Environmental Assessment

Proposed Xcel Energy 115 kV Transmission Tap Line to Serve the City of Chaska's West Creek Substation

Minnesota Public Utilities Commission
Docket No. E002/LR-12-73

City of Chaska
Carver County, Minnesota

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List of Acronyms Used in this Document

ACRONYMS	
BMPs	Best Management Practices
MnPUC	Minnesota Public Utilities Commission
dB dB(A)	Decibel Decibel, A-weighted
DNR	Minnesota Department of Natural Resources
EA	Environmental Assessment
EMF	Electromagnetic fields
EQB	Minnesota Environmental Quality Board
GRE	Great River Energy
kV	Kilovolt
kV/m	Kilovolts per meter
MPCA	Minnesota Pollution Control Agency
NAC	Noise Area Classification
NESC	National Electrical Safety Code
NPDES	National Pollutant Discharge Elimination System
ROW	Right-of-way
SFD	Swan Flight Diverter
SHPO	State Historic Preservation Office
SWPPP	Stormwater Pollution Prevention Plan
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

1.0 Introduction

1.1 Proposed Project and Project Need

Northern States Power Company, a Minnesota Corporation d/b/a Xcel Energy, Inc., (Xcel Energy) proposes to construct an approximately 0.5-mile long, single circuit, 115 kilovolt (kV) transmission tap line and associated facilities to serve as the electric transmission source for the City of Chaska's recently constructed West Creek Substation.

The City's West Creek Substation was planned and constructed to serve 50 megawatts (MW) of electric load, including 20 MW to serve the West Creek Corporate Center, and 30 MW to serve three additional distribution feeders for the electric needs on the west side of Chaska. In order to provide electric service from the City's substation, a new transmission tap line is required.

The proposed project includes construction of 115 kV structures, conductors, bus, and equipment up to the high side switch of the City of Chaska's Transformer #1 breaker. The high-side facilities will be configured in a single-bus in-and-out configuration and will be initially energized at 69 kV, but will be designed to be easily expandable to add in 115 kV breakers and additional 115 kV switches.

The proposed transmission tap line will be operated at 69 kV in the short term, but will be permitted, designed, and constructed to 115 kV standards to meet the long-term needs of the West Creek Substation and the area's electric service load. Operation of the transmission tap line will be converted from 69 kV to 115 kV likely by mid-2013.

1.2 Project Location

The Project site is located approximately 0.2 miles northeast of the intersection of Guernsey Avenue (County Road 11) and County Road 10 in the SE quarter of Section 36, T116N, R24W and the SW quarter of Section 31, T116N, R23W in the City of Chaska, Carver County, MN (see Figure 1).

The proposed transmission tap line route will extend from the west side of the City of Chaska's West Creek Substation and run approximately 80 feet south of, and parallel to, an existing Xcel Energy 230 kV transmission line for approximately 0.4 miles, then run south adjacent to Guernsey Avenue for approximately 0.1 mile. From that point, the tap line will cross County Road 11 and connect to a new switch structure on Great River Energy's transmission line on the west side of County Road 11 (see Figure 2.)

1.3 Construction Schedule

Xcel Energy anticipates Project construction to commence in the summer of 2012 with a projected in-service date of August 31, 2012. Project construction is expected to take approximately four weeks.

1.4 Project Cost

The approximate Project cost is $2,050,000.

2.0 Regulatory Framework

2.1 Permit Requirement

The proposed Project falls under the Minnesota Power Plant Siting Act, (Minn. Statue §216E and Minn. Rules Chapter 7850) for transmission projects over 100 kV and requires a permit from the Minnesota Public Utilities Commission (MnPUC). However, for eligible projects, a utility may seek approval from the local unit of government (LGU) that has jurisdiction over the site or route in lieu of applying to the MnPUC for a Route Permit. The proposed 115 kV transmission tap line project is eligible for local review.

Xcel Energy has elected to follow the local permit review process set forth in Minn. Stat. §216E.05; Minn. Rules 7850.5300 to permit the proposed transmission line and associated facilities. The City of Chaska (City) is the permitting authority in the area of the project. The City has agreed to act as the lead LGU with jurisdiction to approve the project. The City was afforded the opportunity to relinquish its jurisdiction by requesting that the MnPUC assume jurisdiction, but the City has elected to maintain jurisdiction of the project.

As required by Minn. Rules 7850.5300 Subp.3, Xcel Energy notified the MnPUC of the intent to seek local approval of the project and that notice of the project was mailed to those persons on the Power Plant Siting General Notification list (see Appendix A). A letter from the Department of Commerce confirming that the MnPUC received notification that Xcel Energy intends to seek local approval is also included in Appendix A.

2.2 Environmental Assessment Requirement

In accordance with Minn. Rules 7850.5300 Subp. 5, the local unit of government with jurisdiction over the project (i.e., City of Chaska) must prepare an Environmental Assessment (EA). The EA contains information on the human and environmental impacts of the proposed project and addresses methods to mitigate such impacts.

When the EA is complete, the City must publish a notice in the Environmental Quality Board (EQB) Monitor that: (1) indicates that the EA is available for review, (2) specifies how a copy of the document may be reviewed, and (3) details the procedures for the public to submit comments on the EA to the City. A final decision on the project cannot be made until at least ten days after the notice appears in the EQB Monitor.

2.3 Public Participation / Scoping of Environmental Assessment

On February 6, 2012, the City sent notice of the project to surrounding landowners, including a comment form to provide comments on the scope of the EA, and an invitation to a public information open house (see Appendix B). On February 16, 2012, the City of Chaska and Xcel Energy held an open house at Chaska City Hall to provide the public an opportunity to learn about the project, ask questions, and provide comments on the scope of the EA. No one from the public attended the open house. One public comment was received via email regarding the siting of the West Creek Substation (see Appendix B). However, the West Creek Substation was previously permitted by the City of Chaska and is not part of this project or EA scope.

2.4 Conditional Use Permit

The City of Chaska is the governing body for the Conditional Use Permit (CUP) required for the proposed project. Pursuant to Zoning Ordinance Section 2.3(b), electric transmission lines are considered an "essential service"- a use by conditional permit in all zoning districts. Xcel Energy submitted a CUP application to the City on January 12, 2012.

Section 1.2 of the City's Zoning Ordinance explains "[t]he basic purpose of this Ordinance is to ensure public health, safety, and general welfare in accordance with the official 'Comprehensive Plan' of the City of Chaska, and with adopted development goals, policies and proposals contained therein." In order to achieve the objectives of the Comprehensive Plan certain uses, including "essential services," are permitted subject to a Conditional Use Permit. The project constitutes a "privately owned and operated essential service" as defined by Section 2.3 of the ordinance. Section 2.3 of the City Zoning Ordinance also provides that above ground structures for private essential services shall be classified as a conditional use in all zoning districts. The proposed transmission line is an essential service that will provide electrical transmission support for planned and future development within the designated service area, including the development of the Business Park as defined in the City's 2030 Comprehensive Plan. Thus, the proposed project is consistent with the City's Comprehensive Land Use Plan and the intent of the City Zoning Ordinance.

After the EA is finalized, notice of the EA has been published in the EQB Monitor, and the comment period requirements have been met, the City of Chaska Planning Commission will hold a public hearing and the City Council will make a final decision on Xcel Energy's request for a CUP.

3.0 Engineering Design, Right-of-Way Acquisition, and Construction

3.1 Engineering Design

The proposed transmission tap line will be designed using single pole, horizontal or braced post structures composed of galvanized or weathering steel. The poles will be

approximately 60-90 feet high with a span length of approximately 300-400 feet. Tangent structures will be directly embedded into the ground and angle/dead-end structures will be constructed using 6 to 8-foot diameter concrete pier foundations. Approximately nine (9) tangent structures and two (2) angle/dead-end structures will be installed to suspend the wires (conductors) overhead. Table 1 below summarizes the proposed structure specifications.

Photos 1 and 2 below show typical single circuit 115 kV tangent structures and Figures 3 and 4 show renderings and elevations of the typical structures proposed to be used to construct the transmission tap line.

TABLE 1. PROPOSED STRUCTURE SPECIFICATIONS

Line Type	Structure Type	Structure Material	Right-of-Way Width (feet)	Structure Height (feet)	Foundation	Foundation Diameter (feet)	Span Between Structures (feet)
115 kV Single Circuit	Single pole, horizontal or braced post insulator	Galvanized or Weathering steel	Up to 75'	60'-90'	Direct embedded for tangent structures; and self-supporting for angle/ dead-end structures	Direct embedded or 6 to 8 foot concrete foundation for angle/dead-end structures	300' to 400' average

Photos 1 & 2. Typical Single Circuit 115 kV Structures

Photo 1. Galvanized steel, horizontal post.

Photo 2. Weathering steel, horizontal braced post.

3.2 Right-of-Way Acquisition

A right-of-way (ROW) width of up to 75 feet will be required for the construction of the transmission tap line (i.e., 37.5 feet on either side of the centerline of the transmission line route). Tree removal and vegetation clearing will occur within the right-of-way along the transmission line route prior to construction, and vegetation will be maintained following construction as necessary to meet operation and safety standards.

For transmission lines, utilities acquire easement rights across certain parcels to accommodate the facilities. The evaluation and acquisition process includes title examination, initial owner contacts, survey work, document preparation and purchase.
An Xcel Energy land agent has contacted the landowners in the project area and will continue to work with landowners to acquire any new right-of-way and/or modify existing right-of-way easements as necessary. Additionally, the land agent will work with landowners to address any construction needs, impacts, damages or restoration issues.

3.3 Construction Procedures

Construction will begin after all approvals are obtained, property and rights-of-way are acquired, soil conditions are determined, and the design is completed. The precise timing of construction will take into account various requirements that may be in place due to permit conditions, system loading issues, available workforce and materials.

Project construction will comply with industry and Xcel Energy standards regarding clearance to ground, utilities, and buildings; ROW widths, erecting pole structures, and stringing conductors, as applicable. Typical construction equipment used on transmission projects includes 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, and concrete trucks.

Construction access will be primarily from Guernsey Avenue and will proceed through the agricultural field on the Haasken property to access the new right-of-way. The new right-of-way may also be accessed from the east through the City's West Creek Substation site.

During construction, ground disturbance will be largely limited to the specific pole locations. Disturbed areas will be restored to their original condition to the maximum extent practicable and as negotiated with the landowner. Post-construction activities include:

- Removing and disposing of construction debris;
- Removing any temporary facilities (e.g., staging and laydown areas);
- Employing appropriate erosion control measures;
- Reseeding and mulching disturbed areas; and
- Restoring disturbed areas to their original condition to the extent possible.

In locations where excessive soil compaction has occurred, Xcel Energy will use various methods to correct the over-compacted soil to the extent possible and as negotiated with landowners.

Poles will be delivered to each staked pole location and placed in the ROW. Insulators and other hardware are typically attached while the pole is on the ground. The pole is then lifted, placed, and imbedded into the pre-drilled hole in the ground surface. Steel pole tangent structures are proposed to be directly embedded into the ground if soil conditions warrant. Rock-filled culvert foundations may be required in areas with poor soils. This method typically involves digging a hole for each pole, filling it partially with crushed rock and then setting the pole on top of the rock base. The area around the pole is then backfilled with crushed rock and/or soil. Culvert foundations involve auguring a hole for each pole, installing a galvanized steel culvert, filling the annular space outside the culvert with spoils from the hole, filling the culvert partially with crushed rock and then setting the pole on top of the rock base. The annular space between the pole and culvert is filled with crushed rock.

Angle/ dead-end structures will require concrete foundations. In these cases, holes will be drilled in preparation for the concrete foundations. Drilled pier foundations may vary from six to eight feet in diameter and 20 to 30 feet deep, depending on soil conditions. Steel reinforcing bars and anchor bolts are installed in the drilled holes prior to concrete placement. Concrete trucks are required to bring the concrete in from a local concrete batch plant. Steel pole structures are hauled unassembled on pole trailers to the staked location and placed within the right-of-way until the pole sections are assembled and the arms attached. Insulators and other hardware are attached while the steel pole is on the ground. The pole is then lifted, placed and secured on the foundation using a crane.

After structures are erected, conductors and shield wires will be installed by establishing stringing setup areas within the right-of-way. Conductor stringing operations require brief access to each structure to secure the conductor wire to the insulators or to install shield wire clamps once final sag is established. The wires will be pulled with a rope lead that connects to every structure through a dolly attached at the insulator/clamp location.

In some cases, additional space (temporary lay down areas) may be required. These areas will be selected for their location, access, security and ability to efficiently and safely warehouse supplies. The areas are chosen to minimize excavation and grading. The temporary lay down areas outside of the transmission line right-of-way will be secured from affected landowners through rental agreements, as necessary.

3.4 Maintenance Procedures

Transmission lines are designed to operate for decades and require only moderate maintenance, particularly in the first few years of operation. Transmission infrastructure has very few mechanical elements and is built to withstand weather extremes. With the

exception of severe weather such as tornadoes and heavy ice storms, transmission lines rarely fail.

Transmission lines are automatically taken out of service by the operation of protective relaying equipment when a fault is sensed on the system. Such interruptions are usually only momentary. Scheduled maintenance outages are also infrequent. As a result, the average annual availability of transmission infrastructure is very high, in excess of 99 percent.

Xcel Energy will periodically use the transmission line right-of-way to perform inspections, maintain equipment, and repair any damage. Regular route maintenance will also be conducted for weed control and removal of undesired vegetation that would interfere with the operation of the transmission line.

4.0 Assessment of Impacts and Mitigation

As described above, the proposed project consists of constructing a transmission tap line between the West Creek Substation and an existing transmission line owned by GRE. The new transmission tap line will be located adjacent and parallel to an existing transmission line corridor. Therefore, permanent impacts to the environment are expected to be minimal. As described below, Xcel Energy will further minimize temporary environmental impacts, such as fugitive dust, rutting, and soil compaction, by employing construction best management practices (BMPs) as applicable.

Correspondence received from state and federal agencies that reviewed the project are included in Appendix C.

4.1 Description of Environmental Setting

The project site is located within the Minnesota and Northeast Iowa Morainal Section (222M), a section within the biogeographic province known as the Eastern Broadleaf Forest Province under the Ecological Classification System (ECS) developed by the Minnesota Department of Natural Resources (DNR) and the United States Forest Service (USFS) (DNR, 2010). Agriculture, development, and settlement have changed the original landscape throughout the area. Pre-settlement vegetation consisted primarily of oak woodland and maple basswood forest. The project area has been converted to agricultural and rural residential use. The proposed transmission tap line corridor is located in a Rural Residential Zoning District (R).

4.2 Impacts on Human Settlement

4.2.1 Socioeconomics

Socioeconomic impacts resulting from the project will be primarily positive, as the expanded capacity in electric energy infrastructure resulting from the project will provide

electric service needs to support surrounding development in the City. During construction, which is expected to take approximately four weeks, there would be a small positive impact on the local community due to revenue created from expenditures of the construction crew (i.e., local community services, hotels, restaurants, construction materials). No permanent jobs will be created by this project.

4.2.2 Displacement

The nearest structure is located approximately 400 feet away from the transmission tap line. Construction and operation of the new transmission tap line will not displace any residences or businesses and will not affect any public services.

4.2.3 Noise

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

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

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

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

In Minnesota, statistical sound levels (L Level Descriptors) are used to evaluate noise levels and identify noise impacts. The L_5 is defined as the noise level exceeded 5% of the time, or for three minutes in an hour. The L_{50} is the noise level exceeded 50% of the time, or for 30 minutes in an hour.

TABLE 2. COMMON NOISE SOURCES AND LEVELS

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

Source: (Minnesota Pollution Control Agency, 2008).

Land areas, such as picnic areas, churches, or commercial spaces, are assigned to an activity category based on the type of activities or use occurring in the area. Activity categories are then categorized based on their sensitivity to traffic noise. The Noise Area Classification ("NAC") is listed in the MPCA noise regulations to distinguish the categories.

Table 3 identifies the MPCA established daytime and nighttime noise standards by NAC. The standards are expressed as a range of permissible dBA within a one hour period; L_{50} is the dBA that may be exceeded 50 percent of the time within an hour, while L_{10} is the dBA that may be exceeded 10 percent of the time within the hour.

TABLE 3. NOISE STANDARDS BY NOISE AREA CLASSIFICATION (dBA)

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

The nearest residence is located over 400 feet from the proposed transmission tap line. Noise levels produced by a 115 kV transmission line are generally less than outdoor background levels and are therefore not usually audible.

The EPRI "Transmission Line Reference Book, 345 kV and Above," Chapter 6, provides empirically-derived formula for predicting audible noise from overhead transmission lines. Computer software produced by the Bonneville Power Administration (BPA) (BPA, 1977) is also frequently used to predict the level of audible noise from power transmission lines that is associated with corona discharge. Audible noise is predicted for dry and wet conditions, with wet conditions representing a worst case. These procedures are considered to be reliable and represent International best practice.

Computer modeling performed by Xcel Energy using the BPA 1977 software under the worst case wet conditions scenario for operation of the transmission tap line at 115 kV indicated that the audible L5 and L50 noise levels (discussed above) measured at the edge of the 75-foot-wide right-of-way (37.5 feet from centerline) would be at 22.2 and 18.7 dBA, respectively, well below the MPCA nighttime L50 limit of 50 dBA for Noise Area Classification 1. These findings are shown in Table 4.

TABLE 4.
CALCULATED AUDIBLE NOISE (db) FOR PROPOSED 115 KV TRANSMISSION LINE DESIGNS (3.28 FEET ABOVE GROUND)

Structure Type	Noise L5 (37.5 Feet From Centerline) (Decibels a weighted)	Noise L50 (37.5 feet From Centerline) (Decibels a weighted)
Horizontal Post 115kV Steel Pole Single Circuit	22.2	18.7
Horizontal Post 115kV Steel Pole Single Circuit (Operated at 69kV)	4.6	1.1

4.2.4 Aesthetics

The proposed structures will be approximately 70 to 90 feet tall and constructed of galvanized or weathering steel with an average span of 300-400 feet. The transmission tap line will be located adjacent to an existing 230 kV transmission line, which will consolidate the transmission corridor through the area and minimize the proliferation of transmission lines into otherwise undisturbed areas (see Figure 2). Required tree removal in the eastern portion of the transmission tap line right-of-way will result in a minor change in the appearance of the area. However, the nearest residential structures are located over 400 feet from the proposed transmission line route and therefore, any potential negative aesthetic impacts to adjacent property owners will be minimal. The transmission tap line will be most visible from Guernsey Avenue where the line will be located adjacent and parallel to the road for approximately 900 feet. Due to the existing GRE transmission line that parallels either side of Guernsey Avenue, the transmission tap line will not result in a significant change to the visual character of the area.

4.2.5 Cultural Values

Cultural values include those perceived community beliefs or attitudes in a given area, which provide a framework for community unity. The region surrounding the project area has cultural values tied to the area's strong German and Scandinavian heritage, and the agricultural and industrial economy. The proposed project is not expected to conflict with the cultural values of the project area.

4.2.6 Transportation

The proposed project will have limited impact on local roads. Access to the transmission tap line construction corridor will be from Guernsey Avenue. Temporary road closures or lane restrictions will be minimal and are not currently anticipated. Road related permits will be acquired by Xcel Energy as needed from the City or County prior to any work activities that may affect roadways.

4.3 Impacts on Public Health and Safety

The project will be designed and constructed in compliance with all applicable industry and Xcel Energy standards regarding clearance to ground, clearance to crossing utilities, clearance to buildings, strength of materials, and right-of-way widths. Additionally, established Xcel Energy and industry safety procedures will be followed during and after installation of the transmission tap line.

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

4.3.1 Electric and Magnetic Fields (EMF)

The term electromagnetic fields ("EMF") refer to electric and magnetic fields that are coupled together such as in high frequency radiating fields. For the lower frequencies associated with power lines (referred to as "extremely low frequencies" ("ELF")), EMF should be separated into electric fields ("EFs") and magnetic fields ("MFs"), measured in kilovolts per meter ("kV/m") and milliGauss ("mG"), respectively. These fields are dependent on the voltage of a transmission line (EFs) and current carried by a transmission line (MFs). The intensity of the electric field is proportional to the voltage of the line, and the intensity of the magnetic field is proportional to the current flow through the conductors. Transmission lines operate at a power frequency of 60 hertz (cycles per second).

4.3.2 Electric Fields

There is no federal standard for transmission line electric fields. The MnPUC, however, has imposed a maximum electric field limit of 8 kV/m measured at one meter above the ground in *the Matter of the Route Permit Application for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota,* Docket No. ET-2/TL-08-1474, Order Granting Route Permit (*adopting* ALJ Findings of Fact, Conclusions and Recommendation at Finding 194 (April 22, 2010 and amended April 30, 2010)) (September 14, 2010). The standard was designed to prevent serious hazards from shocks when touching large objects parked under AC transmission lines of 500 kV or greater.

Table 5 provides the calculated electric fields at maximum operating voltage for the proposed transmission line (obtained from 'ENVIRO', a software program licensed by the Electric Power Research Institute, Inc.). Maximum operating voltage is defined as 105 percent of the nominal voltage, which is 121 kV for the proposed project. As indicated in Table 5, the maximum electric field calculated for Xcel Energy's proposed 115 kV transmission tap line is 1.13 kV/m, which is well under the maximum limit of 8

kV/m that has been a permit condition imposed by EQB in other transmission line route permits.

TABLE 5.
CALCULATED ELECTRIC FIELDS (KV/M) FOR PROPOSED 115 KV TRANSMISSION LINE DESIGNS (ONE METER ABOVE GROUND)

Structure Type	Maximum Operating Voltage (kV)	Distance to Proposed Centerline										
		-300'	-200'	-100'	-50'	-25	0'	25	50'	100'	200'	300'
Horizontal or Braced Post 115kV Steel Pole Single Circuit	121	0.01	0.01	0.04	0.15	0.39	1.13	0.51	0.15	0.05	0.01	0.01
Horizontal or Braced Post 115kV Steel Pole Single Circuit (Operated at 69kV)	72.5	0.00	0.01	0.03	0.10	0.23	0.66	0.30	0.10	0.03	0.01	0.00

4.3.3 Magnetic Fields

There are presently no Minnesota regulations pertaining to MF exposure. Xcel Energy provides information to the public, interested customers and employees so they can make informed decisions about MFs. Such information includes the availability for measurements to be conducted for customers and employees upon request.

The magnetic field profiles around the proposed transmission tap line (i.e., GRE Victoria Tap Line to West Creek Substation) is shown in Table 6. Magnetic fields were calculated under three system conditions: the expected peak and average current flows as projected for the year 2015 under normal (system intact) conditions, and peak current flow for the year 2025 under normal (system intact) conditions. The peak magnetic field values are calculated at a point directly under the transmission line and where the conductor is closest to the ground. The same method is used to calculate the magnetic field at the edge of the right-of-way. The magnetic field profile data show that magnetic field levels decrease rapidly as the distance from the centerline increases (proportional to the inverse square of the distance from source).

The magnetic field produced by the transmission line is dependent on the current flowing on its conductors. Therefore, the actual magnetic field when the project is placed in service is typically less than shown in Table 6. This is because the Table represents the magnetic field with current flow at expected normal peak based on projected regional load growth through 2025, the maximum load projection timeline available. Actual

current flow on the line will vary, so magnetic fields will be less than peak levels during most hours of the year.

TABLE 6.
CALCULATED MAGNETIC FLUX DENSITY (milligauss) FOR PROPOSED 115 KV TRANSMISSION LINE DESIGNS (ONE METER ABOVE GROUND)

Segment	System Condition	Current (Amps)	Distance to Proposed Centerline										
			-300'	-200'	-100'	-50'	-25	0'	25	50'	100'	200'	300'
Victoria Tap to West Creek 115kV Single Circuit	Peak	64	0.10	0.18	0.56	1.66	3.72	7.10	3.94	1.60	0.45	0.12	0.06
	Average	38.4	0.06	0.11	0.34	1.00	2.23	4.26	2.36	0.96	0.27	0.07	0.04

Considerable research has been conducted throughout the past three decades to determine whether exposure to power-frequency (60 hertz) magnetic fields causes biological responses and health effects. Epidemiological and toxicological studies have shown no statistically significant association between MF exposure and health risks. Public health professionals have also investigated the possible impact of exposure to MF upon human health for the past several decades. While the general consensus is that electric fields pose no risk to humans, the question of whether exposure to magnetic fields can cause biological responses or health effects continues to be debated.

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

In 2007, the World Health Organization ("WHO") concluded a review of the health implications of electromagnetic fields. In this report, the WHO stated:

> Uncertainties in the hazard assessment [of epidemiological studies] include the role that control selection bias and exposure misclassification might have on the observed relationship between magnetic fields and childhood leukemia. In addition, virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level ELF magnetic fields and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal, but sufficiently strong to remain a concern. (*Environmental Health Criteria Volume N°238 on Extremely Low Frequency Fields* at p. 12, WHO (2007)).

Also, regarding disease outcomes, aside from childhood leukemia, the WHO stated that:

> A number of other diseases have been investigated for possible association with ELF magnetic field exposure. These include cancers in children and adults, depression, suicide, reproductive dysfunction, developmental disorders, immunological modifications and neurological disease. The scientific evidence supporting a linkage between ELF magnetic fields and any of these diseases is much weaker than for childhood leukemia and in some cases (for example, for cardiovascular disease or breast cancer) the evidence is sufficient to give confidence that magnetic fields do not cause the disease. (*Id*. at p.12.)

Furthermore, in their "Summary and Recommendations for Further Study" WHO emphasized that:

> The limit values in [ELF-MF] exposure guidelines [should not] be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection. (*Id.* at p. 12).

Although WHO recognized epidemiological studies indicate an association on the range of three to four mG, WHO did not recommend these levels as an exposure limit but instead provided: "The best source of guidance for both exposure levels and the principles of scientific review are international guidelines." *Id*. at pp. 12-13. The international guidelines referred to by WHO are the International Commission on Non-Ionizing Radiation Protection ("ICNIRP") and the Institute of Electrical and Electronic Engineers ("IEEE") exposure limit guidelines to protect against acute effects. *Id*. at p. 12. The ICNIRP-1998 continuous general public exposure guideline is 833 mG and the IEEE continuous general public exposure guideline in 9,040 mG. In addition, WHO determined that "the evidence for a casual relationship [between ELF-MF and childhood leukemia] is limited, therefore exposure limits based on epidemiological evidence is not recommended, but some precautionary measures are warranted." *Id*. at 355-56.

WHO concluded that:

> given both the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukemia, and the limited impact on public health if there is a link, the benefits of exposure reduction on health are unclear. Thus, the costs of precautionary measures should be very low. . . Provided that the health, social and economic benefits of electric power are not compromised, implementing very low-cost precautionary procedures to reduce exposure is reasonable and warranted. (*Id.* at p. 13).

In 2010, ICNIRP revised its continuous general public exposure guideline increasing it from 833 mG to 2,000 mG. The WHO has not provided any analysis of the ICNIRP-2010 continuous general public exposure guideline to date.

Wisconsin, Minnesota and California have all conducted literature reviews or research to examine this issue. In 2002, Minnesota formed an Interagency Working Group ("Working Group") to evaluate the body of research and develop policy recommendations to protect the public health from any potential problems resulting from HVTL (High Voltage Transmission Lines) EMF effects. The Working Group consisted of staff from various state agencies and published its findings in a White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options in September 2002, (Minnesota State Interagency Working Group , 2002). The report summarized the findings of the Working Group as follows:

> Research on the health effects of EMF has been carried out since the 1970s. Epidemiological studies have mixed results – some have shown no statistically significant association between exposure to EMF and health effects, some have shown a weak association. More recently, laboratory studies have failed to show such an association, or to establish a biological mechanism for how magnetic fields may cause cancer. A number of scientific panels convened by national and international health agencies and the United States Congress have reviewed the research carried out to date. Most researchers concluded that there is insufficient evidence to prove an association between EMF and health effects; however, many of them also concluded that there is insufficient evidence to prove that EMF exposure is safe. (*Id.* at p. 1.)

The Public Service Commission of Wisconsin ("PSCW") has periodically reviewed the science on MFs since 1989 and has held hearings to consider the topic of MF and human health effects. The most recent hearings on MF were held in July 1998. Recently, January 2008, the PSC published a fact sheet regarding MFs. In this fact sheet the PSC noted that:

> Many scientists believe the potential for health risks for exposure to EMF is very small. This is supported, in part, by weak epidemiological evidence and the lack of a plausible biological mechanism that explains how exposure to EMF could cause disease. The magnetic fields produced by electricity are weak and do not have enough energy to break chemical bonds or to cause mutations in DNA. Without a mechanism, scientists have no idea what kind of exposure, if any, might be harmful. In addition, whole animal studies investigating long-term exposure to power frequency EMF have shown no connection between exposure and cancer of any kind. (*EMF-Electric & Magnetic Fields*, PSC (January 2008)).

The Minnesota Public Utilities Commission, based on the Working Group and World Health Organization findings, has repeatedly found that "there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health

effects." *In the Matter of the Application of Xcel Energy for a Route Permit for the Lake Yankton to Marshall Transmission Line Project in Lyon County*, Docket No. E-002/TL-07-1407, Findings of Fact, Conclusions of Law and Order Issuing a Route Permit to Xcel Energy for the Lake Yankton to Marshall Transmission Project at p. 7-8 (Aug. 29, 2008); *See also*, *In the Matter of the Application for a HVTL Route Permit for the Tower Transmission Line Project*, Docket No. ET-2, E015/TL-06-1624, Findings of Fact, Conclusions of Law and Order Issuing a Route Permit to Minnesota Power and Great River Energy for the Tower Transmission Line Project and Associated Facilities at p. 23 (Aug. 1, 2007)("Currently, there is insufficient evidence to demonstrate a causal relationship between EMF exposure and any adverse human health effects.").

The MnPUC again confirmed its conclusion regarding health effects and MFs in the Brookings County – Hampton 345 kV Route Permit proceeding ("Brookings Project"). In the Brookings Project Route Permit proceeding, Applicants Great River Energy and Xcel Energy and one of the intervening parties provided expert evidence on the potential impacts of electric and magnetic fields on human health. The ALJ in that proceeding evaluated written submissions and a day-and-half of testimony from these two expert witnesses. The ALJ concluded: "there is no demonstrated impact on human health and safety that is not adequately addressed by the existing State standards for [EF or MF] exposure." *In the Matter of the Route Permit Application by Great River Energy and Xcel Energy for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota*, Docket No. ET-2/TL-08-1474, ALJ Findings of Fact, Conclusions and Recommendation at Finding 216 (April 22, 2010 and amended April 30, 2010). The MnPUC adopted this finding on July 15, 2010. *In the Matter of the Route Permit Application by Great River Energy and Xcel Energy for a 345 kV Transmission Line from Brookings County, South Dakota to Hampton, Minnesota*, Docket No. ET-2/TL-08-1474, Order Granting Route Permit (September 14, 2010).

4.3.4 Stray Voltage

"Stray voltage" is a condition that can occur on the electric service entrances to structures from distribution lines. More precisely, stray voltage is a voltage that exists between the neutral wire of the service entrance and grounded objects in buildings such as barns and milking parlors. Because transmission lines convey power for subsequent distribution and are not connected to non-utility structures, stray voltage is not encountered in such lines. Therefore, no impacts related to stray voltage are expected from the proposed transmission tap line.

4.4 Impacts on Land-based Economies

4.4.1 Recreation and Tourism

There are several recreation areas located within one mile of the project area, including Community Park and Friendship Park. The construction and operation of the proposed transmission tap line will not impact these recreation areas or otherwise impede

recreation opportunities in the vicinity of the project. There are no tourist attractions in the vicinity of the project; therefore, no impacts to tourism are expected from the project.

4.4.2 Agriculture

The proposed project is located on property used for agricultural purposes. Permanent impacts will be limited to: (1) the minimal loss of agricultural use of the land at the location of each pole structure (a total of approximately 650 square feet of agricultural land), and (2) the potential hindrance to equipment operation around the pole structures.

Construction of the transmission tap line will require repeated access to structure locations to install foundations, structures, and conductors. Equipment used in this process may include drill rigs, concrete trucks, backhoes, cranes, boom trucks and assorted small vehicles. Operation of these vehicles across the subject property can cause temporary impacts such as rutting and soil compaction, particularly in wet conditions.

Affected landowners or their tenants will be compensated for the use of their land through easement payments. Additionally, Xcel Energy will compensate affected landowners for any crop damage and soil compaction that occurs as a result of the project.

4.4.3 Mining and Forestry

There are no active mining areas in the vicinity of the project; therefore, the proposed project will not impact mining resources.

A wooded area exists along the eastern portion of the project area and directly west of the City's West Creek Substation. Tree removal within the approximately 75-foot-wide right-of-way will be required to accommodate the transmission tap line. However, the existing tree cover in the area is primarily associated with the adjacent Chaska Creek drainage and is not considered an economically significant forest resource.

4.5 Archaeological and Historic Resources

In February of 2011, a review of records at the Minnesota State Historic Preservation Office ("SHPO") and the Minnesota Office of the State Archaeologist ("OSA") identified four archaeological sites and twenty-two inventoried historic architectural properties within one mile of the project area. However, none of the twenty-six identified cultural resource sites are located within the project corridor.

As there are no known archaeological or historical resources identified within the proposed project area, no impacts are anticipated. Should archeological artifacts be discovered during construction, Xcel Energy shall cease work and consult with SHPO before continuing work in the area of discovery. While avoidance would be the preferred action, should impacts to archaeological resources be encountered, mitigation for may include resource investigations and/or additional documentation through data recovery.

4.6 Natural Environment

4.6.1 Air Quality

As transmission lines themselves do not appreciably affect air quality, there will be no permanent environmental impacts to air quality from the operation of the transmission tap line. Minor temporary effects on air quality may occur during construction of the proposed project as a result of exhaust emissions from construction equipment and other vehicles, and from fugitive dust that may become airborne during right-of-way clearing or construction activities in dry conditions. Xcel Energy will employ Best Management Practices (BMP), such as tracking control at access roads and wetting dry surfaces as necessary, to minimize the amount of fugitive dust created by construction activities. Potential impacts to air quality from exhaust emissions are expected to be negligible because of the relatively short construction timeframe (i.e., approximately four weeks).

4.6.2 Water Resources

The proposed transmission tap line will cross Chaska Creek, which is a Minnesota Department of Natural Resources (DNR) Public Water (see Figure 1). The MnDNR Division of Lands and Minerals regulates utility crossings on, over or under any state land or public water identified on the Public Waters and Wetlands Maps. A license to cross Public Waters is required under Minn. Statute §84.415 and Minn. Rules Chapter 6135. Xcel Energy works closely with the MnDNR on these permits and will file for a utility crossing license as required. The MnDNR Division of Waters requires a Public Waters Work Permit for any alteration of the course, current, or cross-section below the ordinary high water level of a Public Water or Watercourse. No such alterations are anticipated as part of the proposed project.

In addition to any terms or conditions required by the DNR license, Xcel Energy will avoid permanent impacts to the Chaska Creek drainage by spanning the creek to avoid placing structures in the creek channel. Temporary construction impacts to the creek will be minimized by implementing erosion control measures such as the use of silt fencing to control sedimentation and prevent material discharge to surface waters. Additionally, disturbed surface soils will be stabilized using re-vegetation or mulching methods as necessary following completion of construction. The project will not involve land disturbance in excess of one acre; therefore, a National Pollutant Discharge Elimination System (NPDES) stormwater permit is not required.

4.6.3 Wetlands

The US Army Corps of Engineers (USACE) was contacted regarding the proposed project. In a reply letter dated February 21, 2012, (Appendix C), the USACE indicated that there may be seasonally flooded wetlands and/or wet meadow wetlands located adjacent to Chaska Creek and along portions of the proposed transmission tap line route. On March 16th, 2012, Michael Setering, USACE project Manager for Carver County, conducted a site visit along the transmission tap line route to determine the potential presence of wetlands. In follow-up email correspondence dated March 19, 2012

(Appendix C), Mr. Setering confirmed that based on his site observations, wetlands were not present within the proposed transmission tap line corridor. Mr. Setering further indicated that if any wetland areas are present, impacts resulting from the project would be minimal, and would qualify as non-reporting under the ACOE Regional General Permit (RGP-3-MN).

4.6.3 Flora and Fauna

The Minnesota Department of Natural Resources (DNR) was contacted regarding the proposed project. In an email reply dated March 8, 2012, (Appendix C), the DNR provided comments (1) recommending that vegetation removal be minimized to the extent feasible, (2) indicating that differing heights of adjacent transmission lines can result in a greater likelihood of avian collisions, and (3) noting that a license to cross Chaska Creek, a Public Water, will be required.

Avian Collisions

As noted by the DNR, newly constructed transmission lines may affect waterfowl and other bird species, as birds have the potential to collide with all elevated structures, including power lines. Avian collisions with transmission lines can occur in proximity to agricultural fields that serve as feeding areas, wetlands and water features, and along riparian corridors that may be used during migration.

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 a conductor and a grounding device. Xcel Energy's design standards for transmission and distribution lines provide adequate spacing to minimize the risk of raptor electrocution.

Xcel Energy has been working with various state and federal agencies for over 20 years to address avian issues. In 2002, Xcel Energy Operating Companies, including Xcel Energy, entered into a voluntary Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service (USFWS) to work together to address avian issues throughout its service territories. The MOU sets forth standard reporting methods and the development of Avian Protection Plans (APP) for each state that Xcel Energy serves. APPs include designs and other measures aimed at preventing avian electrocutions as described in guidance provided by the Avian Power Line Interaction Committee (APLIC, 2006) and the guidelines for developing APPs (APLIC and USFWS, 2005). The APP for the Minnesota Territory is complete and retrofit actions for areas with potential avian impacts are underway across the territory. Xcel Energy also addresses avian issues related to transmission projects by:

- Working with resource agencies such as the MnDNR and the USFWS to identify areas that may be appropriate for marking transmission line shield wires with bird diverters; and

- Attempting to avoid areas known as primary migration corridors or migratory resting areas.

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

Regarding the potential for avian collisions at the subject site, the proposed transmission tap line site is not within an area that has been identified in Xcel Energy's APP as an area recommended for the installation of bird diverters. The height of the proposed transmission tap line will be equal to or less than the adjacent 230 kV transmission line. As described in guidance provided by APLIC, "clustering" transmission lines, as proposed in this case, may be preferable because the resulting network of wires is confined to a smaller area and is more visible. Birds have to make only a single ascent and descent to cross a series of parallel lines in this arrangement.

Therefore, the proposed transmission tap line design and location will minimize avian impacts by providing adequate line spacing to minimize the risk of raptor electrocution, and by clustering the transmission tap line with an adjacent transmission line of the same or greater height.

Vegetation

Vegetation in the project area has been largely disturbed by surrounding agricultural land uses and from vegetation clearing associated with the existing adjacent transmission corridor. The transmission tap line corridor is vegetated with a mix of annual agricultural crops and perennial grasses and shrubs. The eastern approximately 1,200 feet of the transmission tap line corridor is densely wooded with tree species including ash, elm, oak, cedar, maple, cherry, and basswood.

Clearing of trees and vegetation within the right-of-way will occur prior to construction activities as allowed by landowner agreements and permit conditions. Clearing may be accomplished with the use of chainsaws, mowers, and hydraulic tree-cutting equipment. Vegetation will be cut at, or slightly above, the ground surface. Rootstock or stumps will be left in place unless transmission structure installation or construction access requires otherwise.

Landowners will be notified as early as possible prior to construction to allow them to harvest trees within easement boundaries prior to the initiation of clearing. At the time of clearing, any merchantable trees will be cut to standard logging lengths and stacked in upland areas within the right-of-way. The landowner will retain the title to all timber material. Non-merchantable material, including trees, brush, and slash, will be either cut and scattered, placed in windrow piles, or chipped within the right-of-way. Non-merchantable felled material may also be removed from the right-of-way.

Consistent with DNR recommendations, Xcel Energy will limit vegetation removal to the minimum extent necessary to safely construct and operate the transmission tap line.

Wildlife

Wildlife habitat in the project area is largely limited by agricultural activity and residential development. Wildlife species may use vegetated portions of the project site for food and cover. Wildlife found in the area include species typically found in open rural areas such as deer, rabbits, skunk, fox, coyote, and a variety of small rodents. Vegetation clearing necessary for project construction and ROW maintenance may result in a small loss of vegetative cover; however, no significant wildlife impacts are anticipated and no mitigation measures are proposed.

4.6.5 Rare and Unique Natural Resources

The Minnesota Department of Natural Resources Natural Heritage Rare Features Database was obtained from the MnDNR which identifies know occurrences of rare plants and animal species along with other significant features within an approximately one-mile radius of the project area. Based on this review, there are no occurrences of rare species or unique features identified in the project area.

5.0 Regulatory Permits and Approvals Required

Xcel Energy will obtain all necessary permits and approvals prior to project construction. Permit requirements or approvals anticipated for this project are shown in Table 7. Agency correspondence related to the project can be found in Appendix C.

TABLE 7.
REGULATORY PERMITS AND APPROVALS REQUIRED

Government Unit	Type of Permit	Regulated Activity
DNR Lands and Minerals	License to Cross Public Water	Utility crossing over designated DNR Public Water (Chaska Creek).
City of Chaska	Conditional Use Permit	Construction of essential public service (transmission line).
Carver County	County Highway Access Permit	Utility crossing and temporary construction access on County roadways.