECT DESCRIPTION AND DESIGN

## 2.1 The Applicant

The applicant is Xcel Energy, a Minnesota based, investor owned electric and natural gas utility.

## 2.2 Project Description

The proposed BRIGO transmission line project is the subject of this ER. The Project includes three separate 115,000 volt (115 kV) high voltage transmission lines (HVTL), each between 10 and 20 miles long in the southwestern Minnesota counties of Murray, Lincoln, Nobles, and Lyon. The Project is a Large HVTL as defined by Minnesota Statute 216B.243 and requires a CON from the PUC. Prior to construction, the Project(s) will also require designation of transmission line routes, which will be reviewed by the PUC or local government in a separate, future routing proceeding. Minnesota Statute 216E.

The proposed BRIGO Project lines are intended to increase the capacity of the transmission system to export wind energy generated on the Buffalo Ridge to Xcel Energy's customers. Xcel indicates that the proposed transmission lines will increase the transmission outlet capacity on the Buffalo Ridge by approximately 350 MW, from approximately 825 MW to approximately 1,175 MW. In addition, the Project has a secondary purpose to resolve electric reliability issues in the city of Marshall.

## 2.3 Project Locations

Maps of the proposed BRIGO Project transmission line corridors proposed by Xcel Energy are shown in Appendix B, and are described below:

- A 10 – 15 mile, 115 kV line from the Lake Yankton Substation near Balaton to the Southwest Marshall Substation near Marshall. (see Appendix B). The project is proposed within the Lyon County townships of Lake Marshall, Lynd, Lyons, Sodus, Custer and Rock Lake.

- A second, 15 – 20 mile, 115 kV line between the Fenton Substation near Chandler and the Nobles County Substation near Worthington. (see Appendix B). The project is proposed within the Murray County and Nobles County townships of

Fenton, Moulton, Leota, Iona, Wilmont, Bloom, Lismore, Larkin, and Summit Lake.

• A second, 10 – 15 mile, 115 kV line between the Yankee Substation south of Hendricks to the Brookings County Substation near Brookings, South Dakota. (see Appendix B). The project is proposed within the Lincoln County townships of Verdi, Drammen, and Shakotan.

The routes which the proposed lines may follow, if approved, have not yet been proposed by Xcel Energy. Proposed transmission line routes will be reviewed through a separate PUC or local government permitting process expected to begin sometime in mid to late-2007. The routing process will follow Minnesota Statutes Chapter 216E and Minnesota Rules Chapter 4400.

## 2.4 Project Design and Right-of-Way

The BRIGO Project transmission lines are proposed to be 115 kV and use 795 ACSS (aluminum conductor steel supported) conductor (wire) material. The Yankee to Brookings and the Fenton to Nobles County lines will utilize two conductors per phase. The Lake Yankton to Southwest Marshall line will utilize a single conductor for each phase. The lines will be shielded with a 3/8 inch, high strength steel overhead shield wire for lightning protection.

The lines will be designed to operate at a nominal voltage of 115 kV. During normal operations, voltage will deviate somewhat from nominal levels. The lines will be a three-phase, 60 hertz (Hz) alternating current (AC).

Four transmission structure types (poles) are being considered for the BRIGO Project and are shown in Appendix C. The structure types include single pole, wood davit arm; steel horizontal post; wood horizontal post, and; steel davit arm. Depending upon land use type, topography, right-of-way considerations and other design-dependent or route-dependent features, each of the four transmission line structure designs may be appropriate for the vast majority of applications within the proposed corridors. The transmission line structures proposed require a 75 foot wide right-of-way (ROW). These factors will be addressed in more detail in subsequent routing proceedings.

Transmission structures typical for 115 kV lines are approximately 80 – 100 feet tall and have an average span length of approximately 500 feet. Specific structure heights

and span lengths may vary and exceed the average due to land use requirements and topography. Additional specialty structures may be required at corners and where longer spans or higher clearances are required. These factors will be addressed in subsequent routing proceedings.

Wood transmission structures are typically set approximately 10 - 15 deep into the ground. A 3 - 4 foot wide hole is typically excavated or augured into the ground for each structure. After a wood structure is set in the hole, it is backfilled with material excavated, rock, gravel or concrete dependent on site conditions and design requirements.

Steel pole transmission line structures can be directly buried in the ground in the same manner as wood structures or can be placed on a buried concrete footing. Concrete footings for steel transmission structures can vary from 15 – 30 feet deep and 4 - 8 feet in width depending on the size of the structure, site specific conditions, and design requirements.

## 2.5 Project Purpose

The purpose of the BRIGO Project is to provide transmission capacity for approximately 350 MW of wind farms to be developed on the Buffalo Ridge. The specific wind farms and locations have not been identified or developed, however there are thousands of MW of wind energy transmission interconnection requests in the Buffalo Ridge region, Minnesota's best wind resource area. The BRIGO Project, if approved, would be able to serve the transmission needs for approximately 350 MW of new wind farms in the area.

Wind energy development in Minnesota is heavily driven by laws requiring utilities to procure greater and greater amounts of renewable energy every year. On February 22, 2007, Governor Pawlenty signed into law amendments to Minnesota's Renewable Energy Objectives (REO) which significantly increases the amount of renewable energy utilities are required to generate or procure. The REO statute, Minnesota Statute 216B.1619, requires renewable energy sources to make up 25 percent of retail electrical sales to Minnesota consumers by the year 2025. The law requires 20 percent of the 25 percent goal to be met with wind energy. The law requires Xcel Energy to meet a higher standard of 30 percent by 2020. The law will require approximately 5,000 MW of new renewable energy capacity to be built by 2020, most of which is required to come from wind energy.

The Legislature recognized the need for transmission plans to be established very quickly to determine the need for future transmission capacity due to the new REO statute and significantly more aggressive renewable energy goals. The statute states:

> "Minnesota electric utilities…. must study and develop plans for the transmission network enhancements necessary to support the renewable energy standards and milestones established in Minnesota Statutes, section 216B.1691, subdivision 2a. The study process must be designed to identify and optimize delivery of that renewable energy to Minnesota retail customers while maintaining system reliability." (Minnesota Session 2007, Chapter 3, Section 2).

## 2.6 Project Cost

Xcel Energy's Application provides an estimate the cost of the proposed BRIGO Project transmission lines and substation improvements at approximately $37.4 million. Table 2-1, below, summarizes the estimated cost of each proposed line.

**Table 2-1- Estimated Project Cost**

| Proposed Transmission Line | Estimated Cost (Million) |
|---|---|
| Yankee to Brookings | $11.2 |
| Fenton to Nobles County | $13.7 |
| Lake Yankton to Southwest Marshall | $12.5 |
| Total Project Cost | $37.4 |

# 3.0 GENERAL DESCRIPTION OF PROJECT ALTERNATIVES

An ER at the CON stage must address certain alternatives to the proposed project, which is spelled out in Minnesota Rule 4410.7035, subp. 1.B. The purpose of an ER is to provide the PUC and the public with information on the potential environmental impacts of a proposed project and of alternatives to the project. In transmission line cases, this normally means comparing the impacts of one set of transmission lines with other transmission options, using electrical generation near the load center rather than delivering energy using transmission lines, the use of renewable energy, a no build option, and using energy conservation.

The BRIGO Project represents a somewhat unique case. Traditionally, transmission line cases have been proposed for one of two factors;

1) growth of electrical consumption in a geographic area requiring a larger transmission to serve customer demand, or;

2) to provide an interconnection to the transmission system for specific electrical generating plant.

This ER analyzes the potential impacts associated with the BRIGO Project and the impacts of four alternatives to the proposed project: a no build alternative; use of alternate lines or corridors; generation; and, use of conservation measures.

## 3.1 No-Build Alternative

The no-build alternative means that the proposed transmission lines are not constructed. In this case, the no-build alternative is not feasible to fulfill the alleged need. The no-build alternative is analyzed in Chapter 5.

## 3.2 Existing Lines or Alternate Corridors

The ER examines the impacts, mitigation and feasibility of utilizing alternative transmission lines or corridors as an alternative to the BRIGO Project. The basis for these alternative lines is the BRIGO Engineering study conducted by Xcel Energy and included in its CON Application as Appendix B. The existing line or alternative corridor alternative is analyzed in Chapter 6 of this ER.

## 3.3 Generation Alternative

The generation alternative is analyzed in Chapter 7. The generation alternative considered in this ER provides an alternative to the Lake Yankton to Southwest Marshall

transmission line to resolve reliability issues in Marshall. A generation alternative to increase transmission capacity by 350 MW for future Buffalo Ridge wind farms is not feasible.

## 3.4 Conservation and Demand Side Management Alternative

The conservation alternative assumes that energy conservation or demand side management (DSM) measures are implemented to reduce electric demand with the idea that reduced demand can take the place of the proposed BRIGO transmission line project. The conservation and DSM alternative is analyzed in Chapter 8. The alternative is not a feasible alternative to the proposed project.

# 4.0 ASSESSMENT OF IMPACTS, MITIGRATION AND FEASIBILITY OF THE PROPOSED PROJECT

Minnesota Rule 4410.7035 requires the ER to describe and analyze the impacts of the proposed BRIGO Project. The ER identifies the possible impacts, mitigation measures, and the feasibility of the Project. This chapter describes general impacts and mitigation measures for all three of the proposed BRIGO transmission lines. Impacts or mitigation measures specific or unique to any one of the lines are highlighted in greater detail.

As stated in Chapter 2, if the PUC grants a CON for the proposed BRIGO Project, the Xcel Energy would seek approval to build the proposed BRIGO Project lines along specific routes within the proposed project corridors. Environmental review and permitting of transmission line routes is conducted through a separate permitting process found in Minnesota Statutes Chapter 216E and Minnesota Rules Chapter 4400. If approved, the PUC or a local jurisdiction issued route permit would describe a specific route, and in some cases a specific alignment, within applicant's project corridor. Through this process specific routes will be identified that avoid, to the extent possible, areas where a transmission line could create significant impacts.

## 4.1 Impacts on Human Settlement

Land use within the three proposed project corridors are dominated by agricultural land uses and are low in population density. Farmland represents approximately 79 percent to 90 percent of the land use within the counties where the BRIGO Project is proposed.

**Table 4-1 - Land Use and Human Population Density**

| County | Square Miles | Percent Farmland | Persons/Square Mile (2000) |
|---|---|---|---|
| Lincoln | 537 | 78.95% | 12 |
| Lyon | 714 | 88.41% | 36 |
| Murray | 704 | 90.44% | 13 |
| Nobles | 715 | 88.14% | 29 |

The major agricultural crops in these counties are corn and soybeans, followed by wheat. Some pasture land is also present in each of the counties. Cattle and hogs are the predominant livestock in the project corridors.

The proposed project corridors generally avoid cities and towns. Xcel has indicated in its CON notice plan filings that it does not anticipate routing any of the proposed transmission lines within cities or towns in for these projects.

### 4.1.1 Socioeconomic Impacts

The direct socioeconomic impacts of transmission lines generally fall into construction phase and long term operational impacts.

During the construction phase, impacts to social and economic resources are expected to be short-term in nature. Construction phase spending in the host communities may increase revenue for some local businesses. Hotels, restaurants, gas stations and grocery stores will likely cater to crews working on the transmission lines. Other local businesses, such as excavation contractors, ready-mix concrete and gravel suppliers, hardware stores, welding and machine shops, packaging and postal services and heavy equipment repair and maintenance service providers may benefit by supplying materials and services during the construction phase. Impacts to social services would likely be minimal due to the short-term nature of construction activities. Construction crews are estimated to be approximately 20-30 personnel who may reside temporarily in the nearby towns.

Long-term beneficial impacts from the proposed transmission lines and substation additions include increased local tax base resulting from the incremental increase in revenues from utility property taxes. The availability of reliable power in the Marshall area will have a positive effect on local businesses in the Marshall area and the quality of service provided to the general public.

A secondary set of positive long term socioeconomic impacts can be expected to coincide with future wind energy development made possible by the BRIGO Project transmission lines. County, township and school districts will benefit directly from increased wind production tax revenues. Local landowners will receive revenues from

wind rights leases and easements. Local residents or businesses may also decide in invest in wind farms resulting in further economic impacts.

### 4.1.2 Displacement

The Project is not expected to displace any homes or businesses. There are no direct impacts to human settlements anticipated as a result of the proposed BRIGO transmission lines. Additional analysis of potential displacement will occur within the rouet permitting process.

### 4.1.3 Noise

Transmission conductors and transformers at substations produce audible noise under certain conditions. The level of noise or its loudness depends on conductor conditions, voltage level, and weather conditions. In foggy, damp, or rainy weather conditions, power lines can create a subtle crackling sound due to the small amount of the electricity ionizing the moist air near the wires. During heavy rain the general background noise level is usually greater than the noise from a transmission line. During light rain, dense fog, snow, and other times when there is moisture in the air, the proposed transmission lines will produce audible noise higher than rural background levels but similar to household background levels. During dry weather, audible noise from transmission lines is a nearly imperceptible, sporadic crackling sound.

The Minnesota Pollution Control Agency (MPCA) noise regulations, Minnesota Rule 7030.0050, list various activity categories by Noise Area Classification (NAC).[1] Table 4-2 below identifies the established noise standards for daytime and nighttime by NAC. The standards are expressed as a range of dBA (decibel – A weighted) within a one hour period; $L_{50}$ is the dBA that is exceeded 50 percent of the time within an hour, while $L_{10}$ is the dBA that is exceeded ten percent of the time within the hour.

[1] http://www.pca.state.mn.us/programs/pubs/noise.pdf

**Table 4-2 - MPCA Noise Standards (dBA – Decibel, A-weighted)**

| Noise Area Classification | Daytime | | Nighttime | |
|---|---|---|---|---|
| | $L_{50}$ | $L_{10}$ | $L_{50}$ | $L_{10}$ |
| 1 | 60 | 65 | 50 | 55 |
| 2 | 65 | 70 | 65 | 70 |
| 3 | 75 | 80 | 75 | 80 |

The audible noise generated from the proposed transmission lines is not expected to, and – if permitted – will be required to meet Minnesota noise standards. Additional analysis of noise impacts and mitigation measures will be addressed in routing proceedings.

### 4.1.4 Aesthetics

Transmission lines ranging in size from 69 kV to 345 kV in size are present, and in some cases under construction, in each of the proposed project corridors. In addition, several hundred utility scale wind turbines are present within in and near the project corridors. The BRIGO Project transmission lines and structures will contrast with existing agricultural land use causing an incremental visual impact.

As described in Chapter 2, the proposed 115 kV transmission lines will utilize single steel or wood structures each approximately 80 – 100 feet tall which will be spaced approximately 500 feet apart. Xcel Energy proposes a 75 foot wide ROW for the proposed transmission lines.

The proposed lines and ROW will likely be visible to those traveling on highways, county and township roads. However, the visual impact may be tempered or significantly smaller in scale than the visual impacts of past and future wind turbine developments in the areas.

The public will have an additional opportunity to identify concerns related to the transmission line aesthetics and minimizing impacts during the route permitting process and ROW easement negotiations with individual landowners.

The BRIGO Project corridors generally have low population densities. The proposed transmission lines are unlikely to have visual impacts to large numbers of people. The only area within the project corridors containing a major city is the area immediately adjacent to and north of the Southwest Marshall Substation. This area is generally exurban, however residential and light commercial development is encroaching as development in Marshall expands toward the south.

In general and where practicable, new HVTLs are routed parallel to existing transmission, road or distribution ROWs which helps to minimize new visual disruptions to the landscape. Practices such as placing two transmission lines on a common structure ("double circuit") or placing distribution lines on a common transmission structure ("underbuild") can limit or reduce the amount of total ROW needed and visual impact of the proposed transmission lines.

Additional mitigation measures for visual impacts include structure design, materials used, route selection, and, where practicable, maintaining a vegetated screen between lines and homes. Minnesota Rule 4400.3350 generally prohibits transmission line routing within several types of protected lands including, national parks, state parks, wilderness areas, and Scientific and Natural Areas. These land uses are generally associated with scenic areas worthy of protection. These issues will be addressed in a separate transmission line routing proceeding.

### 4.1.5 Radio and Television Interference

"Radio Noise" is a term used to refer to any unwanted interference of an electromagnetic nature with any signal or communication channels throughout the radio frequency band of operation, 3 kilohertz (kHz) to 30,000 kHz. Corona-generated radio noise could cause interference with virtually any type of radio reception. However, in practice it has been found that the bands principally affected are the amplitude-modulated (AM) broadcast band, 535 to 1,605 kHz and in particular those stations broadcasting below approximately 1,000 kHz. Frequency-modulated (FM) stations are seldom impacted by electric transmission facilities. Cellular phones are unlikely to be affected due to the high frequencies used.

The radio noise generated from transmission lines is a function of conductor size and geometry, conductor height above ground, phase spacing, and ground resistance. Because radio noise is due to corona discharges, it also depends on the line's operating voltage and weather conditions.

The Federal Communications Commission (FCC) considers transmission lines inadvertent emitters and therefore they are not covered directly by FCC regulations. However, in the past, the FCC and the State of Minnesota have suggested that transmission line radio noise should not result in interference within a licensed broadcast station's primary coverage area for non-mobile receivers outside the line's right of way. The proposed HVTLs are not expected to impact reception of commercial AM radio stations with non-mobile receivers.

Corona generated noise could cause interference with TV picture reception similarly as in the case with AM radio interference since the picture is broadcast as an AM signal. The level of interference depends on the TV signal strength for a particular channel. TV audio is an FM signal that it is typically not affected by transmission line radio frequency noise.

Due to the higher frequencies of the TV broadcast signal (54 megahertz and above), 115 kV transmission lines seldom result in reception problems within a station's primary coverage area. In the rare situation that the proposed transmission line would cause TV interference, Xcel Energy would work with the affected party to correct the problem.

Usually any reception problem can be corrected with the addition or modification of an outdoor antenna. TV picture reception interference can also be the result of a transmission structure blocking the signal to homes in close proximity to a structure. Measurements can be made to verify whether a structure is the cause of reception problems. Reception problems can usually be corrected with the addition of an outside antenna, an amplifier or both. If issued a CON and route permits, Xcel Energy will be required to correct any interference to communications facilities it causes or creates.

### 4.1.6 Human Health and Safety

The proposed BRIGO Project transmission lines will be designed in compliance with local, state, National Electric Safety Code (NESC), and Xcel Energy standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and ROW widths. Xcel Energy and its construction crews will comply with local, state, NESC, and Xcel standards regarding installation of facilities and standard construction practices. Established Xcel Energy and industry safety procedures will be followed during and after installation of the transmission line. This will include clear signage during all construction activities.

The proposed transmission lines will be equipped with protective devices to safeguard the public from the transmission line if an accident occurs, such as a structure or conductor falling to the ground. The protective devices are breakers and relays located where the line connects to the substation. The protective equipment will de-energize the line should an accident occur. In addition, the substation facilities will be fenced and access limited to authorized personnel. Proper signage will be posted warning the public of the risk of coming into contact with the energized equipment.

Electric and magnetic fields (EMF) arise from the flow of electricity and the voltage all electrical conductors. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors.

Many years of research on the biological effects of electromagnetic fields have been conducted on animals and humans. No association has been found between exposure to EMF and human disease. While the consensus is that EMF poses no risk to humans, the question of whether exposure to EMF can cause biological responses or even health effects continues to be the subject of medical research and public debate.

In 2002, Minnesota formed an Interagency Working Group to evaluate the body of research and develop policy recommendations to protect the public health from any potential problems resulting from HVTL EMF effects. The Working Group consisted of staff from the Department of Health, the Department of Commerce, the Public Utilities Commission, the Pollution Control Agency, and the Environmental Quality Board (EQB). The Department of Health coordinated the activities of the Working Group.

In September 2002, the Working Group published its findings in a White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options (hereinafter "White Paper"). The Minnesota Department of Health made the following statement on EMF exposure in the "White Paper:"

> "The Minnesota Department of Health concludes that the current body of evidence is insufficient to establish a cause and effect relationship between EMF and adverse health effects. However, as with many other environmental health issues, the possibility of a health risk from EMF cannot be completely dismissed. The uncertainty surrounding EMF health effects presents a difficult context in which to

make regulatory decisions. This approach suggests that one should avoid any activity or exposure about which there are questions of safety or health, at least to the extent that an activity can be avoided easily or cheaply."

Additional discussion of EMF can be found in the White Paper[2].

Minnesota does not have an exposure standard for magnetic fields. The PUC, and prior to it, the EQB, have recognized in other transmission line proceedings that other states have established standards for magnetic fields, e.g., Florida (150 milligauss limit) and New York (200 milligauss limit).

The anticipated magnetic field was calculated for the structures being considered for the BRIGO projects by Xcel Energy. The expected magnetic fields associated with the proposed transmission lines were estimated by Xcel Energy and are found below.

**Table 4-3 - Estimated Magnetic Fields (milligauss) at One Meter above Ground**

| Type | Voltage | Distance to Centerline (Miligauss) | | |
|---|---|---|---|---|
| | | 37.5' | 0' | - 37.5' |
| 115 kV maximum loading conditions | 115 kV | 54 | 110 | 54 |
| 115 kV normal loading conditions | 115 kV | 32 | 65 | 32 |

The proposed lines are expected to fall well below limits found in other states, and within the limits allowed by the PUC in prior route permit proceedings.

The electric field from a transmission line can induce an electric charge on other conducting objects in the vicinity of the line, such as vehicles and fences. If these objects are insulated or semi-insulated from the ground, and a person touched them, 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 a grounded object or another person. Due to the relatively low operating voltage of the proposed lines, these discharges are unlikely to reach an annoyance level.

[2] http://www.health.state.mn.us/divs/eh/radiation/emf/links.html

There are no state or federal standards for transmission line electric fields. However, in previous transmission line permits, the EQB and PUC have imposed a maximum electric field limit of eight (8) kV/meter measured one meter above the ground. The restriction was designed to prevent serious hazard from shocks when touching large objects like a bus or combine parked under high voltage transmission lines.

The proposed HVTL will be designed such that the discharge from any large object such as a bus or truck parked under or adjacent to the line will be approximately 1 kV/meter directly below the transmission line and approximately 0.5 kV/meter at the edge of the ROW. Xcel will assure that any fence or other large permanent conductive object in close proximity or parallel to the line would be grounded so that excessive discharges would not occur.

## 4.2 Impacts on Land-Based Economics

The vast majority of lands within the proposed BRIGO Project corridors are rural and agricultural in nature. Additional land uses include rural residences and farmsteads, lands protected for conservation or wildlife purposes, wetlands, and lakes. The Project corridors include a few small towns and small commercial districts which are assumed to be avoided.

The proposed BRIGO Project is expected to have minimal impacts on existing land uses. In general, new transmission lines are often co-located with existing roads, utility rights-of-way (including existing transmission lines), or similar linear corridors such as underground pipelines or railroads.

While temporary impacts associated with construction are expected, no significant long term impacts or conversion of land to other uses are expected.

### 4.2.1 Recreation

Recreational opportunities in the general area of the proposed project areas include horse-back riding, boating, fishing, hunting, snowmobiling and cross-country skiing. There are numerous natural resource focused recreational sites located in this area and including many state wildlife management areas (WMAs), public lakes and streams, U.S. Fish and Wildlife Service Waterfowl Production Areas (WPAs), a state park, federal wetland easements, and county parks.

*Lake Yankton to Southwest Marshall Corridor*

The Lake Yankton to Southwest Marshall project corridor has many more recreational resources and protected lands present than the Yankee to Brookings and the Fenton to Nobles project corridors. The area surrounding and north of the Lake Yankton Substation contains several lakes, rivers, WMAs and the Black Rush Lake WPA. Camden State Park is approximately 1 mile west of the project corridor. Designated snowmobile trails are present in the corridor and are found parallel to Minnesota Highway 23 and U.S. Highway 59.

*Yankee to Brookings Corridor*

The Minnesota portion of the Yankee to Brookings project corridor has several state WMAs located in the north eastern portion of the project area. No additional recreational facilities, protected lands, or designated trails are present.

*Fenton to Nobles County*

The Fenton to Nobles County project corridor has several state WMAs concentrated in the northeastern part of the corridor. Additional WMAs and WPAs are scattered throughout the corridor. The corridor contains designated snowmobile trails between Slayton and Iona, and connecting Lismore, Wilmont, and the Reading areas.

Construction and operation of the proposed BRIGO Project could have a visual impact on recreational resources depending on the route permitted. Impacts are not expected to reduce the availability or quality of recreational uses in the corridors. It is assumed that the specific routes and alignments will located near existing transmission line corridors and/or other corridors such as county and township road and railroad ROWs. This will minimize or mitigate the visual and physical impacts to the surrounding areas and avoid new impacts in undisturbed areas.

The route permitting process will provide additional opportunity to evaluate alternate routes and mitigation measures to minimize impacts to recreational resources.

### 4.2.2 Farmland

The BRIGO Project corridors are primarily active farmland. Impacts to farmlands are usually highest during the construction phase. During the construction, utility construction equipment may damage crops, compact soil, require grading, require temporary relocation of livestock fencing, and temporarily interrupt some farming activities. In general, or by permit, utilities contact the landowners prior to construction to

discuss transmission line construction schedules, potential crop damages, negotiate payments and additional mitigation measures for damage, soil compaction and other impacts.

In those areas where there is potential to cross agricultural fields, efforts are made to place transmission line structures placed in a manner to minimize interference with agricultural operations, especially maneuvering equipment around transmission structures.

To reduce or mitigate against interference with farm operations, transmission lines are typically placed along existing road ROW, along section lines, or along existing transmission lines to reduce, mitigate, or prevent impacts on agricultural operations. The proposed transmission lines will not cause a significant loss of farmland. Additional information and analysis on farmland impacts will be addressed in the routing process.

### 4.2.3 Transportation

New transmission lines generally do not affect surface transportation systems except for minor impacts during the construction period. These impacts are typically found at the edge of the road ROW well off the road surface and away from traffic. Utilities are required to obtain permits from federal, state, or local road management jurisdictions if a transmission line crosses a road or when the line is to occupy any part of a road ROW.

Several airports are near the project corridors. The Southwest Minnesota Regional Airport is approximately 2 miles north of the Southwest Marshall Substation. The Tyler Municipal Airport is approximately 10 miles west of the Lake Yankton – Southwest Marshall corridor. The Worthington Municipal Airport is approximately 10 miles south of the Nobles County Substation. The Slayton Municipal Airport is approximately 10 miles northeast of the Fenton Substation.

Xcel Energy may need to secure a flight hazard determination from the Federal Aviation Administration (FAA) if transmission line structures exceed the 100:1 glide slope within a 20,000-foot airport runway buffer zone. To meet this standard, a 100 foot tall transmission line structure would need to be located at least 4,000 feet of a primary airport runway, 2,000 feet of a secondary runway, or 1,200 feet on either side of a runway. This

process involves providing the FAA with the general configuration of the structures along with elevations and height.[3]

The proposed transmission lines are not expected to have any impact on aviation. Transportation impacts and mitigation measures will be examined in greater detail during the route permitting process.

### 4.2.4 Mining and Forestry

Xcel reports that forestry resources are not present in the project corridors. The BRIGO Project transmission lines are not expected to impact any active forestry resources.

Xcel reports that several active and inactive gravel, sand, and aggregate quarries are present within the Lake Yankton to SW Marshall project corridor and no mining facilities within the Minnesota portion of the Yankee to Brookings and the Fenton to Nobles County corridors. The BRIGO Project is not expected to have impacts on mining resources.

### 4.2.5 Archeological and Historic Resources

Construction of new HVTL structures in the proposed project corridors could impact previously identified and currently unknown cultural resources.

In general, the Buffalo Ridge is recognized to have a high occurrence of archeological sites. Cultural and archeological sites in the area are typically concentrated near permanent waterways or near ridges. Historic sites, such as historic buildings, trails, and abandoned dwellings are typically scattered throughout the landscape.

Within each of the project corridors, Xcel indicates that there are known archeological sites, and potential for discovery of additional archeological and historic sites. Maps of the proposed BRIGO Project corridors are reproduced in Appendix B and provide a general geographic location of sites without identifying specific resources and locations. There are no historic sites within the project corridors listed on the National Register of Historic Places (NRHP), however some may be discovered or eligible upon formal evaluation.

Archaeological sites may be discovered during construction of transmission structures, maintenance structures, staging areas or access roads. Historic buildings or

[3] Title 14 of the Code of Federal Regulations CFR Part 77 (http://www1.faa.gov/ats/ata/ata400/oeaaa.html)

other sites may be impacted as construction of modern transmission structures may compromise the integrity of a historic view shed from cultural resources. The potential impacts would be determined once routes are selected within the project corridors.

Prior to or during the route permitting process, Xcel Energy will request a search of the State Historic Preservation Office (SHPO) cultural and historic resources database to determine if cultural or historic resources are present along proposed routes. Xcel Energy may be required to conduct a Phase 1 study to determine if a proposed route or alternative has a high potential for cultural resources. A Phase 1 study would be coordinated with the appropriate landowners or land management agency. A product of the survey would be a cultural resources report recording findings and suggesting mitigation measures. The findings would be reviewed with the SHPO and specific mitigation measures necessary for each site or resource would be determined.

Mitigation may include modifications to the route, relocation of ROW, structure sites and other disturbed areas to avoid cultural or historic sites. Additional mitigation measures consistent with minimizing visual impacts may be recommended or implemented. Additional analysis of impacts and mitigation for archeological and historic resources will occur during the route permitting process.

## 4.3 Impacts on the Natural Environment

The environmental setting, and the general potential impacts and mitigation measures for the three BRIGO Project transmission line corridors are very similar.

Each of the proposed BRIGO Project corridors are located within the Minnesota Department of Natural Resources (DNR) North Central Glaciated Plains Ecological Classification section. Portions of the proposed corridors fall into two subsections of the North Central Glaciated Plains section: Coteau Moraines and Inner Coteau. The corridors are characterized by glacial moraines with rolling to steep grades. Prior to human settlement, most of the landscape in these areas consisted of tall grass prairie, some wetland areas and forested areas along streams and rivers.

### 4.3.1 Air Quality

During transmission line construction, there will be emissions from vehicles and construction equipment and fugitive dust from ROW clearing. Temporary air quality impacts caused by the construction-related emissions are expected to occur. Exhaust emissions from diesel equipment will vary during construction, but will be minimal and

temporary. Fugitive dust may result from ROW clearing. The magnitude of these emissions is influenced heavily by weather conditions and the specific construction activity taking place.

The only potential air emissions from a 115 kV transmission line result from corona and are limited. Corona can produce ozone and oxides of nitrogen in the air surrounding the conductor, especially in humid conditions. Corona consists of the ionization of air within a few centimeters immediately surrounding conductors. Ozone is a very reactive form of oxygen and combines readily with other elements and compounds in the atmosphere. Because of its reactivity, it is relatively short-lived.

### 4.3.2 Water Quality

This section describes and analyzes each of the BRIGO Project corridors separately as there are specific differences among the project corridors. Following the description of each corridor, the ER discusses general mitigation measures and permitting requirements relevant to transmission line construction potentially affecting water resources.

***Yankee to Brookings Project Corridor***

The Minnesota portion of the Yankee to Brookings project corridor is on the divide of the Missouri River and Minnesota River watersheds. Lakes, streams, and wetland areas are scattered throughout the area. Most of the water bodies present are listed in the DNR's Public Waters Inventory (PWI). The major streams in the area include Medary Creek, and Spring Creek which flow into the Missouri River watershed and Norwegian Creek which flows into Lake Benton and the Minnesota River watershed.

It is important to note that several of the streams in the area are designated by the United States Fish and Wildlife Service (USFWS) as critical habitat for the Topeka Shiner, an endangered species of fish. While the proposed transmission line is unlikely to have direct impacts on critical habitat, additional consultation, planning, permitting, and best management practices may be required to ensure that critical habitat is protected.

***Lake Yankton to Southwest Marshall Project Corridor***

The Lake Yankton to Southwest Marshall project corridor is entirely in the Minnesota River watershed. The southern portion of the project corridor contains several lakes, numerous wetlands, and the Cottonwood River. Several state WMAs, a large federal WPA, and numerous PWI streams are present in the southern portion of the corridor.

The northern portion of the corridor contains more streams and fewer wetlands and lakes than the southern portion. The streams in this area generally flow from the southwest to the northeast toward Meadow Creek, the Redwood River, and Marshall Lake.

***Fenton to Nobles County Project Corridor***

The Fenton to Nobles County project corridor straddles the divide between the Minnesota River watershed and the Missouri River watershed. Small streams, lakes and wetlands are scattered throughout the corridor.

The northeastern portion of the corridor contains a higher concentration of wetlands and lakes than the remainder of the corridor. Corabelle Lake and Willow Lake are two of the larger lakes in the area.

It is important to note that several of the streams in the corridor are designated by the USFWS as critical habitat for the Topeka Shiner, an endangered species of fish. While the proposed transmission line is unlikely to have direct impacts on critical habitat, additional consultation, planning, permitting, and best management practices may be required to ensure that critical habitat is protected.

***Impacts and Mitigation Measures***

Wetlands, lakes, rivers and floodplains perform several important functions within a landscape, including flood attenuation, ground water recharge, water quality protection and wildlife habitat production. Water resources are regulated by several different agencies in Minnesota, including the United States Army Corps of Engineers (USACE), the Minnesota Board of Water and Soil Resources (BWSR), the DNR and the Minnesota Pollution Control Agency (PCA).

Wetlands are defined by the USACE as "Waters of the United States" and are subject to jurisdiction under Section 404 of the Clean Water Act. Waters of the United States include both wetlands and non-wetlands that meet USACE criteria. In Minnesota, all wetlands are regulated under the Wetland Conservation Act of 1991 (Minnesota Statute 103G.222 - .2373 requiring coordination with BWSR) and Section 404 of the Clean Water Act by the USACE.

Minnesota Public Waters are water basins and watercourses of significant recreational or natural resource value in Minnesota as defined in Minnesota Statute 103G.005. The DNR has regulatory jurisdiction over these waters.

During construction there is the possibility of sediment reaching surface waters when the ground is disturbed by excavation, grading, and construction traffic. Xcel Energy will be required to obtain a National Pollution Discharge Elimination System (NPDES) storm water permit and follow standard erosion control measures identified in the Minnesota Pollution Control Agency's Stormwater Best Management Practices Manual. These measures include using silt fencing to prevent impacts to adjacent water resources. Once the proposed BRIGO transmission line projects are complete they are not expected to have ongoing impacts on surface water quality.

The proposed transmission lines may be able to avoid most wetland areas and surface water features, such as rivers and streams, by spanning the transmission line over water bodies. In practice, utility companies attempt to avoid placing poles in wetlands. If placement of poles in wetlands is necessary, the Xcel will minimize impacts by using special construction mats to limit disturbance and compaction. If areas of the wetland are disturbed, the area will be restored to preconstruction contours and will allow the existing seed bank to re-vegetate the area. Any soil removed from the wetlands will not be placed back into the wetland.

If any of the proposed transmission lines crosses or has an impact to a public river, stream or wetland, Xcel Energy will be required to obtain one of several permits to cross, work or place structures within the specific water resource from the Minnesota DNR, the US Army Corps of Engineers, or the local unit of government.

### 4.3.3 Soils and Geology

Minimal impacts to soils outside of the direct impact of the transmission line structures, are anticipated. Soil erosion control measures will be followed to minimize loss of top soil; areas disturbed will be returned to their pre-construction condition. Route permits generally require that soils compacted by construction are restored by the utility after construction is complete.

No permanent impacts to the subsoil or geology within the proposed corridors are anticipated.

### 4.3.4 Flora, Fauna, Rare and Unique Resources

The BRIGO Project corridors are located in the prairie grassland region of Minnesota. Historically, the corridors were dominated by tall grass prairies and have been converted almost entirely to agricultural cultivation. Small amounts of native prairie remnants are found throughout the region in isolated locations, or in some cases, have been restored on protected lands.

As shown in Table 4-1, 80 percent – 90 percent of the land in Lincoln, Lyon, Murray, and Nobles counties has been converted to farmland use.

Xcel's CON Application indicates that one of the best examples of native prairie remnants in southwest Minnesota can be found in the Lundbald Prairie Scientific and Natural Area (SNA). The SNA is in the extreme northeastern portion of the Fenton to Nobles County corridor, approximately 12 miles northeast of the Fenton Substation. According to the DNR, the Lundbald SNA is one of the best and largest remnant prairies in Minnesota and provides a glimpse into the resettlement landscape. Transmission lines are prohibited in SNAs.

Additional native prairie species or prairies are present or may be present in the WMAs, SNAs, WPAs, and other protected or uncultivated lands within the project corridors.

Impacts to vegetation may occur due to the placement of transmission line structures and ROW clearing. In general, utilities prohibit tall growing tree species within transmission line ROW. However, row crops such as corn, soybeans and wheat are appropriate. Vegetation clearing may be necessary along the ROW, but is dependant upon the final route and alignment of the line.

While the majority of the proposed corridors have been converted to farmland, many species of wildlife are present. WMAs, SNAs, river and stream valleys, and wetlands within the corridors provide habitat for white-tailed deer, pheasants, opossum, wild turkey, migratory waterfowl, and small mammals such as rabbits and fox. Fish, reptiles and amphibians, such as snakes, turtles, toads and frogs are likely be found near the streams, wetlands and open waters within the corridors. Numerous species of avian and waterfowl use southwestern Minnesota for nesting and migration.

Several endangered, threatened or species of special concern are known to inhabit portions of the project areas.

The Topeka shiner, a federally protected endangered species of fish, has been identified and critical habitat designated in portions of Lincoln, Murray and Nobles counties. The Topeka Shiner is a small minnow, less than three inches in total length. It is an overall silvery color, with a well defined dark stripe along its side, and a dark wedge-shaped spot at the base of the tail fin. Mitigation measures include minimizing soil erosion and silt in streambeds.

The Dakota Skipper, a candidate for federal endangered species protection, has been identified in portions of Lincoln County. The Dakota Skipper is a small butterfly with a wingspan of approximately 1 inch. This species is found and relies on high quality native prairie habitat. Mitigation measures include avoiding or minimizing impacts on native prairie habitats.

Raptors, waterfowl and other bird species may be affected by the construction and placement of the transmission lines. Avian collisions are a possibility after the completion of the transmission line and are rare. Waterfowl are typically more susceptible to transmission line collision, especially if the line is placed between agricultural fields that serve as feeding areas or between wetlands and open water, which serve as resting areas.

Additional mitigation measures specific to avian species are available, such as the guidelines published by the Edison Electric Institute's, Avian Power Line Interaction Committee document entitled "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006."

The potential for the permanent displacement of wildlife and loss of habitat from construction of the proposed project is low. Wildlife that inhabits natural areas, such as those near water bodies, conservation lands, and native prairies, could be impacted in the short-term within the immediate area of construction. The distance that animals will be displaced will depend on the species. The impacts to wildlife should be short-term and limited assuming that routes selected would follow existing disturbed ROW, would avoid native prairie, protected lands, and known nesting sites.

## 4.4 Feasibility and Availability

The BRIGO Project is feasible. Transmission line technology of the type proposed is widely available and deployed throughout Minnesota. The proposed BRIGO Project provides approximately 350 MW of additional transmission outlet capacity on the Buffalo Ridge and resolves reliability problems in Marshall.

# 5.0 NO-BUILD ALTERNATIVE

Minnesota Rule 4410.7035 requires the ER to describe and analyze the impacts of and mitigation measures for a no-build alternative. Under the no-build alternative, the BRIGO Project would not be built.

## 5.1 Summary of the No-Build Alternative

If the proposed BRIGO Project is not built, and in the absence of an alternate plan to increase transmission capacity, future development of Minnesota's best wind resource cannot occur. Under the no-build alternative, wind generation on the Buffalo Ridge will be capped at the existing 825 MW level until a time additional outlet capacity (a different transmission line or lines) becomes available.

In addition, under the no-build scenario, Marshall Municipal Utilities (MMU) and its transmission providers will need to find a different solution to address transmission security and adequacy (reliability) issues in Marshall without relying on the Lake Yankton Substation to Southwest Marshall transmission line. Customers in the MMU service territory will continue to be exposed the risk of unplanned blackouts and low voltage risks until a solution can be implemented. Such alternative solutions to reliability may include new or upgraded transmission lines, new electrical generation sited within the Marshall, conservation or demand side management.

While a no-build alternative is feasible - it can be done – the alternative does carry significant impacts, costs and implications affecting Minnesota's energy policies, efficient use of wind resources, landowners, the economy, and electric reliability. Some of these impacts or benefits may be shifted from the Buffalo Ridge region to somewhere else in Minnesota or to neighboring states if transmission lines are developed to serve wind energy development elsewhere.

## 5.2 Impacts on Human Settlement

The no-build alternative has no incremental physical impact to human settlements, simply by not building three new transmission lines.

Socioeconomic impacts are likely under a no-build alternative. These impacts may stem from restricting future development of Minnesota's best wind energy resource and not addressing reliability issues in Marshall.

Capping transmission capacity in the Buffalo Ridge will create negative economic impacts on the local human and socioeconomic environment. According to Xcel's Application, and by reviewing the Midwest Independent System Operator (MISO) interconnection queue, wind developers have made transmission interconnection requests with MISO for at least 2,100 MW of wind generation on or near Buffalo Ridge. While the BRIGO Project only increases the transmission outlet capacity in the area by about 350 MW, if the proposed BRIGO Project is not built, some wind developers will have no other choice than to develop elsewhere. New wind and transmission lines may be proposed in other locations in Minnesota or other states to meet Minnesota's aggressive wind energy production goals. This would shift transmission and wind generation impacts from the BRIGO Project corridors to another unidentified locations.

Restricting future development of wind energy on the Buffalo Ridge may "strand" the pre-development investments of wind developers, will reduce future construction labor sourced locally, and will reduce locally procured materials. Significant additional costs include the loss of future wind energy production tax revenue at the county, township and school district levels in the affected area. Local residents and landowners will be not be able to invest or reap the financial benefits (or risks) associated with developing their local wind resources.

Economic impacts to Minnesota ratepayers can be expected if transmission capacity is not increased on the Buffalo Ridge. As shown in Appendix D, the Buffalo Ridge is Minnesota's best wind resource and among the best wind resources in the region. Future wind generation developed in lower quality wind resource areas is likely to cost more than if developed on Buffalo Ridge. Relying on lower wind resource areas will likely result in lower energy production (and revenue) per MW of installed capacity, while capital costs remain unchanged. The result is higher cost for the same quantity of wind generated electricity.

Finally, economic impacts to electric customers in Marshall will result under a no-build alternative. Customers will continue to be at an increasing risk of low voltage or blackout until electric reliability in Marshall is resolved. Economic impacts will range from minor, inconveniences to major economic losses at major commercial or industrial facilities.

## 5.3 Impacts on Land-Based Economics

Impacts on recreation, farmland, transportation, mining and forestry resources are not expected under the no-build alternative. Such impacts are generally associated with transmission line construction and operation, which do not occur under the no-build alternative.

## 5.4 Impacts on the Natural Environment

Under the no-build alternative, there will be no new potential impacts on air quality, water quality, soil, vegetation, or rare natural resources associated with new transmission line construction and operation.

## 5.5 Feasibility and Availability

The no-build alternative is feasible and available. However, the no-build has significant negative socioeconomic impacts on the future development of Minnesota's best wind resources and on electric customers of MMU.

# 6.0 EXISTING LINE OR ALTERNATE CORRIDOR ALTERNATIVE

Minnesota Rule 4410.7035 requires the ER to describe and analyze the impacts of upgrading existing transmission lines and/or using different transmission line corridors to meet the alleged need. This section examines utilizing various existing and new transmission lines through existing line upgrades and building new lines located in different locations.

The ER examines the transmission system and alternative corridor alternatives studied in Xcel Energy's "Buffalo Ridge Incremental Generation Outlet Electric Transmission Study" (BRIGO Engineering Study) found in Appendix B of the CON Application. The BRIGO Engineering Study analyzed a large number of transmission line options leading to Xcel's selection of the proposed BRIGO Project lines as its preferred alternative. All of the options studied, including those options rejected by Xcel, are new 115 kV lines, upgraded or rebuilt transmission lines at the 115 kV level, and substation improvements in southwestern Minnesota and southeastern South Dakota.

The BRIGO Engineering Study compared the cost, incremental outlet capacity, energy losses, feasibility, use of existing ROW and other factors associated with transmission line construction. Xcel's professional electrical engineers and transmission planners recommended the three BRIGO Project lines as the least cost option to increase transmission system outlet capacity by approximately 350 MW in the Buffalo Ridge region. The study solicited the participation, technical input and comments of transmission engineering staff of at least 10 regional transmission utility companies.

Each option considered in the BRIGO Engineering Study included infrastructure intended to resolve reliability issues in Marshall.

Chapter 7 of Xcel's CON Application provides environmental data about each of the transmission options rejected in the BRIGO Engineering Study. This data forms the basis of comparison between the rejected options and the three options preferred and proposed by Xcel Energy.

In general, the Xcel's rejected transmission line options have very similar impacts to the human, natural and economic environments in southwestern Minnesota.

However, due to the lack of route specific information, it is difficult to compare specific impacts between the proposed BRIGO transmission lines with the transmission options rejected in the BRIGO engineering study. Generally, the impacts of the rejected transmission options are the same as the proposed BRIGO Project, except as noted below.

## 6.1 Impacts on Human Settlement

### 6.1.1 Socioeconomic Impacts

The socioeconomic impacts of the rejected transmission options are likely to be similar to or greater than the proposed BRIGO Project. Xcel's combination options (3-1A, 6-1A, 7-1A, and option 9) provide for approximately 1175 MW of transmission capacity for wind energy on the Buffalo Ridge, but are more expensive, have equal or greater technical complexity, and have higher energy losses (a negative economic impact) than the proposed BRIGO Project.

Xcel's rejected options 5, 9 and the combinations of options 3-1A, 6-1A, and 7-1A also resolve the reliability issues in the MMU service territory, therefore avoiding the negative socioeconomic impacts associated with unreliable electric supply discussed in the no-build option.

### 6.1.2 Displacement

The rejected alternatives are not expected to displace any residential homes or businesses. There are no direct impacts to human settlements anticipated as a result of the rejected transmission line options. Additional analysis of potential displacement would occur within the route permitting process.

### 6.1.3 Noise

Differences in noise impacts between the BRIGO Project and the rejected transmission options are route specific issues due to potential proximity of lines to noise receptors such as homes and businesses. The BRIGO Project and the rejected alternatives are expected to have similar noise impacts as all are 115 kV transmission lines. Mitigation measures would be consistent with those for the proposed BRIGO Project, as described in Chapter 4.

### 6.1.4 Aesthetics

All lines, with the exception of option 9 "reconductor/rebuild only", considered in the BRIGO Engineering Study are 115 kV and would likely use similar structures as the BRIGO Project. Differences in structure type would likely occur where a new 115 kV line and an existing 69 kV or 115 KV line are placed on a shared structure, a practice called a double circuit. The BRIGO Engineering Study indicates that double circuit options are limited in this case due to reliability concerns. However, double circuit opportunities may exist and will be dependent on route selection and presence of existing transmission circuits appropriate for double circuiting. Double circuit structures are usually slightly larger and may have a slightly higher visual impact compared with single circuit structures.

Additional variability in visual impacts may result due to route selection and crossing highly scenic areas, such as the Minnesota River. Rejected options 2, 4, and 8 appear to require a new or upgraded transmission line crossing of the River. Mitigation measures for visual impact would be consistent with those for the proposed BRIGO Project as discussed in Chapter 4.

## 6.2 Impacts on the Natural Environment

In general, all of the BRIGO Engineering Study's rejected options appear to have similar potential environmental impacts to the proposed BRIGO lines. All of the transmission options studied were of the same voltage, structure size, and would be in agricultural areas in southwestern Minnesota. Each would require significant construction work associated with building a new transmission line or ROW and similar environmental impacts on a per line mile basis.

The exceptions include portions of rejected study options 2, 4, and 8, which appear to require new or rebuilt transmission lines approaching, crossing, or routing near the Minnesota River, its bluffs, and protected lands. The Minnesota River valley contains large tracts of state and federally protected lands, cities, biologically significant lands, high scenic values, and cultural resources. While the mere presence of these resources does not prohibit new or rebuilt transmission infrastructure, the presence of and potential impacts to these resources may limit routing options. The presence of and potential impacts of these resources are an important factor for the public and the PUC to consider in the environmental analysis.

Xcel's rejected option 9 may have slightly lower environmental impacts than the others. Option 9 would simply reconductor or rebuild (increase the capacity of the existing

conductors, including voltage, or rebuilt existing lines within existing ROW) approximately 136 miles of existing transmission lines to create 350 MW of new transmission capacity for Buffalo Ridge. Option 9 requires no transmission lines to be constructed, with the exception of the Lake Yankton to SW Marshall line, thus minimizing impacts of new transmission line construction. However, option 9 requires construction work on approximately 136 miles of lines, which has nearly the same overall environmental impacts associated with building a new transmission line. Option 9 likely requires some additional ROW acquisition and clearing to accommodate higher voltage lines, greater setback standards, potential crop damages and soil compaction, and the risk of soil erosion.

Impacts and mitigation measures are expected to be consistent with the proposed BRIGO Project and described in Chapter 4 of this ER.

## 6.3 Impacts on Land-Based Economics

### 6.3.1 Recreation

The rejected transmission options in the BRIGO Engineering study appear to have impacts to recreational resources consistent with the proposed BRIGO Project. In all cases, the majority of recreational resources in the project corridors are associated with natural resource use. The rejected options do not appear to be any potential recreational impacts which could not be avoided or mitigated. Without route specific information, it is difficult to determine the exact impacts on recreational resources. Impacts and mitigation measures are expected to be consistent with the proposed BRIGO Project and described in Chapter 4 of this ER.

### 6.3.2 Farmland

All of the rejected transmission line options studied in the BRIGO Engineering Study are expected to have the same general impacts to farmland resources as the proposed BRIGO Project. These impacts are consistent with the BRIGO Project described and analyzed in Chapter 4. Rejected option 9 requires the least amount of new transmission line construction therefore creating the lowest amount of potential new impediments to farm equipment. Impacts and mitigation measures are expected to be consistent with the proposed BRIGO Project and described in Chapter 4 of this ER.

Without additional route specific information, it is difficult to determine the precise difference in impacts between the BRIGO Project and the rejected transmission options.

### 6.3.3 Transportation

Several public airports are present in the areas near the rejected transmission options. The rejected lines are not expected to have an impact on airports assuming that transmission line routes avoid airport safety zones and that lines are designed to meet FAA and local safety zone standards. Without additional route specific information, it is difficult to determine the precise potential impacts between the BRIGO Project and the rejected alternative options.

Impacts to surface transportation systems are expected to be minimal and consistent with the impacts of the proposed BRIGO Project. Impacts to road systems are typically found at the outer edge of road ROW when new lines are built parallel to roads. Impacts are generally limited to the construction phase. Long term impacts to surface transportation systems are not expected.

Impacts and mitigation measures are expected to be consistent with the proposed BRIGO Project and described in Chapter 4 of this ER.

### 6.3.4 Mining and Forestry

Xcel reports that a small number of managed forestry operations and resources are present near the rejected options, however, state or federal forests are not present. Impacts to forestry resources would be limited to ROW clearing and maintenance, which could potentially clear a 75-foot tree free ROW through forested lands. Route selection could avoid most forested lands thus eliminating potential impacts to forestry. The rejected options are not expected to have impacts on active forestry.

Xcel reports that several active and inactive gravel, sand, and aggregate quarries are present near the rejected options, but impacts are not expected on mining resources.

## 6.4 Feasibility and Availability

The existing line and alternative corridor alternative is feasible, it could be built. Transmission line technology of the type proposed is widely available and deployed throughout Minnesota. The alternative may be able to meet the primary and secondary

purposes of the proposed BRIGO Project at a higher cost and with potentially higher environmental impacts.

# 7.0 GENERATION ALTERNATIVE

Minnesota Rule 4410.7035 requires the ER to describe and analyze the impacts, mitigation measures and feasibility of generating electricity as an alternative to the BRIGO Project proposal.

The DOC staff has made a good faith effort to devise a legitimate, feasible generation alternative to the primary purpose of the BRIGO Project. Generation cannot meet the primary purpose of the proposed BRIGO Project and is not applicable to the proposed Yankee to Brookings and Fenton to Nobles County transmission lines.

Generation is a potential alternative to the Lake Yankton to Southwest Marshall transmission line and is analyzed below.

## 7.1 General Description and Location

Electric generation equipment could be sited in or near Marshall to meet growing electrical demand and to resolve reliability issues as an alternative to building the Lake Yankton to Southwest Marshall transmission line.

The ER expands on the generation alternative proposed in the Xcel CON Application. Xcel briefly analyzed building two 25 MW natural gas fired combustion turbines in Marshall to ensure meet the reliability and growth needs of the Marshall area. Xcel's CON Application indicates that capital costs for such a facility would be approximately $60 million vs. $12.5 million for the proposed Lake Yankton to Southwest Marshall transmission line. In addition, fuel costs would need to be added determine the total cost of the generation facility to ratepayers.

## 7.2 Human and Environmental Impacts

A 50 MW gas fired combustion turbine system will require a 10 - 20 acre industrial site to accommodate generator sets, fuel storage tanks, electrical switch gear, an operating and maintenance building, cooling water storage, a natural gas pipeline terminal, and associated facility infrastructure.

While considered among the cleaner fossil fuel generation systems, combustion turbine generators emit significant quantities of regulated air pollutants, noise, and have visual impacts. Additional potential impacts include a risk of fuel or hazardous materials

spills from pipeline breaks, backup fuel storage and hazardous materials associated with ongoing operations and maintenance.

Combustion turbines have a lower availability rating than transmission lines, meaning that generators may not able to operate when needed by the utility. Typically, transmission lines are available 99.9 percent of the year and generator systems are available approximately 95 percent of the year. A generation alternative may be slightly less reliable than the proposed Lake Yankton to Southwest Marshall transmission line.

Combustion turbine generators produce air emissions greater than, and not associated with, the proposed Lake Yankton to Southwest Marshall transmission line. The air emissions include carbon monoxide (CO), nitrogen oxides (NOx), and to a lesser degree sulfur dioxide (SO2), volatile organic compounds (VOC), and particulate matter (PM). Each of these pollutants are regulated by the MPCA and U.S. Environmental Protection Agency (EPA) and require air permits to be issued.

Air emissions of NOx, PM, and VOC are concern to pollution control agencies. These pollutants mix under certain conditions creating high levels of haze and ground level ozone. Haze and ground level ozone can contribute to respiratory and cardiac problems, especially the young, the elderly, and those with preexisting conditions. These chemicals (and their precursors) can be transported in the air for hundreds of miles, contributing to regional air quality problems. When haze and ground level ozone levels exceed health risk thresholds, air quality advisories are issued to inform the public of the potential for respiratory and cardiac problems in sensitive populations.

Total air pollution generated by a combustion turbine generation system is dependent on facility configuration, use of natural gas or fuel oil as primary fuel, operating characteristics and the duration of operation. The ER assumes the generation system is used only in contingency or peak demand situations to avoid burning high cost natural gas or fuel oil extended periods of time. However, as is discussed in Xcel's CON Application, electrical demand in Marshall exceeds reliable transmission capacity for more than 50 percent of the hours each year and nearly 75 percent of the days each year. With demand growing and forecast to exceed 100 MW by the year 2020, a generation system alternative may require continuous operation in future years to supply MMU customers with continuous, reliable electricity. Extended operation of a generation alternative will increase potential human, economic and environmental impacts.

## 7.3 Mitigation Measures for Human and Environmental Impacts

There are two methods to mitigate air pollution impacts from a generation alternative. First is to choose generation equipment with the lowest emissions. Second is to minimize the use of generation resources to emergency, peak load, and contingency situations, which limits emissions. However, even with these measures in place, a natural gas based generation system alternative would emit more pollution to the air in the area than the proposed transmission line.

To reduce noise impacts, the generation system could utilize noise mitigation measures such as mufflers, insulated buildings or barriers, and sound baffles to ensure compliance with the Minnesota Pollution Control Agency rules limiting noise levels at the nearest residential homes. These measures are generally available.

## 7.4 Feasibility and Availability

The generation alternative is feasible for the Lake Yankton to Southwest Marshall portion of the BRIGO Project. Combustion turbine technology is widely available and deployed throughout Minnesota. However, the generation alternative will be generally less reliable, has greater environmental impacts and costs significantly more than the proposed Lake Yankton to Southwest Marshall transmission line.

# 8.0 CONSERVATION AND DEMAND SIDE MANAGEMENT ALTERNATIVE

Minnesota Rule 4410.7035 requires that an energy conservation and demand side management (DSM) alternative to the proposed project be evaluated in the ER. This alternative assumes that the proposed BRIGO Project transmission lines are not built and energy conservation measures are implemented as an alternative.

Conservation and DSM programs are not a feasible alternative to the proposed BRIGO Project. Energy conservation programs implemented in the Buffalo Ridge region or in any other location in the Xcel Energy service territory cannot create greater transmission line outlet capacity for future Buffalo Ridge wind development.

In fact, additional energy conservation measures implemented in the Buffalo Ridge region may actually increase the need for greater transmission outlet capacity. Energy demand levels in the Buffalo Ridge region are equivalent to approximately 44 MW. If electrical demand on the Buffalo Ridge decreases, a greater amount of wind generated energy would need to be exported via transmission lines to markets elsewhere.

The conservation and DSM alternative cannot reasonably take the place of the Lake Yankton to Southwest Marshall transmission line designed to resolve reliability issues in Marshall. Xcel's CON Application indicates that the MMU peak electric demand is approximately 88 MW, however when one of the two transmission lines serving MMU is out of service, only 70 MW of electricity demand can be delivered to MMU customers. Demand in the MMU service territory exceeds 70 MW for 52 percent of the hours per year and 78 percent of the days each year. MMU forecasts electrical demand to increase to 100 MW by the year 2020.

For a conservation alternative to successfully address the MMU reliability issue, the alternative would need to immediately reduce peak demand by approximately 18 MW (or approximately a 20 percent demand reduction) and cap future electric demand growth in the MMU service territory at or below the current 70 MW transmission reliability threshold. Such an alternative would likely cost significantly more than the proposed transmission line and the likelihood of success is questionable.

The conservation and demand side management alternative is not a feasible alternative to the proposed BIRGO Project.

# 9.0 PERMITS AND APPROVALS REQUIRED

The federal and state permits or approvals that have been identified as being required or potentially required for the construction and operation of the BRIGO Project are shown in Table 9-1.

**Table 9-1 - Permits and Approvals Potentially Required for Construction and Operation**

| Agency | Type of Approval |
|---|---|
| **Federal** | |
| Federal Aviation Administration | Notice of Proposed and Notice of Actual Construction or Alteration |
| Department of Agriculture | Farmland Protection Act Conservation Impact Rating |
| Environmental Protection Agency | Spill Prevention, Control and Countermeasure Plan |
| Fish and Wildlife Service | Section 7 Endangered Species Consultation |
| U.S. Army Corps of Engineers | Section 10 and Section 404 Permits |
| **State of Minnesota** | |
| Minnesota Public Utilities Commission | Certificate of Need and Route Permit |
| State Historic Preservation Office | Cultural and Historic Resources Review |
| Minnesota Department of Transportation | Utility Permits |
| Minnesota Board of Water and Soil Resources | Wetland Conservation Act Approval |
| Minnesota Department of Natural Resources | License to Cross Public Lands and Waters |
| | Endangered Species Consultation |
| Minnesota Pollution Control Agency | NPDES Permit: Construction |
| **Local Permits** | |
| County, Township, or City | Building Permits |
| | Over width Load Permits |
| | Driveway or Access Permit |
| | Utility Permit |
| | Road Crossing or Right of Way Permits |

# Appendix A: Environmental Report Scoping Decision

MINNESOTA DEPARTMENT OF COMMERCE

**In the Matter of the Xcel Energy Certificate of Need Application for Three 115 kV Transmission Lines in Southwestern Minnesota**

**ENVIRONMENTAL REPORT SCOPING DECISION**

**PUC Docket No. E002/CN-06-154**

The above matter has come before the Commissioner of the Department of Commerce (the Department) for a decision on the content of the Environmental Report (ER) to be prepared in consideration of the Xcel Energy Application for a Certificate of Need for three, 115 kilovolt (kV) high voltage transmission lines (HVTL) in Southwestern Minnesota.

The Minnesota Department of Commerce (DOC) Energy Facilities Permitting Unit held public information meetings on February 21 and 22, 2007, in Slayton, Ivanhoe and Marshall to inform the public about the project and the regulatory proceedings; discuss environmental, social and economic issues of importance in the area potentially affected; and to gather public input into the scope of the Environment Report (ER) to be prepared for the project. The meetings provided the public an opportunity to ask questions about the project, and to suggest alternatives and specific impacts to address in the ER. The public was given until March 14, 2006, to submit written comments. No written comments were received.

Having reviewed the matter, and having consulted with staff, I hereby make the following Order on the content of the ER:

## MATTERS TO BE ADDRESSED

The ER will address the following subjects/matters for the proposed project:

### PROJECT DESCRIPTION

The ER will describe the proposed project, right of way requirements, location, purpose, and proposed design.

### REGULATORY FRAMEWORK

The ER will describe the regulations and regulatory processes which the project is being reviewed under, including the Certificate of Need, environmental review, and the public participation process.

### ALTERNATIVES TO THE PROJECT

The ER will describe and analyze the feasibility of the following alternatives:

- No-build alternative;
- Conservation alternative,
- Existing line or system improvements,
- Generation alternative, and
- Use of alternative corridors.

## ASSESSMENT OF IMPACTS AND MITIGATION

The ER will describe the environmental setting within the project area and analyze the potential or unavoidable impacts of and mitigation measures for the proposed project, including:

- Impacts on human settlement: socioeconomic, displacement, noise, aesthetics, radio and television interference, archeological and historic resources, human health and safety (including electric and magnetic fields, and safety codes).
- Impacts on land-based economics: recreation, prime farmland, transportation, mining and forestry, and economic development.
- Impacts on natural environment: air quality, water quality (including surface water, groundwater and wetlands), soils and geology, flora and fauna, rare and unique natural resources

## PERMITS AND APPROVALS REQUIRED

The ER will describe the Federal, state and local permits required to build the project.

## ISSUES OUTSIDE OF THE ENVIRONMENTAL REPORT

The ER will not consider the impacts or mitigative measures associated with specific routes within the proposed corridors. Site specific concerns (i.e., along specific routes) will be addressed in separate PUC or local government permitting process expected to begin sometime in mid to late 2007.

The ER will only identify the general potential impacts from the construction, operation, and maintenance of the proposed HVTLs along the broad geographic areas proposed, and the measures generally available to mitigate these potential impacts.

## SCHEDULE

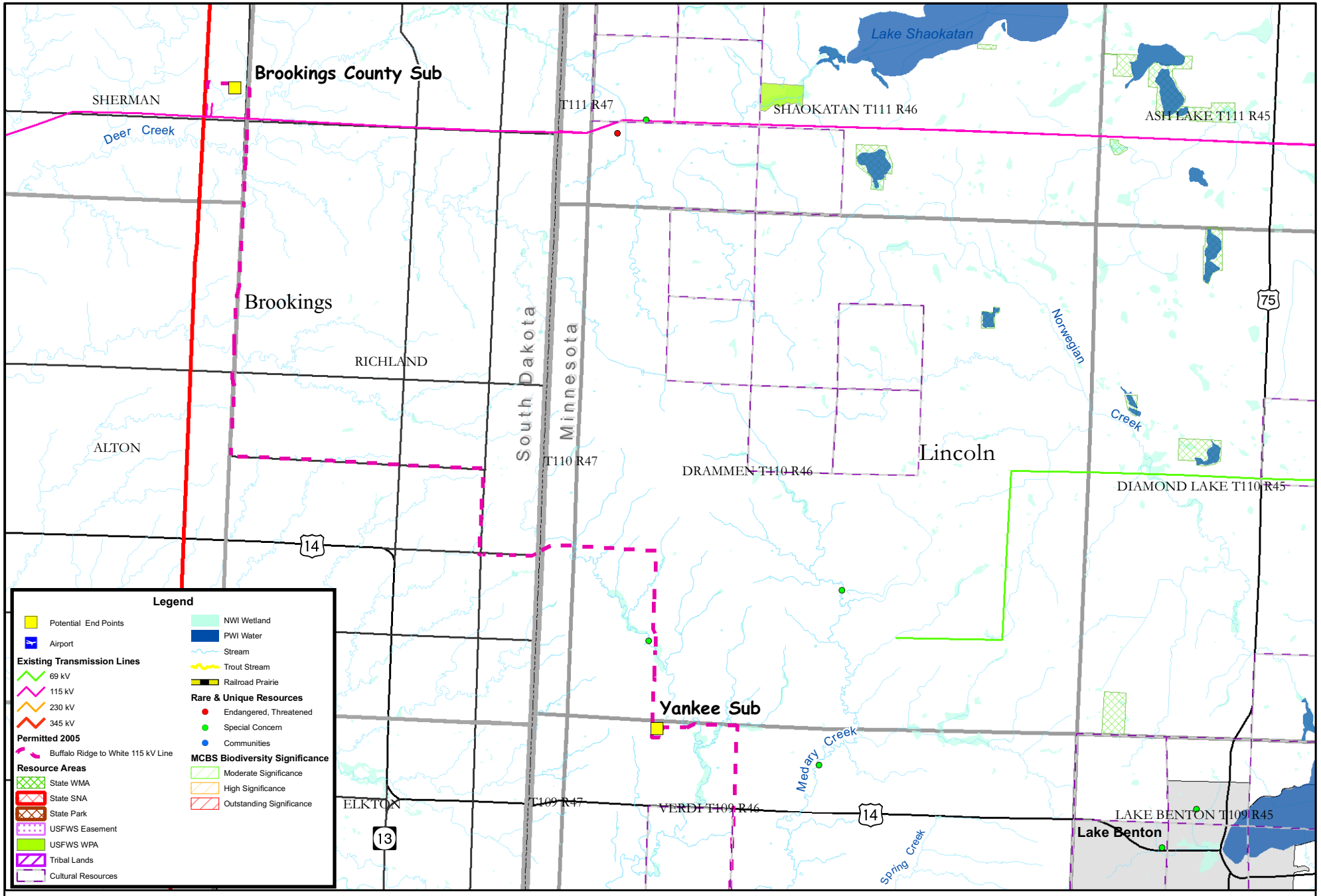
The ER shall be completed by April 24, 2007.

Signed this 22 day of March, 2007

STATE OF MINNESOTA
DEPARTMENT OF COMMERCE

Glenn Wilson, Commissioner

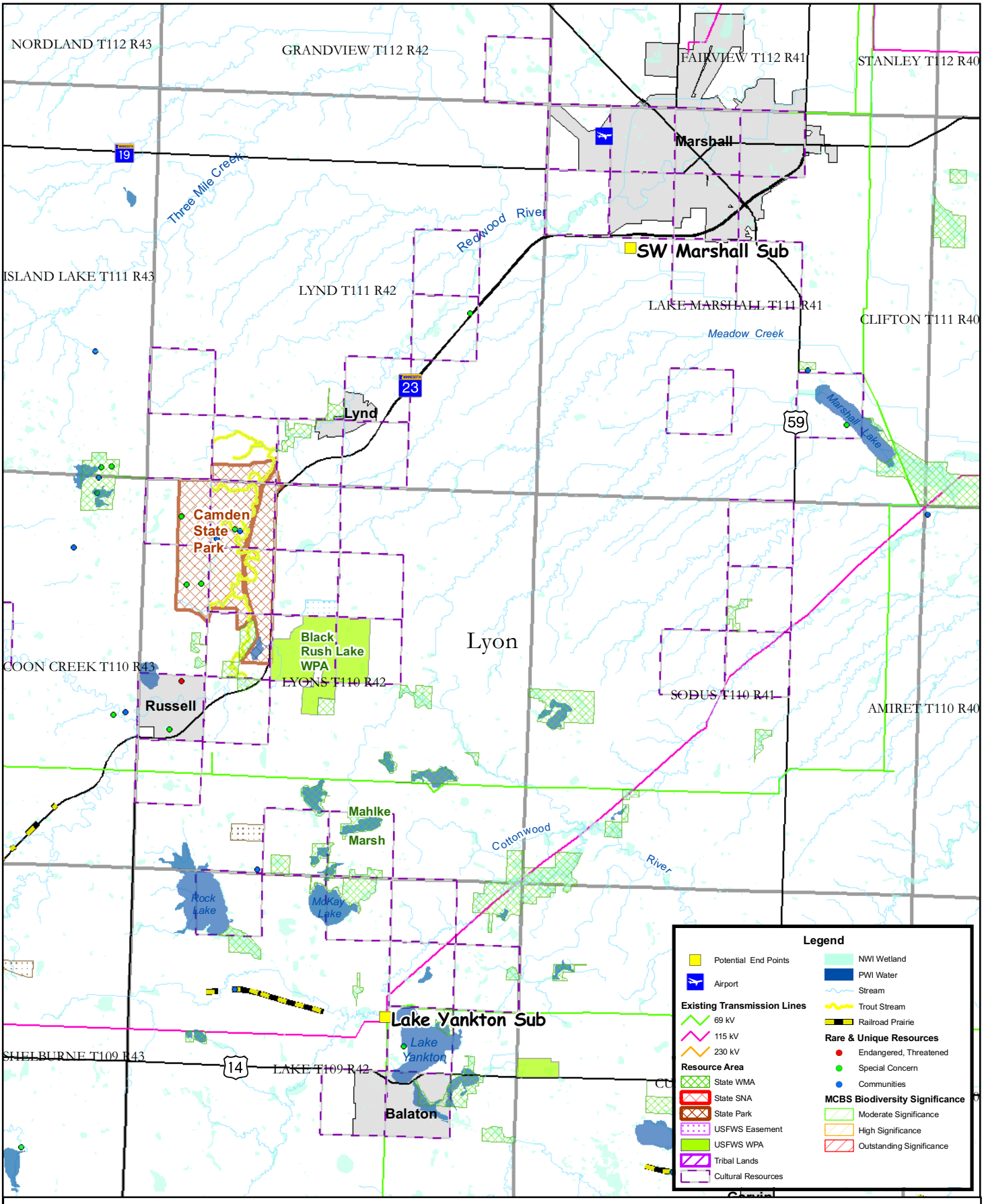
# Appendix B: Selected Project Corridor Maps and Photographs Reproduced from Xcel Energy's CON Application




Brookings County Substation to Yankee Substation
Environmental Setting
BRIGO 115 kV Transmission Line Project
Certificate of Need Application

Xcel Energy
NORTHERN STATES POWER

Figure 1

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December 2006

SW Marshall Substation to Lake Yankton Substation
Environmental Setting
BRIGO 115 kV Transmission Line Project
Certificate of Need Application

Xcel Energy
NORTHERN STATES POWER

Figure 2

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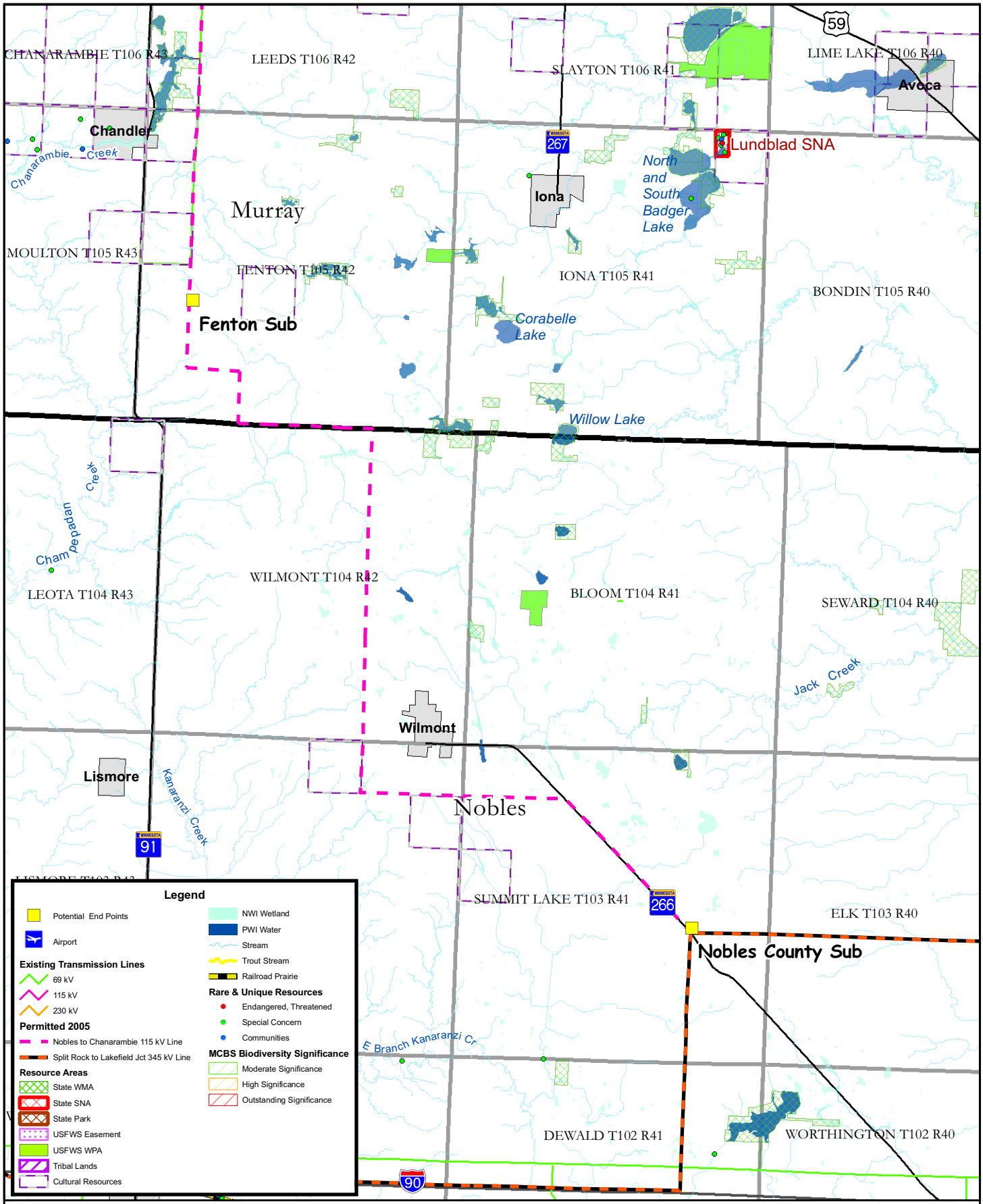


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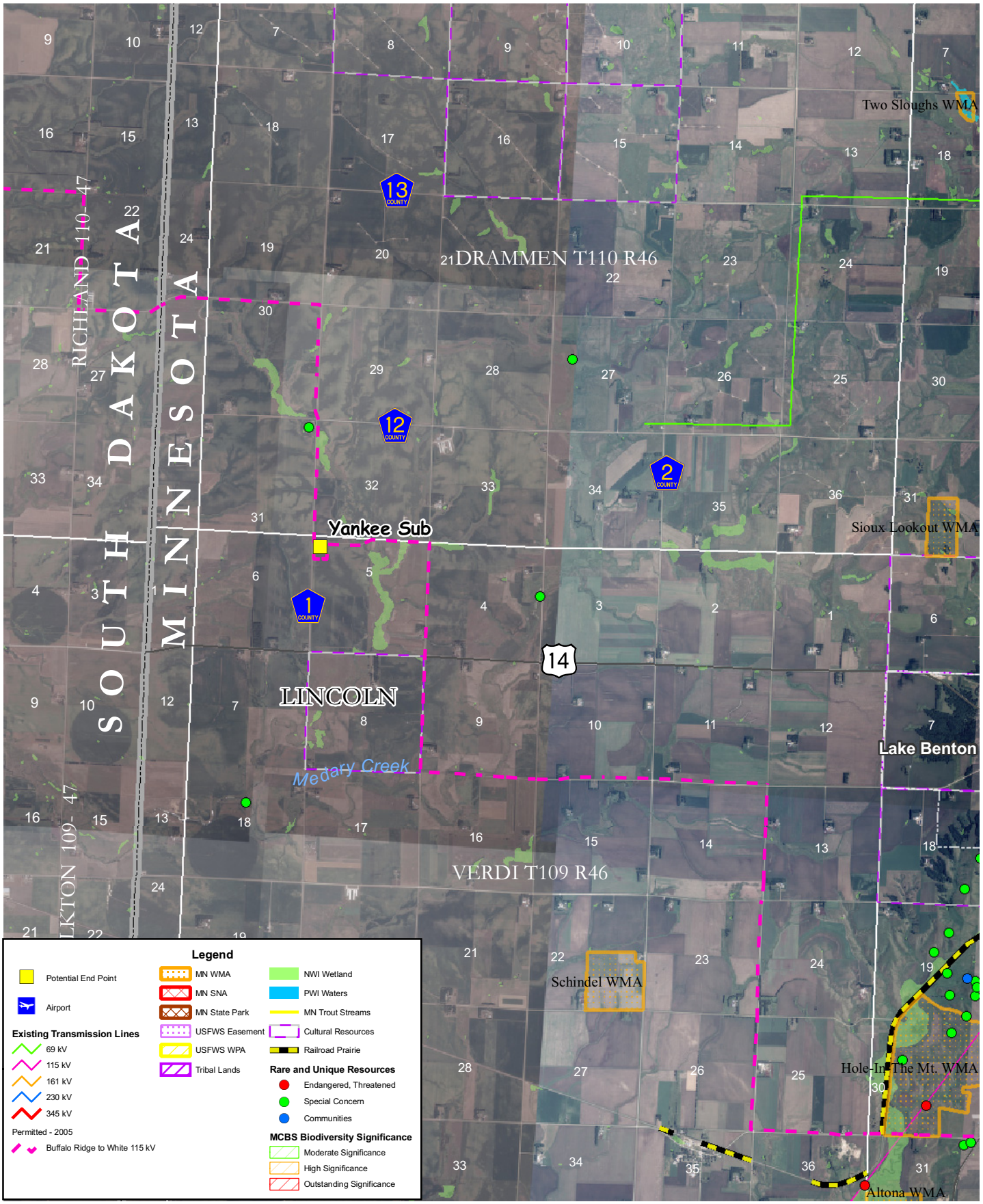
Fenton Substation to Nobles County Substation
Environmental Setting
BRIGO 115 kV Transmission Line Project
Certificate of Need Application

Xcel Energy
NORTHERN STATES POWER

Figure 3

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Yankee Substation Endpoint
Environmental Setting
BRIGO 115 kV Transmission Line Project
Certificate of Need Application

Xcel Energy
NORTHERN STATES POWER

**Figure 10**

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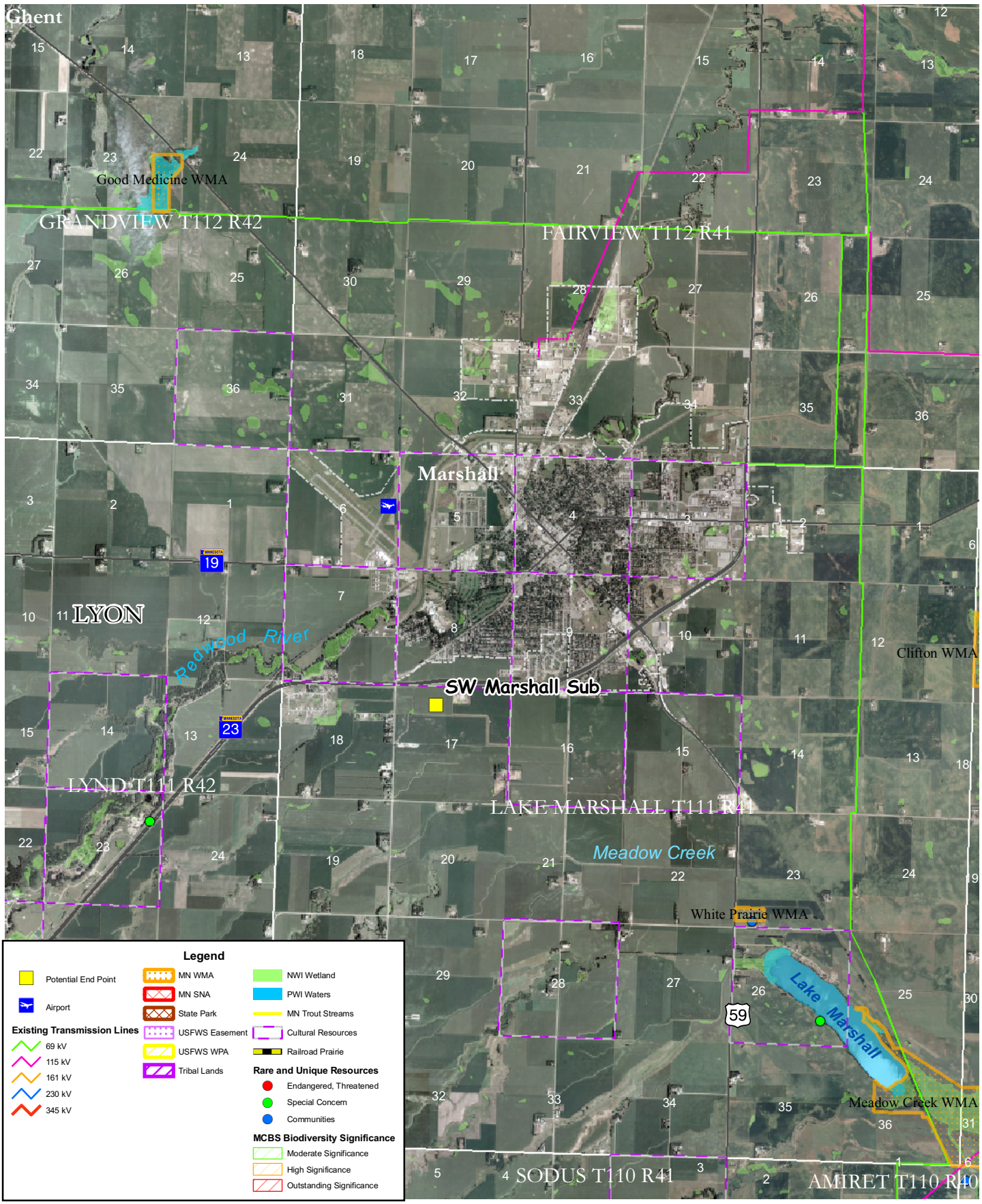


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Southwest Marshall Substation Endpoint
Environmental Setting
BRIGO 115 kV Transmission Line Project
Certificate of Need Application

Xcel Energy
NORTHERN STATES POWER

**Figure 11**

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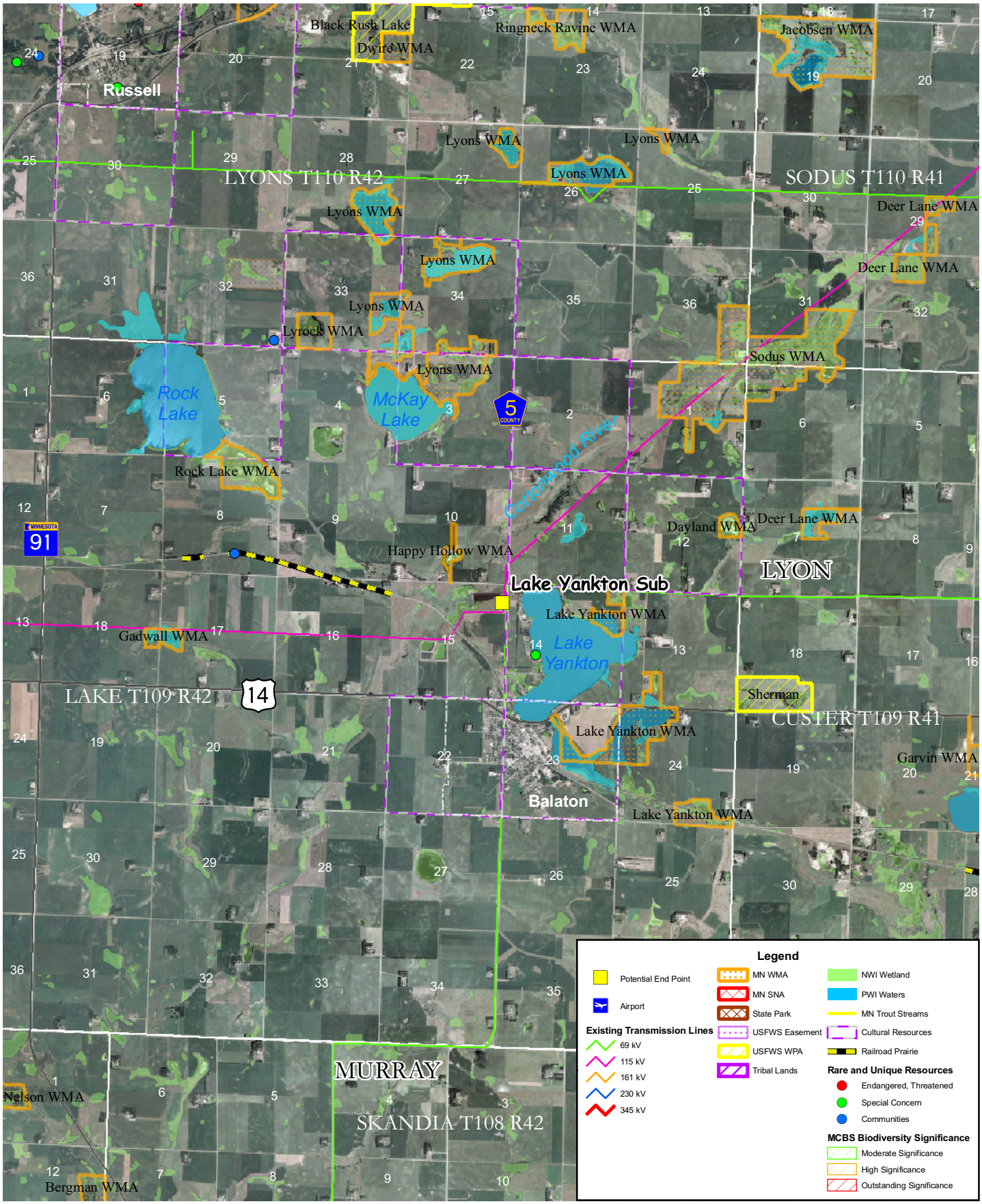


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Lake Yankton Substation Endpoint
Environmental Setting
BRIGO 115 kV Transmission Line Project
Certificate of Need Application

Xcel Energy
NORTHERN STATES POWER

**Figure 12**

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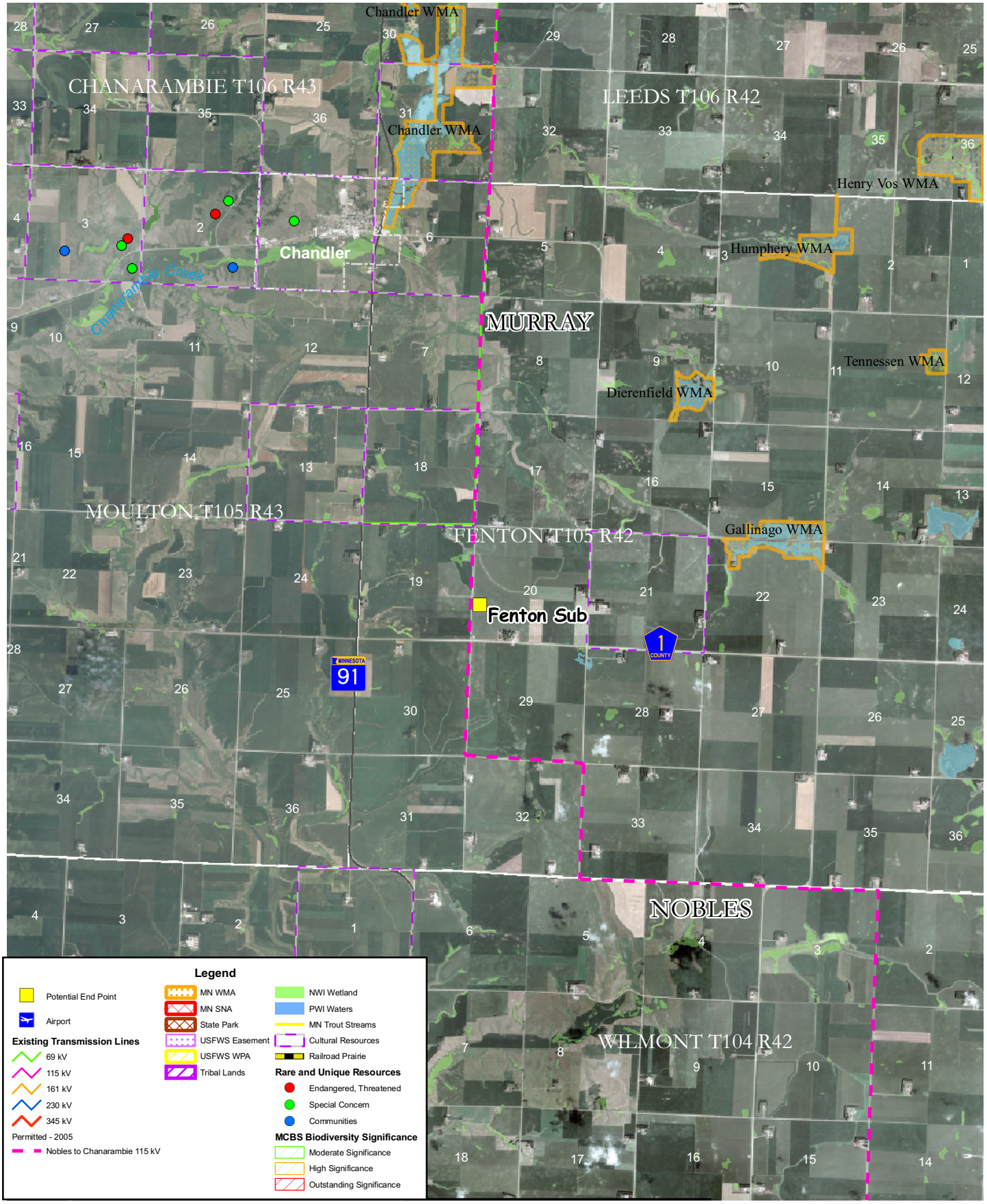


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Fenton Substation Endpoint
Environmental Setting
BRIGO 115 kV Transmission Line Project
Certificate of Need Application

Xcel Energy
NORTHERN STATES POWER

**Figure 13**

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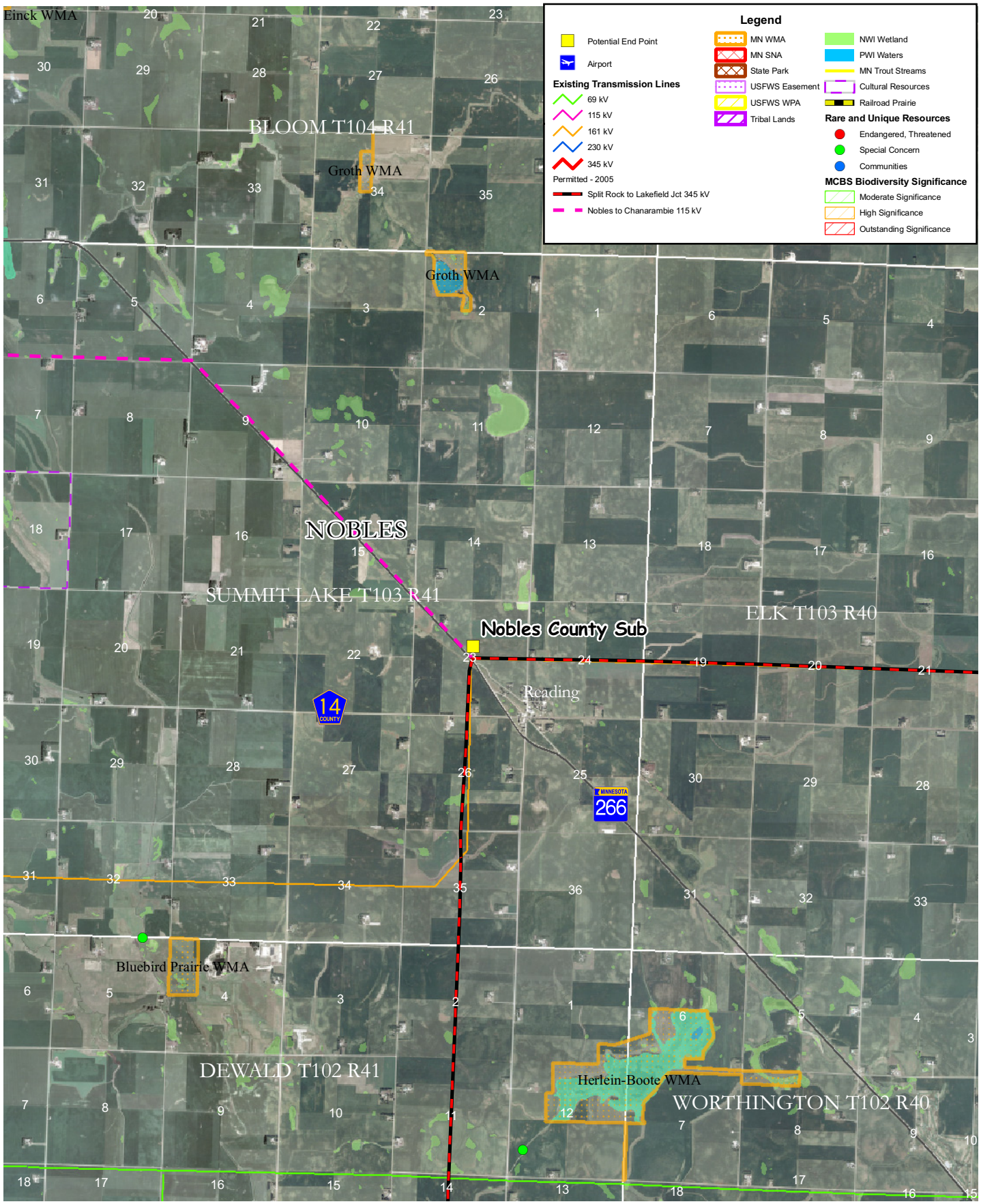


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Nobles County Substation Endpoint
Environmental Setting
BRIGO 115 kV Transmission Line Project
Certificate of Need Application

Xcel Energy
NORTHERN STATES POWER

**Figure 14**

# Appendix C: Proposed Transmission Line Structures Reproduced from Xcel Energy's CON Application

## Figure 2.5 Steel horizontal post structures

**Figure 2.6 Wood Davit arm structurres**

**Figure 2.7 Steel Davit arm structures kwith bundled conductors**

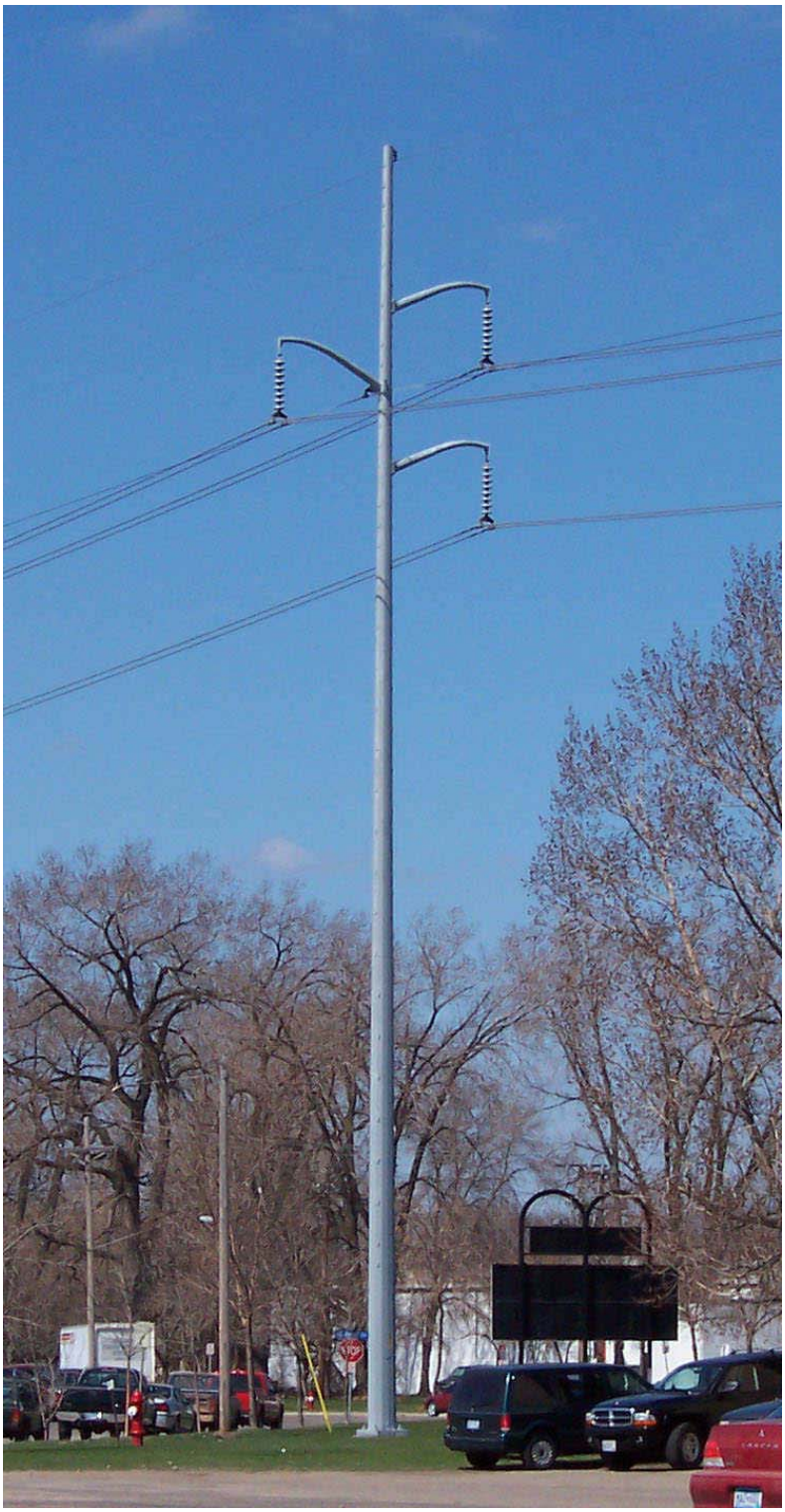
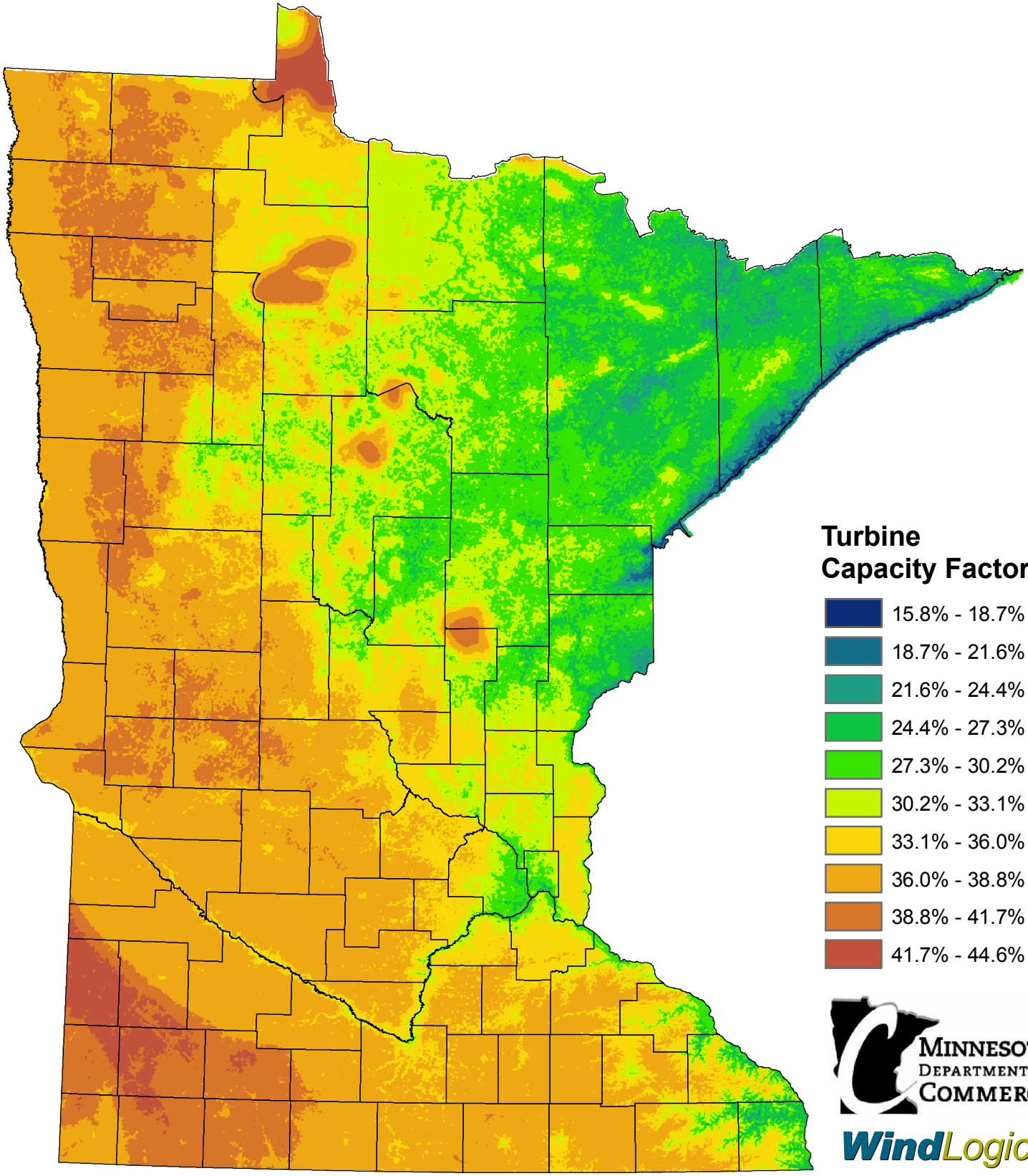


**Figure 2.8 Wood horizontal post structures**

# Appendix D: Minnesota Wind Resource Maps

# Minnesota's Wind Resource by Capacity Factor at 80 Meters



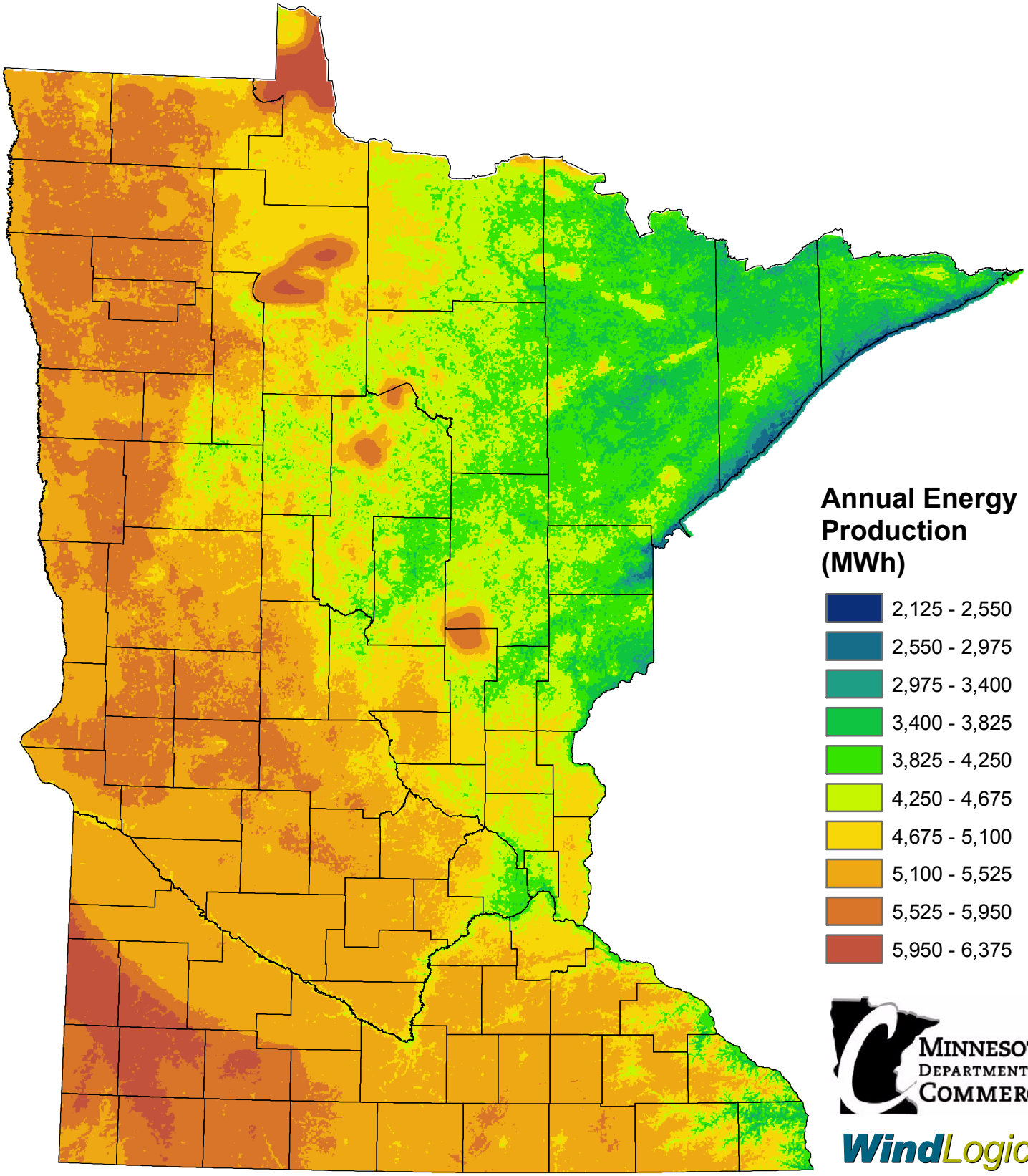

MINNESOTA DEPARTMENT OF COMMERCE

WindLogics®

This map has been prepared under contract by WindLogics for the Department of Commerce using the best available weather data sources and the latest physics-based weather modeling technology and statistical techniques. The data that were used to develop the map have been statistically adjusted to accurately represent long-term (40 year) wind speeds over the state. Capacity factors are based on a 1.65 MW turbine, and production has been discounted 15% to represent real world conditions. Data has been averaged over a cell area 500 meters square, and within any one cell there could be features that increase or decrease the values shown on this map. This map shows the general variation of Minnesota's wind resource and should not be used to determine the performance of specific projects.

*January 2006*

# Minnesota's Wind Resource by Estimated Annual Energy Production at 80 Meters

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*January 2006*