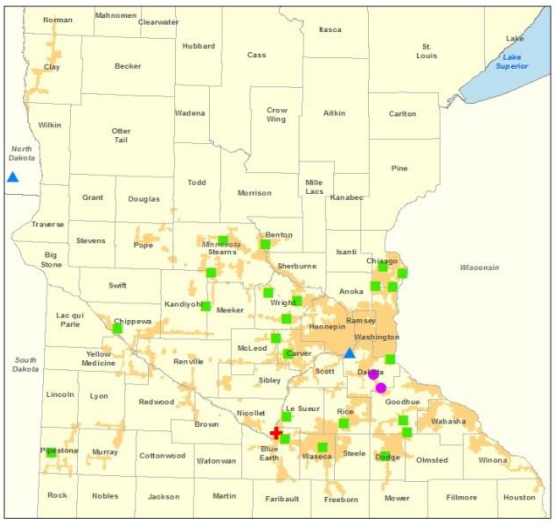
Environmental Report

Xcel Competitive Resources Acquisition Proposals

In the Matter of the Petition of Northern States Power Company doing business as Xcel Energy for Approval of Competitive Resources Acquisition Proposal and Certificate of Need

PUC Docket No. E-002/CN-12-1240



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MINNESOTA DEPARTMENT OF COMMERCE

Responsible Governmental Unit

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Abstract

The Minnesota Public Utilities Commission (Commission) has initiated a Competitive Resource Acquisition Process through which it will select resources to meet the need identified in Xcel's 2010 Integrated Resource Plan (IRP).

Review Process: The Commission accepted proposals from Northern States Power doing business as Xcel Energy (Xcel); Calpine Corporation and its affiliate Mankato Energy Center, LLC, (collectively, Calpine); Invenergy Thermal Development LLC (Invenergy); Geronimo Wind Energy doing business as Geronimo Energy (Geronimo), and Great River Energy (GRE) on June 21, 2013.

In its review, the Commission will consider the following alternatives:

- Xcel's proposed three 215 MW combustion turbine gas generators with a total capacity of 645 MW. One turbine would be installed at Xcel's existing Black Dog plant in Burnsville. The two additional turbines would be built near Hankinson, North Dakota;
- Calpine Corporation's proposed natural gas combustion turbine and a heat recovery steam generator with a total capacity of 345 MW in Mankato;
- Invenergy's proposed three 178.5 MW natural gas combustion turbines, one in Cannon Falls and two in Dakota County or Scott County, for a combined capacity of 535.5 MW;
- Geronimo's up to 100 MW of solar generation distributed at up to 23 sites across Minnesota; and
- GRE's Midwest Independent System Operator (MISO) Zone 1 Resource Credits for capacity only.

The proposals will be weighed against each other in a formal evidentiary proceeding based on the certificate of need statute and rules. The Commission has referred this matter to an Administrative Law Judge (ALJ) for contested case proceedings. At the conclusion of the process, the Commission is expected to select one or some combination of the proposed alternatives to meet Xcel's identified need. This proceeding is the only proceeding in which the no-build alternative and the size, type, timing, system configuration, and voltage will be considered.

As part of the review process the Commission has requested the Department of Commerce to prepare an ER evaluating the proposals under consideration. An ER examines the potential human and environmental impacts of a proposed project, alternatives to the project, and potential mitigating measures for anticipated adverse impacts.

Department of Commerce Energy Environmental Review and Analysis 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 project.

Information about the Commission's process in this docket can be obtained by contacting Tricia DeBleeckere, Minnesota Public Utilities Commission, 121 7th Place E., Suite 350, Saint Paul, MN 55101, phone: (651) 201-2255, email: tricia.debleeckere@state.mn.us.

The official record for this proceeding can be found in the eDockets system at: https://www.eDockets.state.mn.us/EFiling/search.jsp; search on the year "**12"** and number "**1240**".

Information about this project can also be found on the Department's energy facilities permitting website: http://mn.gov/commerce/energyfacilities/Docket.html?Id=33228, or obtained by contacting Suzanne Steinhauer, Minnesota Department of Commerce, 85 7th Place East, Suite 500, St. Paul, Minnesota 55101, phone: (651) 539-1843, email: suzanne.steinhauer@state.mn.us.

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Acronyms, Abbreviations and Definitions

ALJ	Administrative Law Judge
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
DNR	Department of Natural Resources
EMF	electromagnetic field
EPA	United States Environmental Protection Agency
ER	Environmental Report
FAA	Federal Aviation Administration
GPS	Global Positioning System
GRE	Great River Energy
HAP	Hazardous Air Pollutant
HVTL	high voltage transmission line
IRP	Integrated Resource Plan
kV	kilovolt
kWh	Kilowatt hour
MISO	Midwest Independent System Operator
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MW	Mega Watt
NAC	noise area classification
NPDES	National Pollutant Discharge Elimination System
NWI	National Wetland Inventory
OSHA	Occupational Health and Safety Administration
PSD	Prevention of Significant Deterioration
PV	photovoltaic
SDS	State Disposal System
SWPPP	Storm water Pollution Prevention Plan
USACE	United States Corp of Engineers
USFWS	United States Fish and Wildlife Service
VOC	Volatile Organic Compound

1 Introduction

The Minnesota Public Utilities Commission (Commission) has initiated a Competitive Resource Acquisition Process through which it will select resources to meet the need identified in Xcel's 2010 Integrated Resource Plan (IRP).

1.1.1 Project Overview

In March 2011 Xcel filed a petition with the Commission for a Certificate of Need to renovate and increase the capacity of its Black Dog Generating Plant in Burnsville by 2014. In December 2011 Xcel asked to withdraw its petition, arguing that, although new generating capacity would be needed eventually, there was no new generating capacity needed by 2014. In its proposal to withdraw the petition, Xcel argued that the Commission should re-establish the amount of power to be acquired and a schedule for acquiring the power.

The Commission has initiated a Competitive Resource Acquisition Process through which it will select resources to meet the need identified in Xcel's 2010 Integrated Resource Plan (IRP). In its order of November 21, 2012, the Commission ordered the establishment of a new docket to solicit proposals to meet Xcel's revised power needs.[1] In an order issued in Xcel's Integrated Resource Plan proceeding, the Commission determined that Xcel had demonstrated the need for an additional 150 megawatts (MW) by 2017, increasing up to 500 MW by 2019.[2] The Commission designated a deadline of April 15, 2013, for developers to file proposals to meet some or all of Xcel's need.[3] Because Xcel submitted a bid, the Commission has determined that the proposals will be evaluated through a Certificate of Need-like proceeding.

In its order of June 21, 2013, the Commission accepted proposals from Northern States Power doing business as Xcel Energy (Xcel); Calpine Corporation and its affiliate Mankato Energy Center, LLC, (collectively, Calpine); Invenergy Thermal Development LLC (Invenergy); Geronimo Wind Energy doing business as Geronimo Energy (Geronimo), and Great River Energy (GRE).[4]

In its review the Commission will consider the following alternatives:

- Xcel's proposed three 215 MW combustion turbine gas generators with a total capacity of 645 MW. One of the turbines would be installed at Xcel's existing Black Dog plant in Burnsville. The two additional turbines would be built near Hankinson, North Dakota;

[1] Commission, *Order Closing Docket, Establishing New Docket, and Schedule for Competitive Resource Acquisition Process*, November 21, 2012, eDockets ID: 201211-80952-01
[2] Commission, *In the Matter of Xcel's 2011-2025 Integrated Resource Plan, Docket No. E-002/RP-10-825, Order Approving Plan, Finding Need, Establishing Filing Requirements, and Closing Docket*, March 5, 2013, eDockets ID: 20133-84446-01
[3] Commission, *Order Extending Bidding Deadline and Refining Procedural Framework*, March 5, 2013, eDockets ID: 20133-84446-01
[4] Commission, *In the Matter of the Petition of Northern States Power Company d/b/a Xcel Energy for Approval of Competitive Resource Acquisition Proposal and Certificate of Need: Notice and Order for Hearing*, eDockets Document ID: 20136-88404-01 (herein after, *Commission's Notice and Order for Hearing*)

- Calpine's proposed natural gas combustion turbine and a heat recovery steam generator with a total capacity of 345 MW in Mankato;
- Invenergy's proposed three 178.5 MW natural gas combustion turbines, one in Cannon Falls and two in Dakota County or Scott County, for a combined capacity of 535.5 MW;

- Geronimo's up to 100 MW of solar generation distributed at up to 23 sites across Minnesota; and
- GRE's proposed MISO Zone 1 Resource Credits for capacity only.

The proposals will be weighed against each other in a formal evidentiary proceeding based on the certificate of need statute and rules. The Commission has referred this matter to an Administrative Law Judge (ALJ) for contested case proceedings. At the conclusion of the process, the Commission is expected to select one or some combination of the proposed alternatives to meet Xcel's identified need. This proceeding is the only proceeding in which the no-build alternative and the size, type, timing, system configuration, and voltage will be considered.

1.1.2 Organization and Content of this Document

This Environmental Report is organized into seven sections:

Section 1: Introduction
Section 2: Regulatory Framework
Section 3: Description of the Proposals
Section 4: Human and Environmental Impacts
Section 5: Availability and Feasibility of Alternatives
Section 6: Alternatives Comparison
Section 7: Permits

Sections three through five discuss the proposals, associated impacts and mitigation.

1.1.3 Sources of Information

Information for this report is drawn from multiple sources and cited throughout. The primary source documents used are the proposals submitted by Bidders to the Commission as well as subsequent communications with the Bidders. Information from other reports issued by the Minnesota Environmental Quality Board, the Minnesota Department of Commerce, and other Minnesota and Federal agencies has been incorporated as applicable.

To the extent possible this document relies on information that is readily available information in the public realm and provides links to those sources. In some cases information is provided by the Bidders through personal communication; personal communications are compiled and provided in Appendix C of this document.

2 Regulatory Framework

The Commission has established a competitive resource acquisition process under Minnesota Statute 216B.2422, subdivision 5. Although details vary somewhat between proceedings, in general the process follows these steps:

- Xcel publicizes the amount of capacity it needs and the timeframe in which it is needed and solicits proposals for meeting that need.
- Developers, which may include Xcel, file proposals for meeting some or all of Xcel's need.
- The Commission determines which proposals to accept as substantially complete.
- If there are material facts in dispute, the Commission refers the matter to the Office of Administrative Hearings for a contested case proceeding before an ALJ. The ALJ conducts evidentiary hearings and prepares a report recommending a course of action.
- After reviewing the record of the case, including the ALJ's report, the Commission identifies the resources that are best supported by the record.[5]

Because Xcel has submitted a proposal in this proceeding, the Commission has determined the process will follow a "Certificate of Need-like" process. Developers of projects chosen through a Commission-approved competitive resource acquisition process are exempt from the requirement to receive a Certificate of Need required for large energy facilities under Minnesota Statute 216B.243.

The proposals will be weighed against each other in a formal evidentiary proceeding based on the certificate of need statute and rules. The Commission has referred this matter to an ALJ for contested case proceedings. At the conclusion of the process, the Commission is expected to select one or some combination of the proposed alternatives to meet Xcel's identified need. This proceeding is the only proceeding in which the no-build alternative and the size, type, timing, and system configuration will be considered.

Under the Certificate of Need process, the Department of Commerce is required to prepare "an environmental report on a proposed high voltage transmission line or a proposed large electric power generating plant at the need stage."[6] An environmental report (ER) includes an "analysis of the human and environmental impacts of a [proposed] project."[7] An ER examines the potential human and environmental impacts of a proposed project, alternatives to the project, and potential mitigating measures for anticipated adverse impacts.

Consistent with its intent to review the proposals in a "Certificate of Need Like" proceeding, the Commission has requested the Department of Commerce prepare an ER evaluating the proposals under consideration.

The resource acquisition process required the solicitation of actual proposed alternatives to Xcel's proposed project. The Commission has determined that due to the nature of the bidding process,

[5] Commission, *Notice and Order for Hearing*
[6] Minnesota Rule 7849.1200
[7] Minnesota Rule 7849.1500

combined with the analysis completed in the IRP docket, the proposed alternatives and a no-build alternative for each should comprise the scope of alternatives to be evaluated in the ER for this docket.

On June 24, 2013, the Department of Commerce issued a notice requesting comments on issues to be evaluated in the ER prepared for Xcel's Competitive Resource Acquisition Process.[8] Pursuant to the Commission's directive, there was no public meeting held. The public was given until July 10, 2013, to submit comments on the scope of the ER. Four written comments were received on issues to be evaluated in the ER during the comment period.

- Dakota County commented on issues related to potential power plant sites in Dakota County in the Xcel and Invenergy proposals. Comments identified existing and potential soil contamination, waste disposal, and groundwater contamination at the existing Black Dog site identified in Xcel's proposal. The comments also indicated that there is insufficient environmental information on the proposal for the Hampton Energy Center contained in Invenergy's proposal. Dakota County also requested that the ER provide "a complete traffic analysis and assessment that is consistent with Environmental Assessment Worksheet documentation requirements."
- The Minnesota Center for Environmental Advocacy, Fresh Energy, Izaak Walton League of America – Midwest Office, and Sierra Club (collectively "Environmental Intervenors," a party to the proceeding), requested that the environmental report address emissions resulting from GRE's proposal.
- The Minnesota Chamber of Commerce questioned the need for the process in the timeframe anticipated.
- Mr. Bob Messerich indicated a preference for a more distributed solar option than the one proposed by Geronimo Energy.[9]

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 July 17, 2012 (Appendix A). This environmental report has been developed in accordance with the scoping decision.

2.1 Permitting Authority and Additional Permits

Facilities larger than 50 MW selected through the Commission approved process will also require a site permit from the Commission prior to construction of any facility. A site permit authorizes the siting and construction of the project and cannot be issued before the need for the project has been determined by the Commission. All of the natural gas proposals are larger than 50 MW, as is the Distributed Solar Proposal as a whole. However, should the Commission select some portion of the Distributed Solar Proposal that is less than 50 MW it is unclear whether the Commission would have siting authority over the smaller project.

[8] Department of Commerce, *Notice of Comment Period on Impacts to Be Evaluated in the Environmental Report to be Prepared for Xcel Energy's Competitive Resources Acquisition Proposal*, June 24, 2013, eDockets ID: 20136-88454-01

[9] Department of Commerce, *Environmental Report Scoping Comments Received,* July 15, 2013, eDockets ID: 20137-89111-01

In addition to approvals issued by the Commission, facilities selected in this proceeding will require permits and approvals from federal agencies, additional state agencies, and local governments. These permits are discussed in Section 7.

3 Description of the Proposals and No-build Alternatives

Minnesota Rule Part 7849.1200 requires the Commission to consider alternatives to the proposed project. In addition to evaluating alternatives and their impacts, a no build option must also be evaluated. Because the total capacity of all proposals, more than 1000 MW, exceeds Xcel's identified need of up to 500 MW, it is assumed that not all of the proposals will be selected. Therefore a no-build alternative is described for each proposal.

Figure 1 shows the approximate locations of the proposals. Although many of the proposals are located in the seven county metro area, Calpine's Mankato Energy Center Expansion is located in Mankato, the majority of Geronimo's solar facilities are located outside of the metro area, and Xcel's proposed Hankinson facilities are located near the city of Hankinson in southeastern North Dakota, approximately 60 miles south of Fargo.

This report examines human and environmental effects that may result from selection of the proposals accepted by the Commission as well as effects from a no-build option to each proposal.

3.1 Xcel Proposal

Xcel proposes to install three natural gas fueled, simple cycle combustion turbine generators. Under summer heat and humidity conditions, each of the units is capable of producing approximately 215 MW of power, for a combined total of 645 MW of capacity. Under Xcel's proposal, the units would be constructed at two sites, the existing Black Dog Plant and a new Red River Valley Plant.

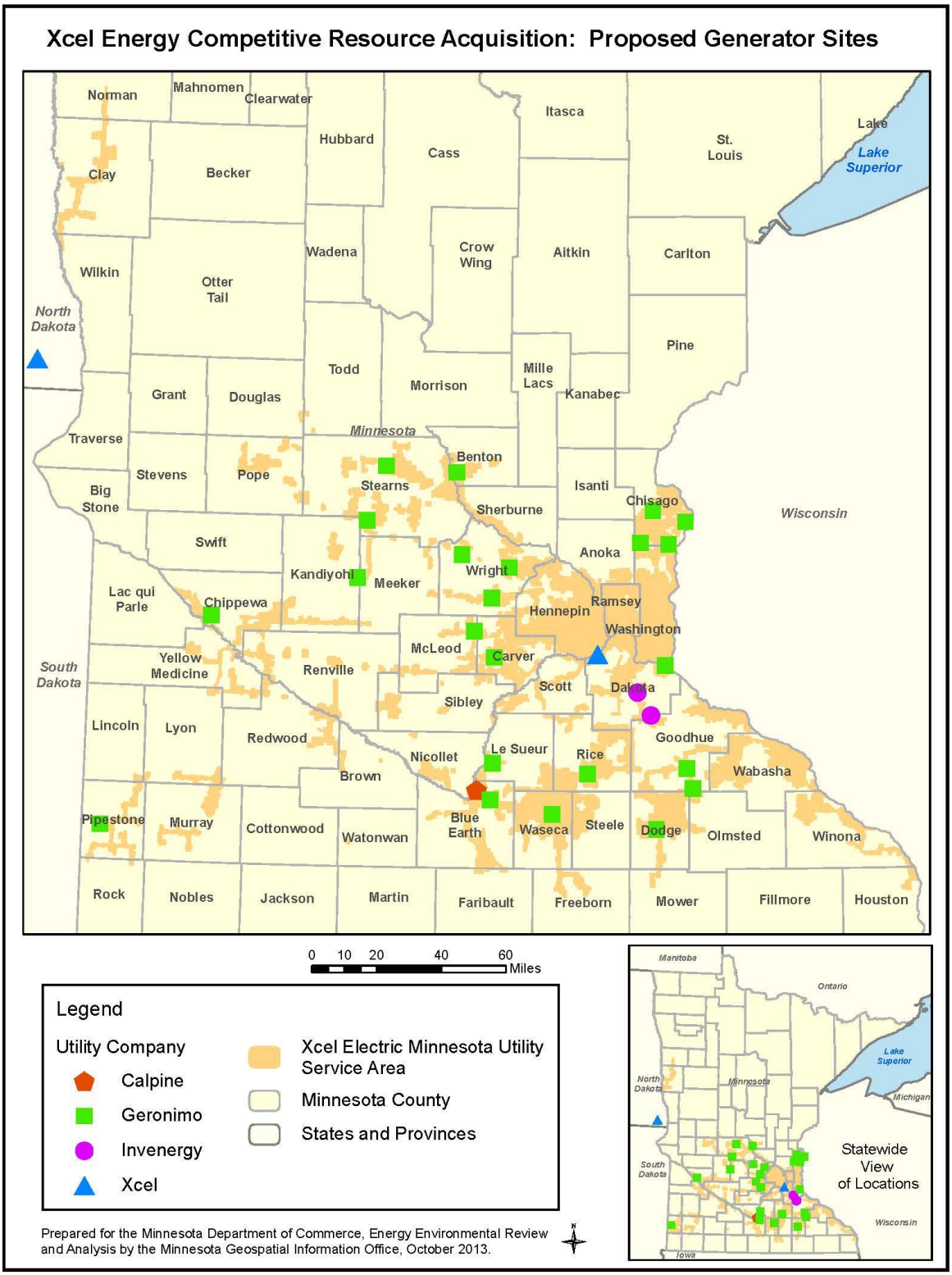
3.1.1 Black Dog Expansion

Xcel proposes to construct one 215 MW combustion turbine at its existing Black Dog plant in Burnsville. This unit would come online in 2017.[10] The existing Black Dog Plant was originally constructed as a coal plant and is now a 538 MW coal and gas-fired plant. The remaining coal units, Units 3 and 4, scheduled to be retired by 2015, after which the facility would be entirely fired by natural gas.

Under Xcel's Black Dog Expansion proposal, the retirement of unit 4 would be moved ahead to 2014 from the current 2015 schedule; Unit 3 would be retired in 2015, as scheduled. Decommissioning, demolition and removal of the turbine, generator, boiler and other components associated with Unit 4 would begin in the fall of 2014. The construction of Unit 6 is anticipated to last approximately 21 months and would commence after Unit 4 is removed, installation of the pipeline is initiated, and other required permits and approvals are acquired.

[10] Xcel, *Application to the Minnesota Public Utilities Commission for Approval of a Competitive Resource Acquisition Proposal and for a Certificate of Need*, April 15, 2013, eDockets ID: 20134-85714-01 (herein after, Xcel Proposal), at p. 4-1

Figure 1: Proposal Locations



If the Black Dog Expansion proposal is not selected, decommissioning of both Black Dog Units 3 and 4 would occur in the planned 2015 timeframe. Xcel would continue to consider development of the Black Dog site for future generation needs if the Black Dog Unit 6 proposal is not selected as part of this proceeding, but there would be no new generation at the site in the foreseeable future.[11]

3.1.2 Red River Valley Plant

Xcel proposes to construct two 215 MW combustion turbines at a new site near Hankinson, North Dakota, for a total capacity of 430 MW. Under Xcel's proposal one of the units would come online in 2018, and the second in either 2018 or 2019. The new turbines would also require construction of an associated natural gas pipeline, transmission and interconnections facilities.[12]

Xcel proposes to acquire approximately 160 acres, within which approximately 35 acres would be developed for the plant.

If the Red River Valley Plant proposal is not selected, Xcel would continue to consider developing generation resources in the Hankinson area, but no facilities would be constructed in the foreseeable future.[13]

3.2 Calpine Proposal

Calpine proposes to expand the existing Mankato Energy Center in Mankato through the addition of one natural gas-fired combustion turbine generator, an additional heat recovery steam generator, and related ancillary equipment. The proposal would increase the plant's output by adding 290 MW of intermediate combined-cycle capacity and 55 MW of peaking capacity. Calpine currently operates the Mankato Energy Center as a 375 MW natural gas-fired combined cycle generating facility in Mankato. As it currently operates, the entire output is sold to Xcel. Under the proposal, the total plant size would be 720 MW. Calpine anticipates that the proposed expansion would be in commercial operation by mid-2017, subject to regulatory approvals and agreements with Xcel and financing parties.[14]

Under the no-build alternative, Calpine would not construct the expansion to the Mankato Energy Center in the foreseeable future. Although Calpine would likely continue to offer the expansion in response to other competitive bidding processes, the timeframe for future construction is unknown.

3.3 Invenergy Proposal

Invenergy has submitted two proposals, one to expand its existing Cannon Falls Energy Center by 178.5 MW, and another to construct a new 357 MW Hampton Energy Center in Hampton Township in Dakota County. Together, the proposals would add 535.5 MW of natural gas generation capacity.

[11] Xcel, personal communication, September 13, 2013, (Appendix C)
[12] Xcel Proposal, at p. 4-1
[13] Xcel, personal communication, September 13, 2013, (Appendix C)
[14] Calpine, *Mankato Energy Expansion Proposal*, April 15, 2013, eDockets ID: 20134-85727-01 (herein after, Calpine Proposal), at p. 4.

3.3.1 Cannon Falls Expansion

Invenergy currently operates the Cannon Falls Energy Center, a 357 MW peaking facility with natural gas as the primary fuel and fuel oil as a backup fuel. Invenergy proposes to add one additional 178.5 MW simple cycle GE 7FA Combustion Turbine Generator to the existing Cannon Falls Energy Center.[15]

If the Cannon Falls Expansion proposal is not selected, no additional generation would be constructed at the facility at this time. Although Invenergy would likely continue to offer the expansion in response to other competitive bidding processes, the timeframe for future construction is unknown.[16]

3.3.2 Hampton Energy Center

Invenergy has also submitted a proposal to construct a new facility with two 178.5 MW GE 7FA turbines at a new location in Hampton Township in Dakota County, adjacent to the newly constructed Hampton Substation. Invenergy has preliminarily identified an alternative site immediately east of I-35 and near the intersection of Dupont Avenue and 250th Street East in New Market Township., but is not actively developing that site.[17]

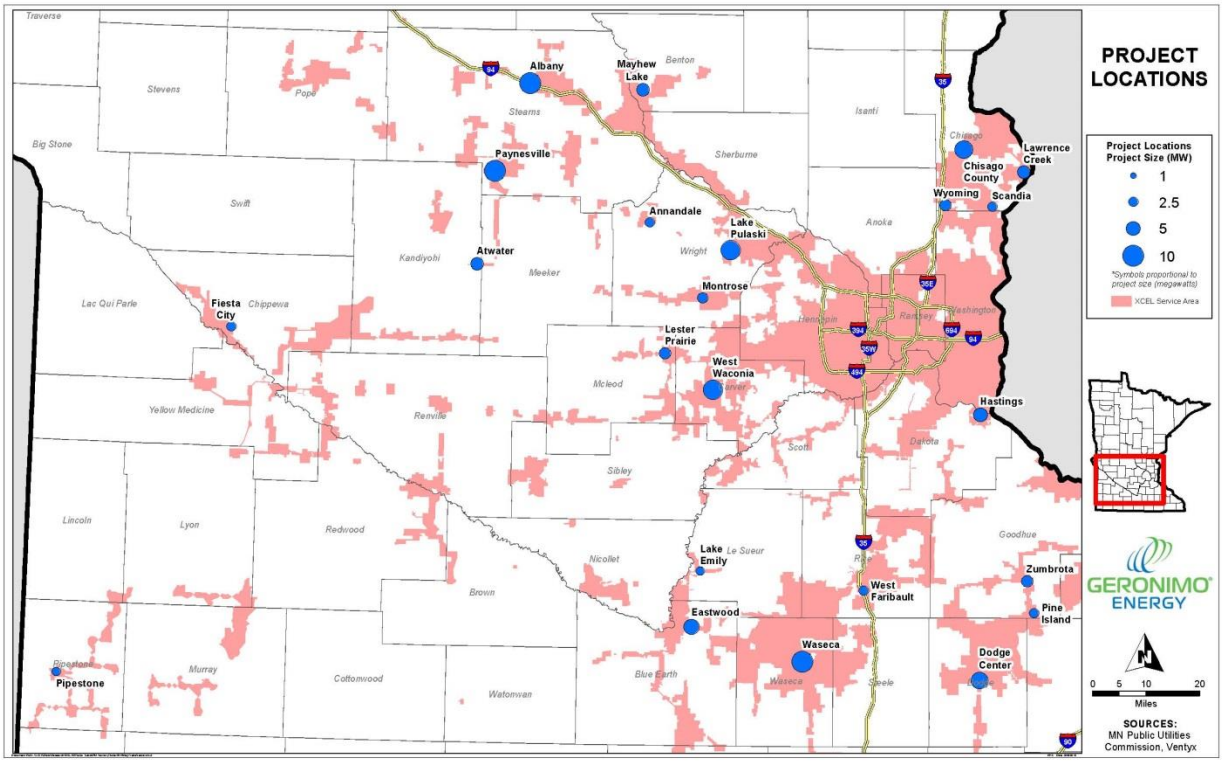
If the Hampton Energy Center is not selected in this proceeding, no new facility would be constructed in the foreseeable future, although Invenergy may continue to offer the expansion in response to other competitive bidding processes. The timeframe for any future construction at these locations is unknown at this time.[18]

3.4 Geronimo Distributed Solar Proposal

Geronimo proposes to construct and operate up to 100 MW of photovoltaic solar facilities distributed at approximately sites located in Minnesota. As described by Geronimo, the proposal would provide Xcel with 71 MW of MISO-accredited capacity and up to 200,000 MWh of energy each year.[19] Geronimo had secured site control for up to 113 MW of solar capacity at 23 sites as of September 10, 2013 (**Figure 2**).[20]

[15] Invenergy, *Cannon Falls Peaking Expansion Proposal*, April 15, 2013, eDockets ID: 20134-85765-01 (herein after, Invenergy Cannon Falls Proposal)
[16] Invenergy, personal communication, August 15, 2013 (Appendix C)
[17] Invenergy, *Hampton Energy Center Proposal*, April 15, 2013, eDockets ID: 20134-85765-02 (herein after, Invenergy Hampton Proposal)
[18] Invenergy, personal communication, August 15, 2013 (Appendix C)
[19] Geronimo Energy, *Geronimo Energy's Distributed Solar Energy Proposal,* April 15, 2013, eDocket ID: 20134-85728-01 et al, (Herein after, Geronimo Proposal), at p. 1; Geronimo Energy, *Direct Testimony of Elizabeth M. Engelking*, September 27, 2013, eDocket ID: 20139-91824-02 (herein after, Engelking Direct Testimony)
[20] Geronimo Energy, *Geronimo Energy's Distributed Energy Generation Zones Update and Public Filing*, September 10, 2013, eDocket ID: 20139-91155-01, 20139-91155-03

Figure 2: Geronimo Distributed Solar Site Locations



As shown in **Table 1**, the proposed sites vary in size from 2 to 10 MW, and the sites range in size between 16 and 294 acres. Geronimo anticipates that the developed area for each of the proposals would be approximately four to 10 acres per MW.[21] Geronimo continues to identify and negotiate agreements for site control of up to 133 MW, or 20 MW beyond their existing agreements.[22]

Under the proposal, each site would be interconnected to a separate distribution substation at a voltage of up to 34.5 kV, although pending review of interconnection requests some interconnections may require transmission voltages of up to 115 kV.[23] Geronimo states that individual sites could be placed in service as early as 2014 or could be phased in over several years, but anticipates an in-service date of no later than December 2016.

[21] Geronimo, personal communication, October 1, 2013 (Appendix C)
[22] *Geronimo Energy's Distributed Energy Generation Zones Update and Public Filing*
[23] Geronimo, personal communication, August 13, 2013 (Appendix C)

Table 1: Geronimo Distributed Solar Sites[24]

Location	Interconnection Voltage	MW - AC	MW - DC	MWh/ year	Site Size (Acres)
Albany	TBD	10	13	20,078	230
Annandale	TBD	2.5	3.25	5,013	24
Atwater	TBD	4	5.2	8,018	40
Chisago County	TBD	7.5	9.75	14,785	62
Dodge Center	TBD	6.5	8.45	12,765	65
Eastwood	13.8	5.5	7.15	10,469	47
Fiesta City	12.47	2.5	3.25	5,197	24
Hastings	12.47	5	6.5	9,837	41
Lake Emily	13.8	2	2.6	3,999	18
Lake Pulaski	34.5	8.5	11.05	16,746	72
Lawrence Creek	12.47	4	5.2	7,637	70
Lester Prairie	TBD	3.5	4.55	6,891	29
Mayhew Lake	TBD	4	5.2	8,028	34
Montrose	TBD	3	3.9	5,909	35
Paynesville	TBD	10	13	20,061	294
Pine Island	TBD	2.5	3.25	5,010	19
Pipestone	23.9	2	2.6	4,147	16
Scandia	TBD	2.5	3.25	4,926	23
Waseca	23.9	10	13	19,643	84
West Faribault	TBD	2.5	3.25	4,926	27
West Waconia	13.8	8.5	11.05	16,729	75
Wyoming	TBD	3.5	4.55	6,770	28
Zumbrota	12.47	3.5	4.55	6,878	33
	Totals	**113.5**	**147.55**	**224,462**	**1390**

If Geronimo's proposal is not selected (the no-build alternative), Geronimo would continue to develop photovoltaic solar facilities in Minnesota and elsewhere. Geronimo has stated that, at this time, it does not intend to develop facilities on a speculative basis, independent of need identified by prospective power purchasers. The location of future sites for these facilities and the timeframe for future construction are unknown at this time, and would be dependent upon need identified by prospective power purchasers.[25]

[24] *Geronimo Energy's Distributed Energy Generation Zones Update and Public Filing*
[25] Geronimo, personal communication, August 13, 2013, response to questions 1 - 2

3.5 GRE Capacity Credit Proposal

GRE has submitted a proposal to sell Xcel Mid-continent Independent System Operator (MISO) Zone 1 Resource Credits. GRE's proposal identified two different amounts of credits, each mutually exclusive of the other. The number of credits in GRE's proposal is classified as trade secret.[26]

MISO's role is to ensure reliability of the electric system in a region of North America that includes Minnesota. To ensure reliability MISO requires each utility to have access to generation capacity that is in excess of that utility's forecasted peak energy demand; this excess amount is often referred to as the "reserve requirement." A Zone Resource Credit is a credit that counts towards MISO reserve requirement, but cannot be used to meet energy demand.

Under GRE's proposal no new facilities would be constructed and no rights to energy production would be transferred to Xcel. GRE's existing generation resources would continue to operate to meet GRE's needs but Xcel could use the credits to meet its MISO reserve requirement.

If either of GRE's proposals is selected, GRE would maintain its current energy production rights and MISO would dispatch GRE's existing generation resources according to GRE directions. Xcel could use the credits to meet its reliability goals, but would need to rely on its own generation resources (its generation plants, long-term contracted energy purchases, and short-term energy purchases) to provide sufficient energy to meet the needs if of its customers. If Xcel does not have sufficient generation capacity to meet its customers' energy demand, Xcel would need to purchase additional energy from the wholesale market.

If GRE's proposal is not selected (no-build alternative), GRE would continue to operate its resource portfolio in the same way as it does today. GRE would likely offer the capacity offered in this proposal to others in the market or through MISO's annual capacity auction.[27]

[26] GRE, personal communications, August 2 and 14, 2013 (Appendix C)
[27] GRE, personal communication, August 2, 2013 (Appendix C)

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 siting and through use of best management practices. This section discusses the potential impacts related to construction and operation of the various proposals. The section also provides an overview of mitigation strategies that may be used to minimize human and environmental impacts.

It is important to note that many impacts and mitigation measures are very specific to the site and the design of a facility. All of the proposals considered in this proceeding, with the exception of the capacity credit proposal by GRE which does not entail construction of any facilities, would require a site permit from the Commission prior to construction. The siting process requires preparation of an environmental review document for each project that looks at specific location and design features to identify potential impacts and appropriate mitigation. Appropriate mitigation can be incorporated in conditions to the site permit issued by the Commission in separate site permitting proceedings.

4.1 Fuel Availability and Delivery

Natural gas for the thermal generation plants will be delivered to each site via pipeline (natural gas) and truck (fuel oil backup). The Mankato Energy Center Expansion would use an existing natural gas pipeline to supply fuel to the facility. New pipelines would be constructed for the Red River Valley Plant, and the Hampton Energy Center. The Black Dog Expansion may require either a new or larger pipeline to the facility.

The sun serves as fuel for the Distributed Solar Facilities proposal. There is no fuel associated with the Capacity Credit proposal for capacity credits, as no energy is associated with that proposal.

Black Dog Expansion

The Black Dog Expansion would be fueled by natural gas. The existing plant is served by Center Point Energy. Xcel plans to initiate a competitive bidding process to provide additional natural gas to fuel the facility in early 2014. Xcel has stated that the existing pipeline may need to be replaced with a higher pressure natural gas line.[28]

If the Black Dog Expansion is not selected, there would be no new natural gas pipeline between the Black Dog Plant and the Cedar Town Border station in the foreseeable future.

Red River Valley Plant

For the Red River Valley Plant, Xcel anticipates constructing a short pipeline to provide natural gas to the facility.[29] No other fuel type is identified in the Red River Valley proposal, although the anticipated layout includes room for distillate oil storage and handling if a need for fuel oil backup is identified in the future.[30]

[28] Xcel Proposal, at p. 1-11
[29] Xcel Proposal, at p. 1-12
[30] Xcel Proposal, at p. 4-9

Mankato Energy Center Expansion
Natural gas to fuel Calpine's proposed Mankato Energy Center expansion would be provided through the existing 20 inch Northern Natural Gas pipeline that supplied the existing facility. Calpine states that there is sufficient capacity on the existing pipeline lateral to accommodate the proposed expansion.[31] Although the existing Mankato Energy Center uses fuel oil as a backup, Calpine's proposal for the expansion is gas only and, as proposed, does not include fuel oil.[32]

If the Mankato Energy Center Expansion is not selected, there would be no change to the existing natural gas pipeline. Delivery of fuel oil to the existing Mankato Energy Center would continue as it is at present.

Cannon Falls Expansion
Invenergy anticipates that the Cannon Falls Expansion would be fueled by natural gas through the same pipeline that supplies the existing facility. Invenergy does not anticipate that the expansion would require more than minor upgrades or operational changes to the existing pipeline.[33] The expansion would also be capable of using fuel oil as a backup and would share the fuel oil unloading and storage facilities at the existing Cannon Falls Energy Center.[34] It is anticipated that there may be some increase in fuel oil deliveries to the Cannon Falls Energy Center resulting from the expansion.

Hampton Energy Center
Invenergy would construct approximately one-half mile of new pipeline to connect the Hampton Energy Center with an existing 16 inch lateral pipeline owned and operated by Greater Minnesota Gas.[35]

Fuel oil used as a backup fuel would be trucked to the facility and stored in an on-site tank. Invenergy anticipates installing a 750,000 gallon fuel oil storage tank, similar in design to that used at the existing Cannon Falls facility.[36]

Distributed Solar Facilities
Geronimo's proposal would use photovoltaic panels to convert solar energy into electricity. No fuel would need to be delivered to the site.

Capacity Credit Proposal
Under GRE's proposal, there will be no changes in how fuel is delivered to GRE's existing resource portfolio.

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[31] Calpine, *Environmental Supplement of Calpine Corporation*, June 14, 2013, eDockets ID: 20136-88179-01 (herein after, Calpine Environmental Supplement)
[32] Calpine personal communication, August 13, 2013
[33] Invenergy, *Invenergy Thermal Development LLC's Filing Pursuant to Commission's June 10, 2013 Notice of Filing Deadline*, June 27, 2013, eDockets ID: 20136-88618-01 , (herein after Invenergy Environmental Supplement), p. 4
[34] Ibid., p. 1
[35] Invenergy, *Hampton Energy Center Proposal*, p. 4, Ibid., p. 4.
[36] Invenergy, *Direct Testimony of Daniel Ewan*, September 27, 2013, eDocket ID: 20139-91837-02 (herein after, Ewan Direct Testimony)

4.1.1 Mitigation Measures

The primary mitigation strategy for delivery of fuels would be to use of existing pipelines where possible, proper routing of new pipelines to minimize human and environmental impacts that may result, and minimizing fuel oil deliveries to the extent possible.

There are no known impacts associated with fuel delivery to be mitigated from the Distributed Solar or Capacity Credit proposals.

4.2 Associated Transmission Facilities

Electrical generation facilities typically require construction of transmission facilities such as transmission lines and substations to connect to the transmission grid. This section discusses these associated transmission facilities and their potential impacts.

The proposals incorporating construction of new facilities anticipate interconnection of their facilities with transmission lines varying from 34.5 kilovolts (kV) to 230 kV. Neither the Black Dog Expansion nor the Mankato Energy Center Expansion would require construction of new transmission facilities. Invenergy anticipates that both the Cannon Falls Energy Center Expansion and Hampton Energy Center would require construction of a 345 kV transmission line between each facility and the Hampton Substation currently under construction in Hampton Township. Xcel anticipates that the Red River Valley Plant would require either expansion of Otter Tail Power's existing Hankinson Substation or construction of a new 230 kV substation and construction of a new 230 kV transmission line between the plant and the substation. The Distributed Solar proposal would connect each of the sites to local distribution substations through new distribution lines at 34.5 kV and lower.

Xcel Proposal – Black Dog Expansion
Under the Xcel Proposal, Black Dog Expansion would be connected to the existing 115 kV transmission system through the existing 115 kV switchyard at the Black Dog facility. No transmission improvements would be required.[37]

Red River Valley Plant
Construction of the Red River Valley Plant would also require either expansion of Otter Tail Power's existing Hankinson Substation or construction of a new 230 kV substation. As part of the proposal, Xcel would construct a new 230 kV double-circuit transmission line between the new plant and the substation.[38] Construction of the units is likely to require an upgrade to the existing Hankinson to Wahpeton 230 kV transmission line.[39]

If neither of Xcel's proposals is selected there would be no changes to the existing transmission system.

[37] Xcel Proposal, p. 1-11
[38] Xcel Proposal, pp. 4-9 – 4-10
[39] Xcel Proposal, p. 1-12

Mankato Expansion

Calpine's proposed Mankato Expansion can be constructed without changes to the existing transmission system.[40]

Cannon Falls Expansion
The Cannon Falls facility currently connects to the transmission system through a 115 kV transmission line between the facility and an adjacent 115 kV substation. An initial MISO study has indicated that connecting the expansion to the grid at the existing interconnection point would overload a number of 69 kV and 115 kV lines in the Cannon Falls area. Given the potential for upgrades of both the 69 kV and 115 kV systems in the Cannon Falls area, Invenergy proposes delivering energy from the Cannon Falls facility to the Hampton Substation, approximately nine miles north of the Cannon Falls facility through a newly constructed 345 kV transmission line.[41] Although Invenergy has proposed co-locating the proposed 345 kV transmission line with the Hampton to Rochester 345 kV High Voltage Transmission Line (HVTL) currently under construction, a transmission line of the proposed size would require a HVTL permit from the Commission. The HVTL permitting process requires review of more than one route for a 345 kV transmission line.

Hampton Energy Center
In the case of the preferred Hampton Energy Center, Invenergy would construct approximately 1000 feet of new 345 kV transmission line between the site and the adjacent Hampton Substation.[42]

Geronimo Proposal
Under Geronimo's proposal, each site would be connected to a nearby distribution substation at voltages up to 115 kV. Although interconnections are still under study, the majority of interconnections are anticipated to be at or below 34.5 kV.[43] Geronimo anticipates that interconnections would vary in length between 0.5 and 3 miles.[44]

GRE Proposal
Under GRE's proposal, capacity from GRE's existing generation resources is connected to the electric grid. No new transmission resources would be constructed.

4.2.1 Mitigation Measures

The primary mitigation measure would be to use existing transmission infrastructure where possible, thereby minimizing the need for new construction. In cases where new transmission facilities are needed, proper routing can minimize human and environmental impacts from new facilities.

Under Minnesota Statute 216E.01, subdivision 4, electric transmission lines that are over 100 kV and longer than 1,500 feet are defined as "high voltage transmission lines," and are subject to regulation by the Commission. Under Minnesota Statute 215E.05, proposers have the option to seek local approval

[40] Calpine Environmental Supplement, June 14, 2013, p. 4
[41] Ewan Direct Testimony, pp. 9 – 10; Invenergy Personal Communication, September 19, 2013 (Appendix C)
[42] Invenergy, Personal Communication, August 15, 2013 (Appendix C)
[43] Geronimo personal communication, August 13, 2013, (Appendix C)
[44] Geronimo Proposal, p. 25

for high voltage transmission lines between 100 and 200 kV. Minnesota lines with a voltage of less than 100 kV are subject to local regulation. The transmission routing process requires preparation of an environmental review document. The Commission may impose conditions on route permits.

In North Dakota, the Public Service Commission follows a two-part process to site electric transmission lines over 115 kV. After first certifying a corridor within which the transmission line may be located, the Public Service Commission designates a route within the certified corridor. The Public Service Commission may impose conditions on transmission line construction and operation in the Route Permit issued for a project.[45]

4.3 Water Usage

Electric generation facilities generally require at least some water for operation of the facility. Water usage can vary greatly depending upon the technology.

During the construction phase, water may be used on an occasional basis to suppress dust generated by construction activities.

Once operational, natural gas plants, such as those anticipated in proposals from Xcel, Calpine, and Invenergy, require water for their process to provide cooling that enhances the operational efficiency of the plant, water for equipment maintenance, and smaller amounts of potable water to provide for basic sanitary needs of employees.

The proposers anticipate that their water supply would be provided through existing wells (Black Dog Expansion and Cannon Falls Expansion), through new wells constructed for the proposal (Hampton Energy Center, and possibly the Red River Valley Plant and one or more of the Distributed Solar Facilities), through a municipal water source (Distributed Solar Facilities, and possibly the Red River Valley Plant), or through treated wastewater provided by the host municipality (Mankato Energy Center Expansion). None of the proposals anticipates use of surface water to supply process or sanitary water.

Black Dog Expansion

As with the combustion turbines currently operating as Black Dog Units 2 and 5, the Unit 6 combustion turbine anticipated in Xcel's Black Dog Expansion proposal would require water during the operation of the facility to provide occasional evaporative cooling. The evaporative cooling enhances operational efficiency of the combustion turbine during the warmest days of the year. Xcel anticipates that water would be used during approximately 20 percent of the time the proposed combustion turbines are in operation.[46]

Xcel anticipates that once Units 3 and 4 are retired, the entire Black Dog Plant including the expansion (Units 2, 5, and 6) will require approximately 1.2 million gallons per year. Unit 6 is anticipated to have a maximum pumping rate of 50 gallons per minute and a daily average pumping rate of of 34 gallons per minute during summer operation.[47] Water for operations at the Black Dog site comes from the existing

[45] North Dakota Public Service Commission, *Information by Jurisdiction: Siting Information*. http://www.psc.nd.gov/public/consinfo/jurisdictionsiting.php
[46] Xcel Proposal, pp. 6-8, 6-9, and tables C4a and C4b
[47] Xcel Proposal, table C4a

well at the facility. Xcel does not foresee any changes to the existing Groundwater Appropriations Permit for the facility resulting from the addition of Unit 6.[48]

If Black Dog Expansion is not selected, water will continue to be used at the site for Units 2 and 5.

Red River Valley Site

Xcel anticipates that the Red River Valley Plant would require approximately 1.2 million gallons per year with a maximum pumping rate per unit of 50 gallons per minute and a daily average pumping rate per unit of 34 gallons per minute during summer operation.[49] If both units are built, the maximum pumping rate would be 100 gallons per minute with an average daily use of 68 gallons per minute. Water for the facility would come from either a new well to be drilled at the site chosen for the project or, if there is not sufficient groundwater at the chosen site, water would be trucked in and stored at the site.[50]

If Red River Valley Plant is not selected, there would be no wells drilled and no water storage tank would be constructed at the proposed site in the foreseeable future.

Mankato Energy Center Expansion

The plant uses process water to produce steam to drive a steam turbine in addition to the combustion turbines fired directly by natural gas. Exhausted steam from the steam turbine is condensed back into water to cycle through the process again. The plant also uses water in a cooling tower to cool hot water from the steam turbine condenser and other heat loads (e.g. generators and lube oil systems). Calpine uses treated wastewater piped from the Mankato Wastewater Treatment Plant to the facility through a dedicated line to provide process water. [51] Potable water is also supplied through the city of Mankato's municipal water supply system.

In its current configuration, the Mankato Energy Center has an average maximum daily water usage of approximately 1.5 million gallons per day. Calpine anticipates that the current agreement with the city of Mankato for water usage of up to 6.2 million gallons per day provides more than sufficient water for the expansion and that no additional infrastructure will be required.[52]

If the Mankato Energy Center Expansion is not selected, there would be no change in water use at the existing plant.

Cannon Falls Expansion

As with the other gas plants in this proposal, the Cannon Falls plant requires water for evaporative cooling as well as sanitary needs. Water for the existing facility is supplied through the Cannon Falls municipal water system, which draws its water from the Jordan and Jordan-St. Lawrence aquifers. Average water use at the existing Cannon Falls facility over the past four years has been less than 500,000 gallons per year. The Cannon Falls facility maintains two on-site 750,000 gallon storage tanks

[48] Xcel Proposal, p. 1-14, 6-9
[49] Xcel Proposal, table C4b
[50] Xcel Proposal, at p. 6-9
[51] Minnesota Environmental Quality Board, *Environmental Assessment: Calpine Mankato Energy Center Power Generating Plant*, July 2004, http://www.eqb.state.mn.us/pdf/FileRegister/Calpine-Mankato/1111CalpineJune30.pdf , pp. 19-21
[52] Calpine Personal Communication, September 19, 2013 (Appendix C)

(one with raw water and one with demineralized water) on site to meet short-term operational fluctuations without impacting the city's water system.[53]

Invenergy anticipates that the proposed expansion would increase water use at the existing facility by approximately 40 percent, or up to 200,000 gallons per year. Water for the expanded facility would continue to be provided through the municipal water system. Invenergy does not anticipate that any changes to the city's water system would be necessary to provide the additional increment of water. The current Cannon Falls plant does not use any surface water and the expansion will not require use of surface water.[54]

Hampton Energy Center

As with the other gas plants in this proposal, the Hampton Energy Center would require water for evaporative cooling as well as sanitary needs. Invenergy estimates the groundwater needed for the Hampton Energy Center will be less than one million gallons per year (less than three acre feet per year), with a maximum groundwater use of up to 30 gallons per minute.[55] Invenergy anticipates that the water required for the Hampton Energy Center will be supplied through a well drilled at the site and installation of a water storage tank. Invenergy does not anticipate use of surface water for the Hampton Energy Center.[56]

Distributed Solar Proposal

Under Geronimo's proposal, the PV installations would not require any water for cooling, but would require water for cleaning of panels annually or semi-annually.[57] Based on the experience of other solar plants operating in Xcel's Upper Midwest Service Region, Geronimo anticipates that rain and snow at the dispersed sites will accomplish much of the necessary cleaning, resulting in less frequent washing than in the west and southwest. Geronimo provides a conservative estimate of approximately 10,000 gallons per MW, or up to one million gallons per year if all 100 MW are constructed.[58]

Geronimo anticipates locating one or more operations and maintenance facilities to serve several distributed sites. Water for sanitary uses and for occasional cleaning of the solar panels would be provided to O&M facilities through municipal water providers. Water for panel cleaning would be provided either through a municipal tap at the project site, if the site is located in an area served by municipal water, or trucked to the site after filling up at a Geronimo operations and maintenance facility.[59]

If the Geronimo proposal is not constructed, there would be no changes in water usage near the 23 identified sites in the foreseeable future.

[53] Invenergy, Personal Communication, September 19, 2013 (Appendix C)
[54] Ibid.
[55] Invenergy Environmental Supplement
[56] Invenergy, personal communication, September 19, 2013 (Appendix C)
[57] PV installations differ from parabolic trough solar technologies, which concentrate the require water to
[58] Geronimo Proposal, at p. 24
[59] Geronimo, personal communication, July 30, 2013 (Appendix C)

Capacity Credit Proposal
Under both the GRE proposal and the GRE no-build proposal, no facility would be constructed and water usage and discharges would continue across GRE's resource portfolio.

4.3.1 Mitigation of Water Usage

Water usage for plant operations can be minimized through choice of generation technology. Once a technology is chosen, water usage can be further minimized through the use of treated wastewater (water that has already been appropriated).

4.4 Wastewater Discharge

Large electric generation facilities have the potential to generate significant amounts of wastewater. This section discusses potential impacts from wastewater generation.

Consistent with water usage of the various proposals described in Section 4.3, the main sources of water discharges are from process water required for cooling of natural gas-fired thermal plants, cleaning and maintenance of generation equipment, and much smaller amounts of sanitary water used by employees. Wastewater is discharged to municipal wastewater systems (Mankato Energy Center Expansion, Cannon Falls Expansion, and possibly the Black Dog Expansion), to surface waters (possibly Black Dog Expansion), to a septic system or a holding tank (Hampton Energy Center). In the case of Geronimo's proposal for Distributed Solar Facilities, water used to clean the panels would either evaporate or run off to the surface under the panels. No water discharge is associated with GRE's Capacity Credit Proposal, as it does not entail construction of any new facilities.

Black Dog Expansion
Wastewater would come from two sources: treatment process for the groundwater used for evaporative cooling; service water used during maintenance activities (e.g. equipment washing). Xcel anticipates the total amount of process and service wastewater to be less than 1.4 million gallons per year.[60] As Xcel does not anticipate a significant change in staffing levels from the addition of Unit 6, sanitary wastewater discharges are not anticipated to change as a result of the project.

Xcel anticipates that both treated process water and service water will be discharged to surface waters or sanitary sewer. Sanitary wastewater will continue to be discharged to the existing sanitary sewer.

Because of the planned retirement of Units 3 and 4, water discharge at the Black Dog Plant would decrease from the present amount regardless of whether Unit 6 was constructed. If Unit 6 is not constructed, the decrease in wastewater discharge would be greater than if Unit 6 were constructed.

Xcel Proposal – Red River Valley
Wastewater would come from two sources: treatment process for the groundwater used for evaporative cooling; service water used during maintenance activities (e.g. equipment washing). Xcel anticipate the total amount of process and service wastewater to be less than 2.8 million gallons per year if both units are constructed. A small amount of domestic wastewater would also be generated.[61]

[60] Xcel proposal, table 6-6
[61] Xcel proposal, table 6-7

Xcel anticipates that both treated process water and service water will be discharged to an on-site settling pond or to a sanitary sewer. Discharge to sanitary sewer would be dependent upon the location of the facility in relation to the municipality's system and the capacity of the wastewater treatment system to accommodate the discharge, both of which are unknown at this time. If the facility does not have the ability to connect to a municipal wastewater system for disposal, Xcel would install a settling pond or tank to accumulate wastewater and contract for truck hauling to a location for disposal. Site storm water runoff would be run through settling and to local drainage. Sanitary wastewater would be discharged to an on-site drain field.[62]

Mankato Energy Center Expansion

Under the Calpine proposal cooling and process wastewater would be discharged to the city of Mankato through a City Wastewater Discharge Permit. Domestic wastewater would be discharged through the plant's existing sewer line.[63] Under the agreement with the city, the current discharge permit allows for the discharge of 1.55 million gallons per day. The wastewater discharge pipe is designed to accommodate 1.7 million gallons per day. The plant currently has a maximum discharge rate of 0.35 million gallons per day. With the expansion, Calpine anticipates that the discharge would approximately double, increasing to approximately 0.70 million gallons per day. Calpine does not anticipate that the proposed expansion would require any changes to Mankato's treatment system.[64]

If Calpine's proposal is not selected, water discharge would remain at current levels.

Cannon Falls Expansion

Blowdown from the evaporative cooler would comprise the largest portion of wastewater discharge from the Cannon Falls expansion proposal. Invenergy anticipates that wastewater from the expansion would continue to be discharged to the municipal wastewater system in Cannon Falls, as it is currently. Invenergy does not anticipate that the additional discharge would require any change to the municipal water treatment plant.[65]

If the Cannon Falls Expansion is not selected, there would be no change to the water discharge from the existing Cannon Falls facility.

Hampton Energy Center

As with the Cannon Falls expansion, blowdown from the evaporative cooler would comprise the largest portion of wastewater discharge at a new Hampton Energy Center. Wastewater would discharge to an on-site septic system or an on-site holding system.

If the Invenergy proposal is not selected, water discharge would remain at current levels at the Cannon Falls Energy Center and there would be no water discharge from a new Hampton Energy Center.

[62] Xcel proposal, Table 6-7; Xcel personal communication, October 8, 2013 (Appendix C)
[63] Calpine Environmental Supplement
[64] Calpine, personal communication, September 19, 2013 (Appendix C)
[65] Invenergy, personal communication, September 19, 2013 (Appendix C)

Distributed Solar Facilities
Wastewater runoff from cleaning of the solar panels would either evaporate or run off into the ground beneath the panels, similar to water used in irrigation of row crops.

If the Geronimo proposal is not selected, there would be no wastewater discharge.

Capacity Credit Proposal
Under both the GRE proposal and the GRE no-build proposal, no facility would be constructed and water usage and discharges would continue as they are presently across GRE's resource portfolio.

4.4.1 Wastewater Discharge Mitigation

The primary mitigation for discharge of wastewater is to minimize the rate and total amount of discharge to the extent possible.

Regulation of wastewater discharges varies depending up where the water is discharged. Wastewater discharges to municipal wastewater systems are subject to agreement between the municipal provider and the utility; this agreement would identify discharge rates, volumes, and water quality.

If water is discharged to surface waters from electric generation facilities the project operator must apply for an Industrial National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit from the Minnesota Pollution Control Agency (MPCA). The NPDES/SDS permit requirements may include monitoring, limits, and implementation of best management practices to protect surface and groundwater quality.

4.5 Geology and Soils

Impacts to geology and soils would be most likely to occur during construction of generation facilities. Impacts to geology are unlikely to result from construction or operation of the proposals.

Topography at the identified sites is generally flat to rolling hills. Although grading will likely be required prior to construction, it is anticipated that the overall character of topography will not change significantly. During construction there is potential for soil compaction resulting from movement of construction vehicles. Disturbed soils are also subject to erosion from wind or water.

Black Dog Expansion
Dakota County has identified soil contamination at the existing Black Dog Site resulting from coal and ash handling. Xcel will begin remediation at the site after retirement of the last remaining coal units are retired regardless of whether the Black Dog expansion is selected. Unit 6 will be constructed in an existing building, significantly minimizing potential for soil compaction and erosion.

If the Black Dog Expansion is not selected, there would be no impact to geology or soils from construction of the expansion in the foreseeable future.

Red River Valley Plant
Xcel has not identified a specific site for the Red River Valley Plant. Topography in the area studied as a potential site for the facility is generally characterized as level to gently rolling and significant impacts to

site topography are not anticipated. Construction of the Red River Valley Plant is likely to result in soil compaction and the potential for soil erosion related to construction of the plant, the natural gas pipeline to serve the plant, and the associated transmission.

If the Red River Valley Plant is not selected, there would be no impact to geology or soils from construction in the foreseeable future.

Mankato Energy Center Expansion
Because the proposed Mankato Energy Center Expansion would be developed adjacent to the existing facility, the potential for topographic impacts and soil compaction is minimized. The potential for soil erosion remains, but is less than for a greenfield site.

If the Mankato Energy Center Expansion is not selected, there would be no impact to geology or soils from construction in the foreseeable future.

Cannon Falls Expansion
Because the proposed Cannon Falls Expansion would be developed adjacent to the existing facility, the potential for topographic impacts and soil compaction is minimized. The potential for soil erosion remains, but is less than for a greenfield site.

If the Cannon Falls Expansion is not selected, there would be no impact to geology or soils from construction in the foreseeable future.

Hampton Energy Center
Both the preferred and alternate sites Invenergy has identified for the Hampton Energy Center are actively farmed and relatively level. Significant impacts to site topography are not anticipated. Construction of the Hampton Energy Center is likely to result in soil compaction and the potential for soil erosion related to construction of the plant, the natural gas pipeline to serve the plant, and the associated transmission.

If the Hampton Energy Center is not selected, there would be no impact to geology or soils from construction in the foreseeable future.

Distributed Solar Proposal
Although the depth of support posts depends upon site specific characteristics, Geronimo anticipates depths of approximately 10 feet.[66] Given this depth, impacts to geology from Geronimo's Distributed Solar proposal are unlikely. There is a potential for soil compaction and erosion resulting from construction of the distributed sites and the electric distribution lines that would deliver energy output to distribution substations.

If the Distributed Solar proposal is not selected, there would be no soil compaction or erosion at the identified sites in the foreseeable future.

[66] Geronimo, personal communication, October 1, 2013 (Appendix C)

Capacity Credit Proposal
Because no facility would be constructed whether or not GRE's capacity credit proposal is selected there would be no soil compaction or erosion as a result.

4.5.1 Mitigation Measures

The preferred mitigation strategy for soil compaction is to minimize the extent of construction activities, particularly in areas with wet or mucky soils, to the extent possible. If construction in areas with wet or mucky soils is necessary, scheduling of construction during frozen ground conditions or use of construction mats can be used to minimize compaction. In areas where soil has been compacted, tillage can be used following the end of construction activities to restore soils.

Avoidance of soil disturbance and excavation activities in areas with steep slopes is the preferred mitigation strategy for minimizing the potential for erosion. In areas of soil disturbance best management practices (such as silt fencing and covering of exposed soils can minimize the potential for impacts. Re-establishment of vegetation following construction is important in reducing the potential for erosion over the long-term.

All construction projects disturbing one acre or more are required to apply for a construction storm water permit through the Minnesota Pollution Control Agency (MPCA). Applicants will submit a National Pollutant Discharge Elimination Systems (NPDES) permit application for construction facilities to the MPCA. As part of the NPDES process a Storm Water Pollution Prevention Plan (SWPPP) will be developed prior to construction, and will identify best management practices (e.g. silt fencing, management of exposed soils and re-vegetation plans) to prevent erosion.

4.6 Land Use and Displacement

The proposals under consideration vary greatly in their land use requirements. The expansion proposals for the Black Dog proposal, Mankato Energy Center, and Cannon Falls facilities would be constructed adjacent to existing generation facilities and would not require additional land acquisition or land use changes. Construction of new natural gas plants proposed for the Red River Valley and Hampton Energy facilities are anticipated to require acquisition of new parcels of up to 160 acres of agricultural land within which up to 35 acres would be developed. The Distributed Solar proposal would develop approximately 20 sites, totaling approximately 700 acres; land use would change from the current uses (predominantly agricultural, but also sites that are adjacent to industrial or residential land uses) to a more industrial use. GRE's capacity credit proposal would not entail any construction and no land use changes would result.

Black Dog Expansion
Xcel established the Black Dog plant in the early 1950s as a coal-fired electric generation plant. Prior to its establishment as a power generation facility the site was an undeveloped floodplain area. The site of the plant is in a floodplain, which has been graded and developed such that the operational portion of the plant is outside of the 100 year floodplain.[67]

[67] Xcel Proposal, at p. 6-20

Unit 6 would be constructed in the approximate location of Unit 4 within the existing 35-acre plant site.[68] There would be no change from its current utility/industrial use and no displacement of any existing land uses.

If the Black Dog Expansion proposal is not selected, there would be no change from the site's current industrial land use, although the footprint of the developed area would be somewhat smaller due to removal of Units 3 and 4. No new generation would be constructed in the foreseeable future.

Red River Valley Site

Xcel proposes to acquire approximately 160 acres of agricultural land near Hankinson, North Dakota. Approximately 35 acres would be developed for the plant, permanently changing the land use from agricultural to industrial and displacing the 35 acres. Xcel anticipates that the remainder of the land will remain farmed.[69]

If the Red River Valley plant is not selected there would be no change in land use and no displacement of any existing land uses in the Hankinson area in the foreseeable future. Although Xcel has stated its belief that the Hankinson area shows potential for development of future generation, the timeline of such development is unknown.

Mankato Energy Center Expansion

The Mankato Energy Center Expansion described in the Calpine proposal, would be constructed within the existing 25 acre site.[70] Construction of the proposed facility would not result in any change in land use or displacement of any existing use, although the developed area of the facility would be larger.

If the Mankato Energy Center Expansion is not selected there would be no change in land use and no displacement of any existing land use.

Cannon Falls Expansion

If the Cannon Falls expansion proposal is selected, the facility would be constructed on approximately 2 acres of Invenergy's existing Cannon Falls site. No additional land would be required and there would be no displacement of the existing use, although the area of the power generation facility would be larger.

If the Cannon Falls expansion proposal is not selected, there would be no change in the existing land use of the site.

Hampton Energy Center

If the Hampton Energy Center is selected Invenergy plans to exercise its option to purchase 20 acres at a site adjacent to GRE's Hampton Corners Substation. Although not being actively developed at this time Invenergy has identified a site near the Lake Marion Substation as an alternative site for the Hampton Energy Center. Selection of the Hampton Energy Center would displace approximately 20 acres of agricultural land use, permanently changing the land use from agricultural to industrial.

[68] Xcel Proposal, at p. 1-13
[69] Xcel, personal correspondence, September 20, 2013 (Appendix C)
[70] Calpine Environmental Supplement

If the Hampton Energy Center is not selected, there would be no change in the existing land use of the site.

Distributed Solar Proposal
Geronimo anticipates installing approximately 20 solar facilities at sites located across Xcel's service territory. Geronimo has preliminarily identified 23 sites, ranging in size from 16 to 294 acres, as potential sites for the solar facilities (Appendix B). The land use at majority of identified sites is agriculture, predominantly row crops, although some sites are identified as "vacant land," or land that is not currently used for housing, infrastructure, or economic use but is changing from one land cover to another, often at the edge between urban and agricultural land covers.[71] Most identified sites are located in agricultural areas with scattered homesteads and woodlots, but some of the identified sites are located near what appear to be industrial areas, rural residential area, or developing residential areas.

Geronimo estimates a range of between 4 and 10 acres of developed area per MW would be required to install the necessary project components including panels, operations facilities, substations and interconnection facilities. [72] Geronimo has estimated that the development of the entire 100 MW proposal would require 700 acres, but could range between 400 and 1000 acres.[73] Installation of the facilities would displace the current land use, which is cropland at the majority of identified sites.

If the Distributed Solar Proposal is not selected through this process, Geronimo would continue to develop potential solar facilities in Minnesota and elsewhere. Because locations, size, and timeframe for development of such facilities are unknown at this time it is not possible to predict future land use changes.

Capacity Credit Proposal
As GRE's capacity credit proposal does not involve construction of any new facilities, there would be no change in land use regardless of whether or not the proposal was selected.

4.6.1 Mitigation of land use impacts

Required land for the proposed projects can be minimized through careful plant siting and design. Potential for conflicts with adjacent land uses can be minimized through siting of the project. In some cases re-establishing agricultural uses on undeveloped portions of the site or establishing vegetative buffers to provide separation between power generation facilities and other land uses could minimize land use conflicts.

4.7 Health and Safety

Safety issues at electric generation facilities are associated both with construction and operation would not vary significantly between proposals. Unauthorized access to generation and transmission facilities, both during construction and operation phases, could result in safety issues. During construction there is a potential for accidents including falls, vehicle accidents, electrical accidents, and power tool accidents and other. Depending upon their height and proximity to airports and helipads, the emissions

[71] Geronimo Proposal, p. 23; Geronimo, personal communication, August 13, 2013 (Appendix C)
[72] Geronimo, personal communication, October 1, 2013 (Appendix C)
[73] Geronimo Proposal, at p. 23; Geronimo, personal communication, October 1, 2013 (Appendix C)

stacks for the natural gas proposals may require lighting to avoid interference with aircraft. As with other industrial facilities, there is the potential for fire or other industrial accidents once operational.

Electric and Magnetic Fields

Electric and magnetic fields (EMF) arise from the voltage and the flow of electricity (current) through a conductor, and are present wherever there is electricity. 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. A summary of electric and magnetic field properties is summarized in **Table 2**.

Table 2: Summary of Electric and Magnetic Field Properties[74]

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.

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. [75]

Natural and human-made electric and magnetic fields are present everywhere in our environment. The Earth's natural static background electric field is approximately 120 to 150 volts per meter. 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, 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.

[74] World Health Organization, "What Are Electromagnetic Fields?" *Health and Environment Briefing Pamphlet, Series 32,* 1999. http://www.who.int/peh-emf/about/WhatisEMF/en/
[75] Long Island Power Authority, *Magnetic Fields Around Your Home,* 2005, http://www.lipower.org/residential/safety/emf.html

The effect of EMF on human health has been the subject of study for more than 25 years. Of particular concern is the link between EMF exposure and cancer. Numerous panels of experts have convened to review research data on whether EMF is associated with adverse health effects. The studies have been conducted by the National Institute of Environmental Health Sciences, the USEPA, the World Health Organization, and the Minnesota State Interagency Working Group on EMF issues. Studies regarding EMF exposure and childhood leukemia and other cancer risks have had mixed results. Some organizations have determined that a link between EMF and cancer exists while others have found this link to be weak or nonexistent.

Currently the USEPA states the following viewpoint of the associated health effects of EMF on its website:

> *Many people are concerned about potential adverse health effects. Much of the research about power lines and potential health effects is inconclusive. Despite more than two decades of research to determine whether elevated EMF exposure, principally due to magnetic fields, is related to an increased risk of childhood leukemia, there is still no definitive answer. The general scientific consensus is that, thus far, the evidence available is weak and is not sufficient to establish a definitive cause-effect relationship.*[76]

It is important to note that although expert panels and agencies, such as the ones discussed above, have not yet identified any viable cause and effect relationships between exposure to EMFs and adverse health effects, hypotheses have existed and continue to be researched.

Natural Gas Proposals

As with all construction projects, there is a potential for accidents from falls, vehicles, electrical equipment and power tools. All of the natural gas plants under consideration in this proceeding would be located inside the fenced area of existing generation facilities, minimizing the potential for unauthorized access to the facility during both construction and operation.

The Red River Valley, Cannon Falls Expansion and Hampton Energy Center proposals all require construction of new gas pipelines to provide fuel and electric transmission facilities to deliver the energy to the electric grid. Health and safety risks associated with natural gas pipelines include leaks and the potential for explosions. Health and safety impacts associated with transmission include transmission equipment failure and electric and magnetic fields.

The tallest features at the natural gas plants would be the emissions stacks. Structures over 200 feet, or in the vicinity of public airports and helipads require review by the Federal Aviation Administration (FAA).

Health effects related to air emissions and estimated emission rates for the various proposals are discussed in Section 4.10.

[76] US Environmental Protection Agency, *Electric and Magnetic Fields (EMF) Radiation from Power Lines*, 2009, http://www.epa.gov/radtown/power-lines.html

Distributed Solar Proposal
As with all construction projects, there is a potential for accidents from falls, vehicles, electrical equipment and power tools. As with the natural gas proposals, each site in the Distributed Solar Proposal would be enclosed by a fence to minimize potential for unauthorized access to solar installations.

Potential impacts to aircraft are not anticipated from PV installations such as those in the Geronimo proposal, although there would be some concern from other solar technologies such as Concentrating Solar Power.[77]

Capacity Credit Proposal
There are no health or safety impacts associated with to GRE's Capacity Credit proposal.

Mitigation
Compliance with the National Electric Safety Code and Occupational Health and Safety Administration (OSHA) regulations, as required by federal law, would minimize the potential for construction related injuries.

Fencing of both the construction site and operating portion of the facility can limit unauthorized access. Security personnel can minimize the potential for equipment theft during construction. The Federal Aviation Administration requires notification of construction of all structures greater than 200 feet, as well as proposed structures near public airports or helipads.[78] Where appropriate, and at the direction of the FAA, emissions stacks may be lighted.

Natural gas pipelines require signage and regular inspections of the pipeline and valves to prevent ruptures. Transmission facilities are required to be equipped with protective devices to safeguard the public from the lines should a line failure occur. In the event of electrical accidents, protective devices, including breakers and relays at the substation, would de-energize the line.

4.8 Economic Impacts

Construction of the generation facilities is expected to generate between 60 and 500 jobs, depending upon the proposal. Once the facilities become operational, up to 10 fulltime operations jobs would be created in the Red River Valley and Distributed Solar proposals. No new operations jobs are expected to be created with the Black Dog, Mankato, Cannon Falls, and Hampton proposals. The amount of new revenues to Minnesota local governments from taxes and fees on the facilities varies between zero for the Distributed Solar proposal (PV installations are exempt from property tax) to approximately $1.4 million for the Black Dog Expansion). The Red River Valley Plant is expected to generate up to $2.8 million annually to local jurisdictions in North Dakota.

[77] U.S. Department of Energy, U.S. Bureau of Land Management, *Solar Energy Development Environmental Considerations*, http://solareis.anl.gov/guide/solar/pv/index.cfm
[78] Federal Aviation Administration, *Obstruction Evaluation/Airport Analysis Webpage,* https://oeaaa.faa.gov/oeaaa/external/portal.jsp, accessed October 1, 2013. Distances from public airports and helipads depend upon the slope of the runway approach.

The selected proposal(s) will also have some effect on the electric rates paid by Xcel's customers. The impact of the competing proposals on rates across Xcel's system is a subject of the contested case hearing in this proceeding. The extent of rate impacts is unknown at this time and will be addressed by the Commission in a separate proceeding, or proceedings, following the Commission's selection of proposals in this proceeding.

Black Dog Expansion

Construction of the Black Dog Expansion proposal is not anticipated to require more than 60 workers at any one time. If the Black Dog Expansion proposal is selected, Xcel plans to add few, if any, staff to the existing Black Dog facility once Unit 6 becomes operational.[79]

Xcel anticipates annual property tax estimates for the Black Dog Expansion (Unit 6 only) would be approximately $1.4 million.[80]

If the Black Dog Expansion is not selected, there would be a lost opportunity for economic benefits associated with short-term construction jobs and long-term for property taxes and fees paid to local governments.

Red River Valley Plant

Xcel has classified the number of both the construction and operations jobs for the Red River Valley Plant proposal as trade secret, but is not anticipated to exceed between 60 at any one time, or 100 if both units are constructed at the same time. Up to 10 jobs may be created to operate the plant.[81]

Xcel anticipates annual property tax estimates for the Red River Valley Plant would be approximately $1.4 million for one unit and approximately $2.8 million for both units.[82]

If the Red River Valley Plant is not selected, there would be a lost opportunity for economic benefits associated with short-term construction jobs and long-term for property taxes and fees paid to local governments.

Mankato Energy Center Expansion

Calpine anticipates that approximately 250 construction workers would be employed during the peak of construction activity. Calpine does not anticipate a noticeable change in operations personnel from current staffing levels once the expansion becomes operational.[83]

Calpine does not anticipates that the expansion would have a significant increase in its overall tax liability of approximately $150,000, as the expansion would be included in a 2003 statutory personal property tax exemption on generation equipment.[84]

[79] Xcel, personal communications, September 20, 2013, October 4, 2013 (Appendix C)
[80] Xcel, personal communication, September 26, 2013 (Appendix C)
[81] Xcel, personal communication, September 20, 2013, and October 4, 2013 (Appendix C)
[82] Xcel, personal communication, September 26, 2013 (Appendix C)
[83] Calpine, Environmental Supplement, p. 4.
[84] Calpine, personal communication, September 19, 2013 (Appendix C)

If the Mankato Energy Center Expansion is not selected, there would be a lost opportunity for economic benefits associated with short-term construction jobs.

Cannon Falls Expansion
Invenergy estimates that approximately 100 construction workers during the peak of construction activity and does not anticipate any change in the level of staffing once the expansion becomes operational.[85]

If the Cannon Falls Expansion is constructed, Invenergy anticipates that the fees and taxes paid to local governments on the existing Cannon Falls facility would increase by approximately 50 percent, or approximately $600, 000.[86]

If the Cannon Falls Expansion is not selected, there would be a lost opportunity for economic benefits associated with short-term construction jobs and long-term for property taxes and fees paid to local governments.

Hampton Energy Center
Invenergy anticipates a workforce of approximately 100 construction workers during the peak of construction activity. Once the expansion begins operation, Invenergy anticipates that existing operations staff from the Cannon Falls Energy Center would operate the Hampton Energy Center, travelling to the site daily.[87]

If the Hampton Energy Center is constructed, Invenergy anticipates that the fees and taxes paid to local governments would be similar to those paid on the existing Cannon Falls facility, or approximately $1.2 million.[88]

If the Hampton Energy Center proposal is not selected, there would be a lost opportunity for economic benefits associated with short-term construction jobs and long-term for property taxes and fees paid to local governments.

Distributed Solar Proposal
Geronimo anticipates that approximately 500 jobs would be created during the construction phase of the project, with work crews at each site ranging in size between 13 and 40. Up to 10 permanent positions would be created to operate and maintain the facilities. [89]

If the Distributed Solar proposal is selected, Geronimo would pay property taxes on the land parcels developed for the solar facilities, but the PV equipment itself is exempt from Minnesota property taxes under Minn. Stat. § 272.02, subd. 24.[90]

[85] Invenergy, Environmental Supplement, Cannon Falls, p. 7
[86] Invenergy, personal communication, September 26, 1013 (Appendix C)
[87] Invenergy, Environmental Supplement, Hampton, p. 7
[88] Invenergy, personal communication, September 26, 1013 (Appendix C)
[89] Geronimo Proposal, p. 10
[90] Geronimo, personal communication, September 19, 2013 (Appendix C)

If the proposal for Distributed Solar is not selected there would be a loss of economic benefits associated with short-term construction jobs and a small number of operations jobs in the project area. There would be no discernible impact to local property tax revenues if the proposal is not selected.

Capacity Credit Proposal
There would be no changes economic impacts regardless of whether GRE's Capacity Credit proposal is selected.

4.8.1 Mitigation Measures

Economic impacts from the proposals are anticipated to be primarily positive and no mitigation measures are proposed.

4.9 Traffic

Construction of any of the proposed facilities would create traffic from construction personnel and delivery of materials. Additionally, delivery of materials to the construction sites and construction of new pipelines or transmission facilities across or adjacent to public roads may create short-term traffic disruptions from road or lane closures. Once facilities are operational, traffic impacts are anticipated to be minimal, both the expansion proposals and proposals involving construction of new facilities would result in few, if any, operations jobs. Although none of the proposals use fuel oil as a primary fuel, its use as a backup fuel would require that adequate supply is maintained through delivery by truck. Geronimo's solar proposal would result in a relatively minor traffic increase from maintenance traffic to the distributed sites.

Black Dog Expansion
Traffic would increase during the construction phase of both the Black Dog Expansion addition and construction of the Red River Valley units. Xcel anticipates that construction of Unit 6 at the Black Dog would occur over a period of approximately 21 months between April 2015 and December 2016.[91] As there would be no fuel deliveries and a small, if any, increase in operations employment there would not be any noticeable changes from the current traffic at the Blackdog facility once Unit 6 becomes operational.

If the Black Dog Expansion proposal is not selected there would be no noticeable change in traffic due to plant operations. Although there would be no traffic increase from construction of Unit 6, there would still be increased traffic at the facility to remove Units 3 and 4.

Red River Valley Plant
There would be a noticeable increase in traffic to the site during construction. Xcel anticipates that construction of Red River Valley Unit 1 would occur over a period of approximately 18 months between July 2016 and December 2017.[92] Xcel anticipates that construction of Red River Valley Unit 2 would occur over a period of approximately 17 months between June 2017 and October 2018.[93]

[91] Xcel Proposal, at p. 4-6
[92] Ibid.
[93] Ibid.

If one or both of the Red River Valley proposals is selected, traffic during operations would increase somewhat from its current state due to the change in use from agricultural to industrial. Xcel also anticipates that fuels oil may be used as a startup fuel at the Red River Valley site. If fuel oil is used it would be delivered to the site by truck and stored in an on-site storage tank. It is anticipated that fuel deliveries would be infrequent.

If the Red River Valley proposal is not selected through this proceeding there would be no impact to traffic in the Hankinson area in the foreseeable future.

Mankato Energy Center Expansion
Traffic around the Mankato Energy Center would increase during construction with the delivery of materials and the addition of approximately 250 construction workers during the peak of construction activity.[94]

Once the expansion begins operation, Calpine does not anticipate a noticeable change in operations personnel from current staffing levels.[95]

If the Calpine proposal is not selected there would be no change in traffic at the existing facility.

Cannon Falls Expansion
Traffic around the Cannon Falls Energy Center would increase during construction with the delivery of materials and the addition of approximately 100 construction workers during the peak of construction activity. Once the expansion begins operation, Invenergy does not anticipate a noticeable change in operations personnel from current staffing levels.[96] It is anticipated that fuel deliveries would increase somewhat from what the current plant requirements are, but would remain infrequent.

If the Cannon Falls Expansion is not selected there would be no change in traffic at the existing facility.

Hampton Energy Center
Traffic near the Hampton Energy Center site would increase during construction with the delivery of materials and the addition of approximately 100 construction workers during the peak of construction activity. Once the expansion begins operation, Invenergy anticipates that existing operations staff from the Cannon Falls Energy Center would operate the Hampton Energy Center, travelling to the site daily.[97] Fuel oil would be delivered by truck to the facility infrequently.

If the Hampton Energy Center is not selected there would be no change in traffic at the existing facility.

Distributed Solar
As with all the proposals involving construction of new generation facilities, traffic impacts from the Distributed Solar proposal would be concentrated during the construction phase of the project.

[94] Calpine, Environmental Supplement, p. 4
[95] Ibid.
[96] Invenergy, Environmental Supplement, p. 7
[97] Ibid.

Geronimo anticipates a work force of up to 500, with a typical construction work force of between 13 and 36 at any site.[98]

If the Distributed Solar proposal is not selected, there would be no change in traffic at any of the selected sites.

Capacity Credit
There would be no traffic impacts regardless of whether or not the Capacity Credit proposal is selected.

4.10 Air Quality

Electric generating facilities often have both short-term and long-term impacts on air quality. In the short-term dust is often generated during the construction phase of a project. Over the longer term the combustion of fuels used to generate electricity produces a variety of air emissions.

4.10.1 Criteria Pollutants and Carbon Dioxide

Certain air emissions (sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), lead (Pb), and particulate matter (PM)), are referred to as criteria pollutants.[99] Ozone (O3), is also considered a criteria pollutant. Ozone is not emitted directly, but results from a chemical reaction between NOx and VOCs in the presence of sunlight and is discussed in Section 4.10.3.

Each of these pollutants is known to cause human or environmental health impacts. Sulfur dioxide causes acid rain and human respiratory illness.[100] Nitrogen oxides are greenhouse gases that cause ozone and related respiratory illnesses.[101] Carbon monoxide is a colorless, toxic gas produced by incomplete burning of carbon-based fuels and reduces the blood's ability to provide sufficient oxygen to the body.[102] Lead is a metal that is known to have adverse health impacts on the nervous system, kidney function, immune system, reproductive and developmental systems and the cardiovascular system.[103] Inhalation of particulate matter causes and contributes to human respiratory illness.[104]

Carbon dioxide (CO_2) is a greenhouse gas that contributes to climate change and associated impacts.[105] Carbon dioxide emissions are not currently regulated at the federal or state level, but the Commission does review Carbon dioxide emissions under Certificate of Need proceedings.

All of the natural gas proposals would produce some level of criteria pollutants and CO_2 from combustion of the natural gas. The actual amount of emissions is dependent upon a combination of

[98] Geronimo Proposal, p. 25
[99] EPA, *What Are the Six Common Air Pollutants?*, http://www.epa.gov/air/urbanair/.
[100] EPA, *Health and Environmental Impacts of SO_2*, http://www.epa.gov/air/sulfurdioxide/
[101] EPA, *Health and Environmental Impacts of NO_x*, http://www.epa.gov/air/nitrogenoxides/.
[102] MPCA, *Glossary of Terms Used on This Site*, http://cf.MPCA.state.mn.us/gloss/index.cfm?alpha=C&glossaryCat=0
[103] EPA, Lead in the Air, Health, http://www.epa.gov/airquality/lead/health.html
[104] EPA, Health and Environmental Effects of Particle Pollution, http://www.epa.gov/air/particlepollution/health.html.
[105] Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report, Summary for Policymakers, An Assessment of the Intergovernmental Panel on Climate Change* (IPCC), http://www.ipcc.ch/.

factors including the length of time the units are operated and the number of startups. The combined cycle unit proposed in Calpine's Mankato Energy Center Expansion is expected to operate more hours than the combustion turbines in the Black Dog and Cannon Falls expansions and the new facilities in the Red River Valley and Hampton Energy Center proposals. The solar and capacity credit proposals would not produce any criteria pollutants.

In addition to emissions during operation of the generation facilities, all of the proposals requiring construction of new facilities would create short-term emissions of criteria pollutants during construction. Impacts from construction will be minimal and localized and would include dust due to earth moving and emissions from diesel-powered construction equipment.

Black Dog Expansion

Xcel anticipates filing an air emissions permit application with the MPCA in mid-2014. Consistent with its intent to operate Black Dog Unit 6 as a peaking unit, Xcel intends to request an air quality permit that will limit the total number of hours the combustion turbine will be allowed to operate. Xcel intends to net the emissions from Unit 6 against the current emissions from the coal-fired units. Using this "netting" approach Xcel anticipates that the expansion will not be subject to the federal Prevention of Significant Deterioration (PSD) program for any emissions, except possibly for Carbon.[106]

Table 3 provides estimates of criteria pollutants and Carbon dioxide emissions at rated capacity.

Table 3: Black Dog Expansion Emissions[107]

Pollutant	Pounds/hour at rated capacity	Pounds/kWh at rated capacity	Annual Emissions (tons/year)
SO_2	3	0.000013	1
NO_x	77	0.000346	43
PM_{10}	23	0.00010	9
$PM_{2.5}$	23	0.00010	9
Pb	0	0	0
CO	47	0.00021	83
CO_2	275,000	1.230	108,400

Red River Valley Plant

In their application, Xcel anticipates filing an air emissions permit application with the North Dakota Department of Health in late 2014 or early 2015. Consistent with the plant's use as a peaking plant, Xcel intends to request an air quality permit that will limit the total number of hours the combustion turbine will be allowed to operate.[108]

[106] Xcel Proposal, p. 6-1

[107] Emissions rates in pounds/hour and estimated annual emissions are taken from Xcel Application at Table 6-1; personal communications, October 4 and 9, 2013 (Appendix C). Emissions in pounds per kilowatt hour are calculated using Xcel's estimated hourly emissions rate per turbine and dividing it by the size of the turbine operating at 59° F, 100 % load (223,500 kilowatts)

[108] Xcel Proposal, p. 6-3

Table 4 provides estimates of criteria pollutants and Carbon dioxide emissions at rated capacity.

Table 4: Red River Valley Plant Emissions[109]

Pollutant	Pounds/hour at rated capacity		Pounds/kWh at rated capacity	Annual Emissions (tons/year)	
	1 unit	2 units		1 unit	2 units
SO_2	3	6	0.000013	1	2
NO_x	77	154	0.000346	43	86
PM_{10}	23	46	0.00010	9	18
$PM_{2.5}$	23	46	0.00010	9	18
CO	47	47	0	83	166
Pb	0	0	0.00021	0	0
CO_2	275,000	275,000	1.230	108,400	216,800

Mankato Energy Center Expansion

Calpine holds an air emissions permit for a 665 MW natural gas plant with fuel oil backup for the existing Mankato Energy Center. Calpine will seek to modify its existing air emissions permit from the MPCA under federal PSD new source review. **Table 5** estimates criteria and Carbon dioxide emissions for the proposed Mankato Energy Center Expansion.

Table 5: Mankato Energy Center Expansion Estimated Emissions[110]

Pollutant	#/hour at rated capacity	#/kWh at rated capacity	Potential Air Emissions (tons/year)
SO_2	1.2	0.000003	5
NO_x	26.25	0.000076	115
PM_{10}	22	0.000064	96
$PM_{2.5}$	22	0.000064	96
CO	25.9	0.000075	113
Pb	0	0	0
CO_2	327,201	0.9774	1,476,940

[109] Emissions rates in pounds/hour and estimated annual emissions are taken from Xcel Application at Table 6-3; personal communications, October 4 and 9, 2013 (Appendix C). Emissions in pounds per kilowatt hour are calculated using Xcel's estimated hourly emissions rate per turbine and dividing it by the size of the turbine in kilowatts (215,000)

[110] Emissions rates in pounds per hour are from *Calpine Environmental Supplement*, pp. 2-3 and Calpine, personal communications, October 2 and 9, 2013 (Appendix C). Emissions in pounds per kilowatt hour are calculated using Calpine's estimated hourly emissions rate per turbine and dividing it by the size of the turbine in kilowatts (345,000). Potential Air emissions are calculated by multiplying the hourly air emissions by 8,760 (hours in one year).

Cannon Falls Expansion

As a peaking plant, the Cannon Falls Energy Center Expansion will operate a limited number of hours annually. In addition to limiting the number of operating hours, Invenergy proposes to further limit the potential emissions through use of pipeline quality natural gas with dry low NOx burners for the majority of its operating time. Invenergy proposes to use a water injection system to minimize NOx emissions when fuel oil is used as an emergency back-up fuel.[111] **Table 6** estimates criteria and carbon dioxide emissions for the Cannon Falls Expansion using information provided by Invenergy in this proceeding and adapted from 2004 Environmental Assessment prepared for the Cannon Falls Energy.

Table 6: Estimated Emissions –Cannon Falls Expansion[112]

Pollutant	#/hour at rated capacity		#/kWh at rated capacity		Potential Air Emissions (tons/year)
	Natural Gas	Fuel Oil	Natural Gas	Fuel Oil	Natural Gas
SO_2	3.2	91	0.00002	0.00051	30
NO_x	58.5	320	0.00033	0.00179	108
PM_{10}	18	34	0.00010	0.00019	33
$PM_{2.5}$	12.8	20.4	0.00007	0.00011	24
CO	29	66	0.00016	0.00037	53
Pb	0	0	0	0	0
CO_2	206,500	274,500	1.15686	1.53782	379,908

Hampton Energy Center

As a peaking plant, the Hampton Energy Center Expansion will operate a limited number of hours annually. In addition to limiting the number of operating hours, Invenergy proposes to further limit the potential emissions through use of pipeline quality natural gas with dry low NOx burners for the majority of its operating time. Invenergy proposes to use a water injection system to minimize NOx emissions when fuel oil is used as an emergency back-up fuel.[113]

Table 7 estimates criteria and carbon dioxide emissions for the Hampton Energy Center using information provided by Invenergy in this proceeding and adapted from 2004 Environmental Assessment prepared for the Cannon Falls Energy.

[111] Invenergy, Daniel Ewan Direct Testimony, p. 18

[112] Hourly and annual emissions are from Invenergy, personal communication, October 10, 2013 (Appendix C). Hourly and annual emissions are based on the equivalent operating hour limits in the existing Cannon Falls Air Emission Permit No 040088-01. Permit allows for a maximum of 3,679.5 hours of natural gas firing or maximum of 669 hours of fuel oil firing per unit; potential air emissions are based on the maximum of these two scenarios. Emissions per Kilowatt Hour are calculated by dividing the hourly emissions rate for each pollutant by 178,500.

[113] Ewan Direct Testimony, p. 18

Table 7: Estimated Emissions – Hampton Energy Center[114]

Pollutant	#/hour at rated capacity		#/kWh at rated capacity		Potential Air Emissions (tons/year)
	Natural Gas	Fuel Oil	Natural Gas	Fuel Oil	Natural Gas
SO_2	6.4	182	0.00002	0.00051	61
NO_x	117	640	0.00033	0.00179	215
PM_{10}	36	68	0.00010	0.00019	66
$PM_{2.5}$	25.6	40.8	0.00007	0.00011	47
CO	58	132	0.00016	0.00037	107
Pb	0	0	0	0	0
CO_2	413,000	549,000	0.00002	0.00051	759,817

Distributed Solar Facilities
Construction and operation of any portion of the Geronimo solar proposal would not generate criteria pollutants or carbon dioxide.

Capacity Credit Proposal
There will be no criteria pollutants or carbon dioxide emitted if GRE's capacity credit proposal is selected.

Mitigation
Dust from construction traffic can be controlled using standard construction practices such as watering of exposed surfaces, covering of disturbed areas, and reduced speed limits on site. Emissions from construction vehicles can be minimized by keeping construction equipment in good working order

Emissions of criteria air pollutants can be mitigated through fuel selection, combustion management, and post-combustion control technologies. Sulfur dioxide and particular emissions can be reduced through use of clean fuels. Sulfur dioxide, nitrous oxides, particulates and carbon monoxide emissions can be reduced through use of good combustion control practices. Sulfur dioxide, nitrous oxides, and carbon monoxide can be further reduced through installation of a selective non-catalytic reduction system.[115]

In addition to the use of control equipment to mitigate pollutant impacts, a best available control technology analysis would be conducted as part of the air emissions permitting process administered by the MPCA. The analysis is a requirement of new facilities under federal new source review prevention of significant deterioration. Implementation of best available control technologies could limit emissions from the plant to less than those presented under each of the proposals.

[114] Hourly and annual emissions are from Invenergy, personal communication, October 10, 2013 (Appendix C). Hourly and annual emissions are based on the equivalent operating hour limits in the existing Cannon Falls Air Emission Permit No 040088-01. Permit allows for a maximum of 3,679.5 hours of natural gas firing or maximum of 669 hours of fuel oil firing per unit; potential air emissions are based on the maximum of these two scenarios. Emissions per Kilowatt Hour are calculated by dividing the hourly emissions rate for each pollutant by 357,000.
[115] Minnesota Environmental Quality Board, Environmental Assessment: Calpine Mankato Energy Center Power Generating Plant, 2004, http://www.eqb.state.mn.us/pdf/FileRegister/Calpine-Mankato/1111CalpineJune30.pdf, p. 86

4.10.2 Hazardous Air Pollutants and Volatile Organic Compounds

In addition to the criteria pollutants, Minnesota Rule 7849.1500 requires this ER to examine emissions of hazardous air pollutants (HAP) and volatile organic compounds (VOC). These classes of pollutants are known or suspected of causing cancer and other serious health effects.[116]

Hazardous air pollutants, sometimes known as toxic air pollutants, are pollutants known or suspected of causing serious health effects (e.g. cancer, reproductive effects, birth defects), adverse environmental, or ecological effects. The United States Environmental Protection Agency (EPA) is required to control 187 HAPs identified in the Clean Air Act Amendments of 1990.[117]

Mercury exists throughout the environment; however, the primary source of mercury in air emission is coal, particularly the burning of coal in a coal-fired power plant. Mercury can cause impaired neurological development in children.[118]

Volatile Organic Compounds (VOCs) are a class of carbon-based compounds which, in a gaseous state, react with sunlight and other chemicals already present in the air to create smog. Many VOCs will evaporate quickly at normal temperatures to form a gas.[119] Common examples of VOCs include: Acetone, Benzene, Ethylene glycol, Formaldehyde, Methylene chloride, Perchloroethylene, Toluene, Xylene, 1,3-butadiene.[120] Although there is overlap between HAPs and VOCs, they are not the same.

HAPs identified as emissions from the natural gas proposals include 1,4-Butadiene, Acetaldehyde, Acrolein, Benzene, Cadmium, Ethylbenzene, Formaldehyde, Napthalene, Propylene Oxide, Toluene, and Xylenes.[121] Formaldehyde is the primary HAP.[122] With the exception of Cadmium, all of the HAPS are also VOCs. There would be no emissions of HAPS or VOCs resulting from selection of either the Distributed Solar Facilities or Capacity Credit proposals.

Table 8 provides estimates of the potential to emit HAP and VOC emissions based on a theoretical combination of startup and shutdown hours and, in the cases where fuel oil serves as a backup fuel, anticipated operating hours for different fuel types.

[116] About Air Toxics, http://www.epa.gov/ttn/atw/allabout.html
[117] EPA, http://www.epa.gov/ttnatw01/pollsour.html
[118] Health Effects, http://www.epa.gov/mercury/effects.htm.
[119] http://www.cleanair.org/sites/default/files/SmallBusinessGuide.pdf
[120] MN Department of Health, Volatile Organic Compounds (VOCs) in Your Home, 2010, http://www.health.state.mn.us/divs/eh/indoorair/voc/vocfactsheet.pdf
[121] Xcel Proposal
[122] Ibid., see also Wien, Beres, and Richani, *Air Emissions Terms, Definitions and General Information.* Published by General Electric Company, 2005. http://site.ge-energy.com/prod_serv/products/tech_docs/en/downloads/ger4249.pdf

Table 8: HAP and VOC Potential Emissions – All Proposals

	Black Dog	Red River Valley (1 unit)	Red River Valley (2 units)	Mankato[123]	Cannon Falls[124]	Hampton[125]	Solar	Capacity Credit
Any Single HAP (tons/year)	0.65	0.65	1.30	4.5	4. 6	9.1	0	0
All HAPs (tons/year)	0.95	0.95	1.90	9.7	5.8	11.7	0	0
Mercury (Hg)	0	0	0	0	0	0	0	0
VOCs (tons/year)	9	9	18	55.1	6.5	13.0	0	0
VOC (lb/hr)	6	6	12	12.6	3.1- 7.3[a]	6.2 – 14.6[a]	0	0

Mitigation
None of the proposals considered in this proceeding burn coal. Thus, emissions of mercury, and related impacts, would be minimal and additional mitigation is not necessary.

VOC emissions are minimized by combustion practices that promote high combustion temperatures, long residence times at those temperatures, and turbulent mixing of fuel and combustion air. Trace amounts of VOCs in the natural gas fuel (e.g., formaldehyde and benzene) may also contribute to VOC emissions if they are not completely combusted.[126]

4.10.3 Ozone

Ground level ozone is not a direct emission, but is the result of a chemical reaction between Nitrogen oxides (NOx), VOCs and sunlight. Large electric power generating facilities have the potential to produce the reactive organic gases, which can lead to ground-level ozone formation. Ground level ozone can cause human health risks and can also damage crops, trees and other vegetation.[127] The State of Minnesota is designated as in attainment for ozone by the EPA.

All of the natural gas proposals would contribute ozone precursors (NOx and VOCs) to the atmosphere. A solar generating farm would not produce ozone or ozone precursors.

The transmission associated with the construction of some of the facilities has the potential for ozone and nitrogen oxide due to corona discharge. Under certain conditions the localized electric field near an energized conductor can become strong enough to produce a tiny electric discharge that can ionize the air close to the conductors. Several factors contribute to corona discharge including conductor voltage, shape and diameter, the surface irregularities (such as scratches, nicks, dust , or water drops) that can

[123] Calpine, Personal Communication, September 19, 2013 (Appendix C)
[124] Invenergy, Environmental Supplement; Personal Communication, September 19, 2013 (Appendix C)
[125] Ibid.
[126] EPA, *Natural Gas Combustion,* http://www.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf
[127] Ozone, http://www.epa.gov/Ozone/. Air Quality – Ozone, http://www.health.state.mn.us/divs/eh/air/ozone.htm

affect a conductor's electrical surface gradient. This partial discharge of electrical energy can produce very small amounts of ozone and nitrogen oxide.

Mitigation

Ozone formation can be mitigated by mitigating ozone precursors. See discussion in Sections 4.10.1 and 4.10.2 regarding nitrous oxides (NO_X) and volatile organic compounds (VOC) respectively.

As discussed above, transmission lines, under certain conditions, produce limited amounts of ozone and nitrogen oxide emissions. Studies designed to monitor the production of ozone under transmission lines have been unable to detect any increase attributable the transmission line.

4.10.4 Visibility Impairment

Although some of the natural gas proposals may generate a steam plume from the cooling tower during some meteorological conditions, none of the proposals under consideration would create visibility impairment through smokestack emissions. Dust generated during construction, which may on occasion create temporary visual impairment, is discussed in Section 4.10.1.

4.11 Solid and Hazardous Wastes

Large electric generation facilities have the potential to generate solid and hazardous wastes during both the construction and operation phases of the facility. If not properly stored and disposed of solid and hazardous wastes can contaminate surface and ground waters, potentially resulting in environmental or human health impacts. This section discusses potential impacts from such wastes. Wastewater is discussed in Section 4.4.

With the exception of the GRE proposal, which does not require construction, there would be some amount of solid waste generated during construction. There is also potential for spills of gas, lubricants, or other hazardous materials from construction vehicles.

During operation of the natural gas plants (proposals by Xcel, Calpine, and Invenergy) solid and liquid wastes would be generated as a result of routine operations and maintenance activities. Waste lubricants and hydraulic fluids would be stored on-site in sealed barrels until removed from the facility by a licensed firm for recycling or disposal in an approved facility. Other solid wastes such as oily and greasy rags, materials packaging, office waste, cleaning residues, and fluorescent light bulbs would be expected to be generated by each facility. Solid waste would be recycled as feasible and allowable, disposed of in a solid waste landfill or, for some materials designated as hazardous wastes, through a hazardous waste treatment and disposal facility.[128]

The operating entity would likely be considered as a hazardous waste generator under Minnesota Hazardous Waste Rules ((Minnesota Rules Part 7045).

It is anticipated that somewhat smaller amounts of solid and hazardous wastes would be generated during the operations phase of the Geronimo solar proposal. The PV panels used in the Geronimo proposal may contain hazardous materials; these panels are sealed during normal operation of the

[128] Xcel Proposal, p. 6-10

facility, provided that panels are not damaged during construction, operation, or decommissioning. None of the proposals would generate radioactive wastes.

Natural Gas Proposals
As with other construction proposals would result in construction debris such as scrap wood, plastics, cardboard and wire would be generated during the construction phase.

Once the natural gas plants become operational, solid and liquid wastes would be generated as a result of routine operations and maintenance activities. Lubricants and hydraulic fluids would be generated as a result of routine maintenance; these wastes would be stored on-site in sealed barrels until removed from the facility by a licensed firm for recycling or disposal in an approved facility. In addition to waste lubricants and hydraulic fluids solid waste, such as oily and greasy rags, materials packaging, office waste, cleaning residues and fluorescent light bulbs would be generated by each facility. Solid waste would be recycled as feasible and allowable, disposed of in a solid waste landfill or, for some materials designated as hazardous wastes, through a hazardous waste treatment and disposal facility.

In addition to the wastes generated in the plant, Xcel also anticipates that solids will need to be removed occasionally from the settling pond used for wastewater disposal at the Black Dog and Red River Valley sites. Xcel estimates that less than one (1) ton per year would be removed from Black Dog unit, and approximately five (5) tons per year would be removed from the combined Red River Valley units. [129]

Distributed Solar Proposal
As with other construction proposals, construction of the solar facilities described in the Geronimo proposal would result in construction debris. There is also potential for vehicle spills during the construction phase.

Some amount of waste related to lubrication and transport to the individual sites would be generated during the operation of the solar facilities, but the operation of the panels does not require greasing or oiling on a regular basis.

The photovoltaic panels used to generate electricity may contain hazardous materials within the sealed panel. Panels are sealed during normal operating conditions, but there is a potential for leakage of potentially hazardous materials if panels are damaged during delivery, installation, operation, or decommissioning.[130]

Capacity Credit Proposal
Under the GRE proposal, there would be no waste generated through construction and no change to waste generated from GRE's existing plants.

[129] Xcel Proposal, pp. 6-10 – 6-11.
[130] US Department of Energy, Office of Energy Efficiency and Renewable Energy and Bureau of Land Management, *Solar Energy Development Environmental Considerations,* http://solareis.anl.gov/guide/environment/index.cfm

4.11.1 Mitigation

Cleanup of waste generated during the construction phase has been a condition of site permits issued by the Commission in previous siting dockets.

Once operational, each facility is likely to be considered as a hazardous waste generator under Minnesota Hazardous Waste Rules (Minnesota Rules Part 7045).

Development and following of best management practices for handling of PV panels during construction, operation, and decommissioning would be expected to minimize the potential for leakage of potentially hazardous materials from damaged panels.

4.12 Wildlife

Impacts to wildlife from facilities considered in this proceeding are anticipated to be most noticeable during the construction phase. Although other types of electric generation, such as hydropower and wind turbines have known wildlife impacts during operation, impacts from gas-fired power plants and solar facilities are expected to be relatively minor and related to clearing activities and habitat changes at the sites.

Natural Gas Proposals
Wildlife impacts from expansions at the Black Dog, Mankato Energy Center, and Cannon Falls facilities would be expected to be minor, as the activity would occur on existing industrial sites. The newly constructed Red River Valley Plant and Hampton Energy Center would convert approximately 35 and 20 acres of existing cropland to an industrial use. Depending upon the routing of transmission lines associated with the proposals, there is the potential for impacts to avian species from collisions with the lines or from electrocution.

Distributed Solar Facilities
The Distributed Solar proposal would result in the clearing and grading up to 70 acres per site, or up to 700 acres in total across approximately 20 sites. There is potential for localized avoidance of developed sites by birds and other wildlife.[131]

Capacity Credit Proposal
The Capacity Credit proposal is not anticipated to have wildlife impacts, as it would not result in any changes to GRE's existing resource portfolio. There would be no impact to wildlife if facilities are not constructed as part of this proceeding.

Mitigation
Mitigation for impacts to wildlife includes siting generation facilities away from known populations of wildlife that may be impacted, minimizing the amount of land converted to generation resources. Transmission lines can be designed to minimize the potential for avian electrocution and collision. Depending upon the location of associated transmission lines, marking the lines may be recommended to reduce the potential for avian collisions.

[131] Shrenzel, personal communication, September 20, 2013 (Appendix C)

4.13 Vegetation

Construction of generating facilities generally requires that the area of disturbance is cleared of vegetation to allow for adequate site preparation and access. Once construction is complete, vegetation in the area of the site that is not developed is re-established. In some cases, the type of vegetation cover can change from what was present prior to construction; sometimes the re-vegetated area is planted with low growing vegetation to provide for easier site maintenance, in some cases taller growing vegetation may be planted to act as a visual buffer between the facility and adjacent land uses, In some instances the ground disturbance from construction may allow for the unintended introduction of non-native or invasive species. In agricultural areas, it is typical that the undeveloped area of a parcel will be restored to agricultural uses. During operations vegetation is maintained through chemical or mechanical methods.

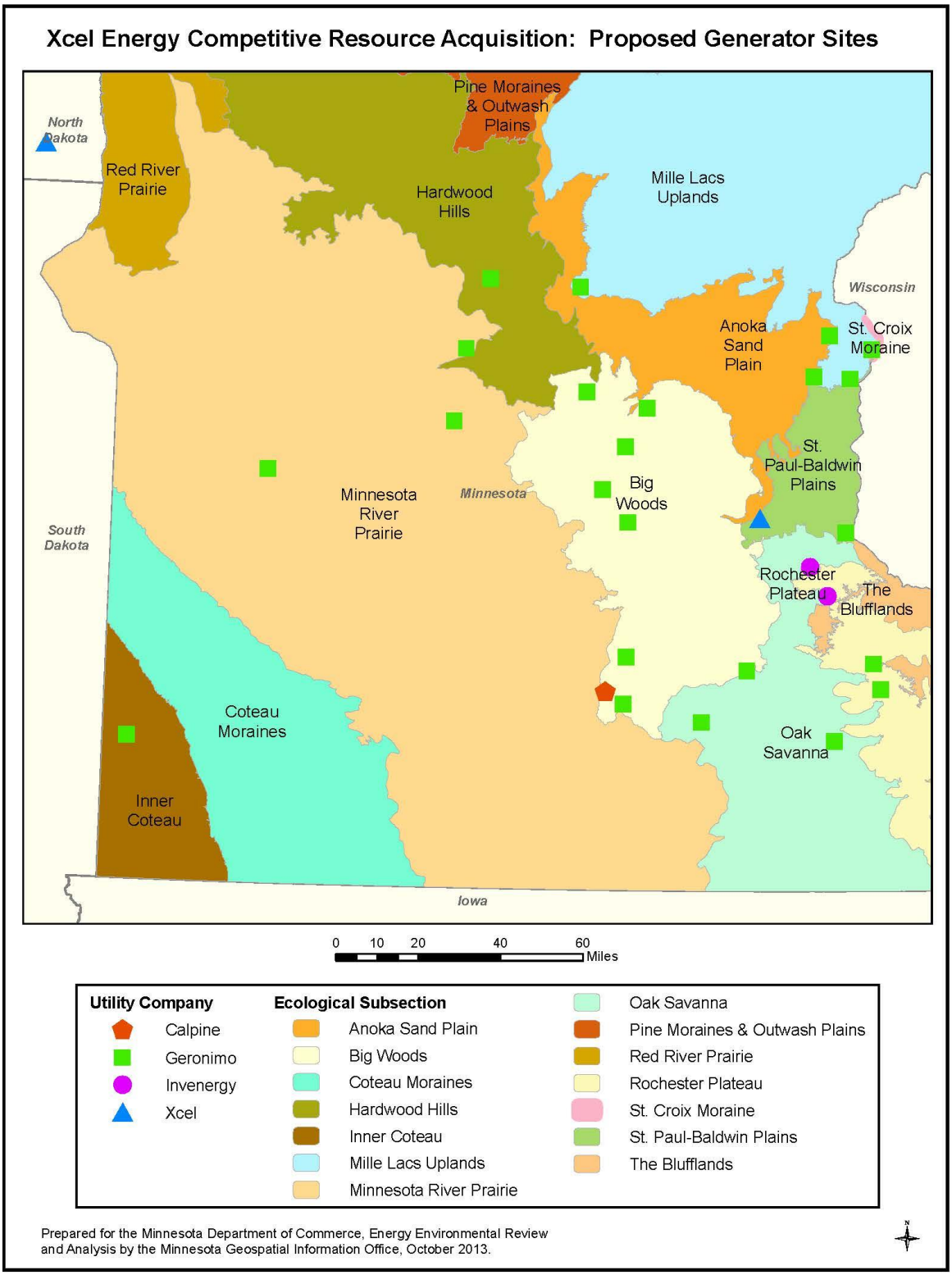
Although specific site and layout information is not fully developed at this time, deforestation is not a likely impact related to any of the proposals.

Proposed generator sites are scattered throughout the central and southern portions of the state. The Minnesota Department of Natural Resources and the United States Forest Service have jointly developed an Ecological Classification System for ecological mapping and landscape classification in Minnesota.[132] **Figure 3** shows the proposed sites overlaid on ecologic subsections of the state.

Because impacts and mitigation are very site specific, more detailed information on vegetation impacts and mitigation is typically developed as part of a site permit proceeding.

[132] Minnesota Department of Natural Resources, *Ecological Classification System: Ecological Land Classification Hierarchy, http://www.dnr.state.mn.us/ecs/index.html*

Figure 3: Proposed Sites by Ecological Subsection



Natural Gas Proposals
The Black Dog, Mankato Energy Center, and Cannon Falls expansion proposals would be developed on existing industrial properties, minimizing the need for vegetative clearing and producing little noticeable change in vegetation cover. The Red River Valley and Hampton Energy Center proposals would remove clear existing cropped fields over a portion of the site, while the remainder of these sites would likely be re-established as row crops. Noxious weeds can be introduced in areas disturbed by construction activities.

Distributed Solar Proposal
The Distributed solar proposal would entail the largest vegetation changes of all the proposals, up to 700 acres, although the facilities would be spread out across approximately 20 non-contiguous sites. The developed area must be cleared of trees prior to construction, but large-scale tree clearing is not anticipated at the selected sites. After construction the site would be re-seeded pursuant to the SWPPP prepared for the project, with the area under the arrays typically seeded with low growing grasses. Once operational, Geronimo anticipates that mowing will be the primary method to control weeds.[133]

Location of the distributed sites could potentially fragment woodland, grassland, prairie or wetland habitat. Noxious weeds can be introduced in areas disturbed by construction activities.

Capacity Credit Proposal
There would be no vegetation impacts associated with GRE's capacity credit proposal, as no new facilities would be constructed.

4.13.1 Mitigation

The primary mitigation strategy to minimize impacts to vegetation from electric generation projects and their associated infrastructure is to minimize the change in vegetative cover to the extent possible. Siting in previously disturbed areas, avoiding habitat fragmentation, and minimizing the amount of clearing, particularly tree clearing are all strategies to reduce impacts. Re-establishment of vegetation following construction minimizes disruption. Power washing or manual cleaning vehicles, particularly those traveling from areas where noxious weeds are known to be present, prior to construction and re-vegetation using native species can be used to prevent the spread of noxious weeds.

4.14 Rare and Unique Natural Resources

Impacts to rare and unique natural resources are very dependent upon the location, design, and construction of the proposal.

It is expected that expansions of the existing facilities, Black Dog, Mankato, and Cannon Falls, would have minimal impacts to rare and unique resources, as the improvements would take place on land that has already been disturbed.

[133] Geronimo, personal communication, October 1, 2013 (Appendix C)

Black Dog Expansion
No known federal species were identified as being potentially affected by the Black Dog expansion proposed in the 2011 site permit proceeding. The DNR recommended mitigation measures for a Bullrush Marsh native plant community in the 2011 site permit proceeding. Peregrine falcons (*Falco peregrinus*), a state listed threatened species were identified as present in the project area, but DNR concluded they were unlikely to be affected by the project proposed in that proceeding.[134]

If the Black Dog Expansion is not selected in this proceeding there would be no impact to rare or unique species or communities in the foreseeable future.

Red River Valley
The whooping crane (*Grus Americana*) and the Western prairie fringed orchid (*Plantanthera praeclara*) are federally listed species protected under the Endangered Species Act within Richland County, where the Red River Plant would be located. North Dakota does not have a state endangered or threatened species list, but does identify species of conservation priority, habitats of concern or other significant ecological communities.[135]

If the Red River Valley Plant is not selected in this proceeding there would be no impact to rare or unique species or communities in the foreseeable future.

Mankato Energy Center Expansion
No known impacts were identified in the 2004 Environmental Assessment for the Mankato Energy Center.[136] Calpine would update this information should the proposal be selected.

If the Mankato Energy Center Expansion is not selected in this proceeding there would be no impact to rare or unique species or communities in the foreseeable future.

Cannon Falls Expansion
No rare or unique species or communities were identified in the 2004 Environmental Assessment prepared for the original Cannon Falls Energy Center.[137] Invenergy would update this information should the proposal be selected.

Hampton Energy Center
No rare of unique species of communities were identified in the area of the proposed location for the Hampton Energy Center in the 2011 Environmental Impact Statement prepared for the CapX Hampton-Rochester-La Crosse 234 kV and 161 Transmission Lines Project.[138] No more recent information is

[134] Xcel proposal, at pp. 6-26 - 27
[135] Ibid.
[136] Mankato Energy Center Environmental Assessment, at p.110
[137] Cannon Falls Environmental Assessment, http://www.eqb.state.mn.us/pdf/FileRegister/04-85-PPS-Cannon%20Falls%20EC/eatext.pdf , at p. 24
[138] Department of Commerce, 2011, *Final Environmental Impact Statement for the CapX Hampton-Rochester-La Crosse 345 KV and 161 kV Transmission Lines Project*, http://mn.gov/commerce/energyfacilities/resource.html?Id=32194 see specifically Appendix A, Sheet NR1 http://mn.gov/commerce/energyfacilities/documents/25731/FEIS%20Appendix%20A%20Segment%201%20Maps.pdf

available as part of this proceeding. Invenergy would update this information should the proposal be selected.

Distributed Solar Facilities
Several of the sited identifies by Geronimo as potential sites for their distributed solar facilities are located near known populations of state-listed animals or plants, or unique or rare habitat types. Impacts on these species or communities are unknown at this time and would depend upon the species or community identified and the design and layout of the facilities.

Capacity Credit Proposal
There would be no impacts to rare and unique natural resources associated with the GRE's capacity credit proposal.

4.14.1 Mitigation

The preferred mitigation measures for minimizing impacts to rare and unique species is avoidance where possible. In some cases this may be accomplished through facility siting that avoids a native plant community. In some cases the staging of construction activities can be used to minimize the potential for impacts to sensitive species at important points in their life cycle.

Prior to applying for a site permit, project proposers query the Minnesota County Biological Survey and the Minnesota Natural Heritage Information System to obtain the most up-to-date information on federal and state listed species, Species of Greatest Conservation Need, and unique or rare habitat types in Minnesota. That information would be provided in the site permit application and information on rare and unique resources potentially affected would be used to develop appropriate mitigation.

4.15 Water Resources

Impacts to ground water from electric generating facilities can occur as a result of aquifer drawdowns related to groundwater usage by the facility as well as potential contamination from spills during construction and operation. The potential for groundwater contamination resulting from construction is higher in areas with karst topography or highly permeable soils.

None of the proposals anticipates use of surface water to supply process or sanitary water. During construction, there is the potential for sediment to reach surface waters due to ground disturbances from vegetation clearing, excavation, grading, and construction traffic. Some of the proposals also anticipate construction of above ground storage tanks for water and, in some cases, fuel oil to be used as occasional startup fuel. Leakage from chemical or fuel storage tanks have a detrimental impact to ground or surface waters.

Some of the natural gas facilities may discharge wastewater directly to surface waters (Black Dog Expansion) or to on-site holding ponds (Red River Valley and Hampton Energy Center). Proper design and maintenance of the ponds is necessary to minimize potential impacts to ground or surface water.

Black Dog Expansion
As discussed in Section 4.3, the Black Dog Expansion will use groundwater to provide process water for occasional evaporative cooling from an existing well at the plant site. Xcel anticipates that the water requirements of the expansion will be met through the existing groundwater appropriation.

Xcel has not yet determined whether wastewater from the Black Dog Expansion would be discharged to the sewer system or to surface water. Black Dog Lake serves as a cooling lake for thermal discharges related to the coal-fired facilities at the Black Dog plant. The facility's NPDES/SDS permit covers wastewater discharge to Black Dog.

Because Unit 6 would be installed inside an existing building, the potential for sediment from construction activities to reach surface waters is minimize, but not entirely eliminated.

Red River Valley Plant
As discussed in Section 4.3, the use of groundwater for the proposed Red River Valley Plant is dependent upon the availability of groundwater at the chosen site. If groundwater resources are not sufficient, water would be trucked into the site and stored.

Xcel has not yet determined whether wastewater from the plant would be discharged to a sanitary sewer or to an on-site settling pond. If sanitary sewer is not used, Xcel would install a settling pond or tank to accumulate wastewater and contract for truck hauling to a location for disposal.

As with all facilities, there is a potential for sediment to reach surface waters during construction and for leakage of chemicals to negatively impact ground or surface water.

Mankato Energy Center Expansion
As discussed in Section 4.3, Calpine anticipates treated wastewater for the expansion would continue to be supplied through an agreement with the city of Mankato. Because of the use of treated wastewater, the Mankato Energy Expansion is not expected to result in any aquifer drawdown. Calpine would continue to discharge wastewater to Mankato's wastewater system through an existing agreement with the city.

As with all facilities, there is a potential for sediment to reach surface waters during construction and for leakage of chemicals to negatively impact ground or surface water.

Cannon Falls Expansion
Invenergy anticipates that expansion would use water supplied by the Cannon Falls municipal water system and that wastewater would continue to be discharged to the municipal wastewater system.

As with all facilities, there is a potential for sediment to reach surface waters during construction and for leakage of chemicals to negatively impact ground or surface water.

Hampton Energy Center
Invenergy anticipates installing a well to provide process water. Wastewater would discharge to an on-site septic system or an on-site holding pond.

As with all facilities, there is a potential for sediment to reach surface waters during construction and for leakage of chemicals to negatively impact ground or surface water.

Distributed Solar Proposal
Geronimo anticipates that water for the project would be supplied through municipal water supplies at the operation and maintenance facility or facilities constructed. It is possible that wells could be installed at one or more of the distributed solar sites to provide water for cleaning of the solar panels.

As discussed in Section 4.4, there is no discharge of process wastewater associated with the Distributed Solar Proposal. Water used to occasionally clean PV panels would evaporate or fall to the ground beneath the panels.

As with all facilities, there is a potential for sediment to reach surface waters during construction and for leakage of chemicals to negatively impact ground or surface water.

Capacity Credit Proposal
There would be no impacts to water resources associated with the GRE's capacity credit proposal.

4.15.1 Mitigation

Plant design can help minimize the amount of groundwater required. In Minnesota a groundwater appropriation permit from the DNR is required for withdrawal of more than 10,000 gallons per day or one million gallons per year.

The potential for water contamination can be minimized through planning and implementation of practices that minimize the potential for spills and ensure prompt cleanup of spills before they reach underlying aquifers. Minnesota requires a spill prevention, control and countermeasures plan (SPCC) plan for above-ground storage tank facilities storing between 10,000 gallons and one million gallons.

For facilities using on-site septic systems or holding ponds, proper design, installation, and maintenance is essential to prevent spills or leakage that may impact groundwater or surface water resources.

Fueling and lubricating of construction equipment away from waterways would ensure that fuel and lubricants do not enter waterways.

All of the construction proposals involve disturbance of more than one of soil, requiring that proposers to submit a NPDES permit application for construction facilities to the MPCA. The application will identify Best Management Practices to be employed during construction of the project. A SWPPP will be developed prior to construction, and will identify best management practices (e.g. silt fencing, management of exposed soils and revegetation plans) to prevent erosion.

Operating natural gas plants would require a NPDES/SDS permit for regulating of wastewater and storm water at the site.

4.16 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 United States Fish and Wildlife Service (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.

Construction activities within wetlands could temporarily affect the function of the wetland. If project components were to be placed within wetlands, the affected wetland would be lost or converted to another type of wetland.

Impacts to wetlands are very site specific, depending upon the site, the layout of the facility, and they type of wetlands that may be present. The Black Dog Expansion, Mankato Energy Center Expansion, and Cannon Falls expansion proposals would occur on existing industrial sites and wetland impacts from these proposals are not anticipated. Construction of the Red River Valley and Hampton Energy Center proposals would develop up to 35 of agricultural land. Given that both proposals anticipate acquiring a larger parcel than the ultimate developed land, it is anticipated that any facility would be sited to avoid wetland impacts. The extent of wetland impacts related to new pipelines and transmission facilities to serve the natural gas plants is dependent upon the route of these linear facilities.

Several of the parcels identified in Geronimo's proposal show the presence of NWI wetland areas.[139] Actual wetland impacts from the proposal would depend greatly upon how the solar arrays and associated distribution lines are laid out. Geronimo has stated that at each of the distributed sites, the facility would be designed to avoid wetlands.[140]

No wetland impacts would be associated with proposals that are not selected

Capacity Credit Proposal
There would be no impacts to water resources associated with the GRE's capacity credit proposal.

4.16.1 Mitigation

The primary mitigation measure to minimize wetland impacts is through site selection and design that avoids wetlands to the extent possible. Once a final project layout is determined, selected proposers will conduct a wetland delineation in areas identified for construction. Depending upon the results of the delineation results, project components may be shifted to avoid delineated wetlands. In cases where access to wetland areas is required during construction, construction can be scheduled during frozen ground conditions or use specially designed mats to minimize temporary disturbance to wetlands.

[139] Geronimo, *Geronimo Energy's Distributed Energy Generation Zones Update and Public Filing*, September 10, 2013, Appendix H, eDockets ID: 20139-91155-01 .
[140] Geronimo, personal communication, October 1, 2013 (Appendix C)

4.17 Noise

Large electric generation facilities generate noise. Potential human impacts due to noise include hearing loss, stress, annoyance, and sleep disturbance.[141] 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. 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”).

In Minnesota the MPCA 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 identified in **Table 9**.

Table 9: Minnesota Noise Standards

Noise Area Classification[142]	Daytime		Nighttime	
	L_{50}[143]	L_{10}	L_{50}	L_{10}
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

There is no state-wide noise standard in North Dakota.

[141] World Health Organization. *Occupational and Community Noise* http://www.who.int/mediacentre/factsheets/fs258/en/.
[142] 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).
[143] 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.

Natural Gas Facilities
All natural gas proposals would result in a temporary increase in noise resulting from construction activities. During operations, the natural gas proposals would result in either an increase in noise (in the case of expansions of the Black Dog, Mankato Energy Center, or Cannon Falls facilities) or the introduction of new noise (Red River Valley Plant, Hampton Energy Center, and Distributed Solar Facilities).

There would be no noise impacts resulting from proposals that are not selected.

Distributed Solar Facilities
In addition to construction-related noise, there would be occasional noise associated with electrical transformers and with the tracking equipment used to adjust the position of the arrays.

If the Distributed Solar Facilities proposal is not selected, there would be no noise impact at the sites identified.

Capacity Credit Proposal
There would be no noise impacts associated with the GRE's capacity credit proposal.

4.17.1 Mitigation Measures

Noise mitigation measures include siting generation facilities away from sensitive noise receptors to the extent possible and landscaping to minimize noise impacts. For natural gas facilities, potential mitigation includes installation of turbines inside buildings and use of noise reduction equipment, such as silencers on air inlets and engines.

5 Availability and Feasibility of Alternatives

All of the proposed alternatives would require more review based on the specifics of the proposed site(s) to develop appropriate mitigation, but all of the proposed alternatives are available and technically feasible.

All of the alternatives under consideration in this proceeding are considered to be available.

All of the alternatives under consideration in this proceeding are considered to be technically feasible. None of the alternatives proposed requires particularly innovative technology. Although the Geronimo solar proposal represents the largest solar facility proposed thus far in Minnesota, the technology is not new, and is used elsewhere.

Because the process designated by the Commission is competitive, and the size of the combined proposals exceeds the capacity identified by the Commission, the no-build alternative for each of the proposals is feasible and available.

The extent to which each of these proposals is able to meet Xcel's identified need is the subject of this proceeding.

6 Alternatives Comparison

This section provides a comparison of the impacts associated with the alternative proposals being considered in this proceeding.

6.1 Fuel Availability and Delivery

- Black Dog Expansion - may require either a new or larger pipeline to the facility.
- Red River Valley Plant – new pipeline would be constructed; may potentially require fuel oil delivered by truck.
- Mankato Energy Center Expansion - would use existing natural gas pipeline.
- Cannon Falls Expansion - would use an existing natural gas pipeline; some increase in fuel oil deliveries is anticipated.
- Hampton Energy Center – new pipeline would be constructed; fuel oil, used as a backup fuel, would be delivered by truck.
- Distributed Solar Facilities –sun serves as fuel.
- Capacity Credit Proposal – no fuel use is associated with this proposal, as it does not entail construction of any new facilities.

6.2 Associated Transmission Facilities

- Black Dog Expansion – no new transmission facilities.
- Red River Valley Plant - would require either expansion of Otter Tail Power's existing Hankinson Substation or construction of a new 230 kV substation and construction of a new 230 kV transmission line between the plant and the substation.
- Mankato Energy Center Expansion - no new transmission facilities.
- Cannon Falls Energy Center Expansion - would require construction of a 345 kV transmission line to the Hampton Substation currently under construction in Hampton Township.
- Hampton Energy Center - would require construction of a 345 kV transmission line between the Hampton Substation currently under construction in Hampton Township.
- Distributed Solar Facilities – anticipates connecting each of the sites to local distribution substations through new distribution lines at 34.5 kV and lower, although pending review of interconnection requests some interconnections may be at transmission voltages of up to 115 kV.
- Capacity Credit Proposal – no new electric transmission facilities are associated with this proposal, as it does not entail construction of any new facilities.

6.3 Water Usage

- Black Dog Expansion - would use water provided through an existing wells.
- Red River Valley Plant – may use municipal water or install a new well.
- Mankato Energy Center Expansion - would use treated wastewater.
- Cannon Falls Expansion - would use water provided through existing well.
- Hampton Energy Center – would install a new well.
- Distributed Solar Facilities – would use municipal water at most sites; may install wells at one or more sites.

- Capacity Credit Proposal – no water use is associated with this proposal, as it does not entail construction of any new facilities.

6.4 Wastewater Discharge

- Black Dog Expansion - would discharge wastewater to either the municipal sewer system or to Black Dog Lake.
- Red River Valley Plant - would discharge wastewater to either a municipal sewer system or to on-site ponds.
- Mankato Energy Center Expansion - would discharge wastewater to host municipal sewer system.
- Cannon Falls Expansion - would discharge wastewater to host municipal sewer system.
- The Hampton Energy Center - would discharge wastewater to either an on-site septic system or an on-site holding tank.
- Distributed Solar Facilities - water used to clean the panels would either evaporate or run off to the surface under the panels.
- Capacity Credit Proposal – no wastewater discharge is associated with this proposal, as it does not entail construction of any new facilities.

6.5 Geology and Soils

- The Black Dog Expansion - construction in an existing building minimizes potential for soil compaction and erosion
- Red River Valley Plant - likely to result in soil compaction and the potential for soil erosion related to construction of the plant, the natural gas pipeline to serve the plant, and the associated transmission
- Mankato Energy Center Expansion - development adjacent to the existing facility minimizes the potential for topographic impacts and soil compaction; potential for soil erosion remains, but is less than for a greenfield site.
- Cannon Falls Expansion - development adjacent to the existing facility minimizes potential for topographic impacts and soil compaction; potential for soil erosion remains, but is less than for a greenfield site
- Hampton Energy Center – likely to result in soil compaction and the potential for soil erosion related to construction of the plant, the natural gas pipeline to serve the plant, and the associated transmission
- Distributed Solar Facilities – likely to result soil compaction and potential for erosion resulting from disturbance over approximately 20 sites
- Capacity Credit Proposal – no geologic or soil impact is associated with this proposal, as it does not entail construction of any new facilities.

6.6 Land Use and Displacement

- Black Dog Expansion –does not require additional land acquisition or land use changes.
- Red River Valley – requires acquisition of up to 160 acres of agricultural land, up to 35 acres developed for industrial facility and remainder returned to agricultural use.
- Mankato Energy Center Expansion –does not require additional land acquisition or land use changes.

- Cannon Falls Expansion –does not require additional land acquisition or land use changes.
- Hampton Energy Center - requires acquisition and conversion of approximately 20 acres of agricultural land to industrial use.
- Distributed Solar Facilities – requires acquisition of approximately 700 acres over approximately 20 sites; sites are predominantly agricultural with some on the urban edge would be developed into solar facilities; land use would change from the current uses (predominantly agricultural) to an industrial use.
- Capacity Credit Proposal – no land use impacts associated with this proposal, as it does not entail construction of any new facilities.

6.7 Health and Safety

- Black Dog Expansion – potential for unauthorized access during construction and operation phases could result in safety issues; potential for accidents during construction; potential for fire or other industrial accidents once operational; stack may require lighting to avoid interference with aircraft.
- Red River Valley Plant – potential for unauthorized access during construction and operation phases could result in safety issues; potential for accidents during construction; potential for fire or other industrial accidents once operational; stack may require lighting to avoid interference with aircraft.
- Mankato Energy Center Expansion – potential for unauthorized access during construction and operation phases could result in safety issues; potential for accidents during construction; potential for fire or other industrial accidents once operational; stack may require lighting to avoid interference with aircraft.
- Cannon Falls Energy Center Expansion - – potential for unauthorized access during construction and operation phases could result in safety issues; potential for accidents during construction; potential for fire or other industrial accidents once operational; stack may require lighting to avoid interference with aircraft.
- Distributed Solar Facilities – potential for unauthorized access during construction and operation phases could result in safety issues; potential for accidents during construction; potential for fire or other industrial accidents during operations is present, but presumed to be smaller than for natural gas facilities.
- Capacity Credit Proposal – no health and safety impacts associated with this proposal, as it does not entail construction of any new facilities.

6.8 Economic Impacts

- Black Dog Expansion – up to 60 construction jobs at any one time; no increase in operations staff from present; increase in annual property tax estimated at $1.4 million.
- Red River Valley Plant – up to 60 jobs at any one time; up to 10 jobs may be created to operate the plant; annual property taxes estimated at approximately $1.4 million for one unit and approximately $2.8 million for both units.
- Mankato Energy Center Expansion – approximately 250 construction jobs during the peak of construction activity; no noticeable change in operations personnel from current staffing levels; no significant increase in its overall tax liability.

- Cannon Falls Expansion – approximately 100 construction jobs during the peak of construction activity; no new operations staff added; increase of approximately $600, 000 in fees and taxes paid to local governments from present level.
- Hampton Energy Center – approximately 100 construction jobs during the peak of construction activity; no new operations staff – staff would be shared between Cannon Falls and Hampton Energy Center facilities; fees and taxes paid to local governments estimated at approximately $1.2 million.
- Distributed Solar Facilities – approximately 500 construction jobs, jobs range at each site from 13 to 40 per site; up to 10 permanent positions to operate and maintain the facilities; no change in taxes paid - Geronimo would pay property taxes on the land parcels developed for the solar facilities, but the PV equipment itself is exempt from Minnesota property taxes.
- Capacity Credit Proposal - no economic impacts associated with this proposal, as it does not entail construction of any new facilities.

6.9 Traffic

- Black Dog Expansion – traffic impacts from movement of construction personnel and delivery of materials during construction of plant and potentially a new or expanded pipeline; if pipeline construction requires crossing or paralleling of public road, short-term traffic disruptions due to road or lane closures may occur; no traffic impacts anticipated once facility begins operation.
- Red River Valley Plant – traffic impacts from movement of construction personnel and delivery of materials during construction of plant, pipeline, and transmission facilities; construction of new pipelines or transmission facilities across or adjacent to public roads may create short-term traffic disruptions from road or lane closures; limited traffic impacts resulting from up to 10 operations personnel and possible fuel oil delivery anticipated once facility begins operation.
- Mankato Energy Center Expansion – traffic impacts during construction of plant from movement of construction personnel and delivery of materials; no traffic impacts anticipated once facility begins operation.
- Cannon Falls Energy Center Expansion – traffic impacts during construction of plant from movement of construction personnel and delivery of materials; construction of new transmission facilities across or adjacent to public roads may create short-term traffic disruptions from road or lane closures; no traffic impacts anticipated once facility begins operation.
- Hampton Energy Center – traffic impacts from movement of construction personnel and delivery of materials during construction of plant, pipeline, and transmission facilities; construction of new pipelines or transmission facilities across or adjacent to public roads may create short-term traffic disruptions from road or lane closures; limited traffic impacts resulting from up to 10 operations personnel and fuel oil delivery anticipated once facility begins operation.
- Distributed Solar Facilities – traffic impacts during construction of plant from movement of construction personnel and delivery of materials; construction of new electric distribution facilities across or adjacent to public roads may create short-term traffic disruptions from road or lane closures; limited traffic impacts from up to 10 operations personnel anticipated once facility begins operation.
- Capacity Credit Proposal - no traffic impacts associated with this proposal, as it does not entail construction of any new facilities.

6.10 Air Quality

- Black Dog Expansion – would emit criteria pollutants, CO2, HAPs and VOCs from combustion of natural gas; would contribute ozone precursors (NOx and VOCs) to the atmosphere; no visibility impairment through smokestack emissions; dust generated during construction may, on occasion, create temporary visual impairment .
- Red River Valley Plant would emit criteria pollutants, CO2, HAPs and VOCs from combustion of natural gas; would contribute ozone precursors (NOx and VOCs) to the atmosphere; no visibility impairment through smokestack emissions; dust generated during construction may, on occasion, create temporary visual impairment .
- Mankato Energy Center Expansion – would emit criteria pollutants, CO2, HAPs and VOCs from combustion of natural gas; would contribute ozone precursors (NOx and VOCs) to the atmosphere; no visibility impairment through smokestack emissions; dust generated during construction may, on occasion, create temporary visual impairment .
- Cannon Falls Energy Center Expansion – would emit criteria pollutants, CO2, HAPs and VOCs from combustion of natural gas; would contribute ozone precursors (NOx and VOCs) to the atmosphere; no visibility impairment through smokestack emissions; dust generated during construction may, on occasion, create temporary visual impairment .
- Hampton Energy Center – would emit criteria pollutants, CO2, HAPs and VOCs from combustion of natural gas; would contribute ozone precursors (NOx and VOCs) to the atmosphere; no visibility impairment through smokestack emissions; dust generated during construction may, on occasion, create temporary visual impairment .
- Distributed Solar Facilities – no emissions of criteria pollutants, CO2, HAPs and; no ozone precursors (NOx and VOCs; no visibility impairment through smokestack emissions; dust generated during construction may, on occasion, create temporary visual impairment .
- Capacity Credit Proposal - no air quality impacts associated with this proposal, as it does not entail construction of any new facilities.

6.11 Solid and Hazardous Wastes

- Black Dog Expansion – solid waste generated during construction; potential for spills of gas, lubricants, or other hazardous materials from construction vehicles; solid and liquid wastes generated as a result of routine operations and maintenance activities; no generation of radioactive wastes.
- Red River Valley Plant – solid waste generated during construction; potential for spills of gas, lubricants, or other hazardous materials from construction vehicles; solid and liquid wastes generated as a result of routine operations and maintenance activities; no generation of radioactive wastes.
- Mankato Energy Center Expansion – solid waste generated during construction; potential for spills of gas, lubricants, or other hazardous materials from construction vehicles; solid and liquid wastes generated as a result of routine operations and maintenance activities; no generation of radioactive wastes.
- Cannon Falls Energy Center Expansion – solid waste generated during construction; potential for spills of gas, lubricants, or other hazardous materials from construction vehicles; solid and liquid wastes generated as a result of routine operations and maintenance activities; no generation of radioactive wastes.

- Hampton Energy Center – solid waste generated during construction; potential for spills of gas, lubricants, or other hazardous materials from construction vehicles; solid and liquid wastes generated as a result of routine operations and maintenance activities; no generation of radioactive wastes.
- Distributed Solar Facilities – solid waste generated during construction; potential for spills of gas, lubricants, or other hazardous materials from construction vehicles; solid and liquid wastes generated as a result of routine operations and maintenance activities; potential for leakage of potentially hazardous materials if panels are damaged during delivery, installation, operation, or decommissioning; no generation of radioactive wastes.
- Capacity Credit Proposal - no solid or hazardous waste associated with this proposal, as it does not entail construction of any new facilities.

6.12 Wildlife

Although other types of electric generation, such as hydropower and wind turbines have known wildlife impacts during operation, impacts from gas-fired power plants and solar facilities are expected to be relatively minor and related to clearing activities and habitat changes at the sites.

- Black Dog Expansion – limited potential for wildlife impacts due to location in an existing industrial use; some potential for wildlife impact associated with new pipeline.
- Red River Valley Plant – some potential for wildlife impacts from ground disturbance and land use changes associated with new plant, pipeline, and transmission facilities.
- Mankato Energy Center Expansion – limited potential for wildlife impacts due to location in an existing industrial use.
- Cannon Falls Energy Center Expansion – limited potential for wildlife impacts due to location in an existing industrial use; some potential for wildlife impact associated with new pipeline and transmission line.
- Hampton Energy Center – some potential for wildlife impacts from ground disturbance and land use changes associated with new plant, pipeline, and transmission facilities.
- Distributed Solar Facilities – some potential for wildlife impacts from ground disturbance and land use changes associated with approximately 20 facilities and distribution lines.
- Capacity Credit Proposal - no wildlife impacts associated with this proposal, as it does not entail construction of any new facilities.

6.13 Vegetation

Construction of generating facilities generally requires that the area of disturbance is cleared of vegetation to allow for adequate site preparation and access. Once construction is complete, vegetation in the area of the site that is not developed is re-established.

- Black Dog Expansion – no vegetation impacts expected from plant due to location in an existing industrial use; some potential for vegetation impact if a new pipeline is constructed.
- Red River Valley Plant –limited potential for vegetation impacts from ground disturbance in an agricultural field from construction of with new plant; some potential for vegetation impacts associated with pipeline and transmission facilities.
- Mankato Energy Center Expansion – no vegetation impacts expected due to location in an existing industrial use.

- Cannon Falls Energy Center Expansion – no vegetation impacts expected from plant due to location in an existing industrial use; some potential for vegetation impact associated with new pipeline and transmission line.
- Hampton Energy Center –limited potential for vegetation impacts from ground disturbance in an agricultural field from construction of with new plant; some potential for vegetation impacts associated with pipeline and transmission facilities.
- Distributed Solar Facilities –potential for vegetation impacts and habitat fragmentation from ground disturbance and land use changes associated with approximately 20 facilities; limited potential for vegetation impacts associated with distribution lines.
- Capacity Credit Proposal - no vegetation impacts associated with this proposal, as it does not entail construction of any new facilities.

6.14 Rare and Unique Natural Resources

Impacts to rare and unique natural resources, and appropriate mitigation strategies, are very dependent upon the location, design, and construction of the proposal.

- Black Dog Expansion – some potential for impacts to unique natural communities. The DNR recommended mitigation measures for a Bullrush Marsh native plant community in the 2011 site permit proceeding.
- Red River Valley Plant – some potential for impacts to rare and unique natural resources. The whooping crane (*Grus Americana*) and the Western prairie fringed orchid (*Plantanthera praeclara*) are federally listed species protected under the Endangered Species Act within Richland County, where the Red River Plant would be located.
- Mankato Energy Center – no rare or unique species or communities have been identified in earlier proceedings for the Mankato Energy Center
- Cannon Falls Energy Center Expansion – no rare or unique species or communities have been identified in earlier proceedings for the Cannon Falls Energy Center
- Hampton Energy Center – no rare or unique species or communities have been identified at the location for the Hampton Energy Center
- Distributed Solar Facilities – some potential for impacts to rare or unique natural resources. Several of the sited identifies by Geronimo as potential sites for their distributed solar facilities are located near known populations of state-listed animals or plants, or unique or rare habitat types. Impacts on these species or communities are unknown at this time and would depend upon the species or community identified and the design of the facilities.
- Capacity Credit Proposal - no vegetation impacts associated with this proposal, as it does not entail construction of any new facilities.

6.15 Water Resources

- Black Dog Expansion –no increase in groundwater appropriation permit; wastewater would be discharged either to the sewer system or to Black Dog Lake; potential for sediment from construction activities to reach surface waters is minimized, but not entirely eliminated.
- Red River Valley Plant –water will come from either a new well or trucked to the site and stored; wastewater would be discharged to a sanitary sewer or to an on-site settling pond; potential for sediment from construction activities to reach surface waters.
- Mankato Energy Center –treated wastewater provided through agreement with host municipality will continue to be used to meet needs for process water needs; wastewater

discharged to municipal wastewater system through an existing agreement with the city; potential for sediment from construction activities to reach surface waters is minimized, but not entirely eliminated.

- Cannon Falls Energy Center Expansion – water and wastewater discharge will both be provided by municipal systems as with the current facility; potential for sediment from construction activities to reach surface waters is minimized, but not entirely eliminated.
- Hampton Energy Center – water will come from installation of a well; wastewater would be discharged to either an on-site septic system or an on-site holding pond; potential for sediment from construction activities to reach surface waters.
- Distributed Solar Facilities – most water is anticipated to come from municipal water supplies, wells could be installed at one or more of the distributed solar sites to provide water for cleaning of the solar panels; water used to occasionally clean PV panels would evaporate or fall to the ground beneath the panels; potential for sediment from construction activities to reach surface waters.
- Capacity Credit Proposal – no impacts to water resources associated with this proposal, as it does not entail construction of any new facilities.

6.16 Wetlands

- Black Dog Expansion – no wetland impacts anticipated from plant, potential for wetland impacts related to pipeline construction.
- Red River Valley Plant – potential for wetland impacts from plant, although larger site should allow room to avoid wetlands; potential wetland impacts from pipeline and transmission line construction.
- Mankato Energy Center Expansion – no wetland impacts anticipated.
- Cannon Falls Expansion – no wetland impacts anticipated from plant construction , potential for wetland impacts from transmission line construction
- Hampton Energy Center – potential for wetland impacts from plant, larger site should allow room to avoid wetlands; potential wetland impacts from pipeline and transmission line construction.
- Distributed Solar Facilities – potential for wetland impacts from construction of solar facilities – several sites show presence of NWI wetland areas – actual impacts dependent upon site design and layout; potential wetland impacts from and distribution lines.
- Capacity Credit Proposal - no wetland impacts associated with this proposal, as it does not entail construction of any new facilities.

6.17 Noise

- Black Dog Expansion – temporary noise from construction; incremental noise increase from new turbine during operations.
- Red River Valley Plant – temporary noise from construction; new noise source introduced to the area during operations.
- Mankato Energy Center Expansion – temporary noise from construction; incremental noise increase from new turbine during operations.
- Cannon Falls Expansion – temporary noise from construction; incremental noise increase from new turbine during operations.

- Hampton Energy Center – temporary noise from construction; new noise source introduced to the area during operations.
- Hampton Energy Center – temporary noise from construction; new noise source introduced to the area during operations.
- Capacity Credit Proposal - no noise impacts associated with this proposal, as it does not entail construction of any new facilities.

7 Permits

Each of the proposals would require permits and approvals prior to construction and operation. Federal, state, and local permits or approvals that have been identified for construction and operation of each of the proposals are listed below in **Table 10**. The identified permits and approvals may not be required of the project proposers, but would still be required prior to each proposal coming online.

Table 10: Anticipated Permits and Approvals

Agency	Type	Description	Black Dog [144]	Red River Valley[145]	Mankato Energy Center[146]	Invenergy Cannon Falls Expansion	Invenergy Hampton Energy Center	Geronimo	GRE
Federal Permit									
Department of Energy	DOE, 10 CFR 503	Exemption to allow burning of Natural Gas for Power Production	Yes	Yes	Yes	Yes	Yes	No	No
Environmental Protection Agency	Spill Prevention Control and Countermeasure (SPCC) Plan	May be required if an oil storage tank is planned.	No	Potentially	Modify existing	Modify existing	Yes	No	No
	Title IV Acid Rain Certificate of Representation	Discharge of sulfur oxides	Modify existing as part of air permit	Yes	Modify existing as part of air permit	Modify existing as part of air permit	Yes	No	No
	Risk Management Plan/Process Safety Management	Required for facilities possessing more than threshold quantities of regulated chemicals	Modify existing	Yes	Modify existing	Modify existing	Yes	Yes	No
Federal Aviation Administration (FAA)	Notice of Proposed Construction Hazard Determination	Notifies FAA of proposed structures that might affect navigable airspace.	Yes	Yes	Yes	Yes	Yes	No	No
United States Army Corps of Engineers (USACE)	Jurisdictional Determination/ Review and Approval of Wetland Delineations	Required to determine extent of USACE jurisdiction, quantify impacts or document avoidance.	No	Potentially	No	No	Potentially	Yes	No
	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.	No	Potentially	No	No	Potentially	Potentially	No

[144] Xcel Proposal
[145] Ibid.
[146] Calpine, personal communication, August 13, 2013

Agency	Type	Description	Black Dog [144]	Red River Valley[145]	Mankato Energy Center[146]	Invenergy Cannon Falls Expansion	Invenergy Hampton Energy Center	Geronimo	GRE
United States Fish and Wildlife Service	Threatened and Endangered Species Review	Review of agency records potentially affected by the project	Yes	Yes	Yes	Yes	Yes	Yes	No
Minnesota State Permits									
Minnesota Public Utility Commission	Site Permit	Required for power plants greater than 50 MW	Yes	N/A	Yes[a]	Yes	Yes	Yes	No
	HVTL Route Permit	Required for electric transmission lines capable of operating at > 100 kV	No	N/A	No	Yes	Yes	Potentially – depending upon location and interconnect	No
	Gas Pipeline Permit		Potentially	N/A	No	No	Yes	No	No
	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 [b]	No	N/A	No	No	No	No	No
Minnesota Pollution Control Agency	Section 401 Certification	Compliance with state water quality standards.	No	N/A	No	No	Yes	Yes	No
	NPDES/SDS General Storm water Discharge Permit for Construction Activities	For storm water discharges from construction activities	Yes	N/A	Potentially	Potentially	Yes	Yes	No
	NPDES/SDS General Storm water Discharge Permit for Industrial Activities	For storm water discharges during operations phase	Modify existing	N/A	Modify existing	Modify existing	Yes	No	No
	Hazardous Waste Generator License	For discharge of hazardous waste.	Modify existing	N/A	Modify existing	Modify existing	Yes	Yes	No
	Major Air Permit/Prevention of Significant Deterioration (PSD)	Air emissions associated with federal new source review and other applicable state/federal requirements	Modify existing	N/A	Modify existing	Modify existing	Yes	No	No
	Aboveground Storage Tank Notification Form	May be required a tank of more than 1,100 gallons is installed	No	N/A	Modify existing	No	Yes	No	No

Agency	Type	Description	Black Dog [144]	Red River Valley[145]	Mankato Energy Center[146]	Invenergy Cannon Falls Expansion	Invenergy Hampton Energy Center	Geronimo	GRE
DNR	License to Cross Public Land and Water	For projects affecting the course, current, or cross-section of DNR Public Waters, or for utility crossings of Public Lands	No	N/A	No	No	Potentially	Potentially	No
	Public Waters Work Permit	Required for construction activities that impact waterways, including wetlands, identified on DNR public waters inventory maps	No	N/A	No	No	Potentially	Potentially	No
Minnesota Board of Water and Soil Resources	Wetland Conservation Act Approval	For wetland impacts. Ranges from an exemption for small or temporary impacts to a permit and mitigation for greater impacts	No	N/A	No	No	Potentially	Yes	No
Minnesota Department of Health	Environmental Bore Hole	Contractors drilling bore holes must be licensed by the MDH	Yes	N/A	Yes	Yes	Yes	Yes	No
	Water Supply Well Notification	New water supply well construction.	No	N/A	No	No	Yes	Potentially at one or more sites	No
	Plumbing Plan Review	Required to ensure compliance with Minnesota Plumbing Code	Yes	N/A	Yes	Yes	Yes	Yes	No
North Dakota State Permits									
North Dakota Public Service Commission	Advance Determination of Prudence/Certificate of Public Convenience and Necessity	Required prior to construction of generation or transmission facilities	N/A	Yes	N/A	N/A	N/A	N/A	No
	Certificate of Site and Corridor Compatibility	Required prior to construction generation or transmission facilities; may impose conditions for construction or operation	N/A	Yes	N/A	N/A	N/A	N/A	No
North Dakota Department of Health	Air Emission Permit/ Prevention of Significant Deterioration Permit	Air emissions associated with federal new source review and other applicable state/federal requirements	N/A	Yes	N/A	N/A	N/A	N/A	No
Other Permits & Approvals									

Agency	Type	Description	Black Dog [144]	Red River Valley[145]	Mankato Energy Center[146]	Invenergy Cannon Falls Expansion	Invenergy Hampton Energy Center	Geronimo	GRE
Local Jurisdictions	Driveway permit		No	N/A	No	No	Yes	Yes	No
MISO	MISO Interconnect		Yes	Yes	Yes	Yes	Yes	Yes	No

A: Original site permit issued by Minnesota Environmental Quality Board in 2004 was for a 655 MW project; the existing 375 MW plant came online in 2006.
B. No Certificate of Need is required for proposals selected through this proceeding. However, a Certificate of Need may be required if a proposal not selected through this proceeding seeks to construct at some point in the future.

Appendix A
Environmental Report Scoping Decision

Appendix B
Proposal Site Maps

Appendix C

Personal Correspondence Used In Preparation of Document