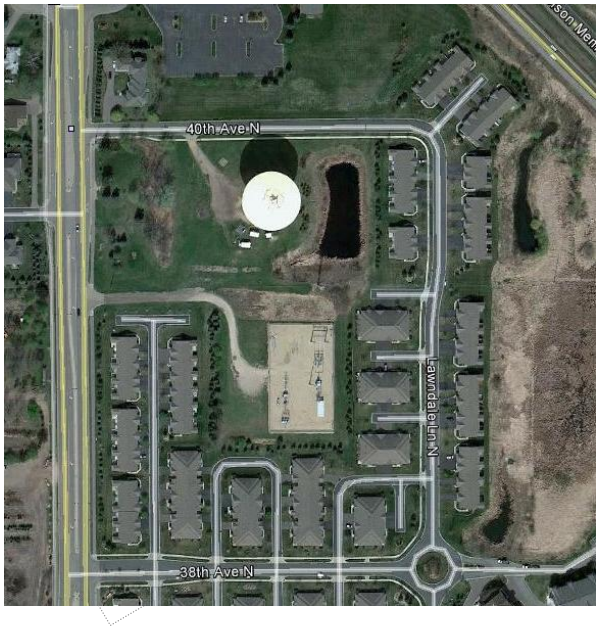
Environmental Report

Hollydale 115 kV Transmission Project

In the Matter of the Certificate of Need Application for the Hollydale 115 kV Transmission Line Project in the Cities of Plymouth and Medina, Hennepin County

PUC Docket No. E002, ET2/CN-12-113



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Abstract

On July 2, 2012, Northern States Power Company, a Minnesota Corporation (Xcel Energy) and Great River Energy (collectively, the Applicants) jointly filed a Certificate of Need application with the Minnesota Public Utilities Commission for the Hollydale 115 kV Transmission Line Project. The Applicants are proposing to construct approximately 8.8 miles of 115 kV transmission line, a new 115 kV substation, and modify associated facilities in the cities of Plymouth and Medina in Hennepin County.

Depending upon the route, the proposed project may qualify as a large energy facility as defined by Minn. Statute 216B.2421. Such a facility requires a certificate of need from the Commission (Minn. Statute 216B.243). As part of the application review, the Department of Commerce must prepare an environmental report for the project (Minn. Rules 7849.1200).

Department of Commerce Energy Facility Permitting staff is responsible for preparing the environmental report. This Environmental Report has been prepared as per Minnesota Rules 7849.1100-2100, and is part of the record which the Commission will consider in making a decision on a certificate of need for the Hollydale Project.

Information about the Commission's certificate of need process can be obtained by contacting Michael Kaluzniak, Minnesota Public Utilities Commission, 121 7th Place E., Suite 350, Saint Paul, MN 55101, phone: 651-201-2257, mike.kaluzniak@state.mn.us.

The official record for the certificate of need for this project can be found on the eDockets system at: https://www.eDockets.state.mn.us/EFiling/search.jsp; search on the year "**12"** and number "**113**".

Information about this project can also be found on the Department's energy facilities permitting website: http://mn.gov/commerce/energyfacilities/Docket.html?Id=32919, or obtained by contacting Suzanne Steinhauer, Minnesota Department of Commerce, 85 7th Place East, Suite 500, St. Paul, Minnesota 55101, phone: (651) 296-2888, email: suzanne.steinhauer@state.mn.us.

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Acronyms, Abbreviations and Definitions

69 kV Rebuild Alternative	69 kV transmission line connecting Pomerleau Lake, Hollydale, and Medina substations
ALJ	Administrative Law Judge
Applicants	Xcel Energy and Great River Energy
BMP	best management practice
Commission	Minnesota Public Utilities Commission
CN	Certificate of Need
dB	decibels
dB(A)	A-weighted sound level recorded in units of decibels
Department	Minnesota Department of Commerce
Distribution Line	Electrical conductor of less than 69 kV
Distribution Alternative	Construction and operation of either a 34.5 or 13.8 kV distribution line
DNR	Department of Natural Resources
EFP	Department of Commerce Energy Facilities Permitting
EMF	electromagnetic field
EPA	United States Environmental Protection Agency
FAA	Federal Aviation Administration
GPS	global positioning system
GRE	Great River Energy
HAP	Hazardous Air Pollutant
Hollydale Project	115 kV HVTL connecting Pomerleau Lake, Hollydale, and Medina Substations
HVTL	high voltage transmission line
HVTL System Alternative	115 kV HVTL connecting Pomerleau Lake, Hollydale, and Gleason Lake Substation
ICE	Internal combustion engine
kV	kilovolt
kWh	kilowatt hour
MCBS	Minnesota County Biological Survey
MISO	Midwest Independent System Operator
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MW	Mega Watt
NAC	noise area classification
NERC	North American Electric Reliability Corporation
NESC	National Electric Safety Code
NEV	neutral-to-earth voltage
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
OSHA	Occupational Health and Safety Administration
ppm	parts per million
Project Area	A polygon encompassing all routes for the Hollydale Project as well as all project alternatives evaluated in this report
SNA	Scientific and Natural Area

SWPPP	Stormwater Pollution Prevention Plan
Transmission line	electrical conductor of 69 kV or greater
USACE	United States Corp of Engineers
USFWS	United States Fish and Wildlife Service

1 Introduction

On July 2, 2012, Northern States Power Company, a Minnesota Corporation (Xcel Energy) and Great River Energy (GRE) filed a Certificate of Need (CN) application with the Minnesota Public Utilities Commission (Commission) for the Hollydale 115 kV HVTL Project (Hollydale Project).[1] Xcel Energy and GRE (collectively, Applicants) propose to construct approximately 8.8 miles of 115 kV transmission line, a new 115 kV substation, and modifications to the existing Medina and Hollydale substations in the cities of Medina and Plymouth in Hennepin County, Minnesota.

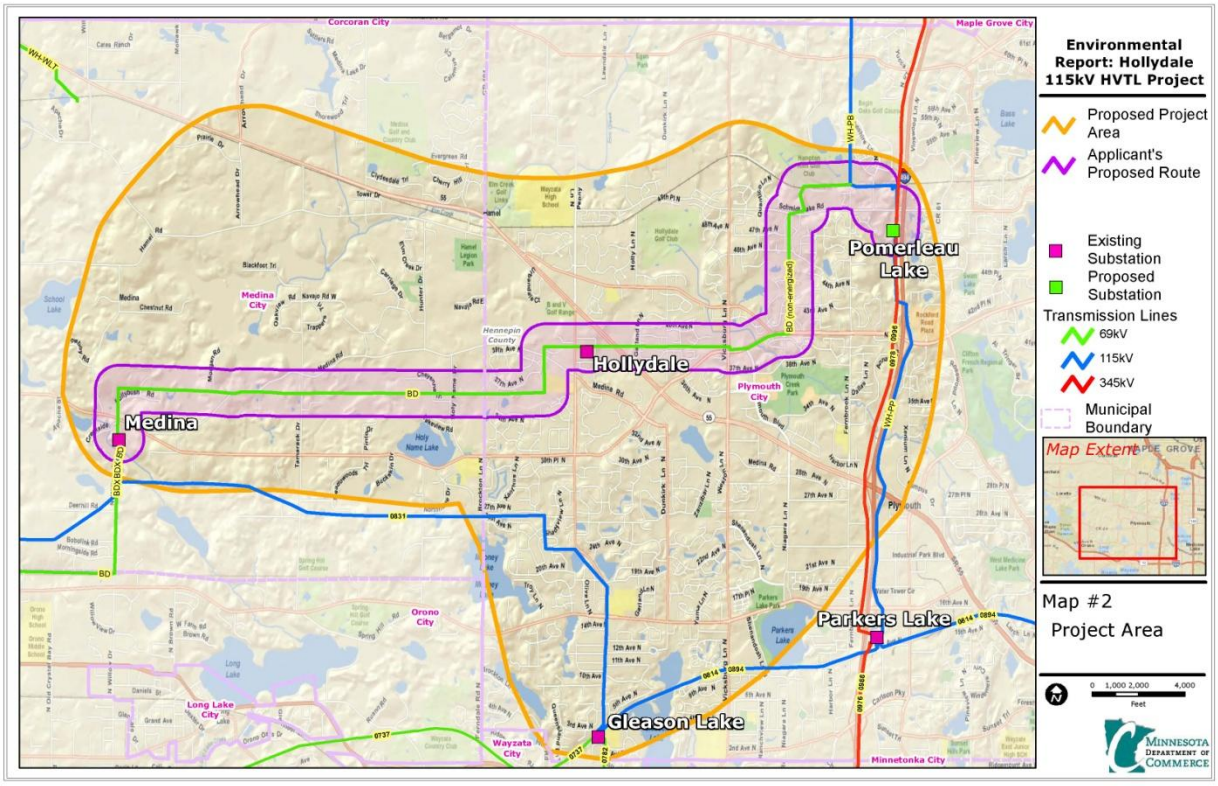
As required by Minnesota Rule 7849.1200, the Minnesota Department of Commerce must prepare an Environmental Report (ER) as part of the CN review proceedings. This ER provides information on potential human and environmental impacts that may occur from the proposed Hollydale Project or its alternatives. The ER also describes potential mitigation techniques that may be used to minimize human and environmental impacts from the proposed Hollydale Project or its alternatives.

1.1 Hollydale Project Purpose and Need

The stated purpose of the Hollydale Project is to meet the electrical needs of the Plymouth and Medina area. The Applicants have stated that demand for power in the Plymouth and Medina area has increased beyond the capability of the current electrical distribution system due to population and commercial growth, particularly in the areas along Minnesota Highway 55 (specifically the Plymouth City Center), Interstate 494, and Interstate 394. The Hollydale Project Area is shown in Figure 1.

[1] Northern States Power Company, a Minnesota Corporation (Xcel Energy), and Great River Energy (GRE). July 2, 2012. *Application to the Minnesota Public Utilities Commission for a Certificate of Need for the Hollydale 1115 kV Transmission Line Project in the Cities of Plymouth and Medina*. eDocket ID: 20127-76388-01 thru -10, and 20127-76389-01 thru -02 (herein after *CN Application)*

Figure 1: Hollydale Project Area



As shown in **Figure 1**, the project area is served at the transmission level primarily by a 69 kV transmission line and also by two 115 kV transmission line and one 345 kV transmission line. At the distribution level, the area is served, by a network of 13.8 and 34.5 kV distribution lines, as shown in **Map B.3**. Historical peak loads on the 13 feeder lines serving the focused study area show a historic peak of 128 MW. When the existing distribution system in the area bounded by County Road 116, County Road 47, Interstate 494, and Highway 12, is operating under contingency conditions, the historic peak load exceeds the system capacity by 37 MW.[2] The Applicants contend that additional electrical infrastructure is required to address electrical distribution concerns, provide additional distribution capacity, and avoid overload conditions in the Plymouth and Medina area. The Applicants further contend that the Hollydale Project will alleviate the current 37 MW deficit identified in Xcel Energy distribution studies, and will provide support for future demand growth in the area until at least 2030 by providing approximately 50 MW of additional load serving capability.[3]

[2] *CN Application,* p. 14
[3] *CN Application*, pp. 14 - 15

1.2 Regulatory Requirements

The Public Utilities Commission is responsible for the siting and routing of large energy facilities. This includes issuing permits for large electric power plants, electric transmission lines, and oil or gas pipelines.

In Minnesota, transmission line projects above certain size and length thresholds must go through a two-stage regulatory process: demonstrating that there is a need for the proposed project in the CN process and a route permitting process to determine the route for the project and any permit conditions that should be part of the route permit.

1.2.1 Route Permit

Minnesota Statutes Section 216E.03, subd. 2, provides that no person may construct a High Voltage Transmission Line (HVTL) without a route permit from the Commission. The Hollydale Project meets the statutory definition of an HVTL as a transmission line of 100 kV or more and greater than 1,500 feet in length (Minn. Statute 216E.01, subd. 4). The route permit is issued by the Commission and is being considered in a separate docket (Docket No. E-002, ET-2/TL-11-152). A route permit authorizes the location and construction of a project.

On June 30, 2011, the Applicants submitted a HVTL Route Permit application to the Commission for the proposed Hollydale Project.[4] Because the proposed transmission line is between 100 and 200 kilovolts, it is eligible for review under the alternative permitting process outlined in Minnesota Rules 7850.2800 to 7850.3900. The Commission accepted the HVTL Route Permit Application as complete on August 25, 2011, and authorized the Department's Energy Facility Permitting (EFP) staff to process the application under the alternative permitting process.

On February 27, 2012, the Applicants, in response to a motion filed by certain landowners within the proposed project area, filed a petition requesting that the Commission convert the route permit proceeding from the alternative permitting process to the full permitting process. In its order dated May 4, 2012, the Commission granted the Applicants' request and authorized review under the full permitting process, pursuant to Minnesota Rules 7850.1700 to 7850.2700. On July 31, 2012, the Department issued a scoping decision identifying the issues and routes to be evaluated in an Environmental Impact Statement (EIS) to be prepared for the routing process.

A contested case hearing conducted by an Administrative Law Judge (ALJ) will be held in this proceeding to further develop the record for a Commission decision. It is anticipated that the public hearing will be held in May 2013 in the project area and that an evidentiary hearing will be held in St. Paul approximately one week after the public hearing.[5] The hearing will be noticed separately.

Persons may testify at the hearing without being first sworn under oath. The ALJ will ensure that the record created at the hearing is preserved and will provide the Commission with a summary of the

[4] Xcel Energy and GRE. June 30, 2011. *Application to the Minnesota Public Utilities Commission for a Route Permit: Hollydale Project – 115 kV Transmission Line and New Pomerleau Lake Substation*. eDocket ID: 20116-64334-03 et al (herein After *Route Permit Application*)

[5] Office of Administrative Hearings (OAH). November 29, 2012. Amended Second and Sixth Prehearing Orders. eDocket ID: 201211-81189-01

testimony from the hearing, a recommendation on the route and permit conditions, proposed findings of fact and conclusions of law related to the route for the Hollydale Project.

1.2.2 Certificate of Need

Before any large energy facility can be constructed in Minnesota, the Commission must determine that the facility is necessary and in the best interest of the state through a CN proceeding. The CN process includes environmental review and public hearings and typically takes 12 months. This process is the only proceeding in which a no-build alternative and the size, type, timing, system configuration and voltage of the proposed project will be considered.

At the time of the route permit application acceptance, the Hollydale Project did not meet the size and length thresholds definition of a Large Energy Facility as described in Minnesota Statutes Section 216B.2421, subd. 2(2) and (3), and did not require the issuance of a CN by the Commission.

However, several of the route alternatives in the EIS scoping decision issued in the routing proceeding are, or have the potential to be, greater than 10 miles in length. If the route chosen by the Commission is longer than 10 miles, the Applicants must obtain a CN from the Commission. For a line of such length, the Commission must determine the need for the project prior to issuing a route permit.

The Applicants applied for a CN on July 2, 2012. The Commission accepted the CN application as complete on September 21, 2012, and referred the matter to the Office of Administrative Hearings (OAH) for a contested case hearing.[6]

A copy of the certificate of need application, along with other relevant documents, can be viewed at the Energy Facility Permitting web page at:

http://mn.gov/commerce/energyfacilities/Docket.html?Id=32919 or on the eDockets website at: https://www.edockets.state.mn.us/EFiling/search.jsp (enter the year “12” and the number “113”).

As with the routing proceeding, a contested case hearing conducted by an ALJ will be held to further develop the record for a Commission decision. It is anticipated that the public hearing will be held in March 2013 in the project area and that an evidentiary hearing will be held in St. Paul approximately one week after the public hearing. The hearing will be noticed separately.

Persons may testify at the hearing without being first sworn under oath. The ALJ will ensure that the record created at the hearing is preserved and will provide the Commission with a summary of the testimony from the hearing, a recommendation on the need, proposed findings of fact and conclusions of law related to the need for the Hollydale Project.

1.2.3 Environmental Review

Both the route permit and certificate of need proceedings require preparation of an environmental review document. The Department's EFP staff is responsible for administering the environmental

[6] Minnesota Public Utilities Commission (Commission). September 21, 2012. *Notice and Order for Hearing in the Matter of the Application for a Certificate of Need for the Hollydale 115 kV Transmission Line Project in the Cities of Plymouth and Medina*. eDocket ID: 20129-78860-01

review process. Although Minnesota Rule does allow for these documents to be combined, separate documents will be prepared for each proceeding in the Hollydale Project.

Environmental Report

Pursuant to Minnesota Rule 7849.1200, the environmental analysis prepared for the CN proceeding takes the form of an environmental report (ER). The ER provides an analysis of potential human and environmental impacts of the Hollydale Project, as well as alternatives to the Hollydale Project.

To develop the ER, EFP staff is required to conduct at least one public meeting in the project area. The purpose of the meeting is to advise the public of the project and to solicit public input into the scope of the ER. A "scope" is a determination of what needs to be assessed in the ER to fully inform decision-makers and the public about the possible impacts and potential alternatives of the proposed project.

On October 10, 2012, EFP staff sent notice of the place, date, and times of the Public Information and Scoping meeting to those persons on the General List maintained by the Commission, the agency technical representatives list and the project contact list established for the routing proceeding. Notice of the public meetings was also published in local newspapers.

EFP staff held public information and scoping meetings on October 25 and 26, 2012, in Plymouth, Minnesota. The meeting provided members of the public an opportunity to learn about the proposed Hollydale Project and the state's CN process, review the Applicants' CN application, ask questions, provide comments, and identify potential impacts and project alternatives to be considered for the scope of the ER. The total attendance for both meetings was approximately 230 people. In total, 33 people provided oral comments or asked questions about the proposed Hollydale Project. Topics and issues raised by the public at the meeting included: health and safety (primarily as related to electric and magnetic fields), impact to property values, accuracy of the data in the CN and Route Permit applications, inadequacy of the meeting notice, and history of the existing 69 kV transmission line. Hollydale Project Alternatives A2 (a distribution alternative) and H2 (a HVTL alternative connecting a new substation located similarly to the Pomerleau Lake Substation to Xcel Energy's existing Hollydale and Gleason Lake substations) were brought up by several citizens as alternatives to the Hollydale Project that should be evaluated in the ER. Although outside of the scope of the need proceeding, several commenters also identified routing preferences.

A public comment period, ending on November 16, 2012, provided the public an opportunity to submit comments to EFP staff via e-mail, fax, U.S. mail or online on issues and project alternatives for consideration for the scope of the ER. EFP staff received 100 written comments by the close of the comment period and an additional three comments after the close of the scoping period.

The scoping meeting comment report and all written comments are available for viewing and downloading on the Hollydale Project website maintained by the Department at: http://mn.gov/commerce/energyfacilities/Docket.html?Id=32919 or on the eDockets website at: https://www.edockets.state.mn.us/EFiling/search.jsp (enter the year "12" and the number "113").

Based on the scoping comments received and the rules governing the scope of an ER (Minn. Rule 7849.1500), the Deputy Commissioner of the Department issued a scoping decision on December 4, 2012 (**Appendix A**). This ER has been developed in accordance with the scoping decision.

This ER will be introduced into the hearing record by EFP staff. Interested persons may comment on the ER at the public hearing. Comments received on the ER become part of the record in the proceeding, but EFP staff is not required to revise or supplement the ER document.

Environmental Impact Statement

On July 31, 2012, the Department issued a scoping decision identifying the issues and routes to be evaluated in the EIS to be prepared for the routing process. The Department anticipates that a Draft EIS will be available in late March 2013, with public meetings on the Draft EIS held in the project area in April 2013, and a Final EIS available in June 2013.

1.3 Additional Permits

In addition to approvals issued by the Commission, the Hollydale Project will require permits and approvals from federal agencies, additional state agencies, and local governments. These permits are discussed in Section 6 of this report.

1.4 Organization and Content of this Document

This report is organized into seven sections:

Section 1: Introduction
Section 2: Description of the Proposed Hollydale Project
Section 3: Description of Hollydale Project Alternatives
Section 4: Human and Environmental Impacts
Section 5: Availability and Feasibility of Alternatives
Section 6: Permits

Sections two through four discuss the Hollydale Project, alternatives, associated impacts and mitigation.

1.5 Sources of Information

Information for this report is drawn from multiple sources and cited throughout. The primary source documents used are the applications submitted by Applicants to the Commission:

- Application for Certificate of Need, Hollydale 115 kV HVTL Project, July 2, 2012 (herein after, *CN Application*)
- Application for Route Permit, Hollydale 115 kV HVTL Project, June 30, 2011 (herein after, *Route Permit Application*)

Information from other reports and orders issued by the Commission, the Minnesota Environmental Quality Board, the Department, and other Minnesota and Federal agencies has been incorporated as applicable.

2 Proposed Hollydale Project

In order to address the described need, Applicants propose to build a 115 kV transmission line of approximately 8.8 miles, modify two substations, and construct a new 115 kV substation in Plymouth. The Hollydale Project proposed by the Applicants consists of the following components:

- Sale of approximately eight miles of GRE's existing 69 kV transmission line BD to Xcel Energy,
- Removal and replacement of the transferred portion of the existing 69 kV transmission line BD with a new 115 kV transmission line,
- Construction of a new Pomerleau Lake 115 kV substation in Plymouth,
- Construction of approximately eight-tenths of a mile of new 115 kV overhead transmission line,
- Modification of the existing Medina substation to accommodate the new 115 kV transmission line, and
- Expansion and modification of the existing Hollydale substation to accommodate the new 115 kV transmission line.

The Hollydale Project is shown in **Figure 1**. Potential routes that the transmission lines would follow, if approved, were identified in the EIS Scoping Decision issued by the Department on July 31, 2012. Potential routes under review in the EIS would be between eight and 10.3 miles long. The project area shown in figures and maps in this report encompasses all routes being evaluated in the EIS. If the Commission determines a need for the project, the Commission will then select a route for the Hollydale Project. Applicants also anticipate that several distribution lines will result from construction of the Hollydale Project; distribution lines are not considered HVTL lines, and their location is subject to local jurisdiction.

The Applicants plan to begin construction of the Hollydale Project in 2014, with the project anticipated in-service by the fourth quarter 2015.[7] Applicants estimate the cost for the Hollydale Project, as proposed, to be in the range of $32.4 to 40.7 million.[8] Estimated costs for the proposed Hollydale Project shown in **Table 1** are broken down in a manner that allows comparison with alternatives to the proposed project described in Section 3 of this report.

[7] Applicants. January 25, 2013. *Direct Testimony of Eugene R. Kotz II* (herein after *Kotz Direct Testimony*), p. 2. eDocket ID: 20131-83199-03

[8] *Kotz Direct Testimony*; Applicants. January 25, 2013. *Direct Testimony of Justin Michlig* (herein after *Michlig Direct Testimony*), Schedule 2, Appendix F. eDocket ID: 20131-83206-01

Table 1: Estimated Hollydale Project Cost[9]

Project Item	Cost ($ Million)
Acquisition and removal of 69 kV Transmission Line BD	0.5
Construction of 8.8 miles of new 115 kV Transmission Line Facilities (Applicant's proposed route)	8.4
Distribution Line Construction – 2015	3.5
Distribution Line Construction – 2016	3.2
New Pomerleau Lake Substation – 2015	15.0
Modifications to Pomerleau Lake Substation – 2016	N/A
Modifications to Medina Substation	2.7
Modifications to Hollydale Substation - 2015	5.1
Modifications to Hollydale Substation - 2016	2.0
Modifications to Gleason Lake Substation - 2015	N/A
Modifications to Gleason Lake Substation - 2016	0.4
Total Hollydale Project Cost	**40.7**

Under the Applicants' proposal, Xcel Energy will construct and maintain the new 115 kV transmission line, the new Pomerleau Lake Substation, and the existing Hollydale Substation. GRE, along with Wright-Hennepin Cooperative Electrical Association (herein after "Wright-Hennepin") will construct and maintain the modifications to the Medina Substation. Generally, the equipment owner will also operate the equipment.[10]

2.1 Transmission Structure Design

Applicants propose to use galvanized steel or weathering steel poles with heights of approximately 70 to 105 feet and average spans of 300 to 500 feet between structures. In certain situations, e.g. wetland areas, special transmission structures, such as Y-frames, may be used to achieve spans of up to 1,200 feet. Applicants anticipate the majority of structures will be braced-post, although the final design may specify other structure types.[11] Double circuit 115/115 kV structures would be used only if the Pomerleau Lake Substation were located at the alternate site. Design features of anticipated structures are summarized in **Table 2,** and shown in **Appendix C**.

[9] Costs are estimated through 2016, Adapted from *Michlig Direct Testimony* using land acquisition costs from *Kotz Direct Testimony* and Xcel Energy personal communication.
[10] *CN Application*, at p. 15
[11] *CN Application*, at p. 98

Table 2: 115 kV Structure Design Summary[12]

Line Type	Structure Type	Dimensions (feet)				
		Typical Right-of-way Width	Structure Height	Structure Base Diameter	Foundation Diameter	Span Between Structures
Single Circuit 115 kV	Single Pole Braced Post (for longer spans)	75	70 to 90	2 to 3.5 (tangent) 3 to 6 (angle)	5 to 8	300 to 500
Single Circuit 115 kV	Single Pole Horizontal Post (all one side)	75	70 to 90	2 to 3.5 (tangent) 3 to 6 (angle)	5 to 8	300 to 500
Single Circuit 115 kV	Single Pole Horizontal Post (Delta Configuration)	75	70 to 90	2 to 3.5 (tangent) 3 to 6 (angle)	5 to 8	300 to 500
Single Circuit 115 kV	Single Pole, Cross Arm, Y-Frame	75	70 to 90	3 to 6	5 to 8	500 to 1,200
Double Circuit 115/115 kV	Single Pole, Davit Arm	75	75 to 105	3 to 4 (tangent) 4 to 6 (angle)	5 to 7 (tangent) 6 to 8 (angle)	300 to 500

2.2 Right-of-Way Requirements and Acquisition

The existing right-of-way along GRE's 69 kV line BD ranges from 70 to 100 feet in width.[13] Several areas along the existing 69 kV transmission line BD have structures including garages, decks, gazebos, and portions of dwellings that have been built into the easement area since construction of the 69 kV line.[14] For any portion of the new 115 kV transmission line along the existing 69 kV transmission line BD, Applicants propose to construct a new centerline along the existing 69 kV centerline using the current transmission line's rights-of-way, granting encroachments for existing structures on a case-by-case basis.[15] In areas where new construction is required, Applicants intend to acquire a right-of-way of 75 feet, 37.5 feet on either side of the centerline, which is typical for new 115 kV transmission lines.[16]

Applicants state that in locations where the new transmission line would parallel other existing infrastructure rights-of-way (e.g., roads, railroads, and existing utilities) it may be possible to reduce the width of right-of-way required for the Hollydale Project if the transmission line can share a portion of the existing right-of-way, thereby reducing the size of the required easement. For example, when the transmission line parallels a road, the applicants indicate that the transmission centerline would be constructed approximately five feet outside the existing road right-of-way when possible.[17] Therefore, a little less than half of the transmission line right-of-way would share the existing road right-of-way, resulting in an easement of lesser width being required from the adjacent landowner. The amount of

[12] Adapted from *CN Application, Table 7* and Xcel Energy personal communication, January 11, 2013
[13] *Route Permit Application*, p. 51.
[14] Xcel Energy, personal communication, January 11, 2013
[15] *CN Application*, p. 101; Xcel Energy, personal communication, January 11, 2013.
[16] *CN Application*, p. 102
[17] *Route Permit Application*, p. 51

new easement required will depend upon the road configuration and the distance between the road and the transmission line. The Applicants will follow industry standard practices and the Minnesota Department of Transportation's (MnDOT) utility accommodation policy[18] to position and manage the right-of-way along roadways.[19]

Utilities typically acquire easement rights, not fee title from landowners to accommodate transmission lines. Although the easement price receives the most attention during easement negotiations, many aspects of the easement, such as location structures, construction and maintenance techniques, can also be negotiated in the easement.

Although Applicants anticipate using existing right-of-way for the majority of the Hollydale Project, new rights-of-way will be required for at least a portion of the project. Where the transmission line would require new right-of-way, the easement acquisition process begins early in the detailed design phase. The easement acquisition process can typically be broken down into the following steps:

Title examination. Following identification of a route in a route permit, Xcel Energy will perform a public records search of the land involved in the Hollydale Project to identify all persons and entities that may have a legal interest in the real estate upon which the Hollydale Project will be built. A title report is then developed for each parcel to determine the owner(s) of record of the property, and to gather information regarding easements, liens, restrictions, encumbrances, and other conditions of record.

Initial contact. A right-of-way representative contacts each property owner or the property owner's representative along the route identified in the route permit to discuss the Hollydale Project and how it may impact each parcel and also seeks information about any construction concerns specific to the landowner. Information on anticipated construction schedule and construction requirements would be provided to the property owner.

Initial transmission line survey. Xcel Energy provides notification to property owners along the permitted route requesting permission for survey crews to conduct preliminary survey work on the property. The survey is performed to establish the right-of-way boundaries, locate natural and man-made features along and within the right-of-way, establish the transmission centerline and determine elevations for use during detailed design. Permission may also be requested at this time to obtain soil samples to assess soil conditions and to determine appropriate foundation design.

During the initial survey the survey crew, with permission of the property owner, may place surveyor's stakes to mark the tentative or anticipated structure locations, thereby allowing the landowner to see where the structures may be located on the property. The right-of-way boundary may also be delineated showing the area that is required for safe operation of the transmission line.

Easement acquisition. Xcel Energy collects land value data and, based on the impact of the easement or purchase to the market value of each parcel, develops what it considers to be a fair market value offer.

[18] Minnesota Department of Transportation, *Mn/DOT, Utility Accommodation Policy*, http://www.dot.state.mn.us/utility/policy/index.html .
[19] *Route Permit Application*, p. 51.

The offer of compensation is based on the specific attributes of each property, the amount of easement area, design of the transmission line, and other factors, as appropriate.

The right-of-way agent will then contact the property owner(s) to present the easement offer and discuss the amount of just compensation for the rights to construct, operate, access, and maintain the transmission facilities within the easement area. The landowner is then allowed time to consider the offer and to present any additional material that the property owner believes is relevant to determining the property's value. Almost any aspect of the easement is negotiable.[20]

Eminent domain. If a negotiated settlement cannot be reached, it may be necessary for the applicant to file for eminent domain, pursuant to Minnesota Statute Chapter 117. In the eminent domain process, a judicial proceeding would commence to determine the scope of the applicant's easement and an independent commission would determine the value of the easement taken. Under Minnesota Statute 117.036, subdivision 2(a), Xcel Energy, as the acquiring authority, must obtain at least one appraisal for the property proposed to be acquired if it intends to use eminent domain proceedings to acquire a right-of-way. If the landowner desires a second opinion on the fair market value of the property, the landowner may have an appraisal made and receive reimbursement from the applicant per Minnesota Statute 117.036 subdivision 2(b).

Pre-construction owner contact. Prior to construction, the right-of-way agent would contact the owner of each parcel along the route to discuss the construction schedule and any additional requirements not discussed during the time of the easement acquisition. To ensure safe construction and operation, special consideration may be needed for fences, crops, or livestock. In each case the right-of-way agent assists in coordinating the process.

2.3 Construction

Hollydale Project construction would begin after the appropriate federal, state, and local permits and approvals are issued. Xcel Energy would need to acquire property rights-of-way, complete soil investigations, and develop the final detailed design. The precise timing of construction would take into account the required permits and their conditions, system loading issues, existing transmission line outage restrictions, construction constraints, weather, road restrictions, mitigation or impact minimization, and availability of work force and materials.

Construction of the transmission line would require the acquisition and preparation of rights-of-way for the transmission line, establishment of work and staging areas, removal and reconstruction of portions of existing transmission lines where necessary, installation of new single pole tangent and specialty structures, and installation of safety structures at road and other utility crossings.

Applicants anticipate that construction will take approximately three weeks per mile of transmission n line with a construction crew of approximately 15 people divided into three- to four-person teams.[21]

[20] Minnesota Department of Commerce (Department). June 3, 2011. *Rights of Way and Easements for Energy Facility Construction and Operation*, http://mn.gov/commerce/energyfacilities/documents/DOC%20Easements%20Fact%20Sheet,%206.3.11.pdf
[21] *CN Application*, p. 125

Construction equipment typically used on a transmission project would include tree removal equipment, mowers, cranes, backhoes, digger-derrick line trucks, track-mounted drill rigs, dump trucks, front end loaders, bucket trucks, bulldozers, flatbed tractor-trailers, flatbed trucks, pickup trucks, concrete trucks and various trailers.

The Applicants state that the proposed transmission line would be designed to meet or exceed local and state codes, the National Electric Safety Code (NESC), and Xcel Energy standards.[22]

2.3.1 Right-of-Way Preparation and Structure Removal

Following right-of-way acquisition, soil testing, and final design, the right of way for the transmission line would be cleared.

For any portion of the Hollydale Project along the existing 69 kV transmission line BD, existing structures would be removed prior to installation of new structures. Because the existing 69 kV line BD is not energized between the Hollydale Substation and the connection point with GRE's 115 kV line WH-PB, existing structures along that segment can be removed without scheduling an outage. If the route includes any portion of the existing 69 kV transmission line BD between the Medina and Hollydale substations, the existing line would need to be de-energized prior to removal.

Typically existing roads or trails that run parallel or perpendicular to the proposed route are used to access the actual transmission line right-of-way. Where use of private field roads or trails is necessary, permission from the property owner would be obtained by Xcel Energy prior to access. In some cases, new access roads or temporary lay down areas may be required due to difficulty in accessing structure locations when no current access is available or existing access is inadequate for the heavy equipment used in construction. Any temporary access locations would be dependent upon final route selections. Should these areas fall outside the right-of-way, temporary easements would be arranged with the affected landowner. These temporary easements are not typically part of the route permit issued by the Commission for high-voltage transmission lines.

The Hollydale Project would require one or more staging area(s) to provide a location to deliver and store materials required for construction. Although existing substation sites are often used as staging areas for transmission projects, neither the Medina nor Hollydale substation sites have sufficient space to serve this function. The Applicants anticipate leasing temporary staging areas from landowners or warehouses in the area to serve as staging areas. No sites have yet been identified.[23]

2.3.2 Overhead Transmission Line Structures

Transmission line structures are generally designed for installation at existing grades. However, along areas with more than 10 percent slope, working areas may have to be graded level or fill would be brought in to create working pads. If the landowner permits, Xcel Energy prefers to leave the leveled working pads in place for future maintenance activities, as necessary. If the landowner does not agree, Xcel Energy will grade the site back to its original condition and any imported fill is removed from the area.

[22] *CN Application*, p. 102
[23] Xcel Energy personal communication, December 31, 2012

Transmission line structures are typically delivered to their staked location or to a designated staging area depending on delivery and contractor availability. If the poles are delivered to a staked site, they are typically designed for the specific site location at which they are to be constructed and are placed along the right-of-way out of the clear zone of any adjacent highways or designed pathways and marked for visibility.

"Tangent" structure, those in a straight line with both its adjacent structures, and light angle structures may be placed on drilled concrete pier foundations or direct embedded. Direct embedding would generally require an excavation of a five to eight foot diameter hole at least 15 feet deep or greater, depending on soil conditions and other factors. The poles are typically framed with insulators and hardware on the ground and then lifted and placed in the hole via a bucket truck or a crane, depending on the weight of the structure. The poles would be backfilled with native soils or crushed rock depending on soil and design conditions. In lowland areas, a galvanized steel culvert may be also inserted for pole stability due to poor soil capacity. Any excess soil would be thin spread or removed from the site as required.

Medium angle, heavy angle, or dead-end structures would be set on drilled concrete pier foundations to support the higher stress. Holes are drilled for foundations at the structure locations. The drilled pier would typically have a diameter of five to eight feet and typically require an excavation depth of approximately 20 to 30 feet or more, depending on soil conditions and design requirements. The excavation is filled with concrete; after the concrete foundation is set, the pole or structure is then bolted to the foundation.[24]

Special construction techniques to minimize impacts to environmentally sensitive areas, such as wetlands, are discussed in Section 4.0 of this document.

2.4 Underground Transmission Line Construction

Applicants propose to construct the Hollydale Project as an overhead transmission line, the typical construction for HVTL lines in Minnesota. In contrast, many distribution lines are constructed underground. Although overhead HVTL lines are typical, HVTL lines can also be placed underground. Although Applicants do not propose underground construction, the issue of underground construction for the Hollydale Project was identified in scoping and construction methods for underground HVTL lines are discussed in this section.

In order to operate safely and effectively, conductors must be adequately insulated from the ground and from each other and must be adequately cooled to prevent equipment failure. In the case of overhead transmission lines, the air serves to provide insulation and to dissipate heat away from the conductor surface. In the case of underground transmission lines, conductors are wrapped with insulating materials and are typically placed inside oil-filled pipes; oil in these pipes is circulated through cooling stations located every few thousand feet to dissipate heat. Some electric cables, such as cross linked polyethylene, use a specially designed plastic covering that eliminates the need for circulating oil to dissipate the heat; such conductors could be used for the Hollydale Project.

[24] *Route Permit Application*, p. 63; Xcel Energy, personal communication, January 11, 2013

Construction of underground transmission lines would require installation of a concrete ductbank measuring approximately five feet wide by three to five feet deep to hold the conduits. Each concrete duct bank would contain one circuit containing four 6-inch polyvinyl chloride (PVC) conduits for transmission circuits and two 2-inch PVC conduits for ground continuity and communication needs. An extra duct bank would be constructed with extra cable to act as a backup in the event that a fault occurs along the transmission line. The use of ductbanks minimizes the length of trench open at any one time, as cables are pulled into the ducts after trench backfilling is completed. Manholes are installed along the duct system to assist in pulling cable through the duct system.

Conductors and associated facilities are placed underground in excavated trenches or pulled through holes bored by a specialized horizontal drilling rig. Prior to detailed design of an underground transmission line, Xcel Energy would conduct soil sampling and testing to determine the thermal conductivity of the earth and ability to trench and bore in the ROW.

Open cut trenching is the most commonly used construction technique to install underground duct systems and has been used by the industry since the early 1900s. Utilities tend to prefer this type of construction because it allows for easier detection of conflicts, such as existing buried utilities or other obstacles. Open cut trenching allows for the exposure and discovery of other buried utilities and allows the relocation of existing utilities or redesign of the concrete ductbank alignment. Open cut trenching is also less expensive than horizontal directional drilling. Depending on the natural features of the route, it may be necessary to shore up the trench for worker safety, dewater the trench due to the presence of shallow groundwater, and backfill the trench with selective fill material to improve heat transfer. Although construction of both overhead transmission and trenching of underground transmission require vegetation clearing along the entire right-of-way, overhead transmission requires ground disturbance only in areas where structures are installed whereas open cut trenching requires ground disturbance along the entire length of the underground portion.

Horizontal directional drilling was developed in the 1970s as a method to avoid open cut trenching and has since been used for the installation of transmission lines, cables, and oil, natural gas, and water pipelines. Because of the cost differential and the specialized techniques required, horizontal boring and directional drilling tend to be used when the natural landscape or man-made features make open trenching difficult; examples of these features include ravines, railroad lines, major roadways, and rivers.

In their route permit application for the Hiawatha 115 kV Transmission Line, Xcel Energy estimated that construction of the initial duct banks for that project would occur at a rate of approximately 200 feet per day,[25] compared to the a rate of approximately three weeks per mile for overhead construction. Underground construction is considerably more expensive, as much as seven to ten times the cost of overhead construction.

Installation of underground transmission facilities minimizes many of the visual features associated with overhead transmission facilities, but underground transmission still requires establishment and maintenance of a transmission right-of-way. Applicants anticipate that underground facilities for the Hollydale Project would require a right-of-way of 70 feet.[26] Once construction of underground facilities

[25] Northern States Power Company. April 24, 2009. *Application to the Minnesota Public Utilities Commission for a Route Permit: Hiawatha Project*. eDocket ID: 20094-36720-09
[26] Xcel Energy, personal communication, January 29, 2013

is completed, vegetation above duct banks is re-established but would be limited under terms of the easement to shallow rooted species to avoid the possibility of deep rooted species invading the duct bank. Typically, a 30-foot portion of the right-of-way directly over the buried transmission lines would be required to be maintained as clear of vegetation other than grasses. In wooded areas, this may result in a noticeable change of vegetation within the right-of-way as taller trees with deeper roots are displaced by more shallow-rooted species. Xcel Energy would seek to work with landowners on compatible species of vegetation that could be planted at the edge of the right-of-way.[27]

While underground transmission lines experience fewer outages, the length of outages tends to be much longer than failure of an equivalent overhead line. Typical overhead line outages are back in service within 10 to 24 hours of the outage event, while typical outages of underground transmission lines take two to three weeks to place back in service. This difference is primarily the result of two factors: underground cables do not suffer the kind of temporary faults, such as falling branches, that are more frequent but also more quickly repaired, and underground cables are not subjected to reclosing operations.

2.5 Conductors

Once the structures have been erected, conductors and shield wires are installed by establishing stringing setup areas within the right-of-way. Stringing operations require brief access to each structure to secure the conductors wire to the insulators or the shield wire to shield wire clamps once final sag is established. These stringing setup areas are typically located every two miles along the right-of-way. The wires are pulled with a rope lead that connects to every structure through a dolly attached at the insulator/clamp location.

Temporary guard or clearance poles are installed at crossings to provide adequate clearance over other utilities, streets, roads, highways, railroads, or other obstructions. Necessary notifications are made or permit requirements are followed, to mitigate any concerns with traffic flow or operations of other utilities.

2.6 Medina Substation

The existing GRE-owned Medina Substation would be converted from 69 kV to 115 kV as part of the proposed Hollydale Project. The conversion would include the removal of the 69 kV transmission facilities and installation of a 115 kV straight bus with two breaker positions, one for the new 115 kV line and one reserved for future use. The existing distribution equipment and existing feeders would be re-orientated and the northwest corner of the substation would be expanded by approximately 0.04 to 0.25 acres within the existing property limits.

2.7 New Pomerleau Lake Substation

As part of the Hollydale Project, Applicants propose to construct a new Pomerleau Lake substation on a parcel of approximately 10 acres in northwest Plymouth. Applicants have identified two potential sites for the new substation. The new substation would be designed to provide for interconnection with proposed, existing, and potential future transmission facilities.

[27] Xcel Energy, personal communication, January 29, 2013

As proposed, the Pomerleau Lake Substation would be constructed in stages; the initial design specifies a fenced area of approximately 400 by 475 feet (approximately 4.5 acres) with an ultimate build out fenced area of approximately 400 by 1000 feet (approximately nine acres).[28] Substation components outside of the fenced area include stormwater ponds, access road and parking and space for potential transmission line structures.

The proposed new Pomerleau Lake Substation would be a conventional outdoor substation and will have line terminations to the Hollydale Substation (the 115 kV transmission Line 5551 rebuild) and connect to the existing GRE 115 kV transmission Line WH-PP (from Parkers Lake to Cedar Island Substations). The substation will include a 115 kV four position ring bus configuration and an electrical equipment enclosure with future expansion capability to an ultimate 115 kV breaker-and-a-half configuration.

The substation site will be designed with room for line terminations for a future 115 kV transmission line section to a future new Meadow Lake Substation in the vicinity of Schmidt Lake Road and Highway 169 as well as future distribution feeders. The substation will be designed with a 115 kV yard and a 13.8 kV yard, with room for a future 345 kV substation yard that will allow the Pomerleau Lake Substation to connect with the existing Parkers Lake to Creek 345 kV line and the Parkers Lake to Dickenson 345 kV line.[29]

2.8 Hollydale Substation

The Xcel-owned Hollydale Substation is currently a 69 /13.8 kV and 34.5/13.8 kV distribution substation near the intersection of Highway 101 and Highway 55 in Plymouth. Although the transmission portion of the substation operates at 69 kV, the substation is built to 115 kV and contains a 115 kV dead-end structure and some 115 kV rated equipment.

As proposed by the Applicants, the Hollydale Project would expand the substation to the northwest by approximately 5,000 square feet, resulting in a fenced area of 250 by 300 feet, or approximately 1.7 acres. The existing 69 kV transformer would be removed and replaced with a new 118-14.3 kV 50 megavolt-amperes (MVA) transformer. The 115 kV portion of the substation would be converted from a tapped configuration to an in-and-out configuration with overhead connections to the existing Medina Substation and the new Pomerleau Lake Substation.[30] Initially the substation will have one 115 /13.8 kV transformer with provisions to install a second 115/13.8 kV transformer, a 115 kV capacitor band, and a third 15 kV switchgear enclosure and associated equipment. Additional 13.8 kV feeder lines would be added from the Hollydale Substation to serve local load.

2.9 Clean-up and Restoration

Construction areas would be disturbed during the normal course of work, which can take several weeks in any one location. As construction on each parcel is completed, disturbed areas would be restored to their original condition. Practices to mitigate potential construction impacts would follow permit

[28] *CN Application*, p. 102
[29] Applicants. January 11, 2013. *Response to West Plymouth Neighborhood Association (WPNA) IR CN-9* (herein after, *Applicants' Response to WPNA IR-CN-9)*.
[30] *CN Application*, pp. 103 - 104

requirements and be based on construction schedules, geology and topography, maintenance guidelines, inspection procedures, and presence of sensitive environments or species.

Landowners would be contacted by a right-of way representative at the close of construction activities to determine whether any damage has occurred (e.g. crops, soil fences or drain tiles) as a result of the project. Areas damaged during construction activities will be restored to their pre-construction condition to the extent possible or Xcel will reimburse the landowner for damages sustained that are not repaired.[31]

Xcel Energy may employ an outside contractor to restore the damaged property to as near its original condition as is possible. Areas with significant soil compaction and disturbance from construction activities along the proposed transmission line route may require assistance in re-establishing the vegetation stratum and controlling soil erosion.

HVTL Route Permits issued by the Commission require the permittee to notify the Commission in writing 60 days after completion of all restoration activities and also require the permittee to compensate landowners for any yard/landscape, soil compaction, drain tile, or other property damages that may occur during construction.

2.10 Maintenance Procedures

Transmission infrastructure has few mechanical elements and is designed and constructed to withstand weather events that are normally encountered. Although infrequent, transmission lines are taken out of service by protective relay equipment when a fault is sensed on the system or for scheduled maintenance outages. As a result, Xcel Energy estimates the average annual availability of transmission infrastructure exceeds 90 percent.

Routine maintenance and inspections are performed over the life of the facility to ensure its continued integrity. Annual inspections of the transmission facilities are usually done by aerial means. Periodic access to the transmission line rights-of-way and substations would be required to perform on-ground inspections and conduct routine maintenance or repairs. Foot patrol inspections are typically performed every four years[32] would be limited to the acquired right-of-way and areas where obstructions or terrain require access off the easement.

The transmission line rights-of-way are managed to remove vegetation that has the potential to interfere with the operation and maintenance of the line. Applicants would conduct vegetation surveys and remove undesired vegetation that may interfere with the operation of the transmission line. Typical vegetation maintenance for a 115 kV transmission line is on a three to seven year cycle dependent on vegetation growth and weather events. Vegetation management generally includes a combination of mechanical, hand clearing, and herbicide application to remove or control the growth of vegetation in or impinging upon the right-of-way.

Herbicide application would be applied following U.S. Environmental Protection Agency (EPA) and state agency regulations and is applied by licensed applicators.

[31] *CN Application*, pp. 128 - 129
[32] Xcel Energy, personal communication, January 11, 2013

Substations require a certain amount of maintenance to keep them functioning in accordance with accepted operating parameters and NESC and North American Electric Reliability Corporation (NERC) requirements. Transformers, circuit breakers, batteries, protective relays, and other equipment need to be serviced periodically in accordance with the manufacturer's recommendation. The site itself must be secure, kept free of vegetation, and proper drainage must be maintained.

3 Description of Hollydale Project Alternatives

Minn. Rule 7849.1200 requires the Commission to consider alternatives to a proposed project. In addition to evaluating alternatives and their impacts, a no build option must also be evaluated. This section describes alternatives to the Hollydale Project.

Alternatives evaluated include: (1) a "no build" alternative, (2) demand-side management, (3) purchased power, (4) generation alternatives, (5) transmission system alternatives, (6) distribution system alternatives, and (7) an upgrade to existing facilities in the form of a re-build of the existing 69 kV transmission line. As discussed in the introduction to Section 4 of this document, not all alternatives described here are carried through for full evaluation.

3.1 No-build Alternative

Under the No-build Alternative, the Applicants would continue to operate and maintain the existing eight-mile 69 kV transmission line BD as it is currently. The 69 kV transmission line was constructed by United Power Association and placed in service in 1971.[33] In February 2006 GRE de-energized the segment of the line from Hollydale Substation to its intersection with the GRE 115 kV WH-PB line; this portion of the line has not been used since being de-energized.[34] The portion of the line between the Medina and Hollydale substations is energized, but only provides load service for a very limited amount of time, approximately 274 hours between January 2008 and mid-December 2012.[35]

3.2 Conservation and Demand-side Management

Applicants have incorporated anticipated demand savings in their load growth forecasts. Therefore, in order to meet the stated need for the Hollydale Project, a Demand-Side Management (DSM) Alternative would need to achieve 50 MW above and beyond the Applicants' current and anticipated efforts.

Between 1990 and 2011, Xcel Energy calculates that its conservation and DSM programs have resulted in electric demand savings of 2,675 MW over their Minnesota system. In their *2013 - 2015 Conservation Improvement Program Triennial Plan* filed with the Department, Xcel Energy proposes investments calculated to achieve an additional 1,307 gigawatt hours and 315 MW of electric demand savings, representing 1.5 percent of annual retail sales, over three years.[36] GRE's DSM programs have an annual energy savings of approximately 33 MW.

Since 2002, Xcel Energy customers in the Hollydale Area (representing zip codes 55340, 55356, 55391, 55441, 55446, and 55447) represent a total of less than three percent of system load.[37] Although DSM efforts can be used to reduce future needs, achieving an additional 50 MW of electric demand savings, or approximately 16 percent of planned system-wide savings over three years, in a project area that

[33] Applicants *Response to WPNA IR-TL-7*, October 4, 2012,
[34] *Ibid.*
[35] *Applicants Response to WPNA IR-CN-16*, December 21, 2012
[36] Xcel Energy, *2013 - 2015 Conservation Improvement Program Triennial Plan*, June 1, 2012, eDocket ID: 20126-75251-01
[37] *CN Application*, Appendix D.3

represents three percent of Xcel Energy's system load, is not feasible within a timeframe that would address existing overload demand.

3.3 Purchased Power

Another alternative required to be reviewed in Certificate of Need proceedings is whether Applicants can meet increased load growth by purchasing power. In order to meet the stated need, Applicants would need to purchase 50 MW of generation.

Purchased power as an alternative tends to be more applicable as an alternative to a power plant than as an alternative to transmission. Applicants have identified current and future inadequacies of the transmission and distribution systems in the project area. Power, whether generated or purchased, would have to be transferred into the area through a transmission and distribution system that, applicants argue, is inadequate. The power purchase would not address the stated need and would, if anything, exacerbate the voltage support and instability issues identified by the Applicants.

3.4 Generation Alternative

This report evaluates two types of generation alternatives: use of small turbine generators (microturbines and reciprocating engines), and renewable generation resources in the form of distributed solar and wind generation.

3.4.1 Small Turbine Generators

Microturbines are promising new technologies for distributed generation and are currently available in the 30 kV to 250 kW size range. Reciprocating engines are widely available and area available in a range of sizes between five kW and seven MW.

Microturbines

Microturbines are small combustion turbines that produce between 30 kW and 250 kW of power. Microturbines were derived from turbocharger technologies found in large trucks or the turbines in aircraft auxiliary power units. Most microturbines are single-stage, radial flow devices with high rotating speeds of 90,000 to 120,000 revolutions per minute. However, a few manufacturers have developed alternative systems with multiple stages and/or lower rotation speeds. Microturbines are nearing commercial status. However, many of the microturbine installations are still undergoing field tests or are part of large-scale demonstrations. An overview of microturbines is provided in **Table 3**.

Table 3. Microturbine Overview[38]

Criteria	Notes
Commercially Available	Yes (limited)
Size Range	30 – 250 kW
Fuel	Natural gas, gasoline, kerosene, diesel, waste gas
Electrical Efficiency	23% - 26%; 47 - 59% for Cogen
Availability	High; manufacturers target 98 to 99 %
Environmental	Low (4 - 9 ppm) NOx
Other Features	Cogen (50 – 80°C water) increases total efficiency (electric and heat used for thermal needs) to 63 to 71%
Commercial Status	Small volume production, commercial prototypes now
Capital Cost	$1,280-$1,410/kW
Total Installed Cost	$2,440 - $2970/kW
Design Life	40,000 to 80,000 hours
O&M Cost	$0.012-0.025/kW
Maintenance Interval	8000 hours replace air and fuel filters; 20,000 hours battery replacement, 40,000 major overhaul & core replacement

Microturbine generators can be divided in two general classes:

- Recuperated microturbines, which recover the heat from the exhaust gas to boost the temperature of combustion and increase the efficiency, and
- Unrecuperated (or simple cycle) microturbines, which have lower efficiencies, but also lower capital costs.

Microturbines can be used for stand-by power, power quality and reliability, peak shaving, and cogeneration applications. In addition, because microturbines are being developed to utilize a variety of fuels, they are being used for resource recovery and landfill gas applications. Their size makes them well-suited for small commercial building establishments such as restaurants, hotels/motels, small offices, retail stores, and many others.

Commercial microturbines used for power generation produce both heat and electricity on a relatively small scale. The fuel-energy-to-electrical-conversion efficiencies are in the range of 23 to 26 percent when using a recuperator (a device that captures waste heat to improve the efficiency of the compressor stage). Cogeneration is an option in many cases as a microturbine is located at the point-of-power utilization. The combined thermal electrical efficiency of microturbines in such cogeneration applications can reach as high as 71 percent depending on the heat process requirements. Unrecuperated microturbines have lower electrical efficiencies at around 15 percent.

Microturbine capital costs range from $1,290/kW for larger units to approximately $1,410/kW for smaller ones. These costs include all hardware, associated manuals, software, and initial training. The addition of a heat recovery system adds between $190 - $430/kW. Site preparation and installation costs vary significantly by location, but generally add 30-40 percent to the total capital cost.

[38] U. S. Environmental Protection Agency (EPA). December 2008. *Technology Characterization: Microturbines*. http://www.epa.gov/chp/documents/catalog_chptech_microturbines.pdf

Microturbine manufacturers are targeting a future capital cost below $650/kW. This appears to be feasible as the market expands and sales volumes increase.

With fewer moving parts, microturbine vendors hope their units can provide higher reliability and require less maintenance than conventional reciprocating engine generators. Manufacturers expect that initial units will require more unexpected visits, but as the technology matures, a once-a-year maintenance schedule should suffice. Most manufacturers are targeting maintenance intervals of 5,000-8,000 hours.

Actual maintenance costs and intervals for mature microturbines are less well known since there is a limited base of empirical data from which to draw conclusions. Estimated forecasts range from $0.005-$0.016 per kWh, which would be comparable to costs for small reciprocating engine systems.

Extensive field test data collected from units currently in use at commercial and industrial facilities will provide manufacturers with the ability to improve the microturbine design, lowering costs and increasing performance, in order to produce a competitive distributed generation product. Utilities, government agencies, and other organizations are involved in collaborative research and field testing. In addition, manufacturers are moving toward packaging microturbine generators with integrated heat recovery equipment to lower both the cost of installation and operation.

Assuming usage of recuperated microturbines with an efficiency rate of 25 percent, approximately 200 MW of microturbines dispersed over 800 to 6,700 sites within the project area would be needed to meet the stated need of the Hollydale Project.

Reciprocating Engines

Reciprocating engines, also referred to as internal combustion engines (ICE), are the most common and most technically mature of all distributed generation technologies, have the lowest initial cost of distributed generation technologies, and are the traditional technology for emergency power all over the world. They are available in sizes ranging from 5 kW, often used for residential back-up generation, to 7 MW for commercial installations. Reciprocating engines use commonly available fuels such as gasoline, natural gas, and diesel fuel.

Table 4. Reciprocating Engine Overview

Criteria	Notes
Commercially Available	Yes
Size Range	5 kW – 7 MW
Fuels	Natural gas, diesel, landfill gas, digester gas
Efficiency	25 – 45%
Environmental	Emission controls required for NOx and CO
Other Features	Cogen (some models)
Commercial Status	Products are widely available

These engines convert the energy contained in a fuel into mechanical power. This mechanical power is used to turn a shaft in the engine and a generator is attached to convert the rotational motion into power.

Reciprocating engines can operate on a wide spectrum of fuels including natural gas, diesel, landfill gas, digester gas, etc. There are two methods for igniting the fuel in an internal combustion engine. In spark ignition, a spark is introduced into the cylinder (from a spark plug) at the end of the compression stroke. Fast-burning fuels, like gasoline and natural gas, are commonly used in spark ignition engines. In compression ignition, the fuel-air mixture spontaneously ignites when the compression raises it to a high-enough temperature. Compression ignition works best with slow-burning fuels, like diesel. Internal combustion engines are also classified as high-speed, medium-speed, or low-speed:

- High-speed units are derived from automotive or truck engines and operate at 1200-3600 rpm. These engines generate the most output per unit of displacement and have the lowest capital costs, but also have the poorest efficiency.
- Medium-speed engines are derived from locomotive and small marine engines, and operate at 275-1000 rpm, have higher capital costs, but also have greater efficiency.
- Low-speed units are derived from large ship propulsion engines and operate at 58-275 rpm. Low-speed engines are designed to burn low-quality residual fuels and are practical only if there is a large price differential between heavy oil and natural gas and there are no environmental restrictions (not in U.S.).

Reciprocating engines have efficiencies that range from 25 to 45 percent. In general, diesel engines are more efficient than natural gas engines because they operate at higher compression ratios.

In the future, engine manufacturers are targeting lower fuel consumption and shaft efficiencies up to 50-55 percent in large engines (>1 MW) by 2010. Efficiencies of natural gas engines, in particular, are expected to improve and approach those of diesel engines.

Uncontrolled NOx emissions from internal combustion engines (especially diesel engines) are the highest among distributed energy technologies. Emission rates for a particular type and size ranges of engines vary from manufacturer to manufacturer. Similarly, emission rates for each type of engine within a manufacturer's product line may vary considerably from the smallest to the largest units in the line. Reasons for these variations include differences in combustion chamber geometry, fuel air mixing patterns, fuel/air ratio, combustion technique, and ignition timing from model to model. Selected NOx and CO emission levels, provided for engines in the 5 kV to 7 MW range, for reciprocating engines are listed in the table below:

Table 5. Reciprocating Engine Emissions

Emission	**Natural Gas ICE**	**Diesel ICE**
	Exhaust gas, ppmv @15% O2	Exhaust gas, ppmv @15% O2
Uncontrolled NOx	45-200	450-1,600
NOx with SCR	4-20	45-160
Uncontrolled CO	140-700	40-140
CO with Oxidation Catalyst	10-70	3-13

Three basic types of post-combustion catalytic control systems for ICEs include:

- Three-Way Catalyst (TWC) Systems - reduce NOx, CO and unburned hydrocarbons by 90 percent or more. TWC systems are widely used for automotive applications.

- Selective Catalytic Reduction (SCR) - SCR is normally used with relatively large (>2 MW) lean-burn reciprocating engines. In SCR, a NOx-reducing agent, such as ammonia is injected into the hot exhaust gas before it passes through a catalytic reactor. The NOx can be reduced by about 80-95 percent.
- Oxidation Catalysts - promote the oxidation of CO and unburned hydrocarbons to CO2 and water. CO conversions of 95 percent or more are readily achieved.

Other performance-related items for reciprocating engines include:

- Startup times range between 0.5 and 15 minutes
- They have a high tolerance for starts and stops
- Compared with combustion turbines, a lower amount of waste heat can be recovered.
- Engine performance ratings are based on an elevation of 1500 feet above sea level. Deratings of about 2-3 percent for each additional 1000 feet are common.
- Deratings of 1-2 percent for every 10°F above the reference temperature (usually 90°F) are common.
- Engine heads and blocks are rebuilt after about 8,000 hours of operation
- Regular oil and filter changes are required at 700 - 1000 hours of operation

The capital cost of a basic gas-fueled generator set package ranges from $300-$900/kW, depending on size, fuel type, and engine type. Overall engine cost ($/kW) increases with size. The total installed cost can be 50-100 percent more than the engine itself. Additional costs include balance-of-plant equipment, installation fees, engineering fees, and other owner costs.

Natural gas is usually less expensive than diesel fuel for the same heat content. If the engine is to be used for a large number of hours per year, the total cost to operate the gas unit may be lower. Natural gas may not be available at all locations, while diesel can be transported anywhere. However, diesel engine emission levels are higher and their use maybe significantly restricted.

Maintenance costs of gas and diesel ICE range between $0.007-$0.015/kWh and $0.005-$0.010/kWh respectively. With proper maintenance, large engines can last for 20-30 years while smaller engines (<1 MW) tend to have shorter lifespans.

Reciprocating engines are a widespread, well-known, and mature distributed generation technology. They currently offer low capital cost, rapid start-up, proven reliability, good load-following characteristics, and heat recovery potential. Significant research and development efforts are underway to continue to improve the efficiency and reliability and reduce the emissions of reciprocating engines for distributed generation applications.

Assuming an efficiency rate of 25 to 45 percent, approximately 110 to 200 MW of internal combustion engines would need to be installed in the project area to meet the stated need of the Hollydale Project.

3.4.2 Renewable Resource Technologies

Minnesota Statutes 216B.243, subd. 3a states, in part, that the Commission may not issue a certificate of need for a large energy facility that transmits electric power generated by means of a nonrenewable energy source unless the applicant for the certificate has demonstrated to the Commission's satisfaction that it has explored the possibility of generating power by means of renewable energy sources and has

demonstrated that the alternative selected is less expensive than power generated by a renewable energy source.

For purposes of this subdivision, "renewable energy source" includes hydro, wind, solar, biomass and geothermal energy. Generation alternatives must be sited locally (i.e., distributed generation) to avoid the need for the transmission lines and substations. There is no locally available hydropower in the project area. Minnesota does have several utility-scale biomass power generating facilities; at the distributed generation level, biomass would be a fuel source for reciprocating engines. Geothermal electricity production is concentrated in the western United States, where approximately 3200 MW of geothermal electric generation was installed by March of 2012. Although the use of geothermal heat pumps in Minnesota is increasing as a source of home heating and cooling, no electric generating plants were in development in 2009.[39]

3.4.3 Distributed Solar and Wind Generation

Solar energy technologies suitable for distributed generation include photovoltaic and solar thermal. This report discusses photovoltaic technology as a potential alterative to meeting the stated need for the project. Solar thermal, used to heat water for homes, commercial faculties, and swimming pools, is not evaluated here, as it is used to replace electricity used to heat water or potentially provide space heating, and cannot be used to generate electricity to meet electric demand needs. Concentrating solar technologies use mirrors or lenses to concentrate a large area of sunlight, or solar thermal energy, onto a small area where it is converted to heat and used to drive an engine (usually a steam turbine) connected to generator and produce electricity. These systems take up large amounts of land to locate the numerous mirrors needed to generate enough electricity to make the installation cost effective. Concentrating solar technologies are not further discussed here.

Photovoltaic Cells

Photovoltaic (PV) cells, or solar cells, convert sunlight directly into electricity. PV cells are assembled into flat plate systems that can be mounted on rooftops or other sunny areas. They generate electricity with no moving parts, operate quietly with no emissions, and require little maintenance. **Table 6** provides an overview of photovoltaics.

Table 6. Photovoltaic Overview

Criteria	Notes
Commercially Available	Yes
Size Range	<1 kW -100 kW.
Fuel	Sunlight
Efficiency	5-15%
Environmental	No emissions
Commercial Status	Commercially deployed, advanced PV films under development
Capital Cost	$4.50 to $7.50/watt

[39] Geothermal Energy Association. April 2012. *2012 Annual US Geothermal Power Production and Development Report*. http://geo-energy.org/reports/2012AnnualUSGeothermalPowerProductionandDevelopmentReport_Final.pdf

A photovoltaic cell is composed of several layers of different materials. The top layer is a glass cover or other encapsulant to protect the cell from weather conditions. This is followed by an anti-reflective layer to prevent the cell from reflecting the light away. Two semiconductor layers in the solar cell create the electron current. Materials, such as silicon, are suitable for making these semiconducting layers, and each has benefits and drawbacks for different applications.

In addition to the semiconducting materials, solar cells consist of two metallic grids or electrical contacts. One is placed above the semiconducting material and the other below. The top grid or contact collects electrons from the semiconductor and transfers them to the external load. The back contact layer is connected to complete the electrical circuit.

An individual photovoltaic cell will typically produce between 1 and 2 watts. To increase the power output, several cells are interconnected to form a module. Similarly, modules can be connected to form an array. A photovoltaic array surface area the size of roughly two football fields could produce 1000 kW DC peak power. Commercially available photovoltaic modules range from about 5 to 15 percent efficiency at converting sunlight into energy. Efforts are currently under way to improve photovoltaic cell efficiencies.

Photovoltaic systems are available in the form of small rooftop residential systems (less than 10 kW), medium-sized systems in the range of 10 to 100 kW, and larger systems above 100 kW connected to utility distribution feeders. The U.S. government launched a program to encourage the installation of 1,000,000 roof-top photovoltaic arrays over 10 years.

The United States has approximately 1.1 Gigawatts (GW) of installed solar capacity, based on data from 2008, which was a 63 percent increase over 2007. Increases in solar energy development are expected to increase substantially as the cost of technology decreases and as incentives are increased (mostly through investment tax credits and rebate programs). The solar market in the U.S. comprises only 8 percent of cumulative installed solar capacity worldwide.

In Minnesota, the average solar resource is about 4.5 kilowatt-hours per square meter per day. Within the state, solar resources vary only about 10-15 percent, from the highest in the southwest to the lowest in the northeast. Solar energy varies significantly throughout the year, especially in northern climates based on the number of hours of daylight and cloud cover. Solar panels with tilt angles can increase output during winter months.

Minnesota currently has approximately 13MW of solar PV installations statewide with over 1100 installations.[40] Current prices range from approximately $7.50 per watt for smaller systems and $4.50-$5.00 per watt for mid-sized projects (40-100 kW). The Department estimates the installed cost of a typical residential system of two kilowatts (kW), producing about 2,400 kWh per year, to be approximately $17,000 to $20,000.[41] The cost of a PV system depends on the system's size, equipment options installation labor costs, a home's age, if the PV is integrated into the roofing materials or mounted on top of the existing roof, and the PV manufacturer.

[40] Department, internal document
[41] Department, *I Want my Own Solar System!*, http://mn.gov/commerce/energy/images/Solar-System-FAQ.pdf

Generation costs range from .33-.77 cents /kWh for solar compared to .03-.07 cents/kWh for generation from conventional sources. The average ratepayer in Minnesota pays approximately .10-.15 cents/kWh, which includes the cost of generation, transmission, and distribution of electricity.

Minnesota has sufficient solar resources for solar electric generation, and currently available solar technology is widely available for both commercial and residential installation. Distributed solar installations of 50 MW would be required to meet the current deficit identified in the study area.

Using assumptions similar to those in the Department's Environmental Report prepared for the Hiawatha 115 kV Transmission Project, Applicants estimated that the largest solar array that could be placed on a home would be 4.6 kW. Using this size, 10,870 PV installations in the project area, or approximately ten times the current number of installations, would be required to meet the 50 MW need. The cost to provide 50 MW is estimated to be in the $283 to $375 million range.[42]

Applicants identified a further disconnect between the peak times for solar generation (typically around noon) and the residential load peak hours of 4 pm to 6 pm.[43]

3.4.4 Wind

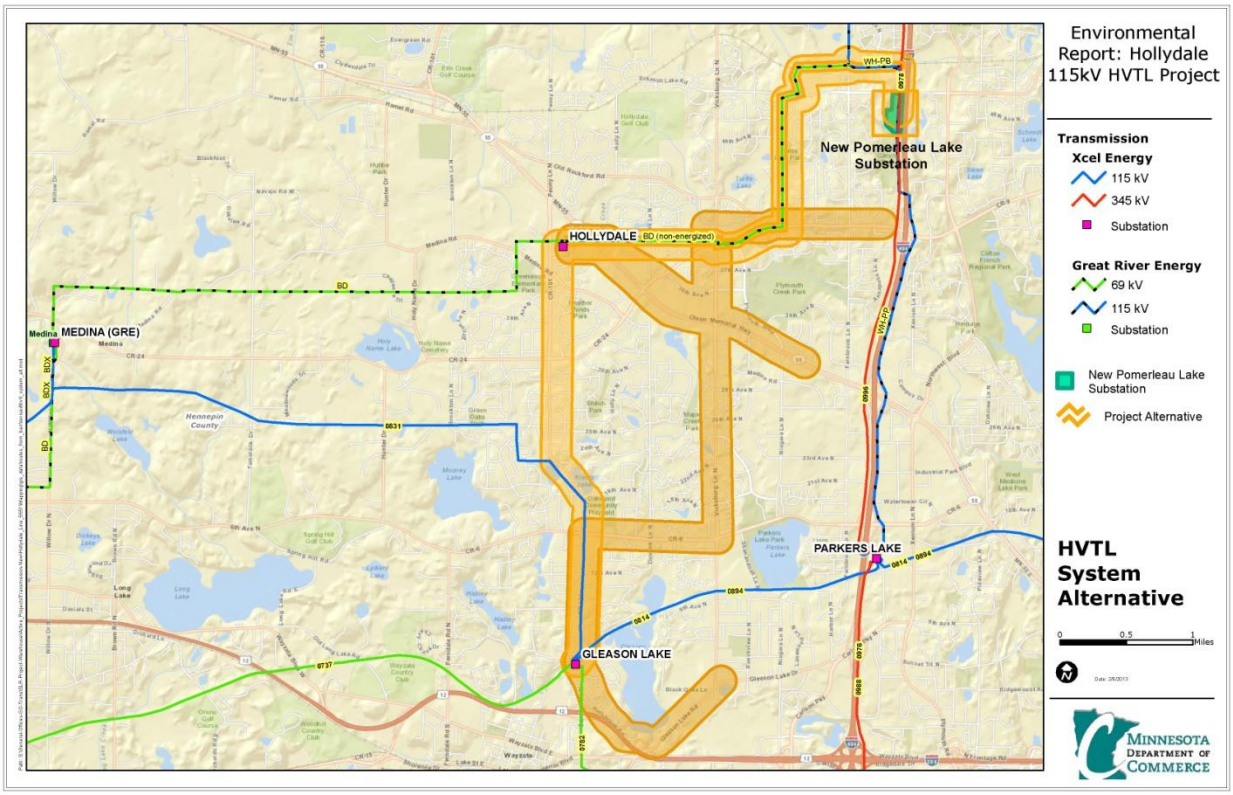
Wind generation has captured an increased share of electricity generation in Minnesota, representing approximately 14 percent of installed generation capacity and approximately 9 percent of generated electricity in 2010.[44] Although most of this growth has been from utility scaled wind turbines developed in multi-turbine projects, smaller turbines, designed to meet household needs, are available. The Department estimates the cost of a residential turbine between $5,000 and $10,000 per kilowatt. A typical household uses 810 kWh or electricity per month, suggesting a turbine rated between 5 and 15 kilowatts to make a significant contribution to the demand.[45] Assuming a capacity factor (percentage of total time the turbine is generating electricity) of 30 percent, approximately 167 MW of wind energy would be needed in the project area to meet the stated need for the Hollydale Project.

3.4.5 HVTL System Alternative

This report will evaluate a transmission alterative of a new 115 kV transmission line connecting a new Pomerleau Lake 115 kV Substation with the existing Hollydale and Gleason Lake substations. Under this alternative the Applicants would construct a new 115/13.8 kV Pomerleau Lake substation and approximately 8.5 miles of 115 kV transmission line connecting the new substation with Xcel Energy's existing Gleason Lake Substation through Xcel Energy's Hollydale Substation. This was also referred to as Alternative H2 in the CN Application. As no route for the transmission line has been developed, routing-specific impacts are not evaluated in this report; potential areas involved in this alternative area shown in **Figure 2**.

[42] *CN Application*, p. 90; EFP calculations using $7.50 per watt cost.
[43] *CN Application*, p. 90
[44] U.S. Department of Energy, Energy Information Administration. March 8, 2012., *Minnesota Renewable Electricity Profile 2010.* http://www.eia.gov/renewable/state/minnesota/
[45] Department, *Can I have a Wind Turbine Please?*, http://mn.gov/commerce/energy/images/Wind-Turbine-FAQ.pdf

Figure 2: HVTL System Alternative



Structure types and rights of way widths for the HVTL System Alternative are assumed to be the same as those proposed for the Hollydale Project. If the Commission determines that the HVTL System Alternative is preferable to the Hollydale Project, routing options would be developed initially by the Applicants, and may be modified either through local review or through the Commission's HVTL routing proceeding. The routing process may show that different structure types or rights-of-way widths are advisable.

Xcel Energy's Gleason Lake Substation is located in the northeastern-most corner of Wayzata on a triangular parcel of approximately 2.1 acres, bounded by the Luce Line Trail to the north and west, Hennepin County Road 101 to the east, and residences to the south.

Under this alternative Xcel Energy would add one new 115 kV transmission line to the Gleason Lake Substation, for a total of four 115 kV transmission lines and two 69 kV transmission lines. Xcel Energy anticipates that the HVTL System Alternative would require the addition of two new breakers and relocation of one existing breaker and one existing transformer. To accommodate these changes in the available space, preliminary designs indicate that Xcel Energy would need to modify the existing 115 kV configuration to an 8-breaker 8-position ring-bus with four 115 kV transmission lines and four transformers with each element having its own position in the 115 kV ring-bus. Such a configuration does not conform to current Xcel Energy standards and would need to be reviewed and approved by Xcel Energy's Operations and Transmission Planning prior to implementing the proposed non-standard

plan.[46] The addition of a new 115 kV transmission line was evaluated electrically, however the feasibility and design of an additional 115 kV line entrance and exit has not been explored.[47]

The existing fenced area of the Gleason Lake Substation is approximately 1.3 acres; Xcel Energy anticipates that the fenced area of the substation would need to expand by approximately 0.2 acres to accommodate these improvements.[48]

Applicants estimate construction of the HVTL system alternative would take place in the 2015 – 2016 timeframe. As shown in **Table 7**, Applicants estimate the total cost for the HVTL system alternative to be approximately $42.6 million through 2016.

Table 7: Cost Estimate - HVTL System Alternative

Project Item	Cost ($ Million)
Acquisition and removal of 69 kV Transmission Line BD	0.5
Construction of 8.5 miles of new 115 kV Transmission Line (Pomerleau Lake, Hollydale, Gleason Lake)	8.4
Distribution Line Construction – 2015	3.5
Distribution Line Construction – 2016	3.2
New Pomerleau Lake Substation – 2015	15.0
Modifications to Pomerleau Lake Substation – 2016	N/A
Modifications to Medina Substation	2.2
Modifications to Hollydale Substation - 2015	5.1
Modifications to Hollydale Substation - 2016	2.0
Modifications to Gleason Lake - 2015	2.4
Modifications to Gleason Lake - 2016	0.4
Total - HVTL System Alterative	**42.6**

3.4.6 Distribution System Alternatives

This report evaluates both a 13.8 kV alternative and a 34.5 kV alternative to the proposed Hollydale Project. Distribution lines are permitted by the local governments. As specific routes for the distribution lines have not been developed, routing-specific impacts are not evaluated here.

Distribution lines are most typically installed within a public right-of-way, such as a street or designated utility easement.[49] As shown in **Map 3** in **Appendix B**, the majority of distribution facilities in the project area are installed underground. Overhead distribution facilities in the project area are typically installed on wood poles, with a typical height of 38 feet.[50]

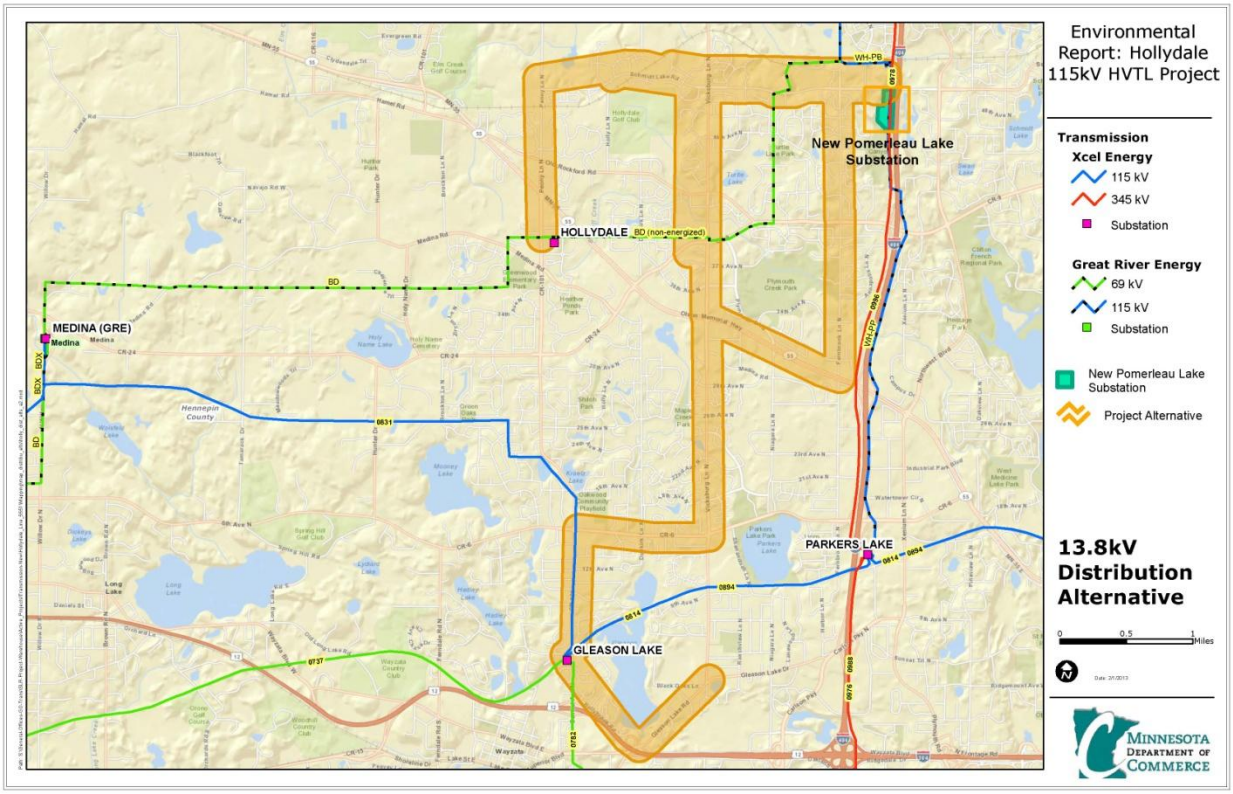
[46] Xcel Energy, personal communication, January 18, 2013
[47] Xcel Energy, personal communication, January 23, 2013
[48] Ibid.
[49] Xcel Energy, personal communication, January 11, 2013
[50] Ibid.

Maintenance requirements for distribution lines are similar, but typically more frequent, to those for transmission lines. Distribution facilities are inspected during vegetation maintenance, on a rotating schedule every three to five years, and approximately every 12 years during pole inspection.[51]

13.8 kV Distribution Alternative

Although routing was not developed for a 13.8 kV distribution alternative, potential project areas are shown in **Figure 3**. Under a 13.8 kV distribution alternative, referred to as Alternative A2 in the *CN Application*, Applicants would construct a new Pomerleau Lake 115/13.8 kV substation that would be fed from GRE's existing 115 kV Parkers Lake – Plymouth transmission line. The substation would initially be developed with both 115 kV and 13.8 kV distribution yards and would include two 115 kV transmission line terminations (Parkers Lake and Cedar Island) and two new 115/13.8 kV transformers (one each in 2015 and 2016). Six new 13.8 kV distribution lines (four in 2015 and one in 2016) would be constructed out of the Pomerleau Lake Substation in public rights-of-way, and one 13.8 kV feeder would be added our of the Gleason Lake Substation in 2016.[52] The substation will also contain room for a possible 345 kV yard at some point in the future.[53]

Figure 3: 13.8 kV Distribution Alternative



[51] Xcel Energy, personal communication, January 11, 2013
[52] *Applicants' Response to WPNA IR 9*, January 11, 2013; Michlig Direct, Schedule 2
[53] *CN Application*, at p. 60; Applicants' Response to WPNA IR 9

Applicants estimate construction of a 13.8 kV alternative would take place in the 2015 – 2016 timeframe. As shown in **Table 8**, Applicants estimate the total cost for a 13.8 kV alternative to be approximately $40.0 million through 2016.

Table 8: Cost Estimate – 13.8 kV Distribution System Alternative[54]

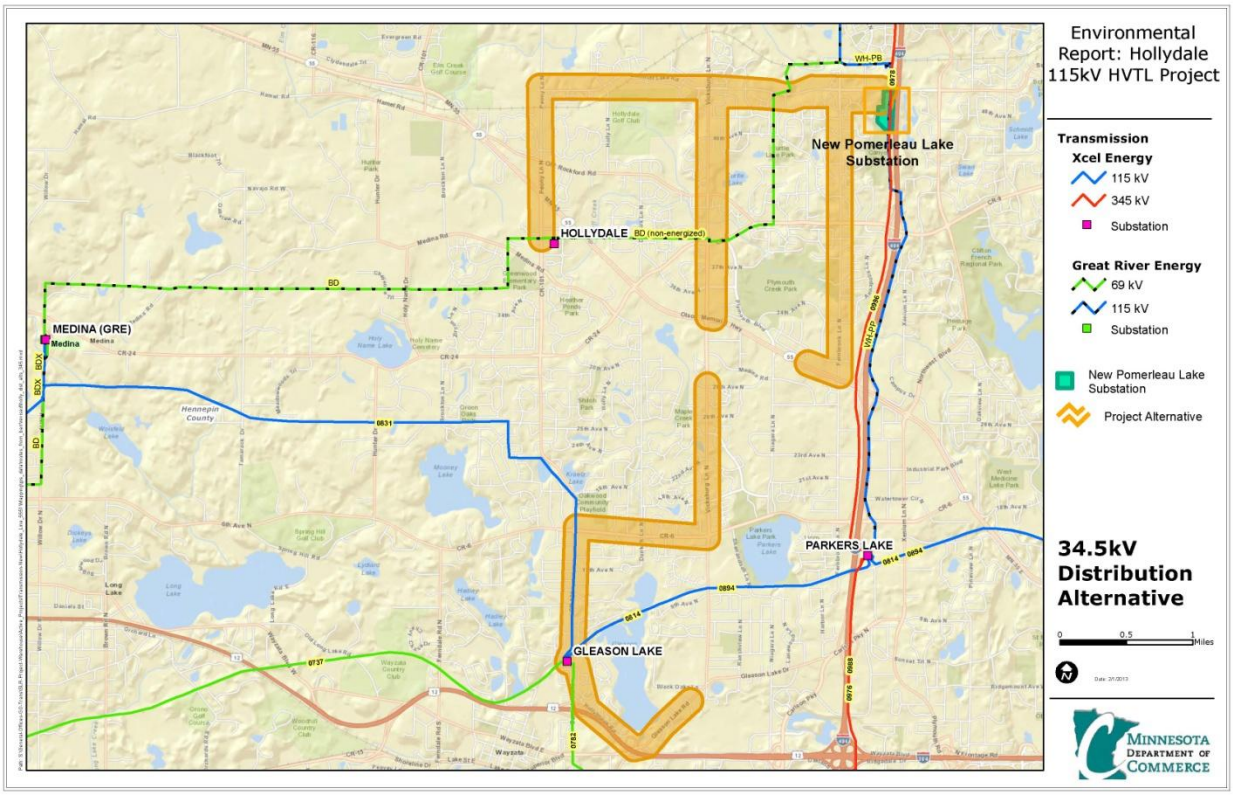
Project Item	Cost ($ Million)
Acquisition and removal of 69 kV Transmission Line BD	N/A
Construction new 115 kV Transmission Line	N/A
Distribution Line Construction – 2015	6.6
Distribution Line Construction – 2016	4.8
New Pomerleau Lake Substation – 2015	16.2
Modifications to Pomerleau Lake Substation – 2016	N/A
Modifications to Medina Substation	2.2
Modifications to Hollydale Substation - 2015	N/A
Modifications to Hollydale Substation - 2016	N/A
Modifications to Gleason Lake - 2015	3.9
Modifications to Gleason Lake - 2016	0.4
HVTL System Alterative – Total through 2016	**40.0**

34.5 kV Distribution Alternative

Applicants did not provide detailed information on a 34.5 kV alternative to the proposed Hollydale Project in the *CN Application*. Applicants did further develop two 34.5 kV alternatives, one involving improvements to Xcel Energy's existing Parkers Lake Substation and one involving the construction of the Pomerleau Lake Substation, referred to as A4 and A5 respectively in the Direct Testimony submitted by Justin Michlig on January 25, 2013. This report uses the 34.5 kV alternative involving construction of the Pomerleau Lake Substation for illustrative purposes, as improvements would occur west of Interstate 494, consistent with the rest of the alternatives reviewed here. **Figure 4** shows the 34.5 kV distribution alternative discussed in this report.

[54] Michlig Direct Testimony, Schedule 2

Figure 4: 34.5 kV Distribution Alternative



Under the 34.5 kV distribution alternative, Applicants would construct a new Pomerleau Lake 115/13.8 kV substation fed from GRE's existing 115 kV Parkers Lake – Plymouth transmission line. Applicants would add two new 115/34.5 kV transformers (one each in 2015 and 2016) to the substation. Four new 34.5 kV distribution lines (two in 2015 and two in 2016) would be constructed out of the Pomerleau Lake Substation in public rights-of-way, and one 13.8 kV feeder would be added our of the Gleason Lake Substation in 2016.[55]

Applicants estimate construction of a 34.5 kV alternative would take place in the 2015 – 2016 timeframe. As shown in **Table 9**, Applicants estimate the total cost for a 34.5 kV alternative to be approximately $36.6 million through 2016.

[55] *Applicants' Response to WPNA IR 9*; *Michlig Direct Testimony*, Schedule 2

Table 9: Cost Estimate – 34.5 kV Distribution System Alternative[56]

Project Item	Cost ($ Million)
Acquisition and removal of 69 kV Transmission Line BD	N/A
Transmission Line Construction	N/A
Distribution Line Construction – 2015	10.9
Distribution Line Construction – 2016	2.6
New Pomerleau Lake Substation – 2015	16.6
Modifications to Pomerleau Lake Substation – 2016	3.9
Modifications to Medina Substation	2.2
Modifications to Hollydale Substation - 2015	N/A
Modifications to Hollydale Substation - 2016	N/A
Modifications to Gleason Lake Substation - 2015	N/A
Modifications to Gleason Lake Substation - 2016	0.4
Total 34.5 kV Distribution Alternative (through 2016)	**36.6**

3.5 Rebuild of Existing 69 kV Transmission Line

The existing 69 kV transmission line is not operated east of Hollydale Substation and is only maintained and used infrequently for emergency backup between the Medina and Hollydale substations. The scoping decision identified an alternative that would rebuild the 69 kV transmission line between the Medina and Plymouth substations. Upon further evaluation Applicants determined that the alternative as described in the scoping decision was not feasible and that a 69 kV rebuild alternative would need to include an additional substation because simply rebuilding the existing 69 kV line without a permanent interconnect to the transmission grid at a substation location would effectively shift the load to the west of the metro area, outside of the 345 kV ring, and would ultimately lead to transmission system overloads and failures.[57] Applicants did develop a feasible 69 kV rebuild alternative that connected the re-built line to the newly constructed Pomerleau Lake Substation, as shown in **Figure 1**.

Based on information in the CN Application, a typical 69 kV sub-transmission line performs best when it carries approximately 20 MW. Because the load in the project area exceeds 20 MW, and may grow to 100 MW, the Applicants anticipate that a non-standard 69 kV design would be necessary.[58] The CN application presented two non-standard 69 kV design options, a bundled 69 kV configuration or a double-circuit 69 kV.[59] In later direct testimony, Applicants concluded that a double circuit 69 kV transmission line is not a feasible alternative due to the lack of available space at the Medina Substation to install the improvements necessary to enable a double circuit 69 kV transmission line.[60]

Under the 69 kV rebuild alternative, Applicants would construct a new Pomerleau Lake 115/69 kV substation that would be fed from GRE's Parkers Lake – Elm Creek 115 kV line. The new substation would include a four position ring, one 69 kV line termination for the new 69 kV line, line terminations for the Parkers Lake – Elm Creek 115 kV line, and two 115/69 kV transformers. Applicants would replace the 69 kV termination at the Medina Substation with 2000A equipment. Xcel Energy would purchase

[56] *Michlig Direct Testimony*, Schedule 2
[57] Xcel Energy, personal communication, January 30, 2013
[58] *CN Application*, at p. 74
[59] *CN Application*, at p. 74
[60] *Michlig Direct Testimony*, pp. 8 - 9

the existing 69 kV transmission line BD from GRE and would remove that line and replace it with either a 795 ACSS 69 kV conductor (single circuit, single conductor design) or a 2-795 ACSS 69 kV conductor (bundled conductor design). In 2016, Applicants would add a second 69/13.8 kV 50 MVA transformer and two distribution feeders at the Hollydale Substation and an additional 13.8 kV feeder at the Gleason Lake Substation.[61]

Applicants anticipate that a re-built 69 kV alternative would use steel poles with heights of 55 to 65 feet. Typical rights-of-way for 69 kV single-circuit bundled conductors are 50 feet. Applicants estimate the cost of construction at approximately $425,000 to $475,000 per mile for bundled 69 kV transmission line.[62] Applicants' cost estimates of a 69 kV Alternative through 2016 are presented in **Table 10**.

Table 10: Cost Estimate – 69 kV Rebuild Alternative[63]

Project Item	**Cost ($ million)**	
	Single Circuit 69 kV Line	Bundled 69 kV line
Acquisition and removal of 69 kV Transmission Line BD	0.5	0.5
69 kV Transmission Line Construction	8.4	11.3
Distribution Line Construction – 2015	3.6	3.6
Distribution Line Construction – 2016	3.2	3.2
New Pomerleau Lake Substation – 2015	22.2	22.2
Modifications to Pomerleau Lake Substation – 2016	N/A	N/A
Modifications to Medina Substation	0.4	0.4
Modifications to Hollydale Substation - 2015	4.7	4.7
Modifications to Hollydale Substation - 2016	1.7	1.7
Modifications to Gleason Lake Substation - 2015	N/A	N/A
Modifications to Gleason Lake Substation - 2016	0.4	0.4
Total Cost – 69 kV Rebuild Alternative (through 2016)	**45.0**	**48.0**

[61] Michlig Direct Testimony, Schedule 2
[62] Xcel Energy, personal communication, January 11, 2013
[63] *Michlig Direct Testimony*, Schedule 2

4 Human and Environmental Impacts

Construction and operation of large energy facilities can result in human and environmental impacts. Many of the impacts can be mitigated through routing and through use of best management practices. This section discusses the potential impacts and impact mitigation strategies for the Hollydale Project and project alternatives. This section discusses possible impacts and mitigations for the following alternatives: (1) the proposed Hollydale Project, (2) a no-build alternative, and (3) an HVTL system alternative constructing a new 115 kV transmission line connecting the Plymouth, Hollydale, and Gleason's Lake substations, (4) Distribution Alternatives consisting of 13.8 kV and 34.5 kV distribution lines, and (5) 69 kV rebuild alternative. An overlay of all alternatives evaluated in detail in this report is shown in **Map 4** in **Appendix B**.

As discussed in Section 3 of this report, demand side management, purchased power, small turbine generators, distributed solar, and small wind installations do not address Applicants' stated need or are readily available at the scale required to meet the stated need for the Hollydale Project; consequently impacts from these alternatives are not addressed in this section.

4.1 Air Quality

Air quality emissions directly related to high-voltage transmission lines are negligible amounts of ozone and oxides of nitrogen caused by the corona effect. The other potential air quality issues are associated with construction activities, such as fugitive dust and exhaust emissions from construction equipment.

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Corona discharge is energy loss that physically creates very small amounts of sound, radio noise, heat, and chemical reactions of the air near a conductor, and is a phenomenon associated with all transmission lines. Under certain conditions, the localized electric field near an energized conductor can become strong enough to produce a tiny electric discharge that can ionize air close to the conductors. Several factors contribute to corona discharge, including conductor voltage, shape and diameter, and surface irregularities that can affect a conductor's electrical surface gradient such as scratches, nicks, dust, or water drops. In the case of air quality, this partial discharge of electrical energy can produce very tiny amounts of ozone and nitrogen oxide with ozone being the primary oxidant.

Ozone also forms naturally in the Earth's lower atmosphere from lightning discharges and from reactions between solar ultraviolet radiation and air pollutants such as hydrocarbons from auto emissions. Typical rural ambient levels are around 10 to 30 parts per billion (ppb) at night with peaks of 100 ppb and higher (EPRI, 1982).[64] In urban areas, concentrations greater than 100 ppb are common.

The natural production rate of ozone is directly proportional to temperature and sunlight and inversely proportional to humidity. Therefore, humidity, the same factor that increases corona discharges from transmission lines, inhibits the production of ozone. Ozone is a very reactive form of oxygen and combines readily with other elements and compounds in the atmosphere. Because of its high reactivity, ozone is relatively short-lived. The state and federal government both have regulations regarding

[64] Electric Power Research Institute. 1982. *Transmission Line Reference Book*. Second Edition.

permissible concentrations of ozone and oxides of nitrogen: Minnesota sets an ozone limit of 0.08 parts per million (ppm) as the highest eight hour average (Minnesota Rule, part 7009.0800), and the federal limit is 0.075 ppm as the fourth-highest eight hour daily maximum average (40 CFR, Part 50).

Calculations according to the BPA Corona and Field Effects Program Version 3 for a standard single-circuit 115 kV project predicted a maximum concentration of 0.006 ppm near the conductor and 0.002 ppm at one meter above ground during foul weather or worst case conditions with rain at one inch per hour. During a mist (rain at 0.01 inch per hour) the maximum concentrations decreased to 0.0002 ppm near the conductor and 0.0001 ppm at one meter above ground level.[65] For both cases, the ozone levels are below federal standards. Studies designed to monitor the production of ozone under transmission lines have been unable to detect any increase attributable to the transmission line facility.

There would be limited emissions from vehicles and other construction equipment and fugitive dust from right-of-way clearing during construction of the Hollydale Project. Temporary air quality impacts are expected to occur during this phase of activity. The magnitude of emissions is influenced heavily by weather conditions and the specific construction activity taking place. Exhaust emissions from primarily diesel equipment would vary according to the phase of construction but would be minimal and temporary. Adverse impacts to the surrounding environment would be minimal because of the short and intermittent nature of the emission and dust-producing construction phases. The Hollydale Project is not anticipated to result in any permanent impacts on air quality.

As a standard HVTL Permit condition, construction activities must follow best management practices (BMPs) to control air emissions (fugitive dust). Petroleum based dust suppressants may not be used. Construction vehicles with excess tailpipe emissions would not be operated until repairs to the vehicle could be made. Minimizing the disturbed area for each route also decreases potential for fugitive dust.

No-Build Alternative

Under the no-build alternative, there would be no changes to air quality.

HVTL System Alternative

Air quality impacts and mitigation would be the same for the HVTL system alternative but they would occur along a different route.

Distribution Alternatives

Air quality impacts would be for both the 13.8 kV and 34.5 kV alternatives would be limited to construction of the alternative. As Xcel Energy's franchise agreement with Plymouth anticipates underground construction of distribution facilities, there may be more ground disturbance and temporary fugitive dust from construction of a distribution alternative, but any impacts would be temporary and localized to the area under construction. Although recommended mitigation would be similar, they would not be contained in an HVTL permit, as both size lines are under the Commission's permitting threshold.

[65] United States Department of Energy, Bonneville Power Administration. *Corona and Field Effects Program, Version 3.0* (Computer Program), Vancouver, Washington.

69 kV Rebuild Alternative

Air quality impacts from the existing 69 kV transmission line would be similar to the Hollydale Project. Although mitigation measures would be similar, they would not be contained in an HVTL permit, as 69 kV lines are under the Commission's permitting threshold.

4.2 Biological Resource

High voltage transmission lines have the potential to impact natural resources, including flora, fauna, habitat, soils and water. This section discusses potential impacts to natural resources from the construction and operation of a generation facility in the project area.

The Hollydale Project is located in the Big Woods Subsection of the Eastern Broadleaf Forest Ecological Province of Minnesota. At the time of European settlement, this subsection was characterized by large blocks of oak woodland and maple-bassleaf forest.[66] Current land cover in the project area is predominated by residential and commercial uses, with areas of cropland (soybeans), wetland, open grassland, and some wooded areas also present.[67] Rare or sensitive plant species and habitat are discussed in Section 4.2.4.

4.2.1 Flora

The primary impact to flora from an electric distribution or transmission project results from the clearing of tall vegetation to establish a right-of-way for the transmission line and associated facilities such as substations.

Hollydale Project

The proposed Hollydale Project would require a right-of-way of up to 75 feet. To the extent that the new 115 kV line would be built along the existing 69 kV transmission line center line, the right-of-way would be the same as it is currently.[68] In some areas, particularly where the line is no longer energized, taller vegetation that has been allowed to encroach upon the existing 69 kV right-of-way would be removed, potentially resulting in a wider clearing than the current line.

Depending upon the route, at least 0.8 of one mile of new right-of-way would be required for the Hollydale Project. In cases where a route would follow existing utility or transportation corridors, the route may be designed to overlap portions of existing utility or road rights-of-way, depending upon the requirements of the utilities or transportation design.

In addition to the transmission line route, the proposed Hollydale Project would require clearing of approximately 10 acres for the proposed Pomerleau Lake Substation. Expansions of the Medina and

[66] Minnesota Department of Natural Resources (DNR). *Ecological Classification System: Big Woods Subsection.* http://www.dnr.state.mn.us/ecs/222Mb/index.html; DNR. 1998. *Minnesota Biological Survey Native Plant Community and Rare Species County Maps: Natural Communities and Rare Species of Carver, Hennepin and Scott Counties, Minnesota*, http://files.dnr.state.mn.us/eco/mcbs/maps/carver_hennepin_scott.pdf
[67] *Route Permit Application*, p. 110
[68] Xcel Energy , personal communication, January 11, 2013

Hollydale substations would occur on areas that are currently graded and covered in gravel or crushed rock.

If any portion of the Hollydale Project were to be placed underground, a right-of-way of 70 feet would be established and maintained. Once construction of underground facilities are completed, vegetation above duct banks would be re-established but would be limited under terms of the easement to shallow rooted species to avoid the possibility of deep rooted species invading the duct bank. In wooded areas, this may result in a noticeable change of vegetation within the right-of-way as taller trees with deeper roots are displaced by more shallow-rooted species.

No-Build Alternative

Under the no-build alternative, the existing 69 kV right-of-way would be maintained as it is now. No additional right-of-way or land for substation construction would be cleared.

HVTL System Alternative

Right of way requirements are anticipated to be the same for the HVTL system alternative. As with the Hollydale Project, to the extent that the new 115 kV line would be built along the existing 69 kV transmission line center line, the right-of-way would be the same as it is currently. Taller vegetation that has been allowed to encroach upon the existing 69 kV right-of-way, most likely in the portion of the existing 69 kV BD that is no longer energized, would be removed potentially resulting in a wider clearing than the current line.

Distribution Alternative

Distribution lines are generally placed in public rights-of-way and, unlike transmission lines, typically do not have a defined rights-of-way. In order to ensure compliance with NESC, Xcel Energy uses an integrated vegetation management program to develop site-specific solutions to vegetation control near electric facilities.

It is anticipated that distribution facilities constructed under this alternative would be constructed underground. Once installed, vegetation is re-established over underground distribution lines, with the exception of areas around ground level transformers where utilities ask that homeowners keep a cleared area of 10 feet in front of doors and three feet from the side and back of the box.[69] For overhead distribution lines, clearances are determined on a tree-by-tree basis by trained line-clearance professionals who assess species growth rates, line voltage and structure type, historic reliability performance, and proposed maintenance cycle. Because of these individual factors, some trees may be left with clearance of less than five feet from the conductors, while others may have closer to 20 feet of clearance.[70]

69 kV Rebuild Alternative

The 69 kV rebuild alternative would rebuild the existing 69 kV transmission line BD along the same right-of-way. As with the Hollydale Project, construction of this alternative may entail removal of taller

[69] Xcel Energy, *Tree Planting Zones*, http://www.xcelenergy.com/Safety_&_Education/Outdoor_Safety/Vegetation_Management/Tree_Planting_Zones
[70] Xcel Energy, personal communication, January 11, 2013

vegetation that has been allowed to encroach along the existing 69 kV right-of-way, potentially resulting in a wider clearing than the current line.

4.2.2 Fauna

Wildlife within the project area consists primarily of deer, small mammals, waterfowl and other birds such as pelicans and egrets, songbirds, raptors, upland game birds, reptiles such as snakes and turtles, and amphibians such as frogs and salamanders. Fish and mollusks inhabit local watercourses. These species are typical of the land use in the project area, which is a mixture of developed residential, commercial, and industrial uses with areas of cropland, wetland, and wooded areas.[71] Threatened and endangered species are discussed in Section 4.2.4.

Hollydale Project

Wildlife could temporarily be displaced and small amounts of habitat could be lost from the project area during construction. It is likely that these species will only be displaced a short distance and would not incur population level effects from construction and operation of the Hollydale Project. Because of the development of much of the project area it is likely that the species present are already acclimatized to human development. No permanent impacts to wildlife are anticipated.

The primary potential impact presented to fauna by transmission lines is the potential injury and death of migratory birds such as raptors, waterfowl, and other large bird species. The electrocution of large birds, such as raptors, is more commonly associated with small distribution lines than large transmission lines. Electrocution occurs when birds with large wingspans come in contact with two conductors or with a conductor and a grounding device. Xcel Energy's transmission line design standards and adherence to current industry standards outlined in the *Avian Powerline Action Committee Report* [72] would provide for adequate spacing to eliminate the risk of raptor electrocution. As such, electrocution is not a concern related to the Hollydale Project.

Avian collisions are also a recognized possibility with the construction and placement of a new transmission line. The species of birds more commonly involved in collisions are large-bodied and have long wing spans such as swans, geese, ducks, herons, pelicans, and cranes. Collision frequency may increase when a new transmission line is located between agricultural fields that serve as feeding areas, wetlands, or open water, which serve as resting areas.

Xcel Energy has been working with various state and federal agencies over the past 20 years to address avian issues. Company personnel work to address problem areas as quickly and efficiently as possible. In 2002, Xcel Energy Inc.'s operating companies entered into a voluntary memorandum of understanding to work together to address avian issues throughout its territory.

In most cases, the shield wire of an overhead transmission line is the most difficult part of the structure for birds to see. Xcel Energy has successfully reduced collisions on certain transmission lines by marking

[71] *CN Application*, p. 51
[72] Avian Power Line Interaction Committee (APLIC). 2006. *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006*. Edison Electric Institute, APLIC, and the California Energy Commission. http://www.aplic.org/uploads/files/2643/SuggestedPractices2006(LR-2).pdf

the shield wires with Swan Flight Diverters, which are pre-formed spiral shaped devices made of polyvinyl chloride that are wrapped around the shield wire.[73]

Applicants state that they will work with resource agencies such as DNR and USFWS to identify areas with greater potential for avian impacts prior to construction and identify areas where bird diverters can be located to minimize impacts to birds.

No-Build Alternative

Under the No-Build Alternative, nothing would be constructed and there would be no impacts to fauna from construction.

HVTL System Alternative

Impacts from an HVTL system alternative would be similar to the Hollydale Project. Mitigation measures would generally be the same, but implementation of the measures (e.g. location of bird diverters) may vary depending upon specific routes.

Distribution Alternative

No permanent impacts to animal species would result from either distribution alternative. Assuming that most distribution would be constructed underground, potential impacts to avian species would be minimized.

69 kV Rebuild Alternative

Rebuilding of a 69 kV transmission line along the existing right-of-way would result in impacts and mitigation measures similar to the proposed Hollydale Project.

4.2.3 Rare and Unique Natural Resources

The Minnesota County Biological Survey (MCBS) and the Minnesota Natural Heritage Information System (NHIS) provide information on federal and state listed species, Species of Greatest Conservation Need, and unique or rare habitat types in Minnesota. The MCBS systematically collects, interprets, and delivers baseline data on the distribution and ecology of rare plants, rare animals, and native plant communities.[74] The NHIS database provides information on Minnesota's rare plants, animals, native plant communities, and other rare features. The NHIS is continually updated as new information is received and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features.[75]

A review of MCBS information has identified several areas of moderate and outstanding Biodiversity Significance in the project area.[76] The NHIS database identified several vertebrate animal and plant

[73] *CN Application*, p. 152
[74] For more information on Minnesota County Biological Surveys, see http://www.dnr.state.mn.us/eco/mcbs/index.html
[75] For more information on the Minnesota Natural Heritage Information System Database, see http://www.dnr.state.mn.us/eco/nhnrp/nhis.html
[76] *Route Permit Application*, Figure B-16

communities in the project area. There are no state parks, national parks, Wildlife Management Areas, or Waterfowl Protection Areas in the project area. Two Scientific and Natural Areas (SNAs) are located southeast of the Medina Substation.[77]

The Applicants search of the NHIS database identified eight vertebrate animals, one plant, three natural communities, and one ecological feature within three miles of the Applicant-proposed route. Results of the NHIS search are summarized in **Table 11**.

Table 11. Rare and Unique Natural Resources[78]

Common Name	Scientific Name	MN Status	State Rank	Last Observance
Vertebrate Animal				
Blanding's Turtle	*Emdoidea blandingii*	THR	S2	2006
Cerulean Warbler	*Dendroica cerulea*	SPC	S3B	1982
Red-shouldered Hawk	*Buteo lineatus*	SPC	S3B, SNRN	2007
Trumpeter Swan	*Cygnus bucciantor*	THR	S2B	2010
Acadian Flycatcher	Empidonax virescens	SPC	S3B	1997
Bald Eagle	Haliaeetus leucocephalus	SPC	23B, S3N	2005
Least Darter	Etheostoma microperca	SPC	S3	2006
Pugnose Shiner	Notropis anogenus	SPC	S3	1948
Vascular Plant				
American Ginseng	Panax quinquefolius	SPC	S3	1995
Natural Communities				
Tamarack Swamp (Southern)	Tamarack Swamp (Southern) –wetland community	NA	S3	1996
Native Plant Community	Native Plant Community (Undetermined Class) – terrestrial community	NA	SNR	1995
Colonial Waterbird Nesting Site	Colonial Waterbird Nesting Site – animal assemblage	NA	SNR	1998
Sugar Maple Forest (Big Woods)	Sugar Maple Forest (Big Woods) – terrestrial community	NA	SNR	1980
Ecological Feature				
Ice Deposition (Quaternary)	Ice Deposition (Quaternary)	NA	SNR	1980

Notes: SPC = Special Concern, THR = Threatened, END=Endangered, NA = Not Applicable. Minnesota state rank; ranks range from S1 (in greatest need of conservation action in the state) to S5 (secure under present conditions); S#B and S#N are used for migratory animals, where B = breeding population and N = nonbreeding population; SNR = rank not yet assessed

Hollydale Project

The principal strategy to minimize impacts to rare and unique natural resources is through avoidance of these resources. Potential impacts to rare and unique natural resources are largely dependent upon route. None of the routes evaluated in the EIS would cross any state or national parks or SNAs,

[77] *Route Permit Application*, Figure B-16
[78] Adapted from *CN Application*, Table 16, p. 154.

resources which are generally considered to be off limits to transmission lines under Minnesota Rule, part 7850.4300.

Identification of natural communities early in the routing stage can be used to develop routes that avoid natural communities and ecological features. Applicants state that they will emphasize project location, design, and construction practices to avoid encroachment on rare and unique natural resources to the extent possible. Applicants will consult with DNR to identify areas or issues where construction practices or schedules should be modified to minimize impacts to sensitive species or communities.[79]

As discussed in Section 4.2.3, installation of Bird Flight Diverters can minimize potential for avian collisions with transmission lines. Applicants anticipate that structure locations may need to be changed to avoid impacts to occupied eagle nests. Construction scheduling may also need to be adapted to avoid nesting season.[80]

Blanding's Turtles, a Minnesota Threatened species, has been identified in the project area. DNR has developed additional recommendations for avoiding and minimizing impacts to Blanding's Turtles. These measures include:

- Providing contractors with a flyer with illustrations of the turtle and a summary of recommendations for avoiding and minimizing impacts.
- Establishing silt fencing to keep turtles out of construction areas and removing the fencing after the area has been re-vegetated.
- Turtles in imminent danger should be moved, by hand, out of harm's way. Turtles not in direct harm's way should be left undisturbed.

No-Build Alternative

There would be no impact to rare and unique natural resources with a no-build alternative.

Transmission System Alternative

As with the Hollydale Project, impacts to rare and unique natural resources would be largely dependent upon the route. Mitigation measures would be the same as identified for the Hollydale Project.

Distribution Alternative

The potential impacts resulting from construction of either distribution alternative would be similar to that of the Hollydale Project, and would be largely dependent upon route. To the extent that distribution facilities would be constructed underground, potential impacts to avian species would be minimized. Mitigation measures would be the same as identified for the Hollydale Project.

69 kV Rebuild Alternative

The potential impacts resulting from construction the 69 kV rebuild alternative would be similar to that of the Hollydale Project. Mitigation measures would be the same as identified for the Hollydale Project.

[79] *CN Application*, p. 155
[80] *CN Application*, p. 155

4.3 Cultural Resources

Impacts to archaeological resources could result from construction activities along the route and could include:

- Damage to surface soils throughout the project area from heavy rubber-tread or metal-tracked vehicle operation.
- Subsurface excavations necessary to remove old wood power poles or install new poles.
- Damage to surface soils from dragging heavy objects (e.g., power poles).
- Damage to surface soils through grubbing, stump removal and grading.

A May 2012 query of the Minnesota State Historic Preservation Office (SHPO) database identified 38 archaeological sites and 233 historical properties within three miles of the Hollydale Substation.[81]

In 2011, the Applicants commissioned a Phase Ia background research and literature review to better understand the existing archaeological and historic resources that may be affected by the Hollydale Project.

Hollydale Project

The Phase Ia report identified 16 historical sites, all farmhouses or houses, located within 0.5 miles of the proposed route and alternative route segments identified in the Route Permit Application. Of the 16 historical structures, only two structures remain standing, the others are no longer in existence. None of the historic sites are registered on the National Register of Historic Places (NRHP). No archaeological sites were identified within 0.5 miles of the routes and route segments identified in the route permit application.

The Phase Ia report suggests that the alternate substation site has a moderate to high potential of containing intact archaeological remains due to its relatively undisturbed state and recommends additional investigation if the alternate substation site is chosen.[82] Since the Phase Ia report was produced in 2011, the alternate substation site has been disturbed by the construction of several homes.

Avoidance of archaeological and historic architectural properties is the preferred mitigation measure. In the event of an unanticipated discovery of cultural resources during construction, HVTL route permits require permittees to stop construction activities and consult with a professional archaeologist and the SHPO to determine the proper course of action. If a cultural resource or feature is determined to be potentially eligible for listing on the NRHP, it will be avoided or mitigated before construction can resume.

No-Build Alternative

As there would be no construction, no impacts to cultural resources would be expected from the no-build alternative.

[81] *CN Application*, pp. 136 - 147
[82] *Route Permit Application*, p. 100

HVTL System Alternative

Impacts to cultural resources would be dependent upon the route. Mitigation measures would be the same as for the Hollydale Project.

Distribution Alternative

Although impacts would be dependent upon routes for distribution facilities, their probable location in public rights-of-way, particularly along roadways, minimizes potential for impacts. Mitigation measures for unanticipated discovery of resources during construction would be the same, but they would not be part of an HVTL route permit.

69 kV Rebuild Alternative

Impacts resulting from construction of the 69 kV rebuild alternative are expected to be similar to the Hollydale Project. Mitigation measures would be the same as for the Hollydale Project.

4.4 Geology and Soils

Topography in the Big Woods Subsection of the Minnesota and Northeast Iowa Morainal Section of the ECS is characterized by gently to moderately rolling hills. Bedrock in the project area varies from 100 to 400 feet below the surface. The project area is underlain by Cambrian sandstone. Soils are formed in deposits of glacial till left by the Des Moines lobe. The soils in this subsection are primarily classified as Alfisoils (soils developed under forests) and are dominantly loamy, with textures ranging from loam to clay loam.[83]

Hollydale Project

Applicants anticipate a maximum excavation depth of approximately 30 feet for both the substation and transmission structures. No geologic impacts are anticipated from the Hollydale Project.

Temporary short-term disturbance of soils would result from site clearing and excavation activities at the substation sites and structure locations, pulling and tensioning sites, setup areas and during transport of crews, machinery, materials and equipment over access routes (primarily along transmission right-of-way).

In areas where open cut trenching is used to install underground transmission facilities, there would be a greater disturbance area than for overhead lines, where disturbances are generally limited to structure locations. Because of the larger area of disturbance required for open trench construction, there is an increased potential for soil compaction.

Construction activities can increase erosion by removing vegetation, disturbing soil and exposing sediment to the elements. The eroded soil can quickly become a sedimentation problem when wind and rain carry the soil off the construction site and sediment is deposited in surface waters unless stabilized. In addition to erosion, any hydric soils in the project area would be susceptible to compaction.

[83] DNR. *Ecological Classification System- Big Woods Ecological Subsection*, http://www.dnr.state.mn.us/ecs/222Mb/index.html

Typical conditions of HVTL route permits require permittees to utilize erosion control techniques throughout the duration of the project to achieve vegetation establishment and, ultimately, final stabilization. HVTL permits also typically require that contours be graded so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate re-vegetation, provide for proper drainage, and prevent erosion. All areas disturbed during construction of the facilities must be returned to their pre-construction condition.

Applicants would apply for a construction stormwater permit through the MPCA, as the Hollydale Project would disturb more than one acre. The permit states that prior to submitting a permit application, the owner must develop a Stormwater Pollution Prevention Plan (SWPPP) for the construction site. Applicants would also be required to adhere to the terms and conditions of the National Pollution Discharge Elimination System (NPDES) permit and SWPPP. Erosion control methods and Best Management Practices (BMPs) pursuant to MPCA requirements will be utilized to minimize runoff during construction. Common mitigation measures employed in transmission projects include:

- Utilizing seed to establish temporary and permanent vegetative cover on exposed soil. MnDOT and DNR have researched various seed mixes and have identified mixes for specific site characteristics and uses.
- Mulch may be applied to form a temporary and protective cover on exposed soils. Mulch can help retain moisture in the soil to promote vegetative growth, reduce evaporation, insulate the soil, and reduce erosion. A common mulch material used is hay or straw.
- Erecting or using sediment control fences that are intended to retard flow, filter runoff, and promote the settling of sediment out of runoff via ponding behind the sediment control. Examples include biorolls, sandbags, and silt fences.
- Using Erosion control blankets and turf reinforcement mats that are typically single or multiple layer sheets made of natural (wood) and/or synthetic materials that provide structural stability to bare surfaces and slopes.

Mitigation measures to minimize soil compaction include:

- Scheduling construction in areas of wet soils during frozen ground conditions.
- Using construction mats to minimize impacts to wet soils.

No-Build Alternative

Under the no-build alternative, there would be no construction, so there would be no impact to geology, topography, or soils.

HVTL System Alternative

Although impacts would occur in a different location, the HVTL System Alternative would impacts to geology, topography, and soils that are similar to the Hollydale Project. Mitigation measures would also be similar.

Distribution Alternatives

Impacts and mitigation would be similar for construction of any overhead distribution facilities. Underground distribution facilities would be installed using either open trench or directional boring,

depending upon location and site constraints.[84] In areas where there are multiple underground distribution lines, new lines may be installed in ductlines;[85] open trench construction would be used if ductlines are required.[86] Because of the larger area of disturbance required for open trench construction, there is an increased potential for soil compaction. To the extent that construction of underground distribution facilities could be coordinated with road construction, cumulative impacts could be lessened.

69 kV Rebuild Alternative

Impacts and mitigation from construction of a 69 kV alternative would be similar to the Hollydale Project.

4.5 Health and Safety

Generally human health and safety issues related to electric transmission and distribution projects can be grouped into issues associated with construction and those associated with the operation and maintenance of the project.

4.5.1 Project Construction

As with any construction project involving heavy equipment and high-voltage electrical facilities, there are safety issues during construction. Potential health and safety impacts would be injuries related to worker falls, falling equipment and electrocution.

Hollydale Project

Due to the use of heavy equipment, worker safety would be an important concern for both construction and operation for all of the alternatives. Indirect impacts may result from the construction activities including minor and major injuries. These types of injuries are associated with any type of construction project. In addition, the potential for a release or spill from the construction equipment is possible.

Compliance with National Electric Safety Code (NESC) and Occupational Health and Safety Administration (OSHA) regulations, as required by federal law, would minimize the potential for construction related injuries. Development of spill prevention and response procedures, such as those required in a Spill Prevention Control and Countermeasure (SPCC) plan and Storm Water Pollution Prevention Plan (SWPPP) under state and federal law, would minimize the likelihood of a release. Thus, these types of incidents are expected to be minimal for the construction and operation of the Hollydale Project.

During construction and operation, the transmission line would be equipped with protective devices to safeguard the public if an accident occurs, such as a structure or conductor falling to the ground. Protective safety measures to minimize potential health and safety effects to workers and the general public are incorporated in the industry design standards. The protective devices are breakers and relays located where the transmission line connects to the substation. The protective equipment would de-

[84] Xcel Energy, personal communication, January 29, 2013
[85] *Michlig Direct*, Schedule 2, p. 68
[86] Xcel Energy, personal communication, January 29, 2013

energize the transmission line should such an event occur. In accordance with industry practice, substation facilities would be fenced and access limited to authorized personnel.

No-Build Alternative

There would be no construction-related safety impacts resulting from a no-build alternative.

HVTL System Alternative

Construction related impacts related to the HVTL system alternative would be similar to those of the proposed Hollydale Project. Mitigation measures would also be similar.

Distribution Alternatives

Construction related impacts related to the distribution alternatives would be similar to those of the proposed Hollydale Project. Mitigation measures would also be similar.

69 kV Rebuild Alternative

Construction related impacts related to the 69 kV rebuild alternative would be similar to those of the proposed Hollydale Project. Mitigation measures would also be similar.

4.5.2 Project Operation

Potential health and safety impacts associated with the operation phase of electric transmission and distribution projects include: electrocution or injury from equipment failure, injuries associated with unauthorized access to energized transmission equipment, stray voltage, induced voltage, and impacts to implantable medical devices.

Equipment Failure

Under certain conditions, high voltage transmission lines or high voltage substation equipment may fail. These failures are most commonly a result of extreme weather or electric circuit overloading. If equipment fails, injury or death may occur as a result. Unauthorized access to transmission equipment by persons who are not trained to work with high voltage equipment can result in serious injury or death.

Stray Voltage

Stray voltage encompasses two phenomena: Neutral to Earth Voltage and Induced Voltage. In general, stray voltage describes any case of elevated potential, but more precise terminology gives an indication of the source of the voltage.

Neutral to Earth Voltage (NEV) refers to a condition that can occur at the electric service entrances to structures, that is, where distribution lines enter structures. It is the phenomena most commonly referred to as "stray voltage." NEV is an extraneous voltage that appears on metal surfaces in buildings, barns and other structures, which are grounded to earth. NEV can be experienced, for example, by livestock who simultaneously come into contact with two metal objects (e.g., feeders, waterers, stalls). If there is a voltage between these objects, a small current will flow through the livestock. The fact that both objects are grounded to the same place (earth) would seem to prevent any voltage from existing

between the objects. However, this is not the case – a number of factors determine whether an object is, in fact, grounded. These include wire size and length, the quality of connections, the number and resistance of ground rods, and the current being grounded.[87]

Neutral to Earth Voltage can result from damaged, corroded or poorly connected wiring or damaged insulation. Thus, NEV can exist at any business, house or farm which uses electricity, independent of whether there is a transmission line nearby. NEV is by and large an issue associated with electrical distribution lines and electrical service at a residence or on a farm. Transmission lines do not create NEV as they do not directly connect to businesses, residences or farms.

NEV can be reduced in three ways: reducing the current flow on the neutral wire entering a home or building, reducing the resistance of the neutral system, or improving the grounding of the neutral system. Making good electrical connections and making sure that these connections have the proper wiring materials for wet and corrosive locations will reduce the resistance of grounded neutral system and thereby reduce NEV levels.

Induced Voltage refers to situations where an electric field extends to a nearby conductive object, thereby "inducing" a voltage on the object. The electric field from a transmission line in some instances can reach a nearby conductive object, such as a vehicle or a metal fence, which is in close proximity to the transmission line. This may induce a voltage on the object, which is dependent on many factors, including the weather conditions, object shape, size, orientation, capacitance and location along the right-of-way. If these objects are insulated or semi-insulated from the ground and a person touches them, a small current would pass through the person's body to the ground. This touch may 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.

The major concern with induced voltage is the current that flows through a person to the ground when touching the object, not the level of the induced voltage. Most shocks from induced current are considered more of a nuisance than a danger, but to ensure the safety of persons in the proximity of high-voltage transmission lines, the NESC requires that any discharge be less than 5 milliAmperes. In addition, the Commission's electric field limit of 8 kV/m was designed to prevent serious hazard from shocks due to induced voltage under high-voltage transmission lines. Proper grounding of metal objects under and adjacent to the transmission line is the best method of avoiding these shocks.

While transmission lines do not, by themselves, create NEV because they do not connect to businesses or residences, they can induce voltage on a distribution circuit that is parallel and immediately under the transmission line. This induced voltage only occurs in the immediate vicinity of the distribution circuit; it does not travel along the transmission or distribution line. Standard industrial designs can mitigate any potential for stray voltage to impact distribution lines.

Induced voltage can be reduced or eliminated using cancellation, separation or enhanced grounding. Cancellation can be achieved by configuring the conductors of the transmission line to minimize EMF levels. Separation literally increases the distance between the transmission and distribution lines by physically placing the lines in different locations or by increasing the vertical distance between

[87] Stray Voltage, NDSU Extension Publication #108, http://www.ag.ndsu.edu/extension-aben/epq/files/epq108.pdf.

transmission and distribution lines collocated on the same poles. Enhanced grounding connects counterpoises to the distribution neutral wire and the transmission shield wire.

Implantable Medical Devices

Implantable medical devices such as pacemakers, defibrillators, neurostimulators, and insulin pumps may be subject to interference from strong electric and magnetic fields. Most of the research on electromagnetic interference and medical devices is related to pacemakers. According to a 2004 Electric Power Research Institute (EPRI) report, implantable cardiac devices are much more sensitive to electric fields than to magnetic fields. In the report, the earliest interference from magnetic fields in pacemakers was observed at 1,000 mG, far greater than the magnetic fields associated with high-voltage transmission lines (EPRI, 2004).[88] Therefore, the focus of research has been on electric field impacts.

Electric fields may interfere with an implanted cardiac device's ability to sense normal electrical activity in the heart if the electric field intensity is high enough to induce body currents strong enough to cause interaction. In the unlikely event a pacemaker is impacted, the effect is typically a temporary asynchronous pacing (commonly referred to as reversion mode or fixed rate pacing). The pacemaker returns to its normal operation when the person moves away from the source of the interference.

Medtronic and Guidant, manufacturers of pacemakers and implantable cardioverter/ defibrillators, have indicated that electric fields below 6 kV/m are unlikely to cause interactions affecting operation of modern bipolar devices (Department of Commerce, 2009).[89] Older unipolar designs, however, are more susceptible to interference from electric fields with research suggesting that the earliest evidence of interference occurred in electric fields ranging from 1.2 to 1.7 kV/m.[90] The risk of interference inhibition of unipolar cardiac pacemakers from high-voltage power lines in everyday life is small.[91]

Hollydale Project

As with the construction phase of the proposed Hollydale Project, the transmission line would be equipped with protective devices to safeguard the public if an accident occurs during the operation of the project. Protective safety measures to minimize potential health and safety effects to workers and the general public are incorporated in the industry design standards. The protective devices are breakers and relays located where the transmission line connects to the substation. The protective equipment would de-energize the transmission line should such an event occur. In accordance with industry practice, substation facilities would be fenced and access limited to authorized personnel.

[88] Electric Power Research Institute (EPRI). 2004. *Electromagnetic Interference with Implanted Medical Devices*,
[89] Department. 2009. *Draft Environmental Impact Statement of the Brookings to Hampton 345 kV Transmission Project*. http://energyfacilities.puc.state.mn.us/resource.html?Id=25589
[90] Toivonen, L., J. Valjus, M. Hongisto, and M. Ritta. 1991. The Influence of Elevated 50 Hz Electric and Magnetic Fields on Implanted Cardiac Pacemakers: The Role of the Lead Configuration and Programming of the Sensitivity. Blackwell Publishing Limited. Helsinki, Finland.
[91] Scholten, A., S. Joosten, and J. Silney. 2004. *Unipolar Cardiac Pacemakers in Electromagnetic Fields of High Voltage Overhead lines*. FEMU, University Hospital, Aachen, Germany.

No impacts due to stray voltage are anticipated from the Hollydale Project, as it is a 115 kV HVTL transmission project that does not directly connect to businesses or residences in the area, and does not change local electrical service. No livestock operations have been identified in the project area.

Xcel has indicated that farm equipment, passenger vehicles, and trucks may be safely used under and near power lines. The power lines will be designed to meet or exceed minimum clearance requirements over roads, driveways, cultivated fields, and grazing lands specified by the NESC. Recommended clearances within the NESC are designed to accommodate a relative vehicle height of 14 feet.

There would be no anticipated permanent impacts on implantable medical devices as a result of the proposed Hollydale Project. These initial interaction levels are higher than 1.52 kV/m maximum electric field predicted for this project.

No-Build Alternative

Although no project would be constructed under a no-build alternative, existing high-voltage transmission facilities would continue to operate and impacts and mitigation from operation of these facilities would be similar to the proposed Hollydale Project.

HVTL System Alternative

Safety impacts and mitigation associated with a HVTL system alternative would be similar to the Hollydale Project. Mitigation techniques would also be similar.

Distribution Alternatives

Safety impacts from the distribution alternatives would be similar to the Hollydale Project. Although distribution failures tend to occur more frequently than with transmission facilities, to the extent that distribution lines are placed underground, the potential for unintentional contact with downed conductors is lessened. Safety impacts associated with substations would be similar to those of the proposed Hollydale Project

Stray voltage can be associated with distribution lines. Xcel Energy maintains a stray voltage hotline for customers suspecting that stray voltage/NEV is a concern on their property. Callers to the hotline can c discuss the situation with an Xcel Energy technician or engineer. If warranted, an on-site investigation will be scheduled. Xcel Energy will conduct an investigation of the distribution utility system serving the property and the electrical wiring at the home or farm and discuss the preliminary results with the customer. In most instances, recording volt meters will be set to measure activity over several days. Upon completing the analysis, an Xcel Energy engineer or technician will call the customer to discuss the results.

69 kV Rebuild Alternative

Safety impacts and mitigation associated with a 69 kV rebuild alternative would be similar to the Hollydale Project. Although mitigation measures would be similar, they would not be addressed in a HVTL Permit.

4.6 Electric and Magnetic Fields

Wherever there is electricity there are electric and magnetic fields (EMF). Electric and magnetic fields are not only created by high-voltage transmission and distribution lines, but also by home appliances, electronics, cell phones, wireless networks, fluorescent lights, and wiring configurations in homes, businesses, and schools. As a result, we are all exposed on a daily basis to a complex mix of electric and magnetic fields at many different frequencies.[92]

Electric and magnetic fields are invisible just like radio, television, and cellular phone signals, all of which are part of the electromagnetic spectrum. The frequency of transmission line EMF in the United States is 60 hertz and falls in the extremely low frequency (ELF) range of the electromagnetic spectrum (any frequency below 300 hertz). By comparison, cellular phone communications operate at frequencies almost one billion times higher than EMF resulting from electric power (Long Island Power Authority, 2005).[93]

Natural and human-made electric and magnetic fields are, in fact, present everywhere in our environment. The Earth's natural static background electric field is approximately 120 to 150 volts per meter (V/m). Natural electric fields are also produced by the local build-up of electric charges in the atmosphere that are associated with thunderstorms. The Earth itself has a magnetic field that ranges from approximately 300 to 700 milligauss (mG), the field is a steady-state or static (zero hertz) magnetic field, but has similar characteristics to the magnetic fields emanating from human-made sources.

Electric and magnetic fields created by humans include X-rays and magnetic resonance imaging (MRIs) machines, electric and magnetic passenger trains, electric cars, and cellular telephones. The general wiring and appliances located in a typical home can produce an average background magnetic field of 0.5 mG to 4 mG.[94]

Electric and magnetic fields arise from the voltage and the flow of electricity (current) through a conductor. 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 electric current. The electric field associated with high-voltage transmission lines "extend" from the energized conductors to other nearby objects whereas the magnetic field "surrounds" the conductor. Together, these fields are generally referred to electric and magnetic fields or EMF. A summary of electric and magnetic field properties is provided in **Table 12**.

[92] World Health Organization (WHO), Radiation and Environmental Health, Department of Protection of the Human Environment. 2002. *Establishing a Dialogue on Risks from Electromagnetic Fields*. . http://www.who.int/peh-emf/publications/en/emf_final_300dpi_ALL.pdf

[93] Long Island Power Authority. 2005. *Magnetic Fields Around Your Home*, http://www.lipower.org/residential/safety/emf.html

[94] United States Environmental Protection Agency, Office of Radiation And Indoor Air (6603J) (EPA). 1992. *Electric Magnetic Fields In Your Environment*. http://www.web-pub.com/library/brochure/emf.html (Herein after, EPA, 1992)

Table 12: Summary of Electric and Magnetic Field Properties[95]

Electric Fields	Magnetic Fields
Electric fields arise from voltage.	Magnetic fields arise from current flows.
Their strength is measured in kilovolts per meter (kV/m).	Their strength is measured in milligauss (mG) or microtesla (µT).
An electric field can be present even when a device is switched off.	Magnetic fields exist as soon as a device is switched on and current flows.
Field strength decreases with distance from the source.	Field strength decreases with distance from the source.
Most building materials shield electric fields to some extent.	Magnetic fields are not attenuated by most materials.

This section of the ER specifically addresses electric and magnetic fields produced through transmission of electric power at 60 Hz or cycles per second.

4.6.1 Electric Fields

Electrical fields are created by voltage. Voltage can be described as the potential difference between two points and will always try to drive an electric current. The voltage on any conductor produces an electric field that extends from the wire in all directions. The intensity of electric fields is associated with the voltage of the transmission line and is measured in kilovolts per meter (kV/m). Some typical electric field strengths measured near common household appliances are presented in **Table 13**.

Table 13: Typical Electric Fields (kV/m) from Common Home and Business Appliances[96]

Source	Electric Field Strength (at a distance of 30 cm)
Iron	0.12
Refrigerator	0.12
Toaster	0.08
Coffee machine	0.06
Vacuum cleaner	0.05

Transmission line electric field levels are typically greatest near the center of the line right-of-way with levels decreasing as one moves away from the central alignment. The electric field associated with a high-voltage transmission line may extend from the energized conductors to other nearby objects such as the ground, towers, vegetation, buildings, and vehicles. These objects are commonly referred to as "screeners." The screening effect associated with these and other objects reduce the strength of transmission line electric fields.

On the whole, scientific evidence indicates that chronic exposure to electric fields at or below levels traditionally established for safety does not cause adverse health effects. Safety concerns related to electric fields are sufficiently addressed by adherence to the Institute of Electrical and Electronics Engineers (IEEE) and NESC standards.

[95] World Health Organization (WHO). 1999. "What are Electromagnetic Fields?" *Health and Environment Briefing Pamphlet*, Series 32. Website http://www.who.int/peh-emf/about/WhatisEMF/en/
[96] Ibid.

4.6.2 Magnetic Fields

Electric current passing through a conductor produces a magnetic field in the area surrounding the wire. Similar to electric fields, magnetic fields are strongest near the conductor and diminish with distance. Magnetic fields, however, are not shielded by most common materials and easily pass through them. The magnetic field may also be called magnetic flux density and is measured in units of milligauss (mG) or microtesla (µT).

We encounter magnetic fields from every-day things such as radar and microwave towers, television and computer screens, motors, fluorescent lights, microwave ovens, cell phones, electric blankets, house wiring and hundreds of other common electrical devices.

The general wiring and appliances located in a typical home can produce an average background magnetic field of 0.5 mG to 4 mG.[97] A U.S. government study conducted by the EMF Research and Public Information Dissemination Program determined that daily magnetic field exposure varies by individual, but on average is approximately 2 mG or less daily (NIEHS, 2002).[98] **Table 14** summarizes the average level of magnetic fields of common appliances.

Table 14: Typical Magnetic Fields (mG) of Common Appliances[99]

Source	Distance from Source			
	0.5 foot	1 foot	2 feet	4 feet
Baby Monitor	6	1	-	-
Computer Displays	14	5	2	-
Fluorescent Lights	40	6	2	-
Copy Machines	90	20	7	1
Microwave Ovens	200	4	10	2
Electric Pencil Sharpeners	200	70	20	2
Vacuum Cleaner	300	60	10	1
Can Opener	600	150	20	2
Color Televisions	NA	7	2	-

The study of cancer in relation to ELF magnetic fields has been a topic of study since the late 1970s. Since that time there have been several epidemiological studies that have explored the possible association of not only cancer risks, including brain tumors, leukemia, and breast cancer, but other potential human maladies including mental health issues. Studies have focused on both occupational exposures for individuals working in electrical industries and public exposures for children and adults living and working around common magnetic field sources (in-home wiring, transmission lines, home and office appliances/equipment). The results of the various studies conducted over the last three

[97] EPA, 1992.
[98] National Institutes of Health. National Institute of Environmental Health Sciences (NIEHS). 2002. *EMF Electric and Magnetic Fields Associated with the use of Electrical Power.* http://www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf
[99] Ibid.

decades, specifically those regarding the relationship between EMF and childhood leukemia and other cancer risks, have been mixed; some have found an association while others have not.[100]

Where there is association suggested in epidemiological studies, it is usually very near the statistical threshold of significance. However, when these studies are repeated in a laboratory, the results have not reproduced or identified a biological mechanism to support a link between health impacts and magnetic fields. Researchers continue to look at magnetic fields until more certain conclusions can be reached.

In a 2007 report the World Health Organization (WHO) concluded that, although some studies have noted a weak statistical link between exposure to EMF and incidence of childhood leukemia, laboratory evidence does not support these findings and that a similar link has not been noted with other types of cancer:

> *… epidemiological evidence is weakened by methodological problems, such as potential selection bias. In addition, there are no accepted biophysical mechanisms that would suggest that low-level exposures are involved in cancer development. … Additionally, animal studies have been largely negative. Thus, on balance, the evidence related to childhood leukaemia is not strong enough to be considered causal. … Regarding long-term effects, given the weakness of the evidence for a link between exposure to ELF [extremely low frequency] magnetic fields and childhood leukaemia, the benefits of exposure reduction on health are unclear.*[101]

4.6.3 Existing EMF Guidelines

Although scientists are still debating whether EMF is a hazard to health, at the current time in the United States, there are no federal standards for occupational or residential exposure to magnetic fields. Florida, New York, and Massachusetts are the only three states in the country that have set standards for magnetic field exposure (**Table 15**). These standards were not in response to health-based analysis, but rather on maintaining transmission systems within historic levels.

There are currently no federal guidelines on the strength of electrical fields beneath high-voltage transmission lines. However, six states have established their own regulations or guidelines with regard to transmission line electric fields (**Table 15**).

[100] National Cancer Institute. 2005. *Magnetic Field Exposure and Cancer: Questions and Answers Fact Sheet*, http://www.cancer.gov/cancertopics/factsheet/Risk/magnetic-fields
[101] World Health Organization (WHO). 2007. *Electromagnetic Fields and Public Health: Exposure to Extremely Low Frequency Fields. Fact Sheet No. 322*. http://www.who.int/mediacentre/factsheets/fs322/en/index.html

Table 15: State Established Electric and Magnetic Field Standards and Guidelines[102]

State	Electric Field (kV/m)		Magnetic Field (mG)
	Within Right-of-Way	Edge of Right-of-Way	Edge of Right-of-Way
Florida	8[a]	2	150[a] (max load)
	10[b]	---	200[b] (max load)
	---	---	250[c] (max load)
Massachusetts	---	---	85[g]
Minnesota	8	---	---
Montana	7[d]	1[e]	---
New Jersey	---	3	---
New York	11.8	1.6	200 (max load)
	11[f]	---	---
	7[d]	---	---
Oregon	9	---	---

Notes:
[a] 69 kV to 230 kV transmission lines
[b] 500 kV transmission lines
[c] 500 kV transmission lines on certain existing ROW
[d] maximum for highway crossing
[e] may be waived by the landowner
[f] maximum for private road crossings
[g] a level above 85 mG is not prohibited, but may trigger a more extensive review of alternatives

In addition to the state guidelines identified above, there are a number of national and international boards, committees, and commissions that have recommended electric field exposure guidelines or thresholds for 60 hertz high-voltage transmission lines. **Table 16** summarizes the suggested electric and magnetic field guidelines from a number of these internationally recognized organizations.

Table 16: Electric and Magnetic Field Guidelines from Internationally Organizations

Organization	Electric Field (kV/m)		Magnetic Field (mG)	
	General Public	Occupational	General Public	Occupational
IEEE	5	20	9,040	27,100
ICNIRP	4.2	8.3	830	4,200
ACGIH	---	25	---	10,000/1,000[a]
NRPB	4.2	---	830	4,200
European Union	4.2	---	830	---

Notes: IEEE – Institute of Electrical and Electronics Engineers, ICNIRP – International Commission on Non-Ionizing Radiation Protection, ACGIH – American Conference of Industrial Hygienists, NRPB – National Radiological Protection Board
[a] for persons with cardiac pacemakers or other medical electronic devices.

[102] Minnesota Department of Health (MDH). 2002. The Minnesota State Interagency Working Group on EMF Issues. 2002. *A White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options*. http://energyfacilities.puc.state.mn.us/documents/EMF%20White%20Paper%20-%20MN%20Workgroup%20Sep%202002.pdf ; National Institutes of Health. National Institute of Environmental Health Sciences (NIEHS). 2002. *EMF Electric and Magnetic Fields Associated with the use of Electrical Power*.

In most cases, these organizations have recognized the difference between general and occupation exposure, and have set different guidelines or thresholds for the general public and occupational exposure. Occupational exposure limits take into account the higher potential for electric and magnetic fields closer to the transmission line from the ground surface. Maintenance of a HVTL may require occupational exposures of greater electric or magnetic field strength; thus, standards for occupational exposure are different to those for the general public. Occupational exposure to electric and magnetic fields from an HVTL is generally limited because of the short duration of routine maintenance activities and de-energizing of the transmission line before significant maintenance occurs near the line. Electric and magnetic field guidelines established for the general public assume a longer term exposure, such as exposure levels that could be experienced by a person walking or driving beneath the transmission line or within a right-of-way. Due to required distance between the conductor and building structures, no homes or businesses would be located directly beneath the transmission line in the center of the right-of-way. However, the right-of-way could be used by persons for recreational activities or by road maintenance personnel.

Hollydale Project

Estimated electrical fields at maximum operating voltage for the proposed Hollydale Project at one meter (3.28 feet) from the ground, as provided by the Applicants, are presented in **Table 17**. The expected electric fields for the structure type and voltage proposed have been calculated at various distances from the centerline.

Table 17: Calculated Electric Fields (kV/m) for Hollydale 115 kV Transmission Line (3.28 feet above ground)[103]

Structure Type	Maximum Operating Voltage (kV)	Distance to Proposed Centerline (feet)														
		-300	-200	-100	-75	-50	-37.5	-25	0	25	37.5	50	75	100	200	300
Single Pole Braced Post 115 kV Single Circuit	121	0.01	.03	0.10	0.16	0.26	0.33	0.49	0.95	0.79	0.56	0.38	0.18	0.10	0.03	0.01
Single Pole Horizontal Post 115 kV Single Circuit (all conductors on one side)	121	0.01	0.02	0.05	0.06	0.05	0.02	0.13	1.12	1.09	0.42	0.09	0.08	0.08	0.03	0.01
Single Pole Horizontal Post 115 kV Single Circuit	121	0.01	0.03	0.13	0.24	0.50	0.70	0.86	1.09	1.38	0.73	0.40	0.20	0.12	0.03	0.01
Single Pole Davit Arm 115 kV/115 kV Double Circuit	121	0.00	0.01	0.02	0.02	0.15	0.44	1.00	0.56	0.10	0.43	0.15	0.02	0.03	0.01	0.00
Single Pole, Davit Arm, 115 kV Single Circuit Y-Frame	121	0.00	0.01	0.09	0.20	0.54	0.96	1.52	0.75	1.52	0.96	0.54	0.20	0.09	0.01	0.00

Underground construction does provide a shield from electric fields; there would not be electric fields along any portion of the Hollydale Project constructed underground. For overhead transmission lines the highest calculated electric field directly under the transmission line is 1.52 kV/m for the Y-frame

[103] Xcel Energy, personal communication, January 11, 2013

structures; the highest calculated electric field at the edge of the right-of-way (37.5 feet from center line) is also for the Y-frame structures, approximately 0.96 kV/m. These electric field strengths are within the range of electric fields generated by other common household/business sources and below the various state and international organization established guidelines identified in Tables 15 and 16.

Xcel Energy calculated magnetic fields for the structure type and voltage at both average and peak system conditions, as presented in **Table 18**.

Table 18: Calculated Magnetic Fields (mG) for Hollydale 115 kV Transmission Line (3.28 feet above ground)[104]

					Distance to Proposed Centerline (feet)												
Segment	**System Condition**	**Current (Amps)**	**-300**	**-200**	**-100**	**-75**	**-50**	**-37.5**	**-25**	**0**	**25**	**37.5**	**50**	**75**	**100**	**200**	**300**
Single Pole Braced Post 115 kV Single Circuit	Peak	250	0.32	0.69	2.53	4.25	8.30	12.47	19.43	32.10	16.27	10.50	7.04	3.63	2.16	0.55	0.24
	Average	150	0.19	0.41	1.52	2.55	4.98	7.48	11.66	19.26	9.76	6.30	4.22	2.18	1.29	0.33	0.14
Single Pole Horizontal Post 115 Single Circuit (all conductors on one side)	Peak	250	0.36	0.76	2.55	3.99	6.93	9.60	13.83	29.87	29.97	20.64	13.91	6.96	4.01	0.98	0.42
	Average	150	0.21	0.46	1.53	2.39	4.16	5.76	8.30	17.92	17.98	12.38	8.34	4.18	2.41	0.59	0.25
Single Pole Horizontal Post 115 Single Circuit	Peak	250	0.64	1.37	4.85	7.86	14.33	20.16	28.38	47.01	37.45	25.24	17.08	8.79	5.18	1.31	0.57
	Average	150	0.38	0.82	2.91	4.72	8.60	12.09	17.03	28.21	22.47	15.14	10.25	5.27	3.11	0.79	0.34
Single Pole Davit Arm 115 kV/115 kV Double Circuit	Peak	250/250	0.21	0.37	1.76	3.59	8.91	15.12	25.75	41.99	24.30	13.91	7.97	3.02	1.39	0.28	0.18
	Average	150/150	0.12	0.22	1.06	2.15	5.35	9.07	15.45	25.19	14.58	8.34	4.78	1.81	0.83	0.17	0.11
Single Pole, Davit Arm , 115 kV Single Circuit Y-Frame	Peak	250	0.44	1.02	4.09	7.16	15.15	24.31	40.31	65.80	40.63	24.61	15.42	7.36	4.25	1.10	0.50
	Average	150	0.27	0.61	2.45	4.29	9.09	14.58	24.19	39.48	24.38	14.77	9.25	4.42	2.55	0.66	0.30

The calculations show that at 3.28 feet (one meter) above the ground, magnetic fields are highest under the Y-frame structures. The maximum estimated magnetic field generated by the proposed transmission line under peak operating conditions is approximately 66 mG directly below the centerline and approximately 24 to 25 mG at the edge of the right-of-way (37.5 feet either side of the center line); under average operating conditions, magnetic fields would be approximately 40 mG directly under the center line and approximately 15 mG at the edge of the right-of-way. As noted in **Table 16**, the ICNIRP has established a magnetic field guideline of 830 mG for the general public. At 300 feet from the transmission centerline the magnetic field level drops to a maximum of approximately 0.6 mG, at the lower end of the average background magnetic field of a typical home of 0.5 mG to 4 mG.[105]

[104] Ibid.
[105] EPA, 1992

Although the ground does shield from electric fields, it does not provide a shield from magnetic fields. If underground construction were used for any portion of the Hollydale Project, magnetic fields would be somewhat higher at ground level than with overhead lines.

Based upon current scientific evidence, no adverse effects from electric fields or magnetic fields on health are expected for persons living or working at locations along or near the proposed Hollydale Project.

The Commission has consistently found that there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects. Below are some references to recent Commission proceedings relating to high-voltage transmission lines and the issue of electric fields and magnetic fields:

> *120. The absence of any demonstrated impact by electric field and magnetic field exposure supports the conclusion that there is no demonstrated impact on human health and safety. No adverse effects from electric fields and magnetic fields on health are expected for persons living or working at locations along or near the proposed Project.* (Minnesota Public Utilities Commission, 2010, Finding 120)
>
> *40. The issue of electric and magnetic fields was discussed in the environmental assessment. A number of national and international health agencies (The Minnesota Department of Health, The World Health Organization, The National Institute of Environmental Health Sciences) have generally concluded in their research that there is insufficient evidence to prove a connection between electric and magnetic fields exposure and health effects. Research has not been able to establish a cause and effect relationship between exposure to magnetic fields and human disease, nor a plausible biological mechanism by which exposure to electric and magnetic fields could cause disease. No Minnesota regulations have been established pertaining to magnetic fields from high voltage transmission lines.* (Minnesota Public Utilities Commission, 2009, Finding 40)

To assist the public in understanding this issue, Applicants may provide information to the public, interested customers and employees. The information may references studies and provides data to help explain the relative impact of transmission line exposure to other common EMF exposures, and allow individuals to make informed decisions regarding EMF.

No-Build Alternative

Under the No-build Alternative, the existing 69 kV Transmission Line BD would continue to operate as it does currently; the line is not energized between the Hollydale Substation and the intersection with the GRE 115 kV WH-PB line and is energized, but only occasionally serving load, between the Medina and Hollydale substations. GRE provided calculations of electric and magnetic fields on the existing 69 kV Transmission Line BD, shown in **Tables 19** and **20**.

Table 19: Calculated Electric Fields (kV/m) for Existing GRE Transmission Line BD (3.28 feet above ground)[106]

Segment	System Condition	Current (Amps)	Distance to Proposed Centerline (feet)														
			-300	-200	-100	-75	-50	-37.5	-25	0	25	37.5	50	75	100	200	300
Hollydale to intersection with 115 kV WH-PB transmission line	Not energized	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medina to Hollydale Single Pole Horizontal Post, 69 kV Single Circuit	Typical Operating Condition[a] -	1	0.00	0.01	0.03	0.05	0.10	0.16	0.27	0.66	0.30	0.15	0.09	0.05	0.03	0.01	0.00
	Peak Operation[b]	142	0.00	0.01	0.03	0.05	0.10	0.16	0.27	0.66	0.30	0.15	0.09	0.05	0.03	0.01	0.00

Notes:
a: Typical Operating Condition for this portion of the line is energized, but not providing electric service
b: Peak condition is when this portion of the line is serving customer load. Between January 2008 and mid-December 2012, the line has provided electric power for 274 hours, or approximately 0.06 percent of total hours. Maximum operating voltage is assumed to be 72.5 kV. Peak current is based on maximum anticipated loading of 17 MVA required at the existing Hollydale Substation.

Table 20: Calculated Magnetic Fields (mG) for Existing GRE Transmission Line BD (3.28 feet above ground)[107]

Segment	System Condition	Current (Amps)	Distance to Proposed Centerline (feet)														
			-300	-200	-100	-75	-50	-37.5	-25	0	25	37.5	50	75	100	200	300
Hollydale to intersection with 115 kV WH-PB transmission line	Not energized	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medina to Hollydale Single Pole Horizontal Post, 69 kV Single Circuit	Typical Operating Condition[a]	1	0.00	0.00	0.01	0.01	0.02	0.03	0.06	0.13	0.07	0.04	0.03	0.01	0.03	0.00	0.00
	Peak Operation[b]	142	0.12	0.26	0.96	1.63	3.24	5.47	8.15	18.03	9.20	6.11	3.55	1.75	1.02	0.26	0.12

Notes:
a: Typical Operating Condition for this portion of the line is energized, but not providing electric service
b: Peak condition is when this portion of the line is serving customer load. Between January 2008 and mid-December 2012, the line has provided electric power for 274 hours, or approximately 0.06 percent of total hours. Maximum operating voltage is assumed to be 72.5 kV. Peak current is based on maximum anticipated loading of 17 MVA required at the existing Hollydale Substation.

[106] Source: Xcel Energy, Personal Communication, January 11, 2013
[107] Ibid.

Based upon current scientific evidence, no adverse effects from electric fields or magnetic fields on health are expected for persons living or working at locations along or near the proposed Hollydale Project.

HVTL System Alternative

Because structure types and loads are expected to be the same for the HVTL system alternative, electric and magnetic fields are also assumed to be the same.

Distribution Alternatives

Applicants have estimated electric and magnetic fields for different distribution structures, as shown in **Tables 21 and 22**.

Table 21: Calculated Electric Fields (kV/m) for 13.8 kV and 34.5 kV Distribution Lines (3.28 feet above ground)[108]

Segment	System Condition	Maximum Operating Voltage (kV)	Distance to Proposed Centerline (feet)														
			-300	-200	-100	-75	-50	-37.5	-25	0	25	37.5	50	75	100	200	300
Single Pole, Tangent 3-Phase 13.8 kV	Typical Operating Condition	15	0.00	0.00	0.00	0.00	0.02	0.04	0.07	0.05	0.06	0.03	0.02	0.01	0.00	0.00	0.00
Single Pole, Tangent 3-phase 34.5 kV	Typical Operating Condition	36	0.00	0.00	0.01	0.02	0.04	0.08	0.15	0.10	0.14	0.08	0.04	00.02	0.01	0.00	0.00

Table 22: Calculated Magnetic Fields (mG) for 13.8 kV and 34.5 kV Distribution Lines (3.28 feet above ground)[109]

Segment	System Condition	Current (Amps)	Distance to Proposed Centerline (feet)														
			-300	-200	-100	-75	-50	-37.5	-25	0	25	37.5	50	75	100	200	300
Single Pole, Tangent 3-Phase 13.8 kV	Typical Operating Condition[a]	171	0.20	0.33	0.84	1.33	2.58	4.07	7.17	18.82	7.44	4.29	2.75	1.44	0.92	0.35	0.21
	Peak Operation	285	0.34	0.54	1.40	2.21	4.30	6.78	11.94	31.37	12.39	7.14	4.58	2.40	1.53	0.58	0.36
Single Pole, angent 3-phase 34.5 kV	Typical Operating Condition[a]	171	0.20	0.33	0.84	1.33	2.58	4.07	7.17	18.82	7.44	4.29	2.75	1.44	0.92	0.35	0.21
	Peak Operation	285	0.34	0.54	1.40	2.21	4.30	6.78	11.94	31.37	12.39	7.14	4.58	2.40	1.53	0.58	0.36
Single Pole, Tangent 3-Phase 13.8 kV	Typical Operating Condition[a]	171	0.20	0.33	0.84	1.33	2.58	4.07	7.17	18.82	7.44	4.29	2.75	1.44	0.92	0.35	0.21
	Peak Operation	285	0.34	0.54	1.40	2.21	4.30	6.78	11.94	31.37	12.39	7.14	4.58	2.40	1.53	0.58	0.36

[108] Ibid.
[109] Ibid.

Based upon current scientific evidence, no adverse effects from electric fields or magnetic fields on health are expected for persons living or working at locations along or near the proposed Hollydale Project.

69 kV Rebuild Alternative

Applicants' calculations for electric and magnetic fields for 69 kV transmission lines are shown in **Tables 23 and 24.**

Table 23: Calculated Electric Fields (kV/m) for 69 kV Transmission Line (3.28 feet above ground)[110]

Segment	System Condition	Maximum Operating Voltage			Distance to Proposed Centerline (feet)											
			-300	-200	-100	-75	-50	-37.5	-25	0	25	37.5	50	75	100	200	300
Single Pole, Davit Arm 69 kV Bundled Conductor		72.5	0.00	0.01	0.05	0.09	0.20	0.33	0.53	1.18	0.59	0.29	0.18	0.09	0.05	0.01	0.00
Single Pole, Davit Arm 69 kV Bundled Conductor		72.5	0.00	0.00	0.01	0.02	0.03	0.06	0.19	0.45	0.19	0.06	0.03	0.02	0.01	0.00	0.00

Table 24: Calculated Magnetic Fields (mG) for 69 kV Transmission Line (3.28 feet above ground)[111]

Segment	System Condition	Current (Amps)			Distance to Proposed Centerline (feet)											
			-300	-200	-100	-75	-50	-37.5	-25	0	25	37.5	50	75	100	200	300
Single Pole, Davit Arm 69 kV Bundled Conductor	Typical Operating Condition[a]	251	0.30	0.64	2.26	3.76	7.35	11.17	18.03	39.36	20.44	12.22	7.77	3.75	2.15	0.52	0.22
	Peak Operation	418	0.50	1.06	3.77	6.27	12.24	18.60	30.03	65.55	34.03	20.36	12.93	6.25	3.58	0.87	0.37
Single Pole, Davit Arm 69 kV Bundled Conductor	Typical Operating Condition[a]	251	0.02	0.05	0.33	0.73	2.04	3.88	8.07	23.23	7.90	3.76	1.96	0.69	0.31	0.05	0.02
	Peak Operation	418	0.03	0.08	0.56	1.21	3.39	6.46	13.44	38.68	13.16	6.26	3.26	1.15	0.52	0.08	0.03

Notes:
a: summer peak and average loading of the 115 kV circuit when operated at 69 kV

Based upon current scientific evidence, no adverse effects from electric fields or magnetic fields on health are expected for persons living or working at locations along or near the proposed Hollydale Project.

[110] Ibid.
[111] Ibid.

4.7 Land Use

Land use in the project area is a mix of uses with rural residential and some agricultural land use in the western portion of the project area, generally in Medina, with much denser residential and commercial at the eastern edge of the project area. The Hollydale Project is located in a combination of zoning classifications in Medina and Plymouth. Generally, the western project area in Medina is zoned as rural residential, while land use and zoning becomes more urban in the Plymouth area.

Hollydale Project

Underground or overhead electric transmission or distribution facilities fall under the definition of "essential services" in Section 21005.02 of the *Plymouth Zoning Ordinance,* and in Section 825.29 of the *Medina City Code*.[112] Essential services are considered to be permitted uses in the Rural Residential, Business, and Industrial zoning districts and are conditional uses in Business Park (BP) zoning district in Plymouth, and are permitted uses with the Rural Residential zoning district in Medina.

Although the Commission's HVTL Permit would supersede local zoning, the proposed Hollydale Project does not conflict with the existing land use. Applicants have stated that the Hollydale Project, as proposed by Applicants, can be constructed without displacement of existing homes or businesses.[113]

No-Build Alternative

There would be no impact to current land use from a no-build alternative.

HVTL System Alternative

Under the HVTL System Alternative, the entire transmission line as well as both the Hollydale and proposed Pomereau Lake Substation would be constructed within Plymouth, while the Gleason Lake improvements would be constructed in Wayzata. The Gleason Lake Substation is located in an area zoned R3, or single- and two-family residential.[114]

Because no route has been developed for an HVTL system alternative, it cannot be determined whether construction of the HVTL system alternative is likely to result in displacement of homes or businesses.

Distribution Alternative

The distribution alternatives identified by Applicants and shown in **Figures 3 and 4** are located within Plymouth. Electric transmission lines over 33 kV require a Conditional Use Permit from the city of Plymouth. Installation of distribution facilities under 33 kV requires a permit from the City Engineer.[115] Under Xcel Energy's franchise agreement with Plymouth, distribution facilities, at both the 13.8 and 34.5

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[112] City of Plymouth, *Plymouth Zoning Ordinance,* November 27, 2012. http://www.plymouthmn.gov/Modules/ShowDocument.aspx?documentid=754; City of Medina, *Medina City Code, Chapter 8, Section 825: Zoning – Administration*. http://www.ci.medina.mn.us/facts/Ordinances%20-%20Current/Chapter_8/825.pdf

[113] *CN Application*, p. 135

[114] City of Wayzata, *Wayzata Zoning Map*, October 11, 2005, http://www.wayzata.org/vertical/sites/%7B95A8F424-4B5B-4F0B-BF37-7DA6B8C22A80%7D/uploads/%7B78A79406-B39E-46E8-9FB3-320F90EA2809%7D.PDF

[115] City of Plymouth, *Plymouth Zoning Ordinance,* at Sections 21160.02 and 21160.03

kV voltages, are typically installed underground. No homes or businesses would be displaced under either distribution alternative.

69 kV Rebuild Alternative

Construction of a 69 kV transmission line would require a Conditional Use Permit from the city of Plymouth. As the 69 kV rebuild alternative is assumed to replace the existing 69 kV line, and follow the applicant-proposed route for the Hollydale Project, it is assumed that the 69 kV rebuild alternative would not result in displacement of any homes or businesses.

4.8 Noise

Large electric generation facilities generate noise. Potential human impacts due to noise include hearing loss, stress, annoyance, and sleep disturbance.[116] Noise can be defined as unwanted or inappropriate sound. Sound has multiple characteristics which determine whether a sound is too loud or otherwise inappropriate. Sound travels in a wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels (dB). Sounds also consists of frequencies, e.g., the high frequency (or pitch) of a whistle. Most sounds are not a single frequency but a mixture of frequencies. Finally, sounds can be constant or intermittent. The perceived loudness of a sound depends on all of these characteristics.

A sound meter is used to measure loudness. The meter sums up the sound pressure levels for all frequencies of a sound and calculates a single loudness reading. This loudness reading is reported in decibels, with a suffix indicating the type of calculation used. For example, “dB(A)” indicates a loudness reading using an A-weighted calculation (or “scale”).

The State of Minnesota has promulgated noise standards designed to ensure public health and minimize citizen exposure to inappropriate sounds. The rules for permissible noise vary according to land use, i.e., according to their noise area classification (NAC). In a residential setting, for example, noise restrictions are more stringent than in an industrial setting. Rural residential homes are considered NAC 1 (residential), while agricultural land and agricultural activities are classified as NAC 3 (industrial). The rules also distinguish between nighttime and daytime noise; less noise is permitted at night. Sound levels are not to be exceeded for 10 percent and 50 percent of the time in a one-hour survey (L_{10} and L_{50}) for each noise area classification. Minnesota’s Noise Standards by noise area classification are listed in **Table 25**.

[116] World Health Organization. *Occupational and Community Noise* http://www.who.int/mediacentre/factsheets/fs258/en/.

Table 25: Minnesota Noise Standards

Noise Area Classification[117]	Daytime		Nighttime	
	L_{50}[118]	L_{10}	L_{50}	L_{10}
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Hollydale Project

Applicants have estimated noise at various distances from the transmission line during operation of the Hollydale Project, as shown in **Table 26**.

Table 26: Calculated Audibile Noise for Proposed 115 kV Transmission Line Designs[119]

Structure Type	Noise (Decibels a-weighted)					
	Edge of ROW		25' from Center Pole		At Center of Pole	
	Noise L_5	Noise L_{50}	Noise L_5	Noise L_{50}	Noise L_5	Noise L_{50}
Single Pole, Braced Post, 115 kV Single Circuit	19.8	16.3	21.0	17.5	22.4	18.9
Single Pole, Horizontal Post (All Ph one side), 115 kV Single Circuit	19.2	15.7	20.2	16.7	20.2	16.7
Single Pole, Horizontal Post, 115 kV Single Circuit	14.0	10.5	15.2	11.7	15.5	12.0
Single Pole, Davit Arm, 115/115 kV Double Circuit	22.0	18.5	23.0	19.5	23.9	20.4
Single Pole, Davit Arm, 115 kV Single Circuit, Y-frame	17.5	14.0	18.9	15.4	20.5	17.7

Noise at substations is generally the result of transformers. As proposed, the Hollydale Project would install up to two new 115/13.8 kV distribution transformers at the Hollydale Substation and would not install any transformers at the Pomerleau Lake Substation.[120] The existing 115/69 kV transformer at the Medina Substation would be removed.[121] All substations would be required to meet Minnesota Noise Standards for daytime and nighttime use.

No-Build Alternative

Under the no-build alternative, there would be no change in noise from construction or operation of the existing 69 kV transmission line BD.

[117] Minnesota Rules 7030.0050, https://www.revisor.leg.state.mn.us/rules/?id=7030.0050. The noise area classification is based on the land use activity at the location of the receiver (listener).
[118] Minnesota Rules 7030.0020, https://www.revisor.leg.state.mn.us/rules/?id=7030.0020. "L_{50}" means the sound level, expressed in dB(A), which is exceeded 50 percent of the time for a one hour survey. "L_{10}" means the sound level, expressed in dB(A), which is exceeded ten percent of the time for a one hour survey.
[119] *Applicants Response to WPNA, IR-TL-11*, Attachment 11-1,(Appendix D)
[120] *Michlig Direct Testimony,* Schedule 2, Section 7 NSP and GRE, Direct Testimony of Philip Spaulding, January 25, 2013, p. 13, eDocket ID: 20131-83199-05 (Herein after, Spaulding Direct Testimony)
[121] NSP and GRE, Direct Testimony of Steve Lawler, January 25, 2013, p. 3, eDocket ID: 20131-83199-04

HVTL System Alternative

Noise impacts from the HVTL system alternative are assumed to be the same as for the Hollydale Project.

Distribution Alternative

Noise generated from either distribution alternative would meet Minnesota Noise Standards.

69 kV Rebuild Alternative

Construction noise from the 69 kV rebuild alternative would be similar to the Hollydale Project. Noise resulting from operation of the rebuild alternative would meet Minnesota Noise Standards.

4.9 Socioeconomic Impacts

Construction and operation of electric transmission or distribution facilities has the potential to create both positive and negative impacts on socioeconomic resources such as property values, local economies, and economic development.

4.9.1 Property values

Large electric generation facilities have the potential to impact property values. Because property values are influenced by a complex interaction between factors specific to each individual piece of real estate as well as local and national market conditions, the effect of one particular project on the value of one particular property is difficult to determine.

One of the first concerns of many residents near existing or proposed transmission lines is how the proximity to the line could affect the value of their property. Research on this issue does not identify a clear cause and effect relationship between the two. Rather, the presence of a transmission line becomes one of several factors that interact to affect the value of a particular property.

Based on the research that has been ongoing since at least the 1950s, several generalizations about the effect of transmission lines on property values can be made:

- Studies have found a potential reduction of sale price for single-family homes of between 0 to 14 percent. Studies conducted in the upper Midwest (Minnesota, Wisconsin, and the Upper Peninsula of Michigan) have shown an average decrease of 4 to 7 percent.
- Although proximity to a transmission line does not appear to affect appreciation of a property, it can sometimes result in increased selling time.
- Property characteristics such as the neighborhood, proximity to schools, lot size, square footage of the house, and other amenities, tend to exert a greater effect on sales place than the presence of a power line.
- High-value properties are more likely than lower-value properties to experience a reduction in sales price.
- The sales price of smaller properties could be more adversely affected than for larger properties.
- For upgrade projects, the level of opposition may affect the size and duration of any reduction in sales price.

- Adverse effects on property prices tend to be greatest immediately after a new transmission line is built and diminish over time.
- The sales price for properties crossed by or immediately adjacent to a transmission line appear to be more adversely affected than prices for homes that are not adjacent to the transmission line right-of-way or are greater than 200 feet from the transmission line right-of-way.
- Mitigation measures such as setback distance, landscaping and integration of the right-of-way into the neighborhood, and visual and noise shielding have been shown to reduce or eliminate the impact of transmission structures on sales price.
- Impacts to the value of agricultural property can be reduced by placing structures to minimize disruption to farm operations.[122]
- Interviews with residents along existing transmission lines show that a high proportion of residents were aware of the lines at the time they purchased their home and between one-half and three-fourths expressed concerns about the lines. The concerns were related to health effects, aesthetics, and effects on property values. Despite the concerns expressed, 67 to 80 percent of survey respondents with negative feelings about transmission lines reported that their decision to purchase the property and the price they offered to pay was not affected by the lines.[123]

Although results of the studies has not been able to provide a basis for accurately predicting the effect of a particular transmission line on a particular property, researchers have attributed the effects of HVTLs on property values to an interaction between five factors:

- Proximity to the transmission towers and lines
- The view of the towers and lines
- Size and type of HVTL structures
- Appearance of easement landscaping
- Surrounding topography[124]

Locating the line away from homes to the extent possible and using line design and landscaping to minimize visual intrusions from the line can be used to minimize impacts to property values from the transmission line.

Federal Housing Administration Regulations

The Federal Housing Administration, (FHA) provides mortgage insurance on home loans made by FHA-approved lenders throughout the United States. In order to qualify for FHA mortgage insurance, a property must go through an appraisal and property condition assessment performed by an FHA-qualified appraiser. FHA qualified underwriters and appraisers are responsible adhering to current the policies contained in the FHA's *Homeownership Center (HOC) Reference Guide.*

[122] Adapted from Wisconsin Public Service Commission, June 2001. *Environmental Impacts of Transmission Lines*. http://psc.wi.gov/thelibrary/publications/electric/electric10.pdf, p. 17.
[123] Chalmers, James A. and Frank A. Voorvaart. "High-Voltage Transmission Lines: Proximity, Visibility, and Encumbrance Effects." *The Appraisal Journal*. Summer, 2009. http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/2009_HVTLs_and_Property_Values.pdf
[124] Pitts, Jennifer M. and Thomas O. Jackson. 2007. "Power Lines and Property Values Revisited." *The Appraisal Journal. Fall, 2007.*

With respect to overhead HVTLs, FHA guidance requires appraisers to review properties under consideration for FHA loans for presence of utility easements. The US Department of Housing and Economic Development provides the following guidance:

- *The appraiser must indicate whether the dwelling or related property improvements is located within the easement serving a high-voltage transmission line, radio/TV transmission tower, cell phone tower, microwave relay dish or tower, or satellite dish (radio, TV cable, etc).*
- *If the dwelling or related property improvement is located within such an easement, the DE Underwriter must obtain a letter from the owner or operator of the tower indicating that the dwelling and its related property improvements are not located within the tower's (engineered) fall distance in order to waive this requirement.*
- *If the dwelling and related property improvements are located outside the easement, the property is considered eligible and no further action is necessary. The appraiser, however, is instructed to note and comment on the effect on marketability resulting from the proximity to such site hazards and nuisances*.[125]

Hollydale Project

Xcel Energy has stated their intent to use existing easements to the extent possible. The existing transmission structures would be removed and replaced with larger structures and it is likely that vegetation maintenance along the existing right-of-way would be managed more stringently than it is currently. Because of the complicated interaction between the many factors that influence the value of an individual property it is unclear what impact, if any, larger structures and a more defined right-of-way would have on property values.

Landowners owning right-of-way through which the line will be routed will be compensated for a property easement for the right-of-way. Potential impacts to the value of properties within the required right-of-way are typically a subject of negotiation in the easement agreement between the applicants and the landowner. New easements would be required, although the extent of new easements is dependent upon route. It is unclear whether property owners with existing easements would receive additional compensation for the new 115 kV line beyond the initial payment for the original easement established for the 69 kV transmission line.

The presence of an HVTL easement on a property does not preclude qualification for FHA mortgage insurance, although the location of an easement on the property does require further documentation than would be required on properties without such easements.

No-Build Alternative

Because there would be no change in the built environment under the no-build alternative, it is assumed that there would be no impact on property values from current conditions.

[125] U.S. Department of Housing and Urban Development. *Is a Property eligible for FHA if there are overhead or high voltage power lines nearby?* http://portalapps.hud.gov/FHAFAQ/controllerServlet?method=showPopup&faqId=1-6KT-2009

HVTL System Alternative

Impacts to property values from the HVTL alternative would be similar to those from the Hollydale Project.

Distribution Alternative

As distribution lines already serve every home and business in the project area, the addition of new distribution lines is unlikely to have any impact on property values.

69 kV Rebuild Alternative

Impacts to property values from the 69 kV rebuild alternative would likely be similar to those from the Hollydale Project. Although it is assumed that a rebuilt 69 kV line would be constructed along the same right-of-way as the existing 69 kV transmission line BD, to the extent that taller structures and a more defined right-of-way have the potential to impact property values, impacts from the rebuild alternative would be similar.

4.9.2 Local Economy and Development

Large energy generating facilities typically generate short-term impacts to local economies through construction jobs and expenditures, such as lodging, food, and some material purchases, during the construction phase of a project. Once the project becomes operational local economies may benefit from more long-term benefits, such as jobs to operate and maintain the facility as well as property or production taxes. To the extent that each alternative maintains or enhances electric reliability, it would have a positive or neutral impact on economic development. To the extent that an alternative would have a deleterious effect on reliable electric service in the project area, the alternative would have a negative impact on economic development in the project area.

Hollydale Project

Applicants anticipate that construction will take approximately three weeks per mile of transmission line with a construction crew of approximately 15 people.[126] Assuming the three weeks per mile rate, construction would occur over the course of approximately 26 to 30 weeks. No permanent jobs are anticipated to directly result from the Hollydale Project.

Applicants contend that the Hollydale Project would ensure continued reliable electric service in the project area.

No-Build Alternative

There would be no direct impact to the local economy from the no-build alternative.

Applicants contend that the no-build alternative would result in a deleterious effect on electricity reliability in the project area.[127]

[126] *CN Application*, p. 125
[127] *Michlig Direct Testimony*, Schedule 2, p. 26

HVTL System Alternative

It is assumed that construction of the project would involve similar economic effects as the Hollydale Project.

Applicants contend that the HVTL system alternative would ensure continued reliable service in the project area.[128]

Distribution Alternative

It is assumed that either distribution alternative would result in similar impacts to the local economy in as the Hollydale Project.

In their pre-filed testimony, Applicants describe the enhancements to the distribution system in the project area since 1993.[129] To the extent that a distribution alternative would ensure continued reliable electric service in the project area a distribution alternative would have a positive or neutral effect on economic development in the project area. To the extent that construction of a distribution alternative would have a deleterious effect on reliable electric service in the project area, the alternative would have a negative impact on economic development in the project area. Applicants' pre-filed testimony contends that distribution enhancements are not sufficient to meet the short- and medium-term needs of the project area.[130] Applicants further state that construction of the distribution alternatives would delay construction of the Hollydale Project until 2026.[131]

Up-grade of Existing Facilities

It is assumed that the 69 kV rebuild alternative would result in similar impacts to the local economy in as the Hollydale Project.

Applicants state that the 69 kV re-build alternative can meet the stated need.[132]

4.10 Transportation

Although electric transmission and distribution facilities rarely require construction of new transportation facilities, existing road networks are used to deliver construction materials to staging areas. To the extent practicable, utilities try to access rights-of-way from public right-of-way including roads.

MnDOT is evaluating the potential for converting MN Highway 55 between County Road 116 (Pinto Drive) in Medina and Interstate 494 from its current four lane design to a four-land grade-separated

[128] Ibid.
[129] Direct Testimony of Philip Spaulding, January 25, 2013, p. 13, eDocket ID: 20131-83199-05 (Herein after, *Spaulding Direct Testimony*)
[130] Ibid.
[131] *Michlig Direct Testimony*, Schedule 2, p. 26
[132] Ibid.

design. Any substantial changes to the Highway 55 design would be long-term, and no current plan or funding exists.[133]

Hollydale Project

Construction of a HVTL Project has the potential to create short-term traffic impacts during the construction phase and during maintenance of the transmission line. Applicants anticipate that ccess to the transmission line during both construction and maintenance of the Hollydale Project will be primarily from existing roads.

Structure placement along roadways can impact future road expansions if not carefully planned and located. Any crossing or paralleling of a state highway would require approval from MnDOT. Poles would need to be placed outside the MnDOT clear zone for any road crossings or portions paralleling state highways. Xcel Energy would work with MnDOT to ensure that transmission structures are outside of MnDOT's clear zone and that all safety requirements are met.

Applicants will coordinate with MnDOT, County, and township road authorities regarding construction plans, permits, traffic safety signage, and schedules to minimize traffic impacts and ensure public safety.[134] During construction, best practices typically require installation of temporary guard or clearance poles at road crossings to ensure adequate clearance is maintained over other utilities, roads, or highways. Guard structures, such as temporary wood poles with a cross arm or line trucks with booms, can be used to protect traffic lanes.

Although tall structures associated with high-voltage transmission lines have the potential to conflict with safe operation of public and private airports and air strips, due to the five mile distance between the proposed Hollydale Project and the nearest airport in Crystal, it is not anticipated that the project would impact air transport.

No-Build Alternative

The no-build would not impact any transportation facilities.

HVTL System Alternative

Impacts from the HVTL system alternative would be similar to the Hollydale Project. Mitigation techniques would also be similar.

Distribution Alternative

Either distribution alternative would locate distribution facilities along existing public rights-of-way. It is anticipated that short-term traffic impacts during construction may occur, mitigation techniques would be similar to those described for the Hollydale Project.

[133] Minnesota Department of Transportation, Highway 55 Project from Plymouth to Rockford, http://projects.dot.state.mn.us/srf/055/
[134] *CN Application*, p. 143

69 kV Rebuild Alternative

Impacts from the 69 kV rebuild alternative would be similar to the Hollydale Project. Mitigation techniques would also be similar.

4.11 Visual Impacts and Aesthetics

The construction of transmission or distribution facilities typically changes to the existing aesthetic environment by introducing new or different transmission structures, new rights-of-way cleared of vegetation and, in some cases, new or expanded substations. The project area is characterized by a mixture of land uses, predominantly rural residential in the western portion of the project area and an increasingly urban mixture of single and multi family residential and commercial in the eastern portion of the project area. The project area is crossed by a network of roads. Existing transmission and distribution facilities are also present in the landscape.

Hollydale Project

The Hollydale Project would introduce several changes to the existing landscape: the new Pomerleau Lake Substation, an expanded Hollydale Substation, new equipment at GRE's Medina Substation, and a new 115 kV transmission line of up to 10.3 miles. At least 0.8 miles of the Hollydale Project would require establishment of a new right-of-way; depending upon the route, up to eight miles of the new 115 kV transmission line may replace the existing 69 kV transmission line BD.

Existing structures used in the 69 kV transmission line BD are a combination of wood single pole and H-frame structures ranging in height from approximately 60 to 90 feet, with spans of approximately 200 to 500 feet between structures.[135] The proposed Hollydale Project would consist of single circuit 115 kV structures constructed of galvanized or weathering steel. Structures under consideration for the Hollydale Project range in height from 70 to 90 feet, with structures of up to 105 feet possible if double circuit structures are used to connect the alternate substation site with base dimensions of between two and six feet and spans between structures averaging between 300 and 500 feet and ranging up to 1,200 feet.[136] Structure dimensions are summarized in **Table 2** and are shown in **Appendix C**.

The Hollydale Project would be visible to residents in the project area. Depending upon the route, the Hollydale Project may also be visible to those travelling through the project area along Interstate 494, Minnesota Highway 55, Hennepin County Roads 24, 115 and 101. Proposed transmission structures would be incrementally larger than the existing shorter wood transmission and distribution structures in the area.

The installation of the transmission line would require tree clearing within an approximately 70 to 75-foot right-of-way. In some areas, particularly where the line is no longer energized, taller vegetation that has been allowed to encroach upon the existing 69 kV right-of-way would be removed, resulting in the perception of an expanded right-of-way, even if the legal dimensions of the right-of-way are the same.

[135] *CN Application*, p. 135
[136] Xcel Energy, Personal Correspondence, January 11, 2013.

In addition to the transmission line, Applicants propose to expand the fenced area of the Medina Substation to the northwest by approximately 0.04 to 0.25 acres and expand the fenced area of the Hollydale Substation to the northwest by approximately 0.1 acres. Applicants would also construct a new Pomerleau Lake Substation with a fenced area of approximately 4.5 acres at the outset and a build out area of approximately nine acres.

Most substation equipment ranges in height from approximately eight feet to 25 feet. Some termination structures can be up to 60 to 70 feet tall, and lightning poles may be up to 100 feet in height.[137] All substations involved in this proposal are designed to include appropriate and sufficient lighting within the substation area in the event of an emergency during low light or night time conditions. During normal operation all of the substation lights will be left off and the substation will be dark, unless required by local units of government for other purposes such as security. During emergencies lights would be needed to facilitate the safety of personnel if work occurs in low light or after sunset; routine maintenance work is typically scheduled during daytime hours. Transmission structures are not lit.[138]

No-Build Alternative

Under the no-build alternative, there would be no changes to the existing environment.

HVTL System Alternative

Structure types and rights of way widths for the HVTL System Alternative are assumed to be the same as those proposed for the Hollydale Project. Proposed transmission structures would be incrementally larger than the existing shorter wood transmission and distribution structures in the area. The installation of the transmission line would require tree clearing within an approximately 70 to 75-foot right-of-way. As with the Hollydale Project, taller vegetation that has been allowed to encroach upon the existing 69 kV right-of-way would be removed, resulting in the perception of an expanded right-of-way, even if the legal dimensions of the right-of-way are the same.

Under the HVTL System Alternative, changes at the Medina, Hollydale, and new Pomerleau Lake substations would be the same as for the Hollydale Project. Although detailed project design has not been prepared for this alternative, Applicants anticipate that some existing equipment would need to be moved and the fenced area of Xcel Energy's Gleason Lake Substation would be expanded by approximately 0.2 acres towards the Luce Line Trail to accommodate the interconnection.[139] Structure heights and substation lighting would generally be the same as for the Hollydale Project, although, depending upon route and more detailed design, significantly taller structures, perhaps 160 feet or greater, may be needed at the Gleason Lake Substation to bring in the new line over existing transmission facilities.[140]

[137] *Applicants Response to WPNA IR 9*, Response 2
[138] Xcel Energy, GRE, personal communication, January 29, 2013
[139] Xcel Energy, personal communication, January 23, 2013
[140] *Michlig Direct Testimony*, p. 7

Distribution Alternative

The distribution alternative would locate distribution facilities along existing public rights-of-way where possible. Under the franchise agreement with the city of Plymouth, in most instances Xcel Energy installs distribution facilities underground. Typical overhead distribution structures used by Xcel Energy in the project area are approximately 38 feet tall.

Unlike transmission lines, distribution lines typically do not have easements, as they are generally constructed within public rights-of-way. Utilities ask that homeowners keep a cleared area of 10 feet in front of doors to ground level transformers and three feet from the side and back of the box.[141] For overhead distribution lines, trees growing in the area of the lines are trimmed periodically to maintain safety and reliability. Tree trimming guidelines vary from tree to tree depending upon tree type and growth rates, maintenance schedules, line voltage and other factors; in some cases trees may have a clearance of less than five feet from the lines, in other cases clearances may be closer to 20 feet.[142]

Under the Distribution Alternative, changes at the Medina, Hollydale, and new Pomerleau Lake substations would be the same as for the Hollydale Project. Structure heights and substation lighting would be the same as for the Hollydale Project.

69 kV Rebuild Alternative

The rebuild alternative would replace the 60 to 90 foot wood single pole and H-frame structures currently used in the existing 69 kV transmission line BD with steel single pole structures with heights of 55 to 65 feet. Right-of-way is anticipated to be approximately 50 feet, and is anticipated to be in the same alignment as the existing line; new right-of-way would be needed to connect the new line to the Pomerleau Lake Substation.

Under the HVTL System Alternative, changes at the Medina, Hollydale, and new Pomerleau Lake substations would be the same as for the Hollydale Project. Structure heights and substation lighting would be the same as for the Hollydale Project.

4.12 Water Resources

Potential impacts to both groundwater and surface water resources from transmission projects are generally related to the construction phase.

The project area lies within the Metro Province that is generally described as containing sand aquifers in thick sandy and clayey glacial drifts that are generally over 100 feet in depth overlying Precambrian sandstone and Cretaceous bedrock. The sedimentary bedrock underlaying this province provides good aquifer properties.[143]

[141] Xcel Energy, *Tree Planting Zones*, http://www.xcelenergy.com/Safety_&_Education/Outdoor_Safety/Vegetation_Management/Tree_Planting_Zones
[142] Xcel Energy, personal communication, January 11, 2013
[143] DNR. 2013. *Groundwater Provinces*. http://www.dnr.state.mn.us/groundwater/provinces/index.html

4.12.1 Ground Water

Potential groundwater impacts from overhead transmission lines are typically associated with the construction phase of the project and may result from structure placement or sedimentation release into shallow aquifers from equipment vibration.

Hollydale Project

It is not anticipated that transmission structures will require excavation of more than approximately 30 feet. As such, the placement of the transmission structures would not have an impact on the groundwater supply or domestic wells in the area of the project. Applicants would not install any wells as part of the Hollydale Project.

No-Build Alternative

Under the No-build Alterative, no project would be constructed and there would be no impact to ground water.

HVTL System Alternative

No impact to groundwater is anticipated from the HVTL system alternative.

Distribution Alternative

No impact to groundwater is anticipated from either distribution alternative.

69 kV Rebuild Alternative

No impact to groundwater is anticipated from the 69 kV rebuild alternative.

4.12.2 Surface Waters

During construction of electric transmission and distribution projects, there is the potential for sediment to reach surface waters due to ground disturbances vegetation clearing, excavation, grading, and construction traffic. Potential impacts to surface waters during operation could result from runoff from the substation site to surface waters.

Hollydale Project

The DNR Public Waters Inventory (PWI) identifies wetlands, basins and watercourses over which DNR has regulatory jurisdiction. Applicants identified 44 PWI basins and 12 PWI watercourses within a 3-mile Project Assessment Area. Crossings of pubic waters require a license from DNR. Depending upon the route, the Hollydale Project may require crossing of one or more public waters. Depending upon the location and nature of the crossing, existing licenses may be applicable or new utility crossing licenses may be required prior to construction. Applicants do not anticipate that construction would alter the course, current, or cross section below the ordinary high water level of a watercourse or public water.

Applicants do not anticipate grading around the pole sites. Expansion areas for the Medina and Hollydale substations are located on previously cleared and graveled area, limited, if any grading at those locations is anticipated. Grading would be required at the site of the Pomerleau Lake Substation.

Because the Hollydale Project will disturb more than one acre of soil, it is anticipated that the project would require a NPDES permit and preparation of a Stormwater Pollution Prevention Plan (SWPP) from the MPCA.

Applicants state that they will employ erosion control measures, such as silt fencing and stabilization of disturbed soils, identified in the MPC Stormwte rBest Management Practices Manual. Applicants further state that they will attempt to span waterways and wetlands and maximize span lengths to the extent practicable.[144]

HVTL permits issued by the Commission typically require that structures be located to span watercourses, wetlands and floodplains to the extent practicable. Upon completion of construction in a specific area route permit conditions require that contours be graded so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate re-vegetation, provide for proper drainage, and prevent erosion. All areas disturbed during construction of the facilities must be returned to their pre-construction condition.

The HVTL permit also requires permittees to adhere to the terms and conditions of the NPDES permit and SWPP prepared for the Project in cases where one is prepared. All construction projects disturbing one acre or more are required to apply for a construction stormwater permit through the MPCA.

HVTL permits require permittees to follow standard erosion control measures outlined in MPCA guidance and employ erosion BMPs, regardless of whether a NPDES permit is required.

In addition to erosion control measures, fueling and lubricating far construction equipment away from waterways would ensure that fuel and lubricants do not enter waterways.

No-Build Alternative

Under the no-build alternative, there would be no impacts to surface water.

HVTL System Alternative

Potential impacts and mitigation measures would be similar for the HVTL system alternative as for the Hollydale Project but actual impacts and mitigation would be dependent upon the location of the route.

Distribution Alternative

Potential impacts and mitigation measures would be similar for the HVTL system alternative as for the Hollydale Project, but actual impacts and mitigation would be dependent upon the location of the facilities.

69 kV Rebuild Alternative

Potential impacts and mitigation measures would be the same for the HVTL system alternative as for the Hollydale Project. It is anticipated that any water crossings would be located as they are currently with the 69 kV transmission line BD.

[144] *CN Application*, p. 149

4.12.3 Wetlands

Wetlands provide direct benefits to the environment and vary according to the type or class of wetland and the season. Wetlands serve as floodwater detentions, provide nutrient assimilation and sediment entrapment (water quality), and provide wildlife habitat. Wetlands are either protected federally under Section 404 of the Clean Water Act or by the State of Minnesota under the Wetland Conservation Act. The National Wetland Inventory (NWI) developed by the USFWS identifies wetlands based on imaging from aerial photography or digital aerial imagery. Although the NWI data has not been field verified, it provides a good start to identify potential wetland areas.

There are scattered wetlands and wetland complexes in the project area.[145]

Hollydale Project

During the construction phase of the Hollydale Project, there is the potential for temporary impacts to wetlands as a result of ground disturbance related to grading, construction traffic, substation construction, and placement of the transmission line structures. Although minimal grading of areas around pole locations is expected, it is anticipated that expansion of the Hollydale Substation and development of the Pomerleau Lake Substation will require some grading. Applicants have identified approximately 3.5 acres of shallow marsh wetlands at both preferred and alternate sites for the Pomerleau Lake Substation.[146]

Permanent impacts to wetlands would occur where structures are located within wetland boundaries.

The Hollydale Project may require wetland and water resource approvals from the U.S. Army Corps of Engineers (USACE), MnDNR, and Hennepin County. Wetlands crossed by the Hollydale Project may be jurisdictional to the USACE under Section 404 of the Clean Water Act. Once a route is finalized and permitting requirement are determined, Applicants will submit the Minnesota Local/State/Federal Application Form for Water/Wetland Projects to the USACE's St. Paul District, MnDNR and, if needed, the Hennepin County Soil and Water Conservation District. As part of the permitting process, Xcel Energy will be required to submit sufficient materials for the USACE to make its jurisdictional determination for impacted wetlands. The joint application will also be subject to MnDNR, and Hennepin County Soil and Water Conservation District, review and regulation under the Minnesota Wetland Conservation Act. A license from the MnDNR is required to cross public water wetlands.

Under the Clean Water Act, Section 401 water quality certification is required for activities that may result in a discharge to waters of the United State. MPCA administers Section 401 water quality certification on non-tribal lands in Minnesota. If the USACE authorizes the Hollydale Project under its General Permit/Letter of Permission permitting program, the MPCA waives its Section 401 Water Quality Certification authority.

If the route selected for the Hollydale Project passes over and across wetlands designated as state public waters, the Hollydale Project would require a License for Utility to Cross Protected Waters from the DNR Division of Waters. The DNR license would outline mitigation measures.

[145] *Route Permit Application*, Figure B-15
[146] *Route Permit Application*, p. 107

Following route determination permittees typically perform a wetland delineation along the permitted route to determine wetland locations and minimize impacts. The MPCA Stormwater BMP Manual identifies standard erosion control practices used during construction to minimize impacts on adjacent water resources. Practices may include containing excavated material, protecting exposed soil, and stabilizing restored soil.

Applicants propose the following mitigation measures:

- Spanning wetlands to the greatest extent possible;
- Assembling structures on upland areas before they are brought to the site for installation;
- Avoid crossing wetlands with construction equipment to the extent possible;
- Construction during frozen ground conditions in wetlands to the extent possible;
- Construction crews will attempt to access the wetland with the least amount of physical impact to the wetland (i.e., shortest route) and will access poles near or in wetlands from roadways whenever possible to minimize travel through wetland areas;
- When construction during winter is not possible, construction mats (wooden mats or a composite mat system) would be used to protect wetland vegetation; and
- Use of standard erosion control measures identified in the MPCA Stormwater BMP Manual, such as silt fencing to minimize impacts on adjacent water resources.[147]

Additional mitigation measures could include:

- No staging or stringing set up areas will be placed within or adjacent to wetlands or water resources, as practicable.
- Restoration of wetland vegetation as soon as possible following construction.

No-Build Alternative

Under the no-build alternative, there would be no construction impact to wetlands. The Hollydale Project would be maintained as it is currently. The existing 69 kV transmission line crosses approximately 11,200 feet of wetland.[148] Maintenance of that line would continue as it is currently, no additional impacts would occur from maintenance of the facility.

HVTL System Alternative

Impacts from construction of the HVTL System Alternative would be similar to the Hollydale Project, but actual impacts and mitigation would be dependent upon the location of the route.

Distribution Alternative

Impacts from construction of distribution facilities would be similar to the Hollydale Project. Actual impacts and mitigation would be dependent upon the location of these facilities.

69 kV Rebuild

Impacts from a rebuild of the existing 69 kV transmission line would be similar to those from the Hollydale Project. Mitigation techniques would also be similar.

[147] *CN Application*, pp. 127 - 128
[148] *Route Permit Application*, p. 106

4.13 Waste Management and Disposal

The majority of waste management and disposal impacts from transmission and distribution projects occur during the construction of the project. Once the project has been constructed waste management and disposal are limited to periodic vegetation clearing of the right-of-way.

Hollydale Project

During right-of-way preparation, woody vegetation will be cleared from the right-of-way and either chipped and spread on the right-of-way, offered to the landowner for use as they would like, or removed from the project area for disposal off-site. In areas where the 115 kV transmission line replaces the existing 69 kV line BD, poles would be removed to an offsite disposal site, and portions would be reused as appropriate. During construction, construction waste (e.g. scrap wood, plastics, cardboard and wire) and personal litter from the crew (e.g. bottles, cans, food wrappings) would be generated. HVTL permits require daily removal of personal litter and removal of all waste and scrap that is a product of construction to be removed from the area and properly disposed of or recycled upon completion of each task.

During the ongoing maintenance of the Hollydale Project, cleared vegetation would be removed for disposal off-site, or offered to the landowner if desired.

No-Build Alternative

As there would be no construction with the no-build alternative, there would be no waste management from construction. Disposal of vegetation from substation and transmission line maintenance would continue as with the Hollydale Project.

HVTL System Alternative

Waste management during both construction and operation phases of the HVTL system alternative would be similar to that of the Hollydale Project.

Distribution Alternative

Waste management during both construction and operation phases of either distribution alternative would be similar to that of the Hollydale Project. Mitigation measures regarding waste disposal would be the same, but would not be part of an HVTL permit.

69 kV Rebuild Alternative

Waste management during both construction and operation phases of the 69 kV rebuild alternative would be similar to that of the Hollydale Project. Mitigation measures regarding waste disposal would be the same, but would not be part of an HVTL permit.

5 Availability and Feasibility of Alternatives

Having analyzed comparative impacts of alternatives, an Environmental Report is required to offer an assessment of the availability and feasibility of those alternatives (Minn. Rule 7849.1500 subp. 1F). This section describes the feasibility and availability of alternatives in the Hollydale 115 kV Transmission Line CN proceeding.

Hollydale Project

The Proposed Hollydale Project is available and feasible to construct. Construction of the Hollydale Project cannot proceed without approval from the Commission.

No-Build Alternative

The No-Build Alternative is available, but as it does not address the stated need for the Hollydale Project it is not feasible.

HVTL System Alternative

A HVTL System Alternative is available and is feasible to construct. Construction of an HVTL system alternative would require approval from local units of government or from the Commission.

Distribution Alternative

A distribution alternative to the Hollydale Project is available and is feasible to construct. Construction of either distribution alternative would require approval from local units of government.

69 kV Rebuild Alternative

A 69 kV rebuild alternative to the Hollydale Project is available and is feasible to construct. Construction of a rebuild of the existing 69 kV line BD would require approval from local units of government.

Demand Side Management

As discussed in Section 3.2, achieving an additional 50 MW of electric demand savings, within the project area is not a feasible alternative.

Purchased Power

As discussed in Section 3.3, although purchase of 50 MW of power is available and technically feasible, it would not meet the stated need for the Hollydale Project and would require construction of transmission facilities to deliver the power to the project area.

Generation Alternatives

As discussed in Section 3.4, approximately 200 MW of microturbines would be needed within the project area to meet the stated need of the Hollydale Project. Because microturbines are not widely commercially available, installation of this size is neither feasible nor available. The use of 110 to 200 MW of small reciprocating engines, while technically feasible is not considered to be available due to the emissions levels that would come with this alternative.

With respect to dispersed solar facilities, installation of nearly 11,000 small photovoltaic installations (4.6 kW) within the project area, or approximately 10 times the number of installations statewide, is not considered to be a feasible alternative. Likewise, installation of approximately 167 MW of wind energy within the project area is not considered to be a feasible alternative due to land use conflicts in an urban area.

6 Permits

The Hollydale Project would require permits and approvals from entities other than the Minnesota Public Utilities Commission. Federal, state, and local permits or approvals that have been identified for construction and operation of the proposed Hollydale Project are listed below in **Table 27**.[149]

Table 27. Potential Permits and Approvals

Agency	Type	Description
Federal Approvals		
United States Army Corps of Engineers (USACE)	Review and Approval of Wetland Delineations	Required to determine extent of USACE jurisdiction, quantify impacts or document avoidance.
United States Army Corps of Engineers (USACE)	Section 404 Jurisdictional Determination/Permit	Project may be eligible for a Letter of No Jurisdiction if wetlands are avoided or impacts are limited to isolated wetlands.
United States Army Corps of Engineers (USACE)	Federal Clean Water Act, Section 404 Permit(s)	Project may require a USACE Regional General Permit or an Individual permit depending upon amount and type of wetland impact proposed. Permit from USACE required if wetlands are jurisdictional and not avoidable.
State Approvals		
Minnesota Public Utility Commission	HVTL Route Permit	For facilities with greater than 100 kV; required for Hollydale Project
	Certificate of Need	Needed for a large energy project in Minnesota. Commission determines basic types of facility to be constructed, size of facility, and the time of the facility
MPCA	Section 401 Certification	Compliance with state water quality standards.
	NPDES Construction Stormwater Permit	For stormwater discharges from construction activities
DNR	License to Cross Public Land and Water	For projects that affect the course, current, or cross-section of DNR Public Waters, or for utility crossings of Public Lands
	Public Waters Work Permit	Required for construction activities that impact waterways, including wetlands, identified on DNR public waters inventory maps
MnDOT	Utility Permit on Trunk Highway Right of Way	Required to install utilities within state owned right of way.
Local		
Hennepin County	County Road Access Permit/Right-of-way Permit	Required for construction activities that impact county highways.
	Minnesota Wetland Conservation Act Certification and Approval	Onsite review of Wetlands delineation in compliance with Wetland Conservation Act. Approval may range from an exemption for small or temporary impacts to a permit and mitigation for greater impacts.
Elm Creek Watershed Commission	Minnesota Wetland Conservation Act Certification and Approval	Onsite review of Wetlands delineation in compliance with Wetland Conservation Act. Approval may range from an exemption for small or temporary impacts to a permit and mitigation for greater impacts.

[149] Adapted from Route Permit Application, Table 25

Appendix A: Environmental Report Scoping Decision

In the Matter of the Certificate of Need Application for the Hollydale 115 kV Transmission Line Project in the Cities of Plymouth and Medina, Hennepin County, Minnesota

Environmental Report
Scoping Decision
PUC Docket No. E002, ET2/TL-12-113

The above matter has come before the deputy commissioner of the Department of Commerce for a decision on the scope of the environmental report (ER) to be prepared for the Certificate of Need (CN) application for the Hollydale 115 kV transmission line project proposed by Xcel Energy and Great River Energy (collectively, the Applicants).

BACKGROUND

On June 30, 2011, the Applicants submitted a high voltage transmission line (HVTL) Route Permit application to the Public Utilities Commission (Commission) for the proposed Hollydale Transmission Project. Because the proposed transmission line is between 100 and 200 kilovolts, it is eligible for review under the alternative permitting process outlined in Minnesota Rules 7850.2800 to 7850.3900. The Commission accepted the HVTL Route Permit Application as complete on August 25, 2011, and authorized the Department's Energy Facility Permitting (EFP) staff to process the application under the alternative permitting process.

On February 27, 2012, the Applicants, in response to a motion filed by certain landowners within the proposed project area, filed a petition requesting that the Commission convert the route permit proceeding from the alternative permitting process to the full permitting process. In its order dated May 4, 2012, the Commission granted the Applicants' request and authorized review under the full permitting process, pursuant to Minnesota Rules 7850.1700 to 7850.2700. On July 31, 2012, the Department issued a scoping decision identifying the issues and routes to be evaluated in an Environmental Impact Statement (EIS) to be prepared for the routing process.

At the time of the route permit application acceptance, the project did not meet the size and length thresholds definition of a *large energy facility* as described in Minnesota Statutes Section 216B.2421, subd. 2(2) and (3), and did not require the issuance of a CN by the Commission.

However, several of the route alternatives in the EIS scoping decision are, or have the potential to be, greater than 10 miles in length. If the route chosen by the Commission is longer than 10 miles, the Applicants must obtain a CN from the Commission. For a line of such length, the Commission must determine the need for the project prior to issuing a route permit.

The Applicants applied for a CN on July 2, 2012.

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PROJECT DESCRIPTION

The stated purpose of the Hollydale Project is to meet the electrical needs of the Plymouth and Medina area. The Applicants have stated that demand for power in the Plymouth and Medina area has increased beyond the capability of the current electrical distribution system due to population and commercial growth, particularly in the areas along Minnesota Highway 55 (specifically the Plymouth City Center), Interstate 494, and Interstate 394. The Applicants contend that additional electrical infrastructure is required to address electrical distribution concerns, provide additional distribution capacity, and avoid overload conditions in the Plymouth and Medina area. The Applicants further contend that the project will meet the immediate distribution system needs and provide support for future demand growth in the area until at least 2030.

In order to address the described need, Applicants propose to build a 115 kV transmission line of approximately 8.8 miles, modify two substations, and construct a new 115 kV substation in Plymouth. The Project proposed by the Applicants consists of the following components:

- Remove and replace approximately eight miles of an existing GRE-owned 69 kV overhead transmission line,
- Construct a new Pomerleau Lake 115 kV substation in Plymouth,
- Construct approximately eight-tenths of a mile of new 115 kV overhead transmission line,
- Modify the existing Medina substation, and
- Expand and modify the existing Hollydale substation.

Potential routes that the transmission lines would follow, if approved, were identified in the EIS Scoping Decision issued by the Department on July 31, 2012. Potential routes under review in the EIS would be between eight and 10.3 miles long. If the Commission determines a need for the project, the Commission will then select a route for the project.

CERTIFICATE OF NEED

Before any large energy facility, in this case HVTL, can be constructed in Minnesota, the Commission must determine that they are necessary and in the best interest of the state. The certificate of need process includes environmental review and public hearings, and typically takes 12 months. This process is the only proceeding in which a no-build alternative and the size, type, timing, system configuration and voltage of the proposed project will be considered.

A copy of the certificate of need application, along with other relevant documents, can be reviewed at the Energy Facility Permitting web page at: http://mn.gov/commerce/energyfacilities/Docket.html?Id=32919, or the Commission's eDockets website at: https://www.edockets.state.mn.us/EFiling/search.jsp (enter the year “12” and the number “113”).

The Department's EFP staff is responsible for administering the environmental review process. The Commission is responsible for determining if the proposed transmission line is needed.

Environmental Review
The environmental review process under the certificate of need procedures, outlined in Minnesota Rules, part 7849.1000 to 7849.1500, includes public information/scoping meetings and the preparation of an environmental review document, the Environmental Report (ER). The ER is a written document that describes the human and environmental impacts of the proposed project, alternatives to the project and methods to mitigate anticipated adverse impacts. The content of the ER for a HVTL is prescribed in Minnesota Rules 7849.1500, subparts 1 and 3. The ER must be prepared before the public hearing and before the Commission can make a decision on the CN application.

HVTL ROUTE PERMITTING

Minnesota Statutes Section 216E.03, subd. 2, provides that no person may construct a HVTL without a route permit from the Commission. An HVTL is defined as a transmission line of 100 kV or more and greater than 1,500 feet in length in Minnesota Statutes Section 216E.01, subd. 4. The proposed transmission line is an HVTL and, therefore, a route permit is required prior to construction.

Xcel Energy and Great River Energy's application for a HVTL Route Permit is being reviewed by the Commission under Docket E002/TL-11-152.

A copy of the HVTL route permit application, the EIS scoping decision identifying routes being evaluated for the HVTL, and other relevant documents, can be reviewed at the Energy Facility Permitting web page at: http://mn.gov/commerce/energyfacilities/Docket.html?Id=32121 or the Commission's eDockets website at: https://www.edockets.state.mn.us/EFiling/search.jsp (enter the year "11" and the number "152").

The Department's EFP staff is responsible for evaluating the HVTL route permit application and administering the environmental review process. EFP staff currently anticipates that a Draft EIS will be released in early 2013. The Commission is responsible for selecting the transmission lines route and issuing the HVTL route permit.

SCOPING PROCESS

On October 10, 2012, EFP sent notice of the place, date, and times of the Public Information and Scoping meeting to those persons on the General List maintained by the Commission, the agency technical representatives list, and the project contact lists. Notice of the public meeting was also published in local newspapers.

Public Scoping Meetings
EFP staff held public information and scoping meetings on October 25 and 26, 2012, at the Plymouth Creek Center in Plymouth, Minnesota. The meeting provided members of the public an opportunity to learn about the proposed project and the state's certificate of need process, review the Applicants' CN application, ask questions, provide comments, and identify potential impacts and alternatives to the Project to be considered for the scope of the Environmental Report. The total attendance for both meetings was approximately 230 people.

A court reporter was present at the public meeting and transcribed questions asked and comments made by the public, as well as responses from EFP and Commission staff and the Applicants. In total, 33 people provided oral comments and/or asked questions about the proposed project. Topics and issues raised by the public at the meeting included: health and safety (primarily as related to electric and magnetic fields), impact to property values, accuracy of the data in the CN and Route Permit applications, inadequacy of the meeting notice, and history of the existing 69 kV transmission line. Project Alternatives A2 and H2 were brought up by several citizens as alternatives to the Project that should be evaluated in the ER. Several commenters also identified routing preferences.

Public Comments

A public comment period, ending on November 16, 2012, provided the public an opportunity to submit comments to EFP staff via e-mail, fax, U.S. mail or online on issues and project alternatives for consideration for the scope of the ER. EFP staff received 100 written comments by the close of the comment period and an additional three comments after the close of the scoping period.

The scoping meeting comment report and all written comments are available for viewing and downloading on the project website maintained by the Department at: http://mn.gov/commerce/energyfacilities/Docket.html?Id=32919 or on the eDockets website at: https://www.edockets.state.mn.us/EFiling/search.jsp (enter the year "12" and the number "113").

Written and oral comments requested that the following items be evaluated in the ER:

Project Alternatives

- Alternative A2, described in the CN application as installing a new 115/13.8 kV substation in the vicinity of the proposed Pomerleau Lake Substation and adding two 13.8 kV distribution lines to feed the system
- Alternative H2, described in the CN application as installing a new substation in the vicinity of the proposed Pomerleau Lake Substation and constructing approximately 8.5 miles of 115 kV transmission line connecting the new substation to the Hollydale Substation and then to the Gleason Lake Substation.
- Demand Management
- Distributed Generation, generators located at big box stores, solar and wind
- No-build alternative, specifically maintaining the existing 69 kV line as non-operational east of Hollydale, and with emergency backup only between Medina & Hollydale
- A 345 kV alternative
- Converting existing 13.8 kV distribution to 34.5 kV distribution
- A 69 kV alternative
- Construction of the proposed Project underground
- Installation of additional 34.5 kV distribution lines beyond the two 34.5 kV lines currently feeding the area

Impacts

- Health and Safety, in particular electromagnetic fields (EMF)
- Property Values
- Development
- Agricultural land
- Water resources
- Flora and fauna
- Sensitive natural resources
- Aesthetics
- Costs and Incentives for the Project, including cost allocation of the Project and alternatives
- Noise
- Impacts reflecting the actual number of homes in each alternative
- Loss of tax revenue

In addition to the alternatives and impacts discussed above, comments also addressed:

- Need for the Project
- Routing preferences.
- Concern over the precedent of using an existing 69 kV transmission line route to establish a new 115 kV line
- Concerns that the number of homes be counted accurately to reflect the number of multi-unit buildings
- Concerns that forecasts used to document need for the Project are not accurate.
- Frustration that postcards notifying residents of the meeting arrived either on or after the meeting dates.

Having reviewed the matter, consulted with EFP staff, and in accordance with Minnesota Rule 7849.1400, I hereby make the following scoping decision:

Matters to be Addressed

The issues outlined below will be identified and described in the ER for the proposed Hollydale 115 kV project. The ER will describe the project and current setting of the proposed project area. It will also provide information on the potential impacts the proposed project could have as they relate to the topics outlined in this scoping decision document, including possible mitigation for identified impacts, identification of irretrievable commitment of resources and permits from other government entities that may be required.

1.0 INTRODUCTION

1.1 Purpose and Need
1.2 Regulatory requirements

2.0 PROJECT DESCRIPTION

2.1 General
2.2 Design
2.3 Right-of-Way Requirements and Acquisition
2.4 Construction
2.5 Operation and Maintenance
2.6 Permits

3.0 ALTERNATIVES TO THE PROPOSED HVTL

3.1 No-build Alternative: This alternative would include no new construction; the existing 69 kV transmission line would continue to be operated as is currently
3.2 Demand Side Management
3.3 Purchased Power
3.4 Generation Alternatives
3.4.1 Fossil Fuel Technologies - Microturbines
3.4.2 Renewable Resource Technologies - Distributed solar and wind
3.5 Transmission System Alternatives
3.5.1 Alternative H2: As described in the CN Application, Alternative H2 would include construction of a new substation in the vicinity of the proposed Pomerleau Lake Substation and construction of approximately 8.5 miles of 115 kV transmission line connecting the new substation to the Hollydale Substation and then to the Gleason Lake Substation. This transmission alternative will be analyzed independent of routing.
3.6 Distribution System Alternatives
3.6.1 Alternative A2: As described in the CN Application, Alternative A2 would include construction of a new 115/13.8 kV substation, located similarly to the Pomerleau Lake Substation proposed in the Project, and construction of six new 13.8 kV distribution lines. Distribution alternatives will be analyzed independent of routing. The new substation would be fed from Great River Energy's existing 115 kV Parkers Lake – Plymouth transmission line. This alternative will be analyzed independent of routing.
3.7 Up-grading Existing Facilities
3.7.1 Re-build of existing 69 kV transmission line: The existing 69 kV transmission line is not operated east of the Hollydale Substation and is only maintained and used infrequently for emergency backup between the Medina and Hollydale substations. The ER will evaluate a re-build of the 69 kV transmission line between the Medina and Plymouth substations.
3.7.2 Expansion of 34.5 kV system: The ER will discuss expansion of the 34.5 kV distribution system in the Project area. Distribution alternatives will be analyzed independent of routing.

4.0 HUMAN AND ENVIRONMENTAL IMPACTS

4.1 Air Quality
4.2 Biological Resources (flora and fauna, sensitive natural resources)
4.3 Cultural Resources
4.4 Geology and Soils
4.5 Health and Safety (including EMF)
4.6 Land Use
4.7 Noise
4.8 Socioeconomics (including property values, development)
4.9 Transportation
4.10 Visual Impacts and Aesthetics
4.11 Water Resources (surface, groundwater, wetlands)
4.12 Waste Management and Disposal

5.0 REQUIRED PERMITS AND APPROVALS

Issues Outside the Scope of the Environmental Report

The scope of the Hollydale 115 kV ER will not consider:

a. A 345 kV alternative: As noted in the CN Application, a 345 kV alternative would be more efficient in terms of minimizing electrical losses, but appears to be far in excess of the stated need.
b. Undergrounding of transmission and distribution as a separate alternative to the Project.
c. Route or substation alternatives
d. Generation alternatives that cannot be sited locally
e. Any alternatives that do not meet the stated purpose of the Project
f. The impacts of specific energy sources, such as carbon outputs, from non-local generating facilities
g. The manner in which land owners are paid for transmission rights-of-way easements, as that is outside the jurisdiction of the Commission.
h. Contested issues or disputes of fact with respect to representations made in the CN application.
i. Cost allocation of the alternatives evaluated in the ER.

Schedule

The ER will be completed and available in February 2013. Following the release of the ER, a public hearing, presided over by an administrative law judge from the Office of Administrative Hearings, will be held in the vicinity of the project area to obtain public comment on the necessity of granting a certificate of need.

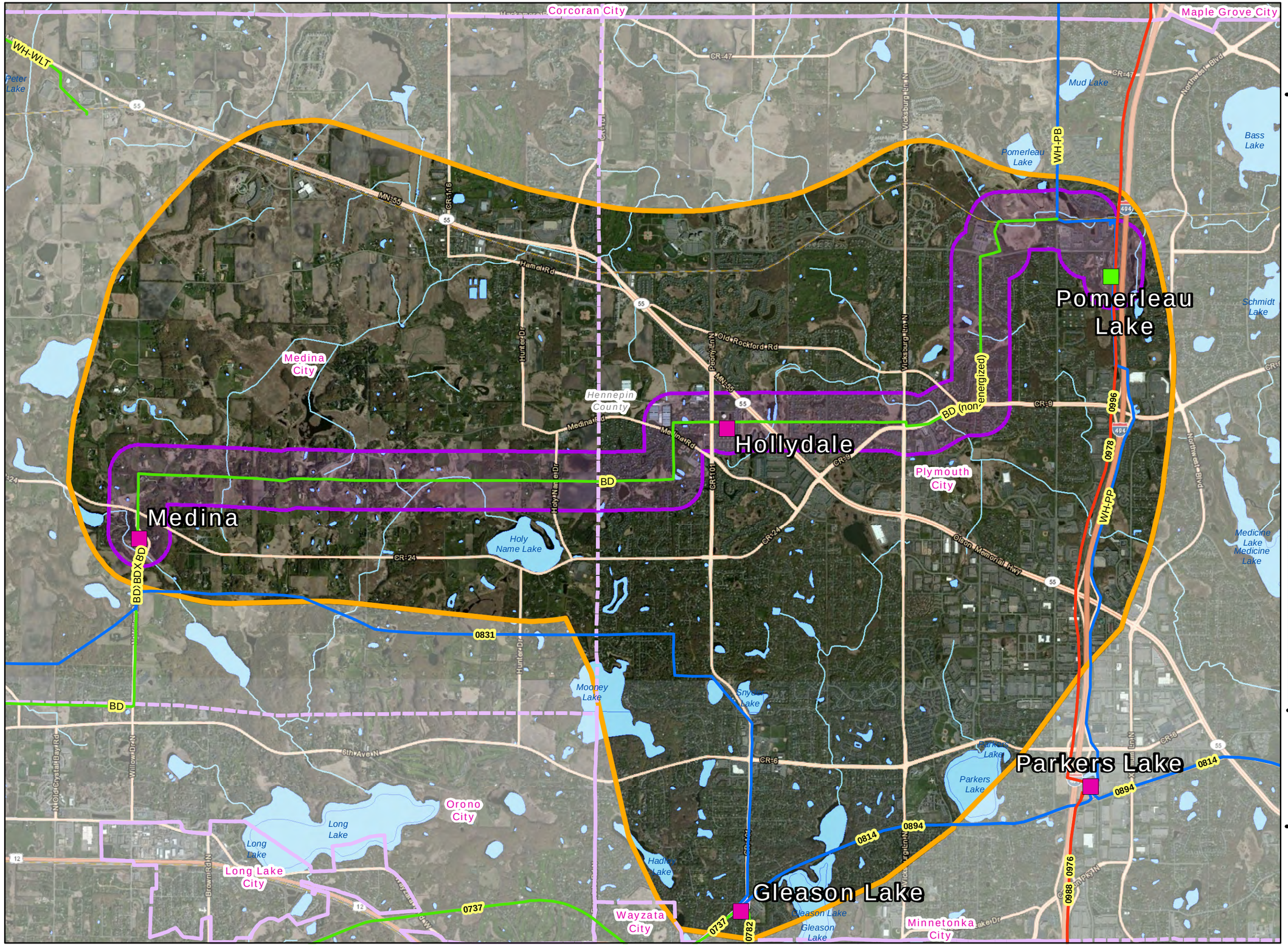
Signed this 3rd day of December, 2012

STATE OF MINNESOTA
DEPARTMENT OF COMMERCE
DIVISION OF ENERGY RESOURCES

William Grant, Deputy Commissioner

Appendix B: Maps

Environmental Report: Hollydale 115kV HVTL Project



Proposed Project Area

Applicant's Proposed Route

Existing Substation

Proposed Substation

Transmission Lines

69kV

115kV

345kV

Municipal Boundary

Map Extent

Map #1

Project Area Overview

0 1,000 2,000 4,000

Feet

Minnesota Department of Commerce

Environmental Report: Hollydale 115kV HVTL Project

Proposed Project Area

Applicant's Proposed Route

Existing Substation

Proposed Substation

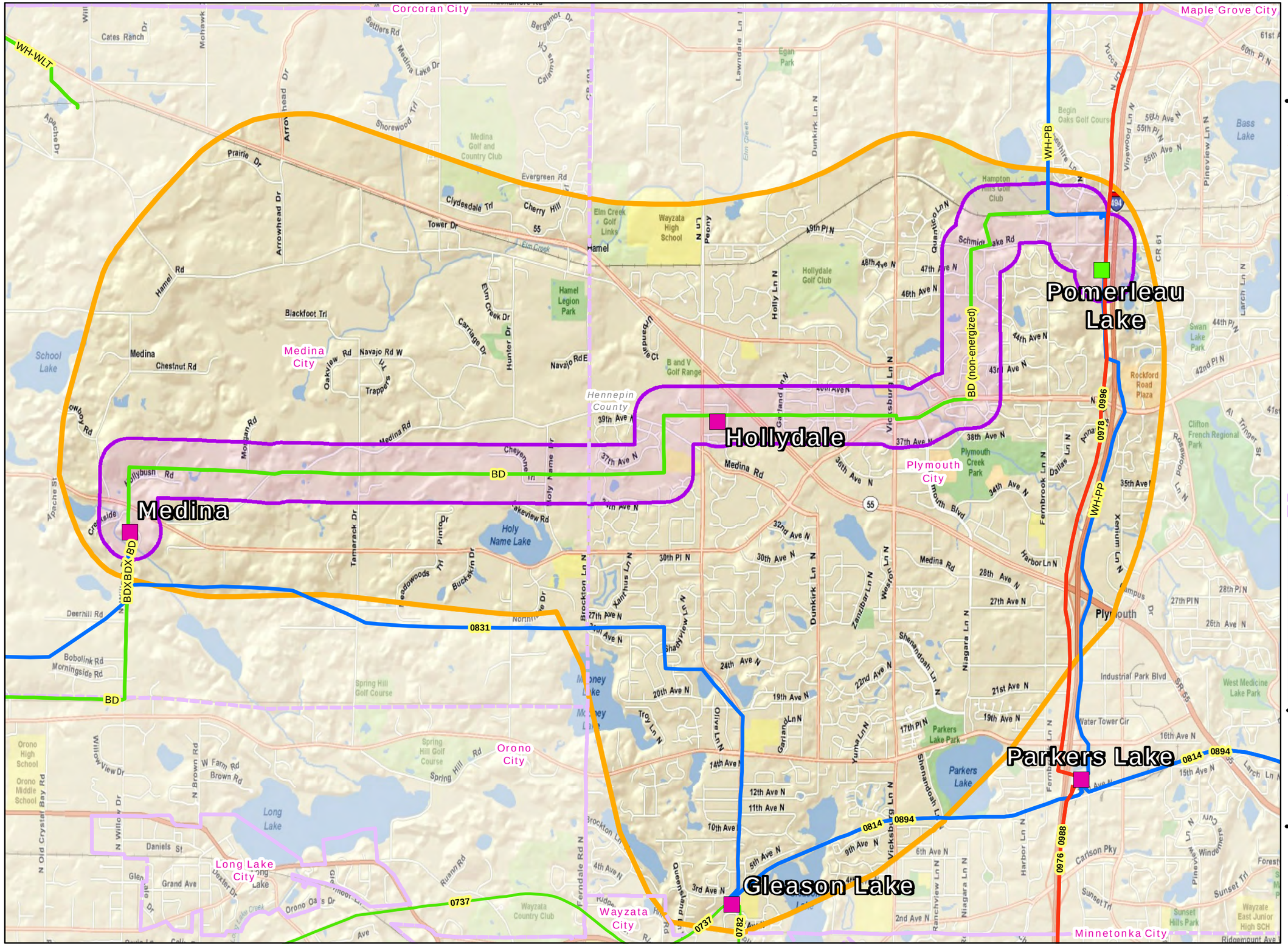
Transmission Lines

69kV

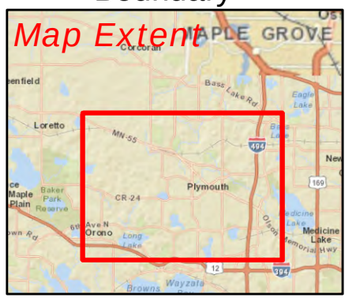
115kV

345kV

Municipal Boundary



Map Extent



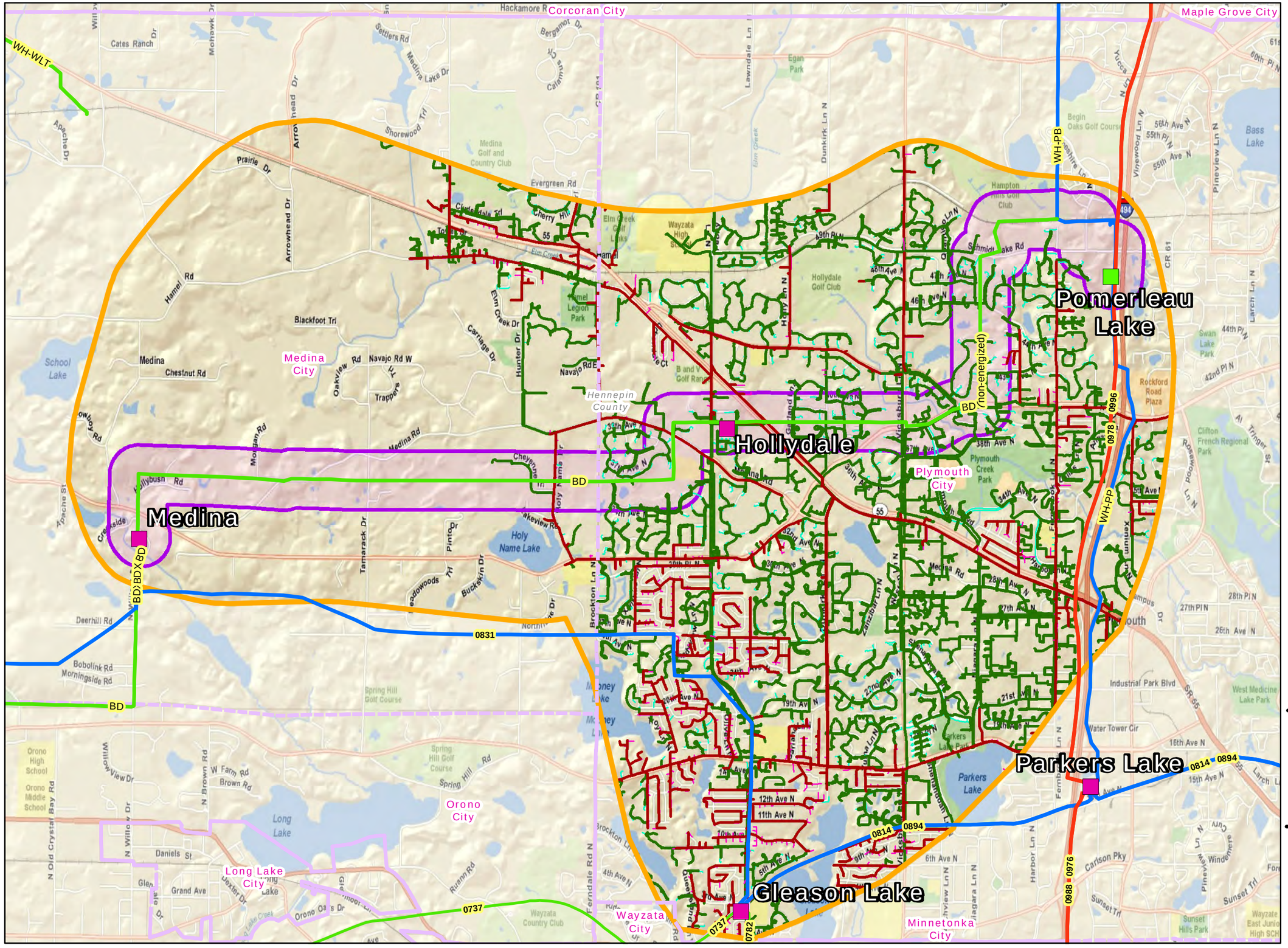
Map #2

Project Area

0 1,000 2,000 4,000

Feet

MINNESOTA DEPARTMENT OF COMMERCE



Environmental Report: Hollydale 115kV HVTL Project

Proposed Project Area

Applicant's Proposed Route

Distribution

	34.5kV	13.8kV
OH		
UG		

Existing Substation

Proposed Substation

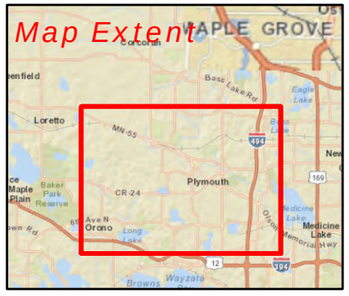
Transmission Lines

69kV

115kV

345kV

Municipal Boundary



Map #3

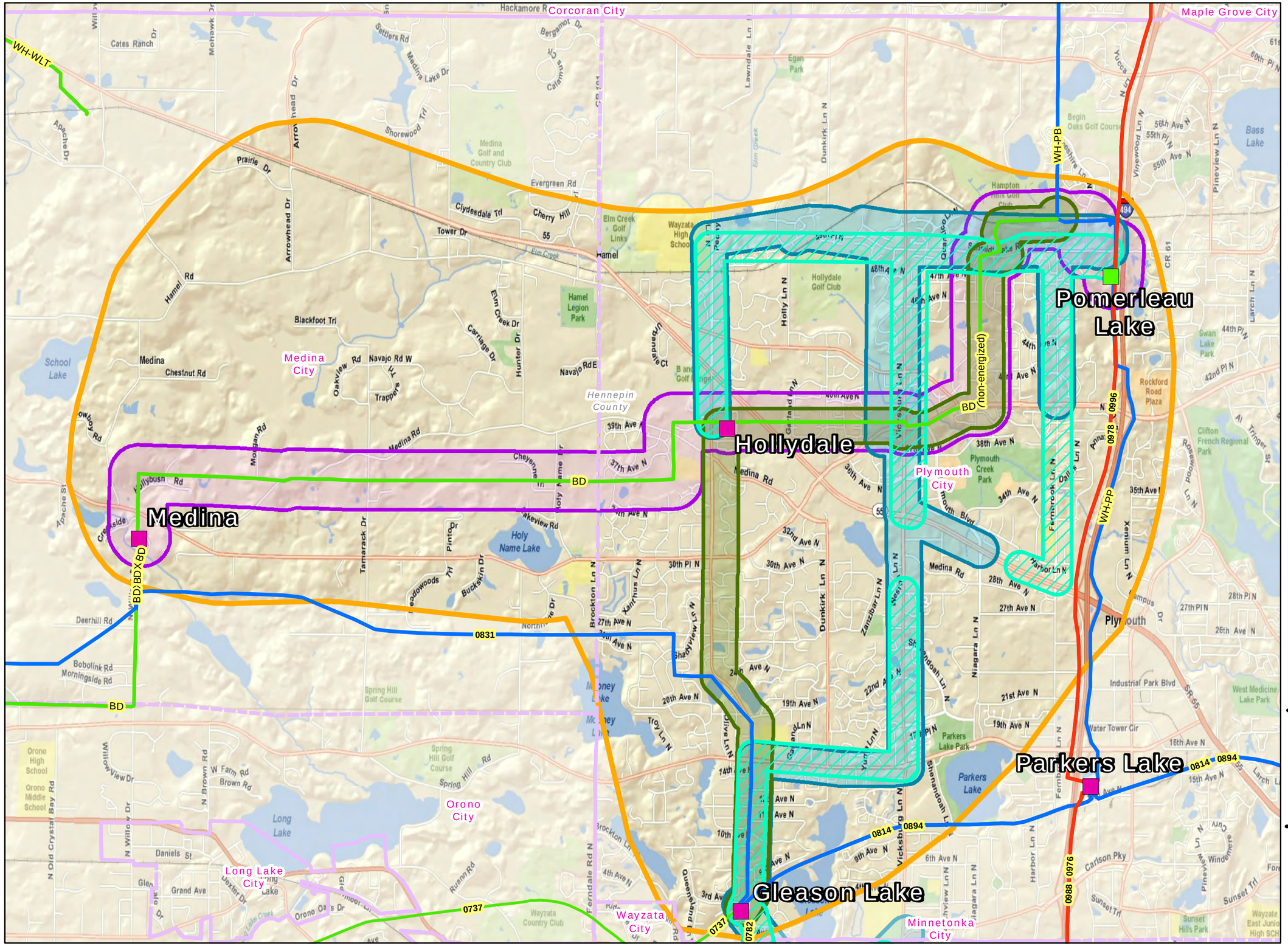
Xcel Energy Distribution System in Project Area

0 1,000 2,000 4,000

Feet

MINNESOTA DEPARTMENT OF COMMERCE

Environmental Report: Hollydale 115kV HVTL Project



Proposed Project Area

Applicant's Proposed Route and 69kV Rebuild

13.8kV Alternative

34.5kV Alternative

HVTL System Alt

Existing Substation

Proposed Substation

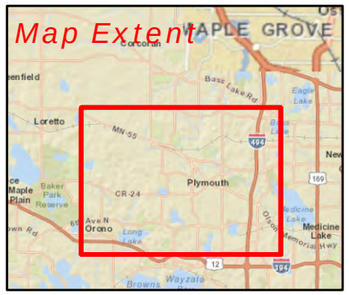
Transmission Lines

69kV

115kV

345kV

Municipal Boundary



Map #4

Proposed Project and Project Alternatives

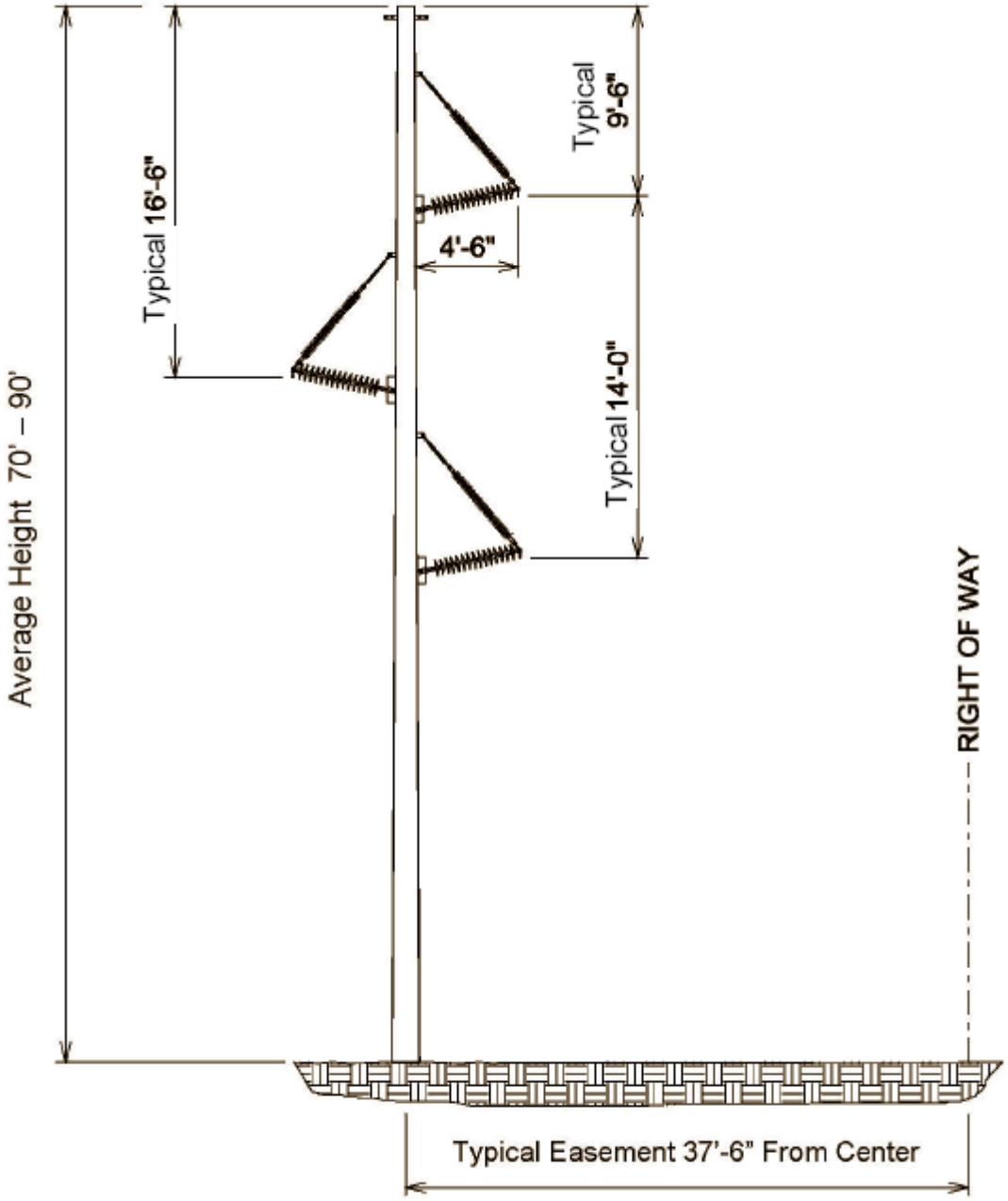
0 1,000 2,000 4,000

Feet

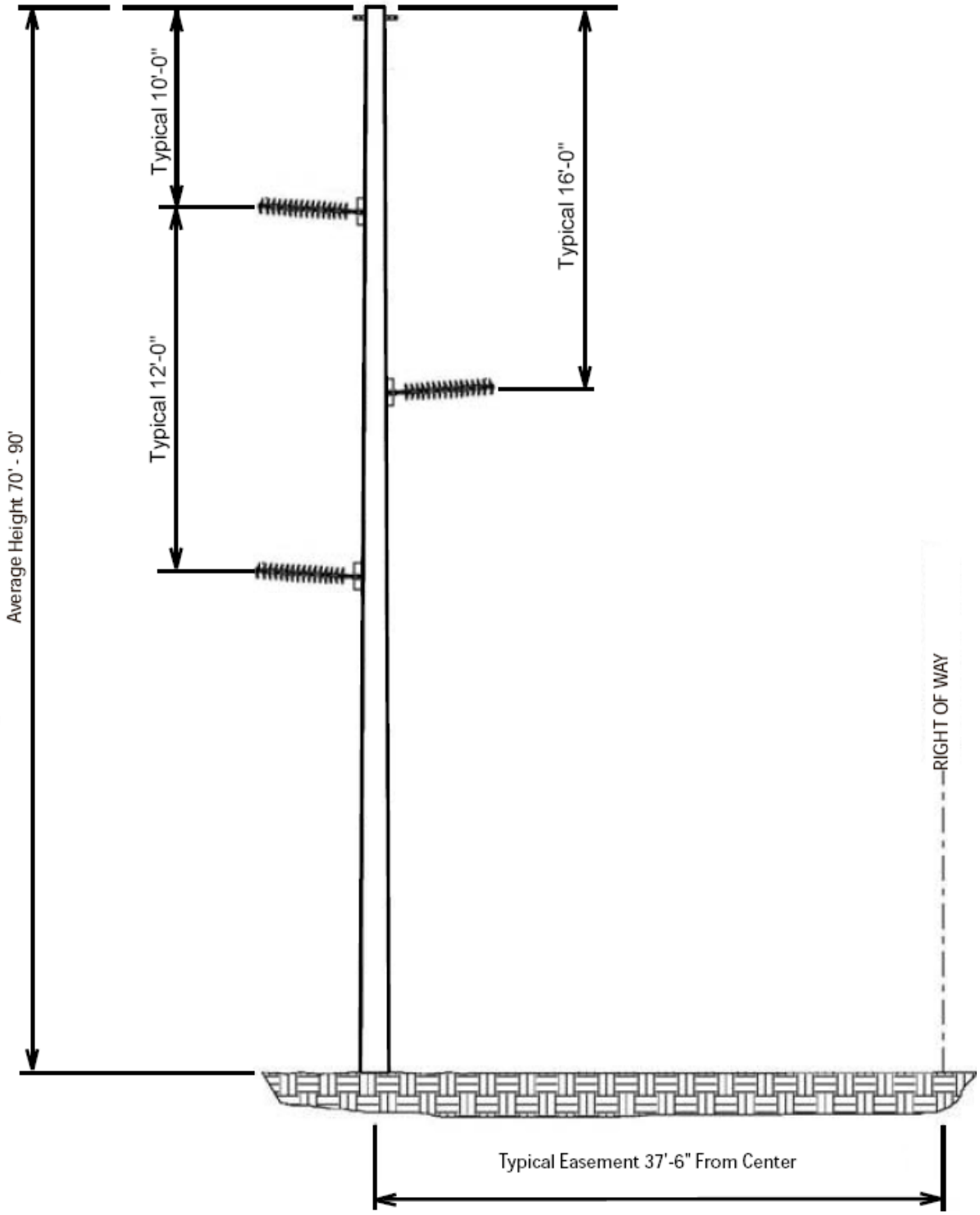
Minnesota Department of Commerce

Appendix C: Structure Illustrations

Typical Dimensions and Right-of-Way Requirements for Single Circuit 115 kV Braced Post Structures



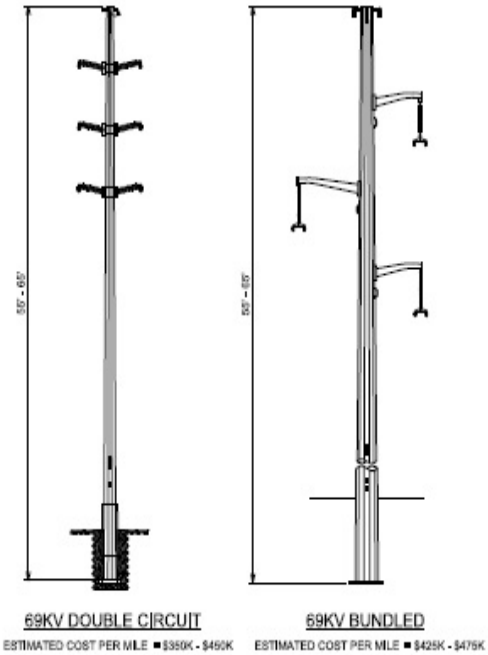
Typical Dimensions and Right-of-Way Requirements for Horizontal Post Structures

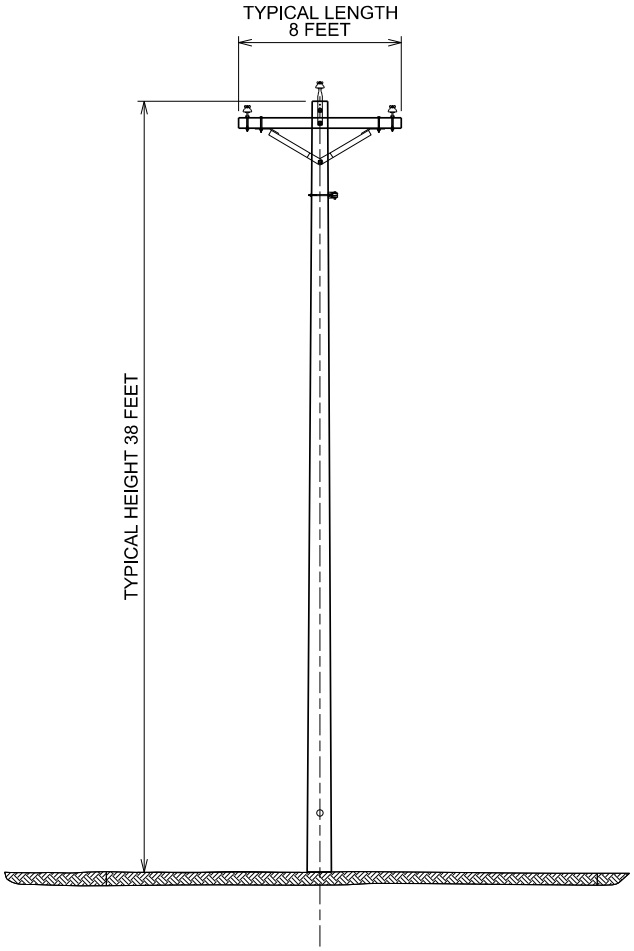


Typical 115/115 kV Double Circuit Davit Arm Structure

Typical 115 kV Single Circuit, Single Pole, Cross Arm Y-Frame Structure

69 kV Distribution Structures





THIS MAP/DOCUMENT IS A TOOL TO ASSIST EMPLOYEES IN THE PERFORMANCE OF THEIR JOBS.YOUR PERSONAL SAFETY IS PROVIDED FOR BY USING SAFETY PRACTICES, PROCEDURES AND EQUIPMENT AS DESCRIBED IN THE SAFETY TRAINING PROGRAMS, MANUALS AND SPARS.

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NSP OPERATING AREA
ENGINEERING
Minneapolis, MN

DISTRIBUTION LINE 13.8 TO 34.5 kV

TYPICAL STRUCTURE CONFIGURATION

3 PHASE TANGENT DISTRIBUTION POLE

Xcel Energy®

SCALE	NL-3 PHASE DISTRIBUTION	REV
NONE		NONE

GRP	SIGNIFICANT NUMBER
LOC ID GRP 1	
3	
4	
5A	
5B	
6	
CL	

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