Application to the North Dakota Public Service Commission for a Site Certificate of Compatibility

for the

Aurora Wind Project

Aurora Wind Project, LLC
Burns & McDonnell Project No. 104200

September 2018

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prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
AADT	Average Annual Daily Traffic
ADLS	Aircraft Detection Lighting System
AGL	above ground level
AM	amplitude modulation
ANSI	American National Standards Institute
APE	Area of Potential Effect
application	Application
ASTs	above ground storage tanks
Aurora Wind	Aurora Wind Project, LLC
BBCS	Bird & Bat Conservation Strategy
BBS	Breeding Bird Survey
BGEPA	Bald and Golden Eagle Protection Act
BMPs	Best Management Practices
Board	Board of University and School Lands
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
Certificate	Certificate of Site Compatibility
CFR	Code of Federal Regulations
Commission	North Dakota Public Service Commission
CRP	Conservation Reserve Program
CUP	Conditional Use Permit
CWA	Clean Water Act

Abbreviation	Term/Phrase/Name
dBA	decibel
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
ECOS	Environmental Conservation Online System
ECPG	Eagle Conservation Planning Guidance
EMF	electromagnetic Field
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FM	frequency modulation
FSA	Farm Service Agency
GIA	General Interconnection Agreement
GIS	Geographic Information System
GW	gigawatt
ICBM	Intercontinental Ballistic Missile
IRAC	Interdependent Radio Advisory Committee
kV	kilovolt
LIDAR	Light Detection and Ranging
MBTA	Migratory Bird Treaty Act
MET	meteorological towers
MISO	Midcontinent Independent System Operator

Abbreviation	Term/Phrase/Name
mph	miles per hour
m/s	meters per second
MW	megawatt
MWh	megawatt hours
MWh/y	megawatt hours per year
NASS	National Agricultural Statistics Service
ND	North Dakota
NDAC	North Dakota Administrative Code
NDCC	North Dakota Century Code
NDDH	North Dakota Department of Health
NDDOT	North Dakota Department of Transportation
NDTL	North Dakota Department of Trust Lands
NDGFD	North Dakota Game and Fish Department
NDGS	North Dakota Geological Survey
NDPDES	North Dakota Pollutant Discharge Elimination System
NDSWC	North Dakota State Water Commission
NEC	National Electric Code
NESC	National Electric Safety Code
NLEB	northern long-eared bat
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTIA	National Telecommunications and Information Administration

Abbreviation	Term/Phrase/Name
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O&M	operation and maintenance
PLOTS	Private Land Opened to Sportsmen
Project	Aurora Wind Project
Project Area	44,000-acre Project area
ROW	right-of-way
SCADA	Supervisory Control and Data Acquisition
SCP	Species of Conservation Priority
SHFC	species of habitat fragmentation concern
SHSND	State Historical Society of North Dakota
SISA	System Impact Study Agreement
Siting Act	NDCC Chapter 49-22
Siting Rules	NDAC Article 69-06-08
SPCC	Spill Prevention Control and Countermeasures
SPP	Southwest Power Pool
SWPPP	Stormwater Pollution Prevention Plan
SODAR	Sound Detection and Ranging
Study Area	101,000-acre study area
Tande Substation	Tande 345-kV Substation
Tradewind Energy	Tradewind Energy, Inc.
THPO	Tribal Historic Preservation Officers

Abbreviation	Term/Phrase/Name
TWh	terawatt hours
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
USTs	underground storage tanks
WEG	Wind Energy Guidelines
WEST	Western EcoSystems Technology, Inc.
WMA	Wildlife Management Area
WPA	Waterfowl Production Area

1.0 INTRODUCTION

Aurora Wind Project, LLC (Aurora Wind) is submitting this application (Application) for a Certificate of Site Compatibility (Certificate) to the North Dakota Public Service Commission (Commission) for the proposed Aurora Wind Project (Project) in Williams County, North Dakota.

The Project will encompass an approximately 44,000-acre project area (Project Area) located approximately 5 miles northwest of the City of Tioga, North Dakota. A 101,000-acre study area (Study Area), which includes the Project Area, was analyzed for the environmental review to best position the Project Area to avoid or minimize impacts. The Project will generate up to 300 megawatts (MWs) of electricity at rated capacity and will result in the construction of up to 121 wind turbines, depending on the final turbine model selected. Additional Project facilities include access roads, electrical collection and communication systems and cabling, an operation and maintenance (O&M) building, permanent meteorological (MET) towers, and a Project substation (see Appendix A, Exhibit 1, Project Location Map).

Aurora Wind also plans to construct an approximately 20-mile-long 345-kilovolt (kV) transmission line to facilitate the Project's interconnection. The proposed transmission line would extend from the Project substation in Williams County to the point of interconnection at the existing Basin Electric Power Cooperative Tande 345-kV Substation (Tande Substation), located in Mountrail County. Aurora Wind is submitting a separate application to the Commission for a Certificate of Corridor Compatibility and Route Permit for the proposed transmission line.

Aurora Wind is in the process of identifying an offtaker for the Project's output. However, given the Project's location in the heart of the Bakken oil production region, the Project is anticipated to meet area demand for electricity resulting from ongoing oil and gas activities in the Bakken and the region's homes and businesses. In addition, energy produced by the Project may help local utilities continue to meet applicable renewable energy standards.

Aurora Wind Project, LLC, is a wholly-owned subsidiary of Tradewind Energy, Inc. (Tradewind). Tradewind is an independent wind and solar development company based out of Lenexa, Kansas, and is recognized as a leader in the renewable energy industry. Tradewind has developed more than 3 gigawatts (GWs) of wind power currently in operations and has an additional 9,800 MW of wind and 5,100 MW of solar power projects under construction or development.

1.1 Compliance with the Energy Conversion and Transmission Facility Siting Act, North Dakota Century Code Chapter 49-22

The North Dakota Energy Conversion and Transmission Facility Siting Act, North Dakota Century Code (NDCC) Chapter 49-22 (Siting Act) requires the proponent of an energy conversion facility to obtain a Certificate from the Commission in order to locate, construct, and operate the facility in the state of North Dakota. An application for a Certificate must meet certain criteria set forth in the Siting Act, as well as in North Dakota Administrative Code (NDAC) Article 69-06-08 (Siting Rules). The siting of an energy conversion facility is to be made in an orderly manner compatible with environmental preservation and the efficient use of resources (NDCC Section 49-22-02).

In this Application, Aurora Wind presents the information required by the Siting Act and the Commission's Siting Rules. Aurora Wind has considered the exclusion and avoidance areas, the selection criteria, and the policy criteria in the design of the Project, in accordance with NDCC Chapter 49-22 and NDAC Chapter 69-06-08. Information regarding Project design, wind resources, and technical information has been included in this Application to allow a thorough understanding of the Project and to aid in review by the Commission, regulatory agencies and the public. Table 1-1 provides a summary of information included in this Application and the section of the document in which each siting requirement is addressed.

1.2 Project Summary

The Project will be located in northeastern Williams County, North Dakota (see Appendix A, Exhibit 1, Project Location Map). The planned nameplate capacity for the Project is up to 300 MW of wind energy capacity. Aurora Wind continues to assess its turbine options but anticipates that it will use a turbine model or combination of turbine models with an output of between 2.0 MW – 4.5 MW. The Project's permanent facilities will include:

- Up to 121 wind turbines and related equipment;
- New gravel access roads and improvements to existing roads (as needed);
- Underground electrical collection and communication lines, with above-ground junction boxes;
- Permanent METs;
- Aircraft Detection Lighting System (ADLS) components;
- O&M building; and
- Project substation.

Table 1-1: Certificate Completion Checklist

State Authority	Description	Section
Chapter 69-06-04-01	**Certificate of Site Compatibility**	
Section 2	**Contents**	
a. (1)	A description of the type of energy conversion facility proposed.	1.0, 4.1
a. (2)	A description of the gross design capacity.	1.2
a. (3)	A description of the net design capacity.	1.2.5
a. (4)	A description of the estimated thermal efficiency of the energy conversion process and the assumption upon which the estimate is based.	NA
a. (5)	A description of the number of acres that the proposed facility will occupy.	1.0, 1.2.2
a. (6) a	A description of the anticipated time schedule for obtaining the certificate of site compatibility.	1.3
a. (6) b	A description of the anticipated time schedule for completing land acquisition.	1.3
a. (6) c	A description of the anticipated time schedule for starting construction.	1.3
a. (6) d	A description of the anticipated time schedule for completing construction.	1.3
a. (6) e	A description of the anticipated time schedule for testing operations.	1.3
a. (6) f	A description of the anticipated time schedule for commencing commercial production.	1.3
a. (6) g	A description of the anticipated time schedule for beginning any expansions or additions.	1.4
b.	Copies of any evaluative studies or assessments of the environmental impact of the proposed facility submitted to any federal, regional, state, or local agency.	Appendices M, N, O, P, Q, R, S
c.	An analysis of the need for the proposed facility based on present and projected demand for the product or products to be produced by the proposed facility, including the most recent system studies supporting the analysis of the need.	2.1
d.	A description of any feasible alternative methods of serving the need.	2.2
e.	A study area that includes the proposed facility site, of sufficient size to enable the commission to evaluate the factors addressed in North Dakota Century Code (NDCC) section 49-22-09.	1.0, 6.0
f.	A discussion of the utility’s policies and commitments to limit the environmental impact of its facilities, including copies of board resolutions and management directives.	Appendix S

State Authority	Description	Section
g.	A map identifying the criteria that provides the basis of the specific location of the proposed facility within the study area.	Exhibit 2, Appendix A
h.	A discussion of the criteria evaluated within the study area, including exclusion areas, avoidance areas, selection criteria, policy criteria, design and construction limitations, and economic considerations.	3.0-3.6
i.	A discussion of the mitigative measures that the applicant will take to minimize adverse impacts which result from the location, construction, and operation of the proposed facility.	6.1.1, 6.2.1, 6.3.1, 6.4.1, 6.5.1, 6.6.1, 6.7.1, 6.8.1, 6.9.1, 6.10.1, 6.11.1, 6.12.1, 6.13.1 6.14.1, 6.15.1, 6.16.1
j.	The qualifications of each person involved in the facility site location study.	10.0
k.	A map of the study area showing the location of the proposed facility and the criteria evaluated.	Appendix A
l.	An eight and one-half-inch by eleven-inch black and white map suitable for newspaper publication depicting the site area.	Exhibit 13
m.	A discussion of present and future natural resource development in the area.	6.2, 6.12-6.17,
n.	Map and Geographic Information System (GIS) requirements. The applicant shall provide information that is complete, current, presented clearly and concisely, and supported by appropriate references to technical and other written material available to the commission.	Appendix A, CD Submittal
NDCC Section 49-22-08	**Description of Application Requirements**	
Section 1	**An application for a certificate shall be in such form as the commission may prescribe, containing the following information:**	
a.	A description of the size and type of facility.	1.0, 4.0
b.	A summary of any studies which have been made of the environmental impact of the facility.	1.2.3, 6.0-6.17
c.	A statement explaining the need for the facility.	2.1

State Authority	Description	Section
d.	An identification of the location of the preferred site for any energy conversion facility.	1.2.1, Appendix A
e.	An identification of the location of the preferred corridor for any transmission facility.	NA
f.	A description of the merits and detriments of any location identified and a comprehensive analysis with supporting data showing the reasons why the preferred location is best suited for the facility.	1.1, 1.2, 2.0-3.6, 6.0-6.17
g.	A description of mitigative measures that will be taken to minimize all foreseen adverse impacts resulting from the location, construction, and operation of the proposed facility.	6.1.1, 6.2.1, 6.3.1, 6.4.1, 6.5.1, 6.6.1, 6.7.1, 6.8.1, 6.9.1, 6.10.1, 6.11.1, 6.12.1, 6.13.1 6.14.1, 6.15.1, 6.16.1
h.	An evaluation of the proposed site or corridor with regard to the applicable considerations set out in section 49-22-09 and the criteria established pursuant to section 49-22-05.1.	3.0-3.6, 6.0-6.17 8.0-8.10
i.	Such other information as the applicant may consider relevant or the commission may require.	Complete Application including Appendices and Exhibits
NDCC 49-22-09	**Factors to be considered in evaluating applications and the designation of sites, corridors, and routes.**	
1.	Available research and investigations relating to the effects of the location, construction, and operation of the proposed facility on public health and welfare, natural resources, and the environment.	6.0, 8.1
2.	The effects of new energy conversion and transmission technologies and systems designed to minimize adverse environmental effects.	8.2
3.	The potential for beneficial uses of waste energy from a proposed energy conversion facility.	8.3
4.	Adverse direct and indirect environmental effects that cannot be avoided should the proposed site or route be designed.	8.4

State Authority	Description	Section
5.	Alternatives to the proposed site, corridor, or route which are developed during the hearing process and which minimize adverse effects.	8.5
6.	Irreversible and irretrievable commitments of natural resources should the proposed site, corridor, or route be designed.	8.6
7.	The direct and indirect economic impacts of the proposed facility.	8.7
8.	Existing plans of the state, local government, and private entities for other developments at or in the vicinity of the proposed site, corridor, or route.	6.11, 8.8, 9.15
9.	The effect of the proposed site or route on existing scenic areas, historic sites and structures, and paleontological or archaeological sites.	3.1, 3.2, 6.6.1, 8.9
10.	The effect of the proposed site or route on areas which are unique because of biological wealth or because they are habitats for rare and endangered species.	8.10
11.	Problems raised by federal agencies, other state agencies, and local entities.	9.0-9.17

1.2.1 Study Area

The Study Area is comprised of 158 sections (containing approximately 100,919 acres) of primarily agricultural land in northeastern Williams County, North Dakota, situated northwest of the City of Tioga. Table 1-2 provides a list of the townships, sections, and ranges (all in Williams County) that are included in the Study Area. Also see Exhibit 1, Project Location Map, in Appendix A.

Table 1-2: Study Area Site Location

Township Name	Township	Range	Section(s)
Tioga	157 N	95 W	6
Golden Valley	157 N	96 W	11-12, 15-22
Champion	157 N	97 W	1-5, 10-15, 22-24
Lindahl	158 N	95 W	7, 18-19, 30-31
South Meadow	158 N	96 W	1-36
New Home	158 N	97 W	1-5, 7-29, 32-36
Big Meadow	159N	96 W	1717-20, 29-34
Hazel	159 N	97 W	44-36
Big Stone	159 N	98 W	1, 12-13, 24-25, 36

1.2.2 Project Area

The Project Area is comprised of 95 sections (containing approximately 44,000 acres) of agricultural land in northeastern Williams County, North Dakota, situated northwest of the City of Tioga. Aurora Wind currently holds Wind Energy Lease and Easement agreements or Authorized Agent forms with approximately 144 landowner partners, which is sufficient acreage to construct the anticipated 300 MW Project (Table 1-3; Appendix A, Exhibit 1).

Table 1-3: Project Area Site Location

Township Name	Township	Range	Section(s)
Golden Valley	157 N	96 W	3-9, 16-18
Champion	157 N	97 W	1, 11-14
South Meadow	158 N	96 W	3-11, 13-28, 30-32, 34-36
New Home	158 N	97 W	1-3, 9-17, 22-28, 33-36
Big Meadow	159N	96 W	19, 30-31
Hazel	159 N	97 W	7-8, 14-30, 33-36

1.2.3 Project Layout

In this Application, Aurora Wind is providing a preliminary Project layout (see Exhibit 2, Facilities Layout, in Appendix A). The Project layout includes 130 turbine locations which provides for 9 alternate turbine locations. Additionally, the preliminary locations for access roads and collection lines are included in the layout. The preliminary layout is designed to accommodate any of the representative turbine models currently under consideration. A more detailed description of the representative turbine models being considered for the Project is included in Section 4.1.1 of this Application.

Based on the analyses completed to date, Aurora Wind's turbine layout optimizes electrical generation and efficiency, while avoiding or minimizing environmental, cultural, and economic impacts. Aurora Wind has and will continue to thoroughly evaluate its preliminary turbine and ancillary facility locations. Further, Aurora Wind will continue to coordinate with landowners and applicable agencies regarding the Project's design and layout. The Project's turbines and ancillary facilities will be sited so as to comply with the Commission's and Williams County's setback requirements.

Once the Project is constructed, Aurora Wind will file as-built surveys with the Commission, Williams County, and other interested agencies at their request.

1.2.4 Selection of Project Area

Tradewind successfully developed the landowner-initiated 150-MW Lindahl Wind Project in Williams County, which is owned and operated by Enel Green Power North America, Inc. Recognizing the unique and favorable combination of traits that make the area ideally suited for wind development, Tradewind looked for additional wind development opportunities. Tradewind selected the Project Area because of its extraordinary wind resource, nearby electrical infrastructure for interconnection to the grid, and landowner support. Further, the Project is compatible with the existing land use and environmental features within the Project Area. These attributes, coupled with high demand for electricity in North Dakota, make this Project well-suited for wind energy development.

1.2.5 Project Area Wind Characteristics

The U.S. Department of Energy (DOE) and the North Dakota Division of Community Services have conducted wind resource assessment studies in North Dakota. According to the DOE, annual average wind speeds of 6.5 meters per second (m/s) and above are suitable for wind power projects. The October 2010 DOE wind map for the state of North Dakota indicates that the wind resources within the Project Area average 7.5 to 9.0 m/s at a height of 80 meters above the ground (DOE, 2010).

Six temporary METs are currently located on-site, and compilation and assessment of wind resource data has been ongoing since February 2016 (when the Sound Detection and Ranging [SODAR] unit was installed). The METs have collected data showing that long-term annual wind speeds are at the upper end of the average range for North Dakota, indicating that the Project Area is an excellent resource for electrical generation. All of the temporary METs will be removed during construction of the Project, or within a year following commercial operation of the Project.

To augment data collection from the existing temporary and proposed permanent METs, the Project deployed a temporary trailer-mounted SODAR and Light Detection and Ranging (LIDAR) units. SODAR measures wind speed and direction by emitting faint acoustic chirps and measuring the frequency shift of the reflected sound wave. LIDAR similarly measures the wind speed and direction, but rather uses a non-visible to the eye beam to determine the frequency shifts. SODARs and LIDARs provide data up to and beyond hub height of the proposed turbines and helps to supplement wind data collected from more traditional measurement towers.

In addition to the on-site METs, the Project has access to the historical data collected from the Lindahl Wind Project measurement campaign, thus giving the Project over 8 years of wind data within the region.

As discussed further in Section 4.1.2 of this Application, Aurora Wind will install permanent METs as part of the Project. The final locations of these permanent METs will be selected by the turbine manufacturer and will meet applicable setback requirements.

1.2.6 Projected Output

The Project will have a nameplate capacity of up to 300 MW with projected average output ranging from 1,100,000 to 1,300,000 MW hours per year (MWh/y), depending on the wind turbine selected. Variations in the actual Project output will depend upon final wind turbine selection and any additional changes to the final design and layout of the facility. As a point of reference, this amount of electrical output is enough to power approximately 120,000 average American homes.

1.3 Project Schedule

Aurora Wind anticipates that civil construction (i.e., roads, gravel pads and potentially aggregate stockpiling) could begin as early as the Second Quarter of 2019, provided that applicable construction permits and approvals have been obtained. The proposed Project schedule is as follows:

- **Land Acquisition**: With the exception of land owned by landowners who have executed an Authorized Agent form and land owned by the North Dakota Department of Trust Lands

(NDTL), all land that is proposed to house Project facilities is subject to agreements allowing for construction of the Project. Prior to seeking building permits from Williams County, Aurora Wind will have secured a Wind Energy Lease and Easement agreement or other land rights agreement from NDTL and those landowners that have executed an Authorized Agent form.

- **Certificate of Site Compatibility**: Aurora Wind anticipates the Certificate will be issued by the Commission in First Quarter 2019.
- **Conditional Use Permit**: Aurora Wind filed an application for a Conditional Use Permit (CUP) with Williams County in May 2018. Williams County issued a CUP in July 2018.
- **Other Permits**: Aurora Wind will acquire all other permits necessary for construction of the Project prior to conducting the work for which the permit is required (see Section 7.0).
- **Construction**: Project construction is anticipated to begin as early as Second Quarter 2019 and be completed by 2020.
- **Commissioning**: Upon completion of the construction phase, the Project will undergo detailed inspection and testing procedures before being commissioned. Inspection and testing will occur for each individual component of the wind turbines, as well as the associated communication, meteorological, collection, and Supervisory Control and Data Acquisition (SCADA).
- **Commercial Operations**: Aurora Wind anticipates full commercial operation to occur no later than the end of 2020.

1.4 Expansion or Addition

No additions or expansions have been identified at this time. However, should the opportunity arise for expansion or addition to the proposed Project, Aurora Wind would take action to develop additional adjacent areas that have been deemed suitable for expansion. Aurora Wind would obtain all necessary permits and approvals for any expansion project.

1.5 Project Ownership

The Project will be developed, constructed, owned and operated by Aurora Wind.

1.6 Project Cost

The estimated total cost to construct the Project is $400 million.

2.0 NEED FOR FACILITY

2.1 Need Analysis

As discussed above, Aurora Wind is in the process of identifying an offtaker for the Project's output. However, given the Project's location in the heart of the Bakken oil production region, the Project is anticipated to meet area demand for electricity resulting from ongoing oil and gas activities in the Bakken and the region's homes and businesses. In addition, energy produced by the Project may help local utilities to continue to meet applicable renewable energy goals and/or standards.

In 2007, the North Dakota Legislature enacted a statutory provision adopting the national "25x25" initiative, which establishes a goal of having not less than 25 percent of the total energy consumed within the United States come from renewable resources by January 1, 2025.[1] Additional renewable resources will be needed to meet the 25x25 initiative.

A need also exists for renewable energy produced in North Dakota to meet state renewable portfolio standards. Of the Midcontinent Independent System Operator (MISO) states, 11 currently have either mandated or voluntary renewable portfolio standards or policies.[2] Under current state standards, total United States renewable portfolio standard demand will increase from 235 terawatt hours (TWh) in 2016 to 450 TWh in 2030.[3] Given existing renewable energy capacity, an additional 150 TWh increase in renewable resources will be required to meet demand through 2030.[4] In addition, the regional transmission grid is being expanded to deliver wind generation in a cost-effective manner; specifically, MISO's Multi-Value Project Portfolio enables 41 million megawatt hours (MWh) of wind energy per year to meet renewable energy mandates and goals.[5]

In summary, the renewable energy produced by Aurora Wind's proposed Project will help meet the national 25x25 initiative and the regional need for renewable energy.

2.2 Alternatives

Potential alternatives to wind generation include electricity generation using coal, natural gas, solar energy, hydropower or biomass.

[1] See N.D.C.C. § 17-01-01.
[2] *MTEP17 MISO Transmission Expansion Plan*, at 76.
[3] Lawrence Berkeley National Laboratory, *USUSUSU.S. Renewable Portfolio Standards 2017 Annual Status Report* (July 2017), at 21.
[4] *Id.* at 22.
[5] *MTEP17 MISO Transmission Expansion Plan*, at 193.

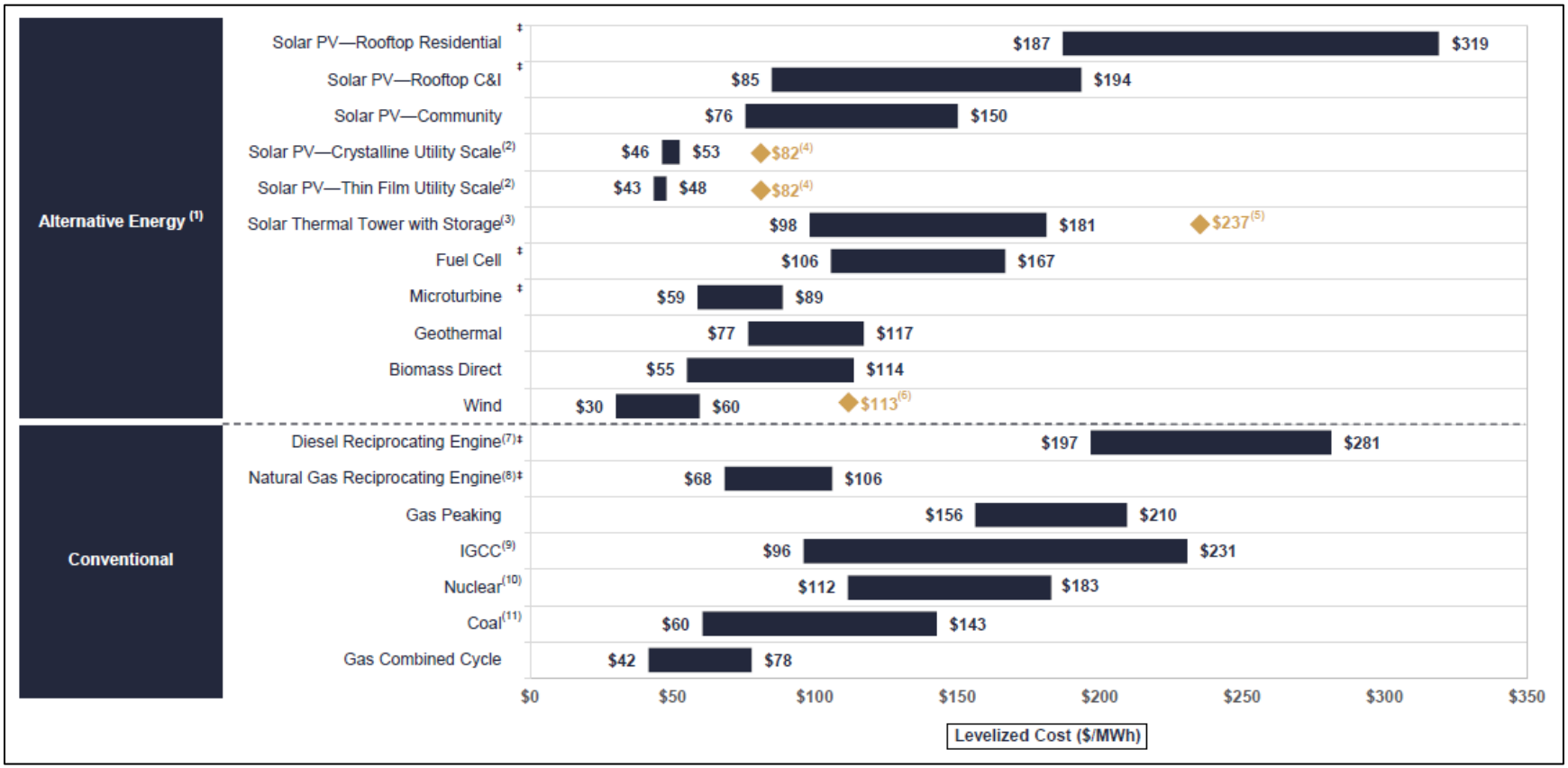
Wind energy is currently among the most cost-effective generation resources. As demonstrated in Lazard's November 2017 *Levelized Cost of Energy Analysis* (Version 11.0), wind energy, which became cost-competitive with conventional generation sources several years ago, is approaching costs that are at or below the marginal cost of certain conventional generation technologies (Figure 2-1).

Due to wind energy's cost effectiveness and the Project's purpose of providing North Dakota and the region with additional renewable energy, coal and natural gas are not alternatives that were considered. Additionally, based on the size, type and timing of the Project, it is unlikely that an alternative source of renewable energy would be feasible. As discussed in Section 1.2.4 above, the Project's location is optimal for wind generation. A 300 MW ground-based solar energy project would require partnership with landowners willing to have a large, contiguous block of farmland removed from production for the life of the project. However, as discussed in Section 1.2.1 above, Aurora Wind has already leased sufficient acreage to construct the anticipated 300 MW wind project and is in the process of obtaining permits required to commence construction. With respect to hydropower and biomass, the necessary hydrological profile for a 300 MW hydropower project is not available in the Project Area, and there is not a steady, sustainable fuel source for a 300 MW biomass plant in the area.

2.3 Ten-Year Plan

In accordance with NDCC Section 49-22-04 and NDAC Chapter 69-06-02, Aurora Wind submitted a Ten-Year Plan for years 2018-2028 on June 29, 2018, included in Appendix B. Aurora Wind's Ten-Year Plan is consistent with this Application for a Certificate.

Figure 2-1: Unsubsidized Levelized Cost of Energy Comparison



Source: Lazard, 2017

3.0 SITE SELECTION CRITERIA

Aurora Wind selected the Project Area based on landowner support, as well as an assessment of area technical and environmental characteristics, and energy demand in the region. Site selection for the Project was also based upon the criteria described in NDAC Chapter 69-06-08. These criteria are discussed further below.

3.1 Exclusion Areas[6]

Per NDAC Section 69-06-08-01(1), certain geographical areas shall be excluded from energy conversion facility siting consideration. NDAC Section 69-06-08-01(2) also lists geographic areas that "must be excluded in the consideration of a site for a wind energy conversion facility" (Table 3-1; Appendix A, Exhibit 3).

Table 3-1: Summary of Exclusion Areas

Exclusion Area	Present within Project Area	Description	Section Addressed
General Exclusion Area			
Designated or registered national: parks; memorial parks; historic sites and landmarks; natural landmarks; historic districts; monuments; wilderness areas; wildlife areas; wild, scenic, or recreational rivers; wildlife refuges; and grasslands.	None	NA	6.2, 6.6, 6.7, 6.8, 6.12
Designated or registered state: parks; forests; forest management lands; historic sites; monuments; historical markers; archaeological sites; grasslands; wild, scenic, or recreational rivers; game refuges; game management areas; management areas; and nature preserves.	None	NA	6.2, 6.6, 6.7, 6.8, 6.12
County parks and recreation areas; municipal parks; parks owned or administered by other governmental subdivisions; hardwood draws; and enrolled woodlands.	None	NA	6.8, 6.9
Prime farmland and unique farmland, as defined by the land inventory and monitoring division of the soil	Present	Within the Project Area, 73 percent of the total land is considered prime farmland	6.9, 6.10

[6] As defined in NDAC Section 69-06-01-01, exclusion criteria are "criteria that remove areas from consideration for energy conversion facility sites and transmission facility routes." Exclusion areas are composed of these limiting criteria.

Exclusion Area	Present within Project Area	Description	Section Addressed
conservation service, U.S. Department of Agriculture in 7 Code of Federal Regulation (CFR) part 657; provided, however, that if the Commission finds that the prime farmland and unique farmland that will be removed from use for the life of the facility is of such small acreage as to be of negligible impact on agricultural productions, this exclusion does not apply.		or farmland of statewide importance. The Project is proposed to permanently impact less than 1 percent of the total land in the Project Area that could be considered prime farmland or farmland of statewide importance. Therefore, Aurora Wind requests that the Commission determine that a prime farmland exclusion shall not apply to the Project.	
Irrigated land.	None	NA	-
Areas critical to the life stages of threatened or endangered animal or plant species.	None	NA	6.16
Areas where animal or plant species that are unique or rare to this state would be irreversibly damaged.	None	NA	6.16
Areas within 1,200 feet of the geographic center of an intercontinental ballistic missile (ICBM) launch or launch control facility.	None	NA	6.2
Wind Energy Exclusion Area			
Areas within 1.1 times the height of the turbine from interstate or state roadway right-of-way.	Present	No turbines will be located within these exclusion areas.	4.2
Areas within 1.1 times the height of the turbine plus 75 feet from the centerline of any county or maintained township roadway.	Present	No turbines will be located within these exclusion areas.	4.2
Areas within 1.1 times the height of the turbine from any railroad right-of-way.	None	NA	-
Areas within 1.1 times the height of the turbine from a 115-kilovolt (kV) or higher transmission line.	Present	No turbines will be located within these exclusion areas.	4.2
Areas within 1.1 times the height of the turbine from the property line of a nonparticipating landowner and 3 times the height of the turbine from an inhabited rural residence of a nonparticipating	Present	No turbines will be sited within these exclusion areas, unless a variance(s) is granted by the Commission.	4.2

Exclusion Area	Present within Project Area	Description	Section Addressed
landowner, unless a variance is granted. A variance may be granted if an authorized representative or agent of the permittee, the nonparticipating landowner, and affected parties with associated wind rights file a written agreement expressing all parties' support for a variance to reduce the setback requirement in this subsection. A nonparticipating landowner is a landowner that has not signed a wind option or an easement agreement with the permittee of the wind energy conversion facility as defined in North Dakota Century Code (NDCC) chapter 17-04.			

3.2 Avoidance Areas[7]

Per NDAC Section 69-06-08-01(3), certain geographical areas may not be approved as sites for energy conservation facilities unless the applicant shows that, under the circumstances, there is no reasonable alternative. In determining whether an avoidance area should be designated for a facility, the Commission may consider, among other things, the following: the proposed management of adverse impacts; the orderly siting of facilities; system reliability and integrity; the efficient use of resources; and alternative sites. Economic considerations alone will not justify approval of these areas. In addition, a buffer zone of a reasonable width to protect the integrity of the area must be included. An additional avoidance area for wind energy conversion facilities is set forth in NDAC Section 69-06-08-01(4) (Table 3-2; Appendix A, Exhibit 4).

Table 3-2: Summary of Avoidance Areas

Avoidance Area	Present within Project Site	Description	Section Addressed
General Avoidance Area			
Historical resources which are not designated as exclusion areas.	Present	Aurora Wind has completed a Class I cultural resource inventory for the Project Area; as well as, a Class III	6.7

[7] As defined in NDAC Section 69-06-01-01, avoidance criteria are "criteria that remove areas from consideration for energy conversion facility sites and transmission facility routes unless it is shown that under the circumstances there are no reasonable alternatives." Avoidance areas are composed of these limiting criteria.

Avoidance Area	Present within Project Site	Description	Section Addressed
General Avoidance Area			
		cultural resource inventory of areas that may be impacted by Project construction. Aurora Wind also completed a Class II Architectural History reconnaissance survey. Cultural resource sites will be avoided, and 50-foot construction setbacks will be implemented. An Unanticipated Discoveries Plan will be developed for unidentified resources encountered during construction and will be provided to the State Historical Society of North Dakota (SHSND) for approval.	
Areas within the city limits of a city or the boundaries of a military installation.	None	NA	6.1, 6.4
Areas within known floodplains as defined by the geographical boundaries of the 100-year flood.	None	NA	6.12
Areas that are geologically unstable.	None	NA	6.11
Woodlands and wetlands.	Present	Wetlands are present within the Project Area. Small wooded areas and shelter belts are also present. All permanent wetland impacts will be avoided to the extent practicable. Temporary impacts may occur due to installation of collection lines. A 50-foot construction setback from wetlands will be implemented during construction. Trees are sparsely located throughout the Project Area and the Project has been designed to minimize tree removal to the extent possible. If impacts to trees occur, Aurora Wind will follow the Commission's tree and shrub mitigation specifications.	6.9, 6.13, 6.14
Areas of recreational significance which are not designated as exclusion areas.	None	NA	-

Avoidance Area	Present within Project Site	Description	Section Addressed
General Avoidance Area			
Wind Energy Avoidance Area			
A geographic area where, due to operation of the facility, the sound levels within one hundred feet of an inhabited residence or community building will exceed fifty decibels (dBA). The sound level avoidance area criteria may be waived in writing by the owner of the occupied residence or the community building.	Present	Aurora Wind has completed a sound assessment, and, using the turbine model with the highest sound emission level and modeling for ground attenuation, no sound levels exceeded 50 dBA within 100 feet of inhabited residences. Aurora Wind used a setback distance of 3 times the height of the turbine (approximately 1,900 feet) between turbines and occupied residences to minimize the potential for sound impacts.	6.5

3.3 Selection Criteria[8]

Per NDAC Section 69-06-08-01(5), a site may be approved in an area only when it is demonstrated to the Commission by the applicant that any significant adverse effects resulting from the location, construction, and operation of the facility in that area, as they relate to specified selection criteria, will be at an acceptable minimum, or that those effects will be managed and maintained at an acceptable minimum (Table 3-3).

Table 3-3: Summary of Selection Criteria

Selection Criteria	Potential Adverse Effects from Project	Section Addressed
The impact upon agriculture:		
(1) Agricultural production.	Out of approximately 44,000 acres in the Project Area, approximately 6 acres of prime farmland and 80 acres of farmland of statewide importance will be permanently impacted. The Project is proposed to permanently impact less than 1 percent of the total land in the Project Area that could be considered prime farmland or farmland of statewide importance.	6.2, 6.10
(2) Family farms and ranches.	While some economic losses to producers will occur due to conversion of farmland, Aurora Wind will provide	6.5, 6.9

[8] As defined in NDAC Section 69-06-01-01, selection criteria is defined as "criteria" that guide and govern the selection of energy conversion facility sites and transmission facility corridors and routes in order to minimize adverse human and environmental impact after the exclusion and avoidance criteria have been applied.

Selection Criteria	Potential Adverse Effects from Project	Section Addressed
	additional income to these households, and has designed the Project to minimize impacts to family farms and ranches to the extent possible. Any economic losses are anticipated to be minor in comparison. Additionally, Aurora Wind has designed the Project with a turbine setback distance of 3 times the height of the turbine (approximately 1,900 feet) from occupied homes to minimize impacts at each residence.	
(3) Land which the owner demonstrates has soil, topography, drainage, and an available water supply that cause the land to be economically suitable for irrigation.	Landowners have not expressed concerns related to irrigation on their property, and no known irrigation is present in the Project Area.	NA
(4) Surface drainage patterns and ground water flow patterns.	No adverse impacts are anticipated to surface drainage or groundwater flow patterns.	6.11, 6.12
(5) The agricultural quality of the cropland.	No adverse impacts to agricultural quality of cropland are anticipated. Landowners will be compensated for the placement of Project facilities on their property and will be reimbursed for revenues lost due to temporary crop damage from construction activities and/or field studies.	6.2, 6.10
The impact upon the availability and adequacy of:		
(1) Law enforcement.	No adverse impacts are anticipated.	6.3
(2) School systems and education programs.	No adverse impacts to school systems and education programs are anticipated.	6.3
(3) Governmental services and facilities.	No adverse impacts to government services and facilities are anticipated.	6.3
(4) General and mental health care facilities.	No adverse impacts to general and mental health care facilities are anticipated.	6.3
(5) Recreational programs and facilities.	No adverse impacts to recreational programs and facilities are anticipated.	6.8
(6) Transportation facilities and networks.	There will be a temporary increase in truck traffic during construction activities. During facility operations no adverse impacts are anticipated.	6.3
(7) Retail service facilities.	No adverse impacts are anticipated to retail service facilities.	6.3
(8) Utility services.	No adverse impacts are anticipated to utility services. Energy produced from the Project will aid in meeting growing power demands in the region.	6.3
The impact upon:		

Selection Criteria	Potential Adverse Effects from Project	Section Addressed
(1) Local institutions.	No adverse impacts to local institutions are anticipated.	6.3
(2) Noise-sensitive land uses.	Sound sensitive land uses within the Project Area include residences near turbine sites. Aurora Wind has maintained a minimum setback distance of 3 times the height of the turbine (approximately 1,900 feet) between turbines and occupied residences. A sound analysis was conducted to analyze potential sound impacts to residences, and Aurora Wind will verify that the final Project layout complies with the Commission's sound avoidance criterion.	6.5
(3) Light-sensitive land uses.	Subject to Federal Aviation Administration (FAA) approval, Aurora Wind will use commercially reasonable efforts to install a light-mitigating technology that is consistent with the requirements of North Dakota Administrative Code (NDAC) Chapter 69-06-11.	5.2, 6.6
(4) Rural residences and businesses.	No turbines have been placed within a distance of 3 times the height of the turbine (approximately 1,900 feet) of occupied residences and businesses, and no adverse impacts are anticipated.	6.5, 6.6
(5) Aquifers.	No aquifers are present within the Project Area; therefore, no adverse impacts to aquifers are anticipated.	6.11
(6) Human health and safety.	No impacts to human health and safety are anticipated.	6.4
(7) Animal health and safety.	Generally, no adverse impacts to domestic animal health or safety concerns are anticipated. Measures to keep livestock away from construction activities will be used as necessary. Coordination is ongoing with U.S. Fish and Wildlife Service (USFWS) regarding any potential risks to avian and bat species.	6.15, 6.16
(8) Plant life.	Temporary and permanent vegetation impacts will occur during construction. Following construction, temporarily disturbed non-cultivated areas will be re-vegetated with a seed mixture free of noxious weeds, in accordance with Commission requirements.	6.14
(9) Temporary and permanent housing.	Temporary housing may be utilized in the form of motels or rental housing. Local housing facilities could experience short-term economic benefits. No long-term adverse impacts are anticipated.	6.1
(10) Temporary and permanent skilled and unskilled labor.	Skilled and unskilled labor would receive short-term economic benefits during construction. No long-term adverse impacts are anticipated. Local contractors will be utilized if possible. The Project is expected to boost the local economy.	3.6
The cumulative effects of the location of the facility in relation to existing and planned facilities and other industrial development.		

Selection Criteria	Potential Adverse Effects from Project	Section Addressed
Cumulative effects	Oil and gas development occurs in the Project Area. Efforts to minimize cumulative effects from the Project include use of existing public and oil roadways to the extent possible. Prior to and during construction, Aurora Wind will continue to coordinate with oil and gas parties in or near the Project Area for the continued development of both the mineral and surface estates. In addition, Aurora Wind completed a one-call locate ticket in March 2018 and implemented a voluntary 500-foot turbine setback requirement from all existing and active above ground oil and gas wellhead and tank battery locations. The 150 MW Lindahl Wind Project is also located in Williams County. As with the proposed Project, the Lindahl project is consistent with land use in the region and compatible with environmental features	6.11, 9.11

3.4 Policy Criteria[9]

Per NDAC Section 69-06-08-01(6), the Commission may give preference to an applicant that will maximize benefits that result from the adoption of 13 specified criteria related to the applicant's policies and practices (the Commission may also require the adoption of such policies and practices). Table 3-4 identifies those 13 criteria and describes how Aurora Wind's policies and practices are consistent with these policy criteria. In addition, the Commission may give preference to an applicant that will maximize interstate benefits.

Table 3-4: Summary of Policy Criteria

Policy Criteria	Applicant's Policies and Practices	Section Addressed
Recycling of the conversion byproducts and effluents	NA	NA
Energy conservation through location, process, and design	The proposed Project has been designed to maximize energy conversion where available.	1.2, 3.5
Training and utilization of available labor in this state for the general and specialized skills required	Aurora Wind will use skilled and trained labor from North Dakota if possible.	6.1
Use of a primary energy source or raw material located within the state	The energy generated will come from the available wind resources of the state. In addition, gravel or scoria will likely be obtained from a local source for	1.2.4

[9] As defined in NDAC Section 69-06-01-01, policy criteria are "criteria" that guide and govern the selection of energy conversion facility sits and transmission facility corridors and routes in order to maximize benefits during the construction and operation of a facility.

Policy Criteria	Applicant's Policies and Practices	Section Addressed
	road and pad construction, as well as for aggregate for concrete.	
Not relocating residents	No relocation of residences will occur.	6.1
The dedication of an area adjacent to the facility to land uses such as recreation, agriculture, or wildlife management	The Project will not interfere with adjacent land uses. As such, Aurora Wind does not currently anticipate dedicating any adjacent areas for land uses such as recreation, agriculture, or wildlife management.	6.8
Economies of construction and operation	As a 300 megawatt (MW) wind energy project, Aurora Wind will benefit from economies of scale related to the Project's construction and operation. Wind energy projects have one-time costs that remain relatively stable despite the scale of the project. Therefore, a larger project will have cost advantages in comparison to a smaller project because the fixed costs are spread out over more units of output. Some examples of wind energy project costs that remain similar despite the size of the project include: an on-site office space, crane mobilization, and substation procurement and construction.	3.6, 6.1
Secondary uses of appropriate associated facilities for recreation and the enhancement of wildlife	None. The Project generally does not interfere with recreation or wildlife uses.	NA
Use of citizen coordinating committees	Aurora Wind has coordinated and will continue to coordinate with landowners and local businesses and groups located within and near the Project Area.	9.0
A commitment of a portion of the energy produced for use in this state	Energy produced by the proposed facility will interconnect to the transmission grid at the Tande Substation owned by Basin Electric Power Cooperative. The power produced by the Project will help meet area demand for electricity resulting from ongoing oil and gas activities in the Bakken and the region's homes and businesses	2.1
Labor relations	No impacts to labor relations are anticipated.	NA
The coordination of facilities	Existing facilities and facility corridors were considered in the location of the Project and its associated facilities.	3.5, 6.3, 6.4
Monitoring of impacts	Aurora Wind will monitor construction activities and use Best Management Practices (BMPs) throughout Project construction. During Project operation and restoration, Aurora Wind will monitor the Project and assess impacts as well as comply with all requirements set forth in the Certificate as	5.1, 5.2, 6.17

Policy Criteria	Applicant's Policies and Practices	Section Addressed
	well as voluntary agreements with state and federal wildlife agencies.	
A commitment to install lighting mitigation technology for wind energy conversion facilities subject to commercial availability and Federal Aviation Administration (FAA) approval.	Aurora Wind will utilize a light-mitigating technology system that is consistent with NDAC Chapter 69-06-11, subject to FAA approval and commercial availability.	5.2, 6.6

3.5 Design and Construction Limitations

When determining the Project location, Aurora Wind considered the following design and construction limitations: wind resources, interconnection to the electrical transmission system, environmental constraints, and landowners and local support. As discussed in Section 1.2.4, Aurora Wind assessed the meteorological conditions of the Project Area to verify the site has an economically viable wind resource.

Further, capacity for interconnection to the existing electrical transmission system was also a significant factor in Project design. The Project is in General Interconnection Agreement (GIA) negotiations with the Southwest Power Pool (SPP) for interconnection to the transmission grid.

Site control was also critical to the Project. Aurora Wind has secured voluntary wind energy lease agreements and easements with the exception of the Wind Energy Easement Agreement with NDTL.

Several site-specific limitations also affected the Project's design and construction, including:

- Avoidance and minimization of permanent impacts on wetlands, including wetland basins subject to U.S. Fish and Wildlife Service (USFWS) wetland easements and Wildlife Management Areas (WMAs);
- Avoidance or mitigation of impacts to cultural resources; and
- Setback requirements from features, including occupied residences, non-participating landowner property lines, existing oil and gas wellhead and tank batteries, and existing roads.

See Section 6.0 for a more detailed discussion of the site-specific resources and mitigation measures utilized.

3.6 Economic Considerations

The economics of a wind farm are driven, first and foremost, by the value of the wind resource. Information on the wind resource at the site is discussed in Section 1.2.4 above. Since 2016, Aurora Wind

has compiled and assessed wind resource data in the Project Area. The data has indicated that the Project Area will provide an excellent resource for wind generation with high economic output.

Aurora Wind would distribute this renewable energy resource for the benefit of local and regional area residents. Construction of the Project will result in positive economic impacts in the general Project Area. The Project will provide approximately $1.3 million per year in direct economic benefits via property taxes generated in addition to direct payments to participating landowners. The Project will also result in significant and measurable indirect economic benefits to the general Project Area, including increased retail activity at restaurants, gas stations, and local purchases of construction materials and supplies, such as concrete, fuel and aggregate. Other benefits flow to the townships, local libraries, parks, and airports; all of which directly enhance the general welfare of the region.

4.0 DESCRIPTION OF THE PROPOSED FACILITY

4.1 Project Components

Project components include wind turbines, associated facilities, and temporary facilities, as discussed in the following subsections.

4.1.1 Wind Turbines

The following subsections describe characteristics of the wind turbines that would be used for the Project.

4.1.1.1 Wind Turbine Technology

Wind turbines convert the kinetic energy of the wind into the rotational energy of a rotor and drivetrain. This energy is in turn converted into electrical power by industrial generators integrated within the wind turbine housing. An automated 'pitch' system will control the speed of the rotor by turning the face of each rotor blade into or out of the wind. Modern wind turbines typically produce energy in a wind speed range of 3.1 to 25 meters per second or 7 to 56 miles per hour (mph). Power quality will be further accomplished through the use of power electronics, which convert generator output to achieve required output voltage and frequency control. An integrated wind speed and direction monitoring system works with a 'yaw' motion control system to keep the face of the turbine presented into the wind.

4.1.1.2 Wind Turbine Characteristics

A specific turbine model has not been selected at this time, but Aurora Wind plans to select the most appropriate technology for the Project in terms of cost efficiency and optimization of wind and land resources. Aurora Wind is considering numerous turbine types for the Project. Table 4-1 describes the characteristics of modern turbine types that are typical of those under consideration. The turbine output possibilities range from 2.5 MW – 4.2 MW. The planned Project layout is designed to accommodate any of the turbine models under consideration (See Exhibit 2 in Appendix A). The turbine list included in Table 4-1 is representative of the turbine options under consideration; however, the Project may opt to use a turbine or combinations of turbines not included in the list.

Table 4-1: Representative Turbine Type Characteristics for the Project

Characteristics	Turbine Options Under Consideration		
Turbine type	GE 2.5 – 127	Siemens Gamesa SG 3.465 - 132	Vestas V136
Rotor diameter in meters (feet)	127 (416.667)	132 (433.07)	136 (446.19)
Rotor swept area in sq. meters (sq. feet)	12,667 (136,346)	13,684 (147,293)	14,527 (156,367)

Rated power (MW)	2.5	3.465	3.45 - 4.2
Cut-in wind speed (m/s)	3	3	3
Cut-out wind speed (m/s)	30	25	25
Blade length in meters (feet)	63.5 (208.33)	66 (216.54)	68 (233.10)
Hub height in meters (feet)	88.6 (290.68)	84 – 114 (275 – 374)	82-105 (269-345)
Highest blade height in meters (feet)	152.1 (499.02)	150 – 180 (492 – 591)	150 (492)
Lowest blade height in meters (feet)	25.1 (82.35)	18 – 48 (59 – 157)	14--37; (45-121)

4.1.1.3 Rotor

The maximum nominal rotor diameter under current consideration is 136 meters (446.2 feet) but could increase slightly pending final design. The rotor consists of three blades mounted to a rotor hub. The hub is attached to the nacelle, which houses the generator, brake, cooling system, and other electrical and mechanical systems.

4.1.1.4 Towers

The towers on which the nacelle is mounted, will be constructed of conical tubular steel, with a hub height range from 82 to 114 meters (269 to 374 feet). All tower welds will be performed according to specifications established by the American National Standards Institute (ANSI). Surfaces of the tower components will be sandblasted and coated by the manufacturer to protect against corrosion. A secured door at the base of the tower will provide internal access to the turbine.

4.1.1.5 Lightning and Ground Protection

Lightning and ground protection for all wind farm equipment is designed and constructed to be compliant with all applicable National Electrical Code (NEC) and National Electric Safety Code (NESC) requirements. Grounding and shielding components are integrated into the foundation and structural elements of all equipment and conductor lines. In particular, each wind turbine will include conductive elements in the blades and a complete grounding and shielding network within the turbine, tower, and foundation.

4.1.1.6 Lighting

Turbines will be lit so as to satisfy minimum Federal Aviation Administration (FAA) requirements. In addition, the Project will comply with the light-mitigating technology system requirements set forth in NDCC Section 49-22-16.4. The components and specific locations of the ADLS system will be dependent on FAA's review of turbine technology, terrain and other factors.

4.1.1.7 Foundation

Each turbine will sit atop a concrete foundation. Foundation size and design will be finalized once geotechnical analyses have been completed and the turbine model selected, though it is estimated that the foundation will be approximately 60 feet in diameter and 7 to 12 feet in depth.

4.1.2 Associated Facilities

Associated facilities include access roads, an electrical collection system, meteorological towers, and a substation.

4.1.2.1 Access Roads

Construction and service access to each turbine location will be facilitated by a compacted gravel road within the Project Area. Roads will be located in consultation with the landowner to avoid or minimize impacts to land use and the environment. The permanent access roads will be approximately 16 feet wide and constructed with locally-sourced gravel, if available. The Project roads will support the size and weight of maintenance vehicles. Following construction, the temporarily affected areas will be restored to pre-construction conditions, to the extent practicable, and pursuant to landowner agreements.

4.1.2.2 Collection System

An electrical collection system consisting of buried cables will interconnect all turbines to the Project substation. This system will operate at up to 34.5 kV and will be sited to minimize cost and land impacts and in consideration of landowner input, setback requirements and other constraints. A small number of cabling junction boxes may be located above ground and marked with bollards. The permanent impact resulting from above ground collection system components will be less than a half-acre. Once construction is complete, the land will be returned to pre-construction conditions, to the extent practicable, following installation of the collection system.

4.1.2.3 Meteorological Towers

The Project will include permanent METs that will remain in place for the life of the Project. These permanent METs will be as tall as the hub height of the selected wind turbine(s) and will provide data critical to assessing the performance of the Project and aid in short-term forecasting for the Project.

4.1.2.4 Substation

The Project's underground collection system will extend from the turbines to a Project substation. The substation will be located on approximately 5 acres. Exhibit 2 in Appendix A shows the preliminary location of the substation.

The substation will be designed to provide voltage step-up from the collection system to the 345-kV transmission system voltage. This facility will house the production metering, various collection system, and facility isolation and protective functions. The facility will be fenced to provide site security and safety.

4.1.3 Temporary Facilities

Other temporary facilities will be required for the construction phase of the Project, including a concrete batch plant, laydown areas for an equipment and construction management facility, intersection improvements to facilitate over-length turning, crane paths and working pads, and staging areas for turbine delivery. The temporarily affected areas will be restored to pre-construction conditions, to the extent practicable after construction has been completed, and in accordance with landowner agreements.

4.2 Project Layout

The Project layout includes up to 130 turbine locations, which provides for 9 alternate turbine locations. Additionally, the preliminary locations for access roads and collection lines are included in the Project layout. The preliminary Project layout is designed to accommodate any of the representative turbine models currently under consideration. A more detailed description of the representative turbine models being considered for the Project is included in Section 4.1.1.

Aurora Wind has designed a Project that optimizes electrical generation and efficiency, while avoiding or minimizing environmental, cultural, economic, and existing land use impacts. Aurora Wind seeks to minimize disruptions to farmland to the extent practicable by coordinating the location of roads with landowners utilizing existing roads, driveways, edge of field lines, or other previously disturbed areas for proposed facility access road locations to the extent possible. Aurora Wind has worked and will continue to work diligently with its landowner partners to successfully integrate the Project with the existing land use, facilities, and infrastructure. The Project's final turbine layout and ancillary facility locations will be sited so as to comply with the Commission's and Williams County's setback requirements, except where a variance has been granted (Appendix B, Williams Count CUP). Table 4-2 identifies Project setbacks applicable to the Project as designated by the Commission and Williams County, as well as voluntary setback commitments made by Aurora Wind. The final Project layout will comply with all of the setback requirements outlined below. Setbacks will be applied measuring from the edge of the base of the turbine tower to the applicable feature based on the final turbine model selected.

Table 4-2: Commission and Williams County Project Setbacks

North Dakota Public Service Commission Setback Type	Distance
Turbine Setback	
Interstate or state roadway right-of-way (ROW)	1.1 times the height of the turbine
The geographic center of an Intercontinental Ballistic Missile launch or launch control facility	NA
County or maintained township roadway	1.1 times the height of the turbine plus 75 feet from the centerline of the roadway
Railroad ROW	1.1 times the height of the turbine
115-kilovolt or higher transmission line	1.1 times the height of the turbine
Property line of a non-participating landowner	1.1 times the height of the turbine[a]
Inhabited residence or a community building	A wind energy conversion site must not include a geographic area where, due to the operation of the facility, the sound levels within 100 feet of an inhabited residence or a community building will exceed 50 decibels (dBA)[b]
Nonparticipating inhabited rural residence	3 times the height of the turbine (approximately 1,900 feet)[c]
Williams County	
Turbines from the perimeter of the facility	2.5 times the rotor diameter
Turbines from existing participating residences[d]	1,400 feet[e]
Turbines from the nearest public road (including section lines) or above ground communication and electrical lines (center of ROW)	200 feet or greater
From any non-public road easement	75 feet[e]
All structures from sensitive areas	100 feet
Voluntary	
Turbines from existing oil and gas wellhead and tank batteries	500 feet[e]
Turbines from Wildlife Management Areas	2,640 feet
Turbines from Alamo Waterfowl Production Area (WPA)	2,640 feet
All infrastructure from Fuller WPA	Greater than 2 miles

(a) As set forth in NDAC Section 69-06-08-01(2), a variance may be granted if an authorized representative or agent of the permittee and affected parties with associated wind rights file a written agreement expressing all parties' support for a variance to reduce the setback requirement in this subsection. A non-participating landowner is a landowner that has not signed a wind option agreement or a wind easement, as defined in NDCC Chapter 17-04, with the permittee of the wind energy conversion facility.
(b) The sound level avoidance area criteria may be waived in writing by the owner of the occupied residence or the community building, as provided in NDAC Section 69-06-08-01(4).
(c) As set forth in NDCC Section 49-22-05.1(3), a variance from this setback requirement may be granted if an authorized representative or agent of the permittee, the nonparticipating landowner, and affected parties with associated wind rights file a written agreement expressing the support of all parties for a variance to reduce the

setback requirement. A non-participating landowner is a landowner that has not signed a wind option or an easement agreement with the permittee of the wind energy conversion facility as defined in NDCC Chapter 17-04.
(d) Based on prior discussions with Williams County Planning and Zoning officials, "structures" do not include fences, above ground communication and electrical lines, or road-related items (such as road signs), as those features are addressed specifically by the 200-foot setback in Chapter 6-10-10(3) of the Zoning Ordinance.
(e) Variance from the 1,400 feet and 75 feet setback requirement was granted to Aurora Wind by Williams County with the CUP, with the exception of occupied residences and a 500-foot turbine setback from existing oil and gas wellheads and tank batteries.

4.3 Estimated Project Facility Impacts

As discussed in Section 4.1.1, Aurora Wind has not yet selected a turbine type; therefore, the Application presents a Project layout that will accommodate multiple turbine types. Each turbine model under consideration would use a subset of the 130 turbine locations identified. In addition, Aurora Wind has identified primary and secondary access road and collection line options for approximate acreage of temporary and permanent impacts (Table 4-3). For purposes of calculating impacts, up to 121 turbine locations and only primary access roads and collection lines were included.

Table 4-3: Estimated Impacts from Project Facilities

Project Facilities	Description of and Approximate Acreage of Impacts	
	Temporary Impacts	**Permanent Impacts**
Turbines	Circular turbine site with 3-acre disturbance	Each turbine base is set atop a concrete pedestal having a diameter of 18 feet and a gravel ring of 20 feet placed circumferentially around it. The total above-ground permanent impact is approximately 0.06 acre.
Total turbine impacts	363.0 acres	7.26 acres
Access roads	100-foot-wide impacts associated with construction of access roads	The roads would be approximately 16 feet wide gravel surface
Total access road impacts	521.5 acres	81.8 acres
Collection lines	A 50-foot construction impact corridor has been estimated for the equipment used to install the collection lines	Impacts associated with collection line installation are all temporary in nature, with the exception of above ground junction boxes
Total collection line impacts	521.2 acres	<1 acre
Communication lines	A 50-foot construction impact corridor has been estimated for the equipment used to install the communication lines	Impacts associated with communication lines are all temporary in nature, with the exception of above ground junction boxes

Project Facilities	Description of and Approximate Acreage of Impacts	
	Temporary Impacts	**Permanent Impacts**
Total communication line impacts	12.3 acres	<1 acre
Meteorological Towers (METS)	Circular tower site with 0.75-acre disturbance	Assumes fenced in area of 50 feet by 50 feet
Total MET tower impacts	6.75 acres	<1 acre
Substation	7.5 acres	The substation will be constructed on a gravel pad up to 5.0 acres.
Laydown yard and concrete batch plant	The combination of these two facilities would be approximately 20 acres.	These facilities are temporary, and the associated land will be converted back to its pre-existing condition following completion of construction.

5.0 PROJECT CONSTRUCTION, OPERATION, AND DECOMMISSIONING

5.1 Project Construction

5.1.1 Construction Activities

A variety of activities must be completed to carry the Project through construction. Below is a preliminary list of activities necessary to develop the Project. Pre-construction, construction, and post-construction activities for the Project include:

- Pre-construction:
  - Geotechnical analysis;
  - Design high voltage electrical system, transmission line, power collection system, and substation;
  - Design turbine foundations, access roads, and associated facilities;
  - Underground utility and oil and gas facility discovery; and
  - Procure all necessary turbine and associated facility components (towers, nacelles, blades, foundations and transformers).
- Construction:
  - Construct temporary laydown yards and construction management facility;
  - Construct temporary intersection modifications to facilitate turbine component delivery;
  - Construct access roads and install collection lines;
  - Construct the Project substation;
  - Install tower foundations and underground cable; and
  - Place towers and set turbines.
- Post-Construction
  - Restore disturbed areas not intended for permanent above ground facilities;
  - Test facility; and
  - Begin commercial production.

Haul road permits will be acquired from the townships, Williams County, or the North Dakota Department of Transportation (NDDOT), as necessary. Furthermore, Aurora Wind will acquire all necessary permits to cross/bore state, county, and township roads required for the installation of its collection lines. Aurora Wind will negotiate a road use and maintenance agreement with Williams County and applicable townships, if needed.

During construction, equipment and worker vehicles will travel to and from the site. Peak construction is anticipated to be in summer and early fall when the majority of the foundation construction, access road, electrical and substation work is taking place. Upon completion of construction, heavy equipment will be removed from the site.

In addition, culverts or other drainage methods will be installed or upgraded as needed in accordance with County and State requirements.

5.1.2 Construction Management

Aurora Wind will be responsible for scheduling and coordinating the Project construction activities, including:

- Obtaining building, electrical, grading, road and utility permits;
- Performing civil, structural and electrical engineering;
- Conducting surveying and geotechnical analysis;
- Forecasting Project labor needs;
- Facilitating subcontractor involvement;
- Securing construction materials;
- Overseeing construction tasks, including: site and access road development; foundation excavation and pouring; electrical and communications installation; turbine and meteorological tower erection; substation installation; and system testing; and
- Managing the Project budget.

During construction, coordination will be ongoing between Aurora Wind and construction teams. The construction manager will engage in ongoing correspondence with local officials, citizens groups, and landowners.

5.1.3 Commissioning

Upon completion of the construction phase, the Project will undergo detailed inspection and testing procedures before being commissioned. Inspection and testing will occur for each individual component of the wind turbines, as well as the associated communication, meteorological, collection and SCADA systems.

5.2 Project Operation and Maintenance

Before the Project becomes fully operational, O&M staff will be integrated into Project construction. The O&M staff will work cooperatively with the construction manager to create a smooth transition from construction through commissioning and operating the facility.

5.2.1 Supervisory Control and Data Acquisition System

Each wind turbine will communicate directly with the SCADA system for remote performance monitoring, energy reporting and troubleshooting. The SCADA system provides data on turbine generation and production, availability, meteorology and communications. The SCADA system allows for 24/7 monitoring of the Project, and relays alarms and communication errors to an off-site operations center. Aurora Wind will provide service and maintenance for the Project. Permanent, full-time staff will perform these duties.

5.2.2 Light-Mitigating Technology

Subject to FAA approval, Aurora Wind will use commercially reasonable efforts to install a light-mitigating technology, consistent with NDAC Chapter 69-06-11. See Section 4.1 above.

5.2.3 Maintenance Schedule

The following schedule is anticipated to be used for scheduled service activities:

- **First Service Inspection –** The first service inspection will take place 1 to 3 months after the turbines have been commissioned. Focus will be placed on bolt tightening, greasing, and oil filtering.
- **Semi-Annual Service Inspection –** Semi-annual service inspections will commence 6 months after the first inspection. The semi-annual inspections will consist of lubrication and safety testing.
- **Annual Service Inspection –** The annual service inspection will include the same items as the semi-annual service inspection plus bolt tightening and a full component check.
- **Two-Year Service Inspection –** The 2-year service inspection will include items checked during the annual inspection, as well as terminal connector tightening.
- **Five-Year Service Inspection –** The 5-year service inspection will include items checked during the annual inspection, as well as braking system inspection, oil and grease testing, balance check and terminal connector tightening.

5.3 Decommissioning and Restoration

At the end of the Project's useful life, Aurora Wind will decommission the Project in accordance with Williams County Zoning Ordinance Chapter 6-10-12 and North Dakota Wind Turbine Decommissioning Guidelines (NDAC Section 69-09-09). This includes:

- Dismantling and removal of all towers, turbine generators, transformers, and overhead cables;
- Removal of underground electrical cables to a depth of 24 inches (60.96 centimeters);
- Removal of foundations, buildings, and ancillary equipment to a depth of 4 feet;
- Site restoration and reclamation to the approximate original topography that existed prior to construction of the facility with topsoil respread over the disturbed areas at a depth similar to that in existence prior to the disturbance; and
- Grading and topsoil of areas disturbed by the facility, and reseeding according to natural resource conservation service recommendations, unless the commission approves an owner request signed by the applicable landowner, identifying the surface features the landowner prefers to remain in place, and the reason the landowner prefers those features to remain.

In accordance with NDAC Section 69-09-09-06, Aurora Wind will file a decommissioning plan with the Commission prior to the commencement of operation of the Project and comply with the applicable financial assurance provisions.

6.0 ENVIRONMENTAL ANALYSIS

This section describes the existing conditions within the 44,000-acre Project Area (Burns & McDonnell Engineering Company Inc. [Burns & McDonnell] and Western EcoSystems Technology, Inc. [WEST], 2018). The Project Area was analyzed to best position the Project to avoid or minimize impacts. The existing conditions, or affected environment, are the baseline conditions that may be affected by the proposed Project. This section discusses the potential direct environmental impacts of the proposed Project. Potential indirect impacts are identified in the resource discussions where applicable. Mitigation measures, such as Best Management Practices (BMPs), which would avoid, minimize, or mitigate impacts, are discussed where appropriate.

Impacts discussed in the following sections are related to the placement of up to 121 turbines and associated access roads, collection and communication lines with above ground junction boxes, permanent METs, O&M facility, and substation. This model represents the potential Project footprint with the greatest anticipated impacts.

6.1 Demographics

The following sections describe existing demographics, potential impacts, and proposed mitigation.

6.1.1 Existing Conditions

The Project is located in a rural area predominantly comprised of cultivated land in northwestern North Dakota. The Project is not expected to interfere with existing or adjacent land uses. The Project Area is located within portions of Golden Valley, Champion, South Meadow, New Home, Big Meadow, and Hazel Townships in Williams County, North Dakota. The nearest incorporated cities to the Project Area are Wildrose (2 miles north), Alamo (9 miles west), Tioga (7 miles southeast), and Ray (5 miles south) (Table 6-1). Major employment industries within this county include oil and gas, healthcare, retail, construction, education and transportation (Statistical Atlas, 2015). In December 2017, Williams County had an unemployment rate of 2.1 percent.

Table 6-1: Demographic Trends

County/City	Estimated Population 2017	Per Capita Income[a]	% of Individuals Below Poverty Level
Wildrose	131	$37,555	11.1
Tioga	1,499	$34,158	9.8
Ray	780	$36,674	6.5

Alamo	69	$34,800	0
Williams County	33,349	$45,442	6.8
Statewide	755,393	$33,107	10.7

Source: U.S. Bureau of the Census, Census 2017
(a) Past 12 months (in 2016 dollars); 2012 - 2016

6.1.2 Demographic Impacts/Mitigation

Aurora Wind has designed the Project to minimize impacts to family farms and ranches to the extent practicable, and any economic losses are anticipated to be minor in comparison to additional income provided by the Project. The Project is designed to be socioeconomically beneficial to landowners, local governments, and communities. The proposed Project will result in increased income to landowners receiving lease payments which could raise the per capita income in Williams County.

Non-local construction workers would need temporary housing. The average rental vacancy rate within Williams County from 2012-2015 was 33 percent (Civic Dashboards, 2018). This indicates that non-local workers should not have difficulty finding temporary housing in the immediate area and be required to travel to the larger cities, such as Stanley or Williston, to find temporary housing.

Construction of the Project could potentially provide temporary increases to the revenue of the area through increased demand for lodging, food services, fuel, and general supplies. Personal income could also be generated by circulation and recirculation of dollars paid out by the Project as business expenditures and state and local taxes.

The proposed Project could increase demand on the Williams County labor force and for local housing during construction; however, the construction period is only temporary. Overall, Aurora Wind anticipates that the Project will be socioeconomically beneficial to the local population and will not impact long-term population trends. Further, no relocation of residences will occur. Aurora Wind has maintained a distance of at least 1,400 feet between turbines and existing occupied participating residences and at least 1,900 feet between turbines and existing occupied nonparticipating residences to comply with Williams County and Commission requirements, which will reduce potential impacts to residences. In addition, the Project will comply with the Commission’s sound avoidance requirement and a voluntary shadow flicker goal. Therefore, no additional mitigation measures are anticipated to be required.

6.2 Land Use

The following sections describe existing land use in the Study Area, potential impacts, and proposed mitigation.

6.2.1 Existing Conditions

The Study Area is located in a rural setting of North Dakota predominantly comprised of grasslands and cultivated land. Table 6-2 provides acreage contained within each land classification in the Study Area and Project Area as well as the representative acreage anticipated to be temporarily and permanently impacted within each land classification based on the construction limits and corridor requirements of the preliminary layout, which includes up to 121 turbine sites, new access roads, underground electrical collection and communication lines with above ground junction boxes, permanent METs, an O&M facility, and the Project substation. The Project Area is comprised primarily of cultivated lands (87 percent) and grasslands (6 percent). Exhibit 5 in Appendix A provides the land use classifications within the Project Area.

Table 6-2: Land Use

Land Classification	Study Area (acres)	Project Area (acres)	Temporary Impacts (acres)	Permanent Impacts (acres)
Barren	5	-	-	-
Cultivated	83,792	37,436	1,127.77	86.30
Developed	3,782	1,654	77.65	16.53
Grasslands	8,321	2,756	86.41	10.93
Shrubland	399	128	17.27	-
Water	1,848	486	16.90	-
Wetlands	2,657	698	26.52	6.70
Woodlands	115	14	-	-
Total	**100,919**	**43,172**	**1,352.53**	**120.47**

Source: National Agricultural Statistics Service (USDA, 2017)

Agricultural production and oil and gas production occur within the Project Area. There are 27 domestic/stock/industrial/observational water wells in the Project Area and 56 in the Study Area. There are 35 residences of farmsteads within the Project Area and 84 within the Study Area. The Study Area contains a total of 80 active or confidential oil and gas wells, of which 32 are within the Project Area. The Project Area is zoned as agricultural land within Williams County, and county zoning regulations require a CUP for a wind energy facility, which the Project obtained on July 3, 2018.

Through coordination with the USFWS, 31 USFWS wetland easement tracts have been identified within the Project Area. Aurora Wind will avoid all wetland basins under USFWS easements. No USFWS grassland easements were identified by the USFWS as occurring within the Project Area, but six tracts, represented by two easements, were identified to occur nearby. Exhibit 6, Public Lands and Easements in Appendix A identifies the locations of USFWS wetland and grassland easements near the Project Area.

The USFWS also administers the National Wildlife Refuge System, which includes National Wildlife Refuges (NWR) and Waterfowl Production Areas (WPA). NWRs serve the purpose of preserving and protecting lands for fish and wildlife and their habitat. WPAs are lands protected and/or restricted for the purpose of waterfowl production. There are no NWRs or WPAs located within the Project Area, and the nearest NWR, Lake Zahl NWR, is approximately 18 miles to the west of the Project Area. The nearest WPAs, Fuller WPA, is approximately 0.75 mile east of the Project Area. Alamo WPA is approximately 5 miles west of the Project Area.

In addition, Private Land Opened to Sportsmen (PLOTS), which are administered through an agreement between the North Dakota Game & Fish Department (NDGFD) and individual landowners, are present and provide hunting and bird watching opportunities to outdoor enthusiasts. Three PLOTS tracts are located within the Project Area: southeast quarter of Section 20 and northeast quarter of Section 29, Township 159 N, Range 97 W; east half of Section 4 and northeast quarter Section 9, Township 157 N, Range 96 W; southwest quarter of Section 6, Township 157 N, Range 96 W.

No NDGFD WMAs occur within the Project Area. The nearest WMA, McGregor Dam WMA, is approximately 5.2 miles northeast of the Project Area.

The Natural Resources Conservation Service (NRCS) administers the Conservation Reserve Program (CRP). Agricultural landowners may enroll their land into the CRP, essentially taking the land out of production for a given timeframe to protect wildlife and water resources in exchange for receiving annual payments. Aurora Wind will coordinate with the local and State NRCS and Farm Service Agency (FSA) office and the local landowners with respect to any areas of CRP land that cannot be avoided to determine seeding specifications for the reclamation of temporarily disturbed land and payment requirements for permanently disturbed land.

Based on information received from the NDTL, common school trust fund surface interests that are managed by the NDTL on behalf of the Board of University and School Lands (Board) are present within the Project Area. Aurora Wind has initiated discussions with the Board to acquire the necessary easements covering the NDTL-managed parcels, and final facility locations will be subject to Board

review and approval. The Board will make final determinations on the easements following issuance of the Certificate.

The Minot Air Force Base was consulted and did not identify any issues of encroachment to Air Force assets from construction of the proposed Project. Refer to Appendix D for a copy of the correspondence.

6.2.2 Land Use Impacts/Mitigation

Construction of the Project will result in the conversion of land within the Project Area from existing land uses into a renewable energy resource for the life of the Project. Temporary impacts from the proposed Project will also result. Temporary land use impacts associated with construction staging and laydown areas and underground collection and communication lines will cease following construction and will be returned to pre-construction land uses, which primarily consist of grasslands and cultivated lands. The Project will impact approximately 93 acres or less of land based on calculations from turbine locations, associated access roads, METs, and the substation during the life of the Project. The Project will temporarily impact approximately 1,262 acres or less of land based on calculations from the above-mentioned facilities plus collection and communication lines and an equipment laydown area.

It is not anticipated that the conversion of existing land use will result in a trend toward modification of existing land use patterns. Conflicts with the existing development plans of state, local, or private entities within the Project Area are not anticipated as the Project generally avoids developed areas. Avoidance of potential impacts to oil and gas wells is discussed in Section 6.11 Geologic and Groundwater Resources.

All permanent impacts to wetland basins under USFWS easements will be avoided. The Project may need to bore some collection lines underneath basins to avoid impacts, but neither boring activities nor the collection lines will impact the hydrology of the wetland. The Project Area does not contain USFWS grassland easements; therefore, no impacts will occur as a result of the Project.

There are no NWRs or WPAs located within the Project Area. The nearest WPA, Fuller WPA, is approximately 0.75 mile east of the Project Area, and Alamo WPA is approximately 5 miles west of the Project Area. The Project complies with a voluntary turbine setback of 2,640 feet from WPAs. In addition, the Project complies with a voluntary infrastructure setback of approximately 2 miles from Fuller WPA. No further mitigation for WPAs is necessary.

As previously mentioned, three PLOTS areas are present in the Project Area. One PLOTS area will have no Project facilities, one will include a turbine and associated collection line, access road, and temporary crane path, and the final PLOTS area will include a collection line and temporary crane path.

No WMAs will be directly affected by the Project as none are located within the Project Area and indirect impacts are not anticipated. The nearest WMA, McGregor Dam, is approximately 5.2 miles from the Project Area, greater than the voluntary turbine setback of 2,640 feet. No further mitigation is necessary for PLOTS or WMAs.

Aurora Wind will coordinate with local and state NRCS offices and FSA office and the local landowners with respect to unavoidable areas of CRP land that cannot be avoided to determine seeding specifications for the reclamation of temporarily disturbed land and payment requirements for permanently disturbed land.

NDTL indicated in a letter dated April 4, 2018, following completion of the local, county, and state regulatory approval processes, the Board will make a final decision with respect to a wind energy easement agreement with Aurora Wind. Appendix D provides a copy of the correspondence.

6.3 Public Services

The following sections describe existing public services in the Study Area, potential impacts, and proposed mitigation.

6.3.1 Existing Conditions

Data identifying public services and infrastructure in the Study Area, including transportation rights-of-way (ROWs), known transmission lines, and telecommunication facilities, was gathered and analyzed to assess potential Project impacts. No missile silos or railroads were identified within the Study Area based on information gathered to date. Specific categories of public infrastructure are discussed below.

6.3.1.1 Local Services

The majority of public services and infrastructure are located in the cities of Tioga and Ray, located approximately 5 miles southeast and south of the Project Area respectively. Tioga contains a hospital and municipal airport. Both Tioga and Ray contain police, fire, and ambulance services, a public school for grades kindergarten through 12th grade, businesses, and churches. The Project Area is located in a rural part of North Dakota mainly used for agricultural and pastoral purposes (Appendix A, Exhibit 7).

6.3.1.2 Electrical Service

Electrical service in the Study Area is provided by Mountrail-Williams Electric Cooperative, Basin Electric Power Cooperative, and the Montana-Dakota Utilities Resources Group, Inc. Transmission infrastructure includes overhead electrical distribution and transmission lines. Additionally, small underground and overhead distribution lines are present going to farmsteads and oil production facilities.

6.3.1.3 Roads

The major highway intersecting the Study Area is North Dakota (ND) Highway 50 in the northern limits of the Project. Other roadways in the Study Area include well maintained gravel surfaced county roadways and two-track trails used for agricultural and oil field purposes. New permanent and improved access roads will be necessary for the Project. A compact gravel road will provide construction and service access to each turbine location. Permanent access roads will be approximately 16 feet wide.

NDDOT traffic counts have been conducted for the ND Highway 50 located within the Study Area. The 2017 average annual daily traffic (AADT) volume included 225 vehicles on ND Highway 50 (NDDOT, 2017). Another traffic count in the center of the Project Area included 116th Avenue Northwest with an AADT of 255. On other roadways in the Study Area, traffic results from oil and gas exploration and production, agricultural purposes, and rural residence access.

6.3.1.4 Water Supply

Rural water is supplied to the Study Area by Northwest Rural Water District. It is common for rural residences in the area to utilize private wells for alternative uses, such as agriculture. According to North Dakota State Water Commission (NDSWC) data, there are 56 domestic/stock/industrial wells located within the Study Area, of which only 27 are located within the Project Area.

6.3.1.5 Microwave, Telephone, TV, and Radio Communications

A microwave beam path study was completed in April 17, 2018. A search of microwave communications within a 290 square mile study area revealed 9 microwave licenses owned by 4 companies. Five fixed point-to-point microwave communications were identified in the report, only two of which cross the Study Area. These included in design considerations (Appendix A, Exhibit 8; Appendix E, Microwave Path Analysis).

A site and regional area-wide based land mobile and emergency services assessment of the Project was conducted May 3, 2018 (Comsearch, 2018; Appendix F, Land Mobile & Emergency Services Report). Registered frequencies for emergency services and management, hospitals, public works, transportation and other state, county, and municipal agencies were evaluated in the vicinity of the Project Area. A total of 49 site-based licenses were identified in and around Aurora Wind, primarily south of the Project Area near Tioga. One regional area-wide license was identified in the analysis, Public Safety Region #32, which contains all of the counties in North Dakota. In the bands licensed by the Federal Communications Commission (FCC) for area-wide first responders, nine licenses were found for the State of North Dakota, and two for Williams County which are designated for mobile use only.

Off-air television station broadcast signals were identified in the vicinity of the Project Area which could be affected by the Project was conducted May 3, 2018, including coverage of the station and communities in the area that could have degraded reception (Appendix G Off-Air TV Analysis). Television stations at a distance of 100 kilometers or less are the most likely to provide off-air coverage to the Project Area and neighboring communities. There were 14 database records for stations within a 100-kilometer radius, only 9 of which are currently licensed and operating, and 6 of which are low-power stations or translators. Three full-power digital stations may have their reception disrupted in and around the Project.

A Communication Tower Study was performed for the Project May 7, 2018, to identify existing tower structures and FCC-licensed communication antennas in the Project area of interest (Communication Tower Study, Appendix H). No tower structures and 4 communication antennas were identified within the Study Area, which are used for microwave, cellular, amplitude modulation (AM), frequency modulation (FM), aviation, and land mobile services.

An AM/FM Radio Analysis was conducted and identified 4 database records for AM stations and 9 records for FM stations within approximately 30-kilometers of the Project Area. Of the 9 database records for FM stations, only 6 are currently licensed and operating and 4 are translator stations that broadcast with limited range (AM and FM Radio Report, Appendix I).

6.3.2 Public Service Impacts/Mitigation

The following subsections discuss potential impacts and proposed mitigation.

6.3.2.1 Local Services

Impacts to local services in and around the Study Area are not anticipated; therefore, no mitigation is required.

6.3.2.2 Electrical Service

The proposed Project will help meet regional demand for electricity, and as a result the Project will have a positive effect on the electrical services in the region.

6.3.2.3 Roads

Existing roadways within the Project Area will be utilized to the extent feasible; however, construction of new private access roads will be required to provide access to the proposed tower locations. In order to reduce the overall Project footprint, constructed access roads may connect several tower locations in a string. Newly constructed permanent access roads will be approximately 16 feet wide. Access roads will be constructed in locations which minimize impacts to the environment and/or existing land uses and will

support the size and weight of maintenance vehicles. Following construction, the temporarily affected areas will be restored to pre-constructions conditions, to the extent practicable.

Traffic volumes will increase temporarily during Project construction. Additional traffic can be expected from workers and large trucks delivering equipment or tower parts; however, this is not expected to be at a volume that will disrupt residents or travel in the Project Area. Aurora Wind's road use will comply with all applicable federal, state, and local laws. Haul road permits will be acquired from townships, Williams County and NDDOT, as necessary. Aurora Wind will negotiate a road use and maintenance agreements with Williams County and the townships, if needed. Aurora Wind will work with Williams County and applicable townships to develop construction traffic plans and follow recommended mitigation. Additional traffic for maintenance of the Project will be minor.

6.3.2.4 Water Supply

The water supply for residents within the Project Area is not anticipated to be permanently affected by the proposed Project. Water will be used during construction for concrete manufacturing and dust control, and this water will be obtained through agreements with local landowners or other entities. Aurora Wind will coordinate with individuals and/or Northwest Rural Water District with respect to use of a potable water supply, as necessary. All applicable permits will be obtained for installation of a water well for the O&M facility.

6.3.2.5 Microwave, Telephone, TV, and Radio Communications

Aurora Wind will coordinate with utility companies to determine utility locations and will comply with North Dakota One-Call requirements. If the Project's facilities cross or may otherwise affect existing utilities, Aurora Wind will coordinate with service providers to avoid interference with their facilities. If the Project negatively impacts telecommunication services, Aurora Wind will provide a specific mitigation plan and take the necessary steps to restore all impacted services.

The Project has been designed to avoid impacts to the two microwave paths overlying the Project.

Impacts to emergency management and public safety communications are typically unaffected by wind turbines due to the operation with multiple base transmitter stations and no signal blockage caused by wind turbines; therefore, no harmful impacts are anticipated. Aurora Wind meets the FCC recommended a 77.5-meter turbine setback from land mobile fixed-base stations. In addition, if it is determined coverage has been compromised by the presence of the Project, signal coverage can be improved through optimization of a nearby base station or adding and repeater site.

Television service locations within 10 kilometers of the Project with clear line-of-sight to a proposed wind turbine would be affected, but not the respective station. Communities and homes in these locations may have degraded reception of these stations due to multipath interference caused by signal scattering as television signals are reflected by the rotating wind turbine blades and mast. However, based on the low number of full-power television channels available in the Project Area from cable service and direct broadcast satellite service, it is unlikely off-air television stations are the primary mode of television service in the area. Should interference be observed in any of the television service areas, it is recommended a high-grain directional antenna be used, preferably outdoors, and oriented towards the signal origin to mitigate the interference. Cable and direct broadcast satellite service will be unaffected by the Project and this service may be offered to those residents who can show their off-air TV receptions has been disrupted by the presence of the wind turbines after they are installed. Mitigation of wind turbines to existing towers is a function of the turbine's turning radius and the characteristics of the communication system on the tower affected. A setback distance greater than the maximum height of the turbine is necessary to insure a "fall" safety zone in the unlikely event of a turbine tower failure, which is typically specified by local zoning ordinances. Separation distance based on the communication system would depend on the allowance for normal coverage. Land mobile and mobile phone system setback distances are based on FCC interference emission limits from electrical devices in those frequency bands. Aurora Wind has sited turbines to comply with a 1.1 times turbine tip height setback from communication towers, antennas, and other systems identified in the Comsearch report (see Appendix F).

Impacts to AM broadcast stations are not anticipated, the closest AM station to the Project is more than 2.7 kilometers from the Project limits, well beyond the station's exclusion distance of 275 meters. FM station coverage is not susceptible to interference caused by wind turbines, especially when sited in the far field region of the radiating FM antenna to avoid the risk of distorting the antenna's radiation pattern. The nearest FM station is more than 1.6 kilometers from the Project limits, adequate to avoid radiation pattern distortion.

6.4 Human Health and Safety

The following sections describe existing conditions, potential impacts, and proposed mitigation for human health and safety.

6.4.1 Existing Conditions

The following sections describe existing air traffic, electromagnetic fields, hazardous materials/hazardous waste, and security in the Study Area.

6.4.1.1 Air Traffic

The FAA regulates federal airspace. Due to their height, wind turbines may have an effect on airports and navigable airspace. The FAA evaluates the proposed Project based on aeronautical compatibility.

The Tioga Municipal Airport (D60) is the nearest public-use airport to the Project Area and is located approximately 7 miles southeast of the Project Area. The Tioga Municipal Airport serves a variety of general aviation users and is capable of handling business jet aircraft.

6.4.1.2 Electromagnetic Field

Electromagnetic field (EMF) refers to two separate fields: electric fields and magnetic fields. Electric fields arise from the voltage or electrical charges, and magnetic fields arise from the flow of electricity or current that travels along transmission lines, power collection (feeder) lines, substation transformers, house wiring, and electrical appliances. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors (wire). EMF can occur indoors and outdoors.

6.4.1.3 Hazardous Materials/Hazardous Waste

Correspondence received from the North Dakota Department of Health (NDDH) on February 7, 2018, and review of the U.S. Environmental Protection Agency (EPA) hazardous materials databases revealed 167 Tier 2 hazardous materials sites within the Study Area. The 167 sites primarily consist of above ground storage tanks (ASTs) containing water, brine, condensate, or hydrocarbon mixtures associated with oil/gas development and are scattered throughout the Study Area. Through a search of the NDDH website, no mapped underground storage tanks (USTs) are present within the Study Area. No landfill locations were listed by NDDH within the Study Area boundaries. Many small farms and abandoned farmsteads occur within the Project Area. These sites are not required by NDDH to register the locations of USTs, ASTs, or landfills. These areas have potential for localized contamination.

Burns & McDonnell also performed an environmental incident search on the NDDH website on February 7, 2018 and determined no incidents have occurred within or within 1 mile of the Study Area boundary since 1975. An environmental incident can include, but is not limited to, releases of petroleum products and chemicals which may potentially have adverse effects to human health or the environment.

6.4.1.4 Security

The Project Area is located northwest of Tioga and southwest of the unincorporated town of McGregor. Multiple residences are located in or around the Project Area; however, no towns are located within the boundaries of the Project Area.

6.4.2 Human Health and Safety Impacts/Mitigation

The following sections describe existing conditions for air traffic, electromagnetic fields, hazardous materials/hazardous waste, and security.

6.4.2.1 Air Traffic

Construction of wind turbines may impact aircraft operations in the Study Area. The FAA requires the submittal of a Notice of Proposed Construction (Form 7460-1) for any object that will extend more than 200 feet above ground level (AGL). Wind turbines will be lit to satisfy FAA requirements; however, depending on comments received on Form 7460-1, the wind turbines may need to be marked and lighted above the minimum FAA requirements to enhance safety for the aircraft. The FAA publishes Advisory Circulars that define the standards for marking and lighting structures to promote aviation safety. Chapter 13, *Marking and Lighting Wind Turbine Farms*, in the regulations and policies document Advisory Circular 70/7460-1K, Obstruction Marking and Lighting, provides guidelines to mark and light wind farms (FAA, 2015). This marking/lighting is intended to assist pilots in identifying and avoiding these obstacles.

In addition to compliance with FAA requirements, Aurora Wind has coordinated with the Tioga Airport Authority via a meeting held January 24, 2018, to discuss the Project. In a letter dated March 19, 2018, signed by the Tioga Airport Authority president, there were no formal objections to the Project assuming the FAA determined there is no impact to the Tioga Airport's current approach path or operations. For a copy of the correspondence, see Appendix D, Agency Scoping Package and Responses.

6.4.2.2 Electromagnetic Fields

The Project facilities are not significant sources of EMF exposure. The collection lines, for example, generate levels of EMF comparable to those generated by household appliances. Turbine generators, with their height, result in little or no EMF at ground level (Fortinet et al., 2013). As outlined in Section 4.2, the wind turbines have been set back a minimum of 1,400 feet from existing occupied residences. Further, collection lines will be buried to a depth of at least 4 feet.

6.4.2.3 Hazardous Materials/Hazardous Waste

It is not anticipated that hazardous waste sites will be encountered within the Project Area during construction. If hazardous waste sites are encountered, construction will be suspended and the NDDH will be contacted immediately to determine the best method for removal or clean up.

Any hazardous materials used for the construction of the Project will be contained according to the North Dakota Pollutant Discharge Elimination System (NDPDES) Permit. In addition, a Storm Water Pollution Prevention Plan (SWPPP) will be developed as part of the NDPDES permit. Hazardous materials used for maintenance will be stored inside a building or surrounded by a containment area to prevent contamination from spills. There will be no USTs installed at the Project site. On-site storage of turbine petroleum products in the maintenance facility is anticipated to be minimal and stored above ground. A Spill Prevention, Control and Countermeasures (SPCC) Plan will be prepared for the Project if oil storage will exceed 1,320 gallons.

6.4.2.4 Security

It is anticipated that construction of the Project will not impact the security of surrounding residents or communities as it is largely a rural area and the turbines will not abut residences. All facilities, including turbine access doors and the Project substation will be locked and have appropriate warning signage. Additionally, the Project substation will be enclosed in a chain-link fence.

6.5 Sound

The following sections describe existing sound conditions, potential impacts, and proposed mitigation.

6.5.1 Existing Conditions

The Project is located in a rural setting in northern North Dakota. Sound is generated by wind turbines due to turbulence at the blade tips, from mechanical systems in the hub or nacelle (which radiates throughout the structure), and from transformers at the base of the turbine mast. Sound increases with wind speed until maximum blade rotational speed is reached, which usually occurs when wind speeds reach 8-10 meters per second at the turbine hub. Sound contributors in the Project Area include farm machinery, roadway traffic and oil facilities and activity. Sound levels in rural settings typically range from 35 to 45 decibels (dBA).

6.5.2 Sound Impacts/Mitigation

State regulations require that wind turbines be sited such that sound levels within 100 feet of an inhabited residence or community building do not exceed 50 dBA. Aurora Wind conducted a sound analysis for the

Project. The sound analysis assessed a worst-case scenario; therefore, the results would be representative of any turbine model with sound levels at or below those evaluated. The worst-case scenario assumed that: (i) all primary and alternative wind turbine locations will be used, (ii) the turbines will be operated at a wind speed resulting in the loudest noise possible being emitted, (iii) the turbine configuration with the highest sound emission level will be used, and (iv) a 2 dBA uncertainty factor is added to each turbine emission. The worst-case scenario, assuming the turbine configuration with the highest sound emission level, resulted in no residences experiencing noise levels above 50 dBA within 100 feet of the residence. The Sound Analysis is located in Appendix J, Sound and Shadow Flicker Analysis Report.

6.6 Visual

The following sections describe existing conditions, potential impacts, and proposed mitigation for the visual environment, including potential effects of shadow flicker.

6.6.1 Existing Conditions

The following sections describe existing aesthetic conditions and shadow flicker.

6.6.1.1 Aesthetics

The visual landscape of the Project Area consists of a rural setting including agricultural fields, grasslands and wetlands. Oil and gas development is very prevalent within the Project Area. Temporarily erected oil and gas drilling rigs reach approximately 100 feet AGL. The pump jacks that are placed over the drilled hole are significantly shorter, 25 to 30 feet at maximum height. The oil and/or saltwater storage tanks on oil production pads are 25 feet at maximum height. The Study Area contains two communication towers and one overhead transmission line that transects the Study Area from north to south. No visually sensitive areas, such as National Parks, exist in or are directly adjacent to the Study Area.

Land within the Study Area is utilized mainly for agricultural purposes. Crops in the Study Area consist mainly of wheat, canola, barley, soybeans and sunflowers, with limited amounts of alternative crops grown. The native vegetation in the Study Area is mainly composed of western wheatgrass, green needlegrass, bluestem, and needle and thread along with prairie cordgrass and reedgrass occurring near wetlands. Wetlands of various hydrology, soils, and vegetation exist within the Project Area. In addition, small drainages exist within the Study Area.

6.6.1.2 Shadow Flicker

Shadow flicker occurs when the rotating blades of a wind turbine are directly between an observer and the sun, causing alternating light and shadow. This effect decreases and ultimately disappears with distance

from the turbine and is also eliminated by obstacles between the observer and the turbine, such as trees or terrain. Shadow flicker is predictable, and it can be minimized through turbine site selection. Shadow flicker is harmless to humans, though it may be considered by some to be an annoyance (Appendix J, Sound and Shadow Flicker Analysis Report).

6.6.2 Visual Impacts/Mitigation

Visual and aesthetic impacts would result from construction of the proposed Project.

6.6.2.1 Aesthetics

Measuring the aesthetic value of a specific landscape is difficult and may vary based on an individual's personal values, experiences, or preferences. The degree of visual contrast will vary based on the viewpoint distance and location in relation to the Project. Given the Project's location within the Bakken oil production region and the existing Lindahl Wind Project, there are several structures visible within the Study Area.

Additional impacts to adjacent land users may occur from tower lighting or marking. The FAA requires specific lighting depending on project location and specifications. Mitigation options for such impacts are limited because the lighting and markings are designed to be visible to pilots. In order to minimize visual impacts to adjacent land users, wind turbine lighting will not exceed FAA lighting requirements unless warranted by the FAA (see the air traffic impacts discussion in Section 6.4.1). Furthermore, the use of a minimum setback of 3 times the height of the turbine (approximately 1,900 feet) between turbines and non-participating residences is anticipated to alleviate some of the direct visual impacts to adjacent residents by reducing the intensity of the lights through distance buffers.

Subject to FAA approval, Aurora Wind will use commercially reasonable efforts to install a light-mitigating technology that is consistent with the Commission's requirements in NDAC Chapter 69-06-11.

6.6.2.2 Shadow Flicker

No local, state, or federal requirements exist with respect to shadow flicker. However, 30 hours of shadow flicker per year is a commonly cited target for wind projects, and Aurora Wind has set a goal of 30 hours or less of shadow flicker at residences per year when siting Project turbines.

A shadow flicker analysis was completed for all known occupied residences within 1.5 miles of any proposed wind turbine locations (a total of 61 receptors) using the windPRO software (Appendix J, Sound and Shadow Flicker Analysis Report). All 130 wind turbine locations were modeled, even though it is likely final turbine-type selection will not utilize all locations. The Lindahl Wind Project wind turbines

were also incorporated in the modeling. Each residence was modeled in greenhouse mode, which assumes flicker from any direction is visible up to a distance of 2,000 m (6,562 ft) from a wind turbine, and sunshine probability data was incorporated, along with wind speed and direction information. The statistical reduction on the shadow flicker hours from the worst case scenario (i.e., the wind turbine always facing the sun, always operating, and no cloudy days), referred to as realistic shadow flicker or anticipated shadow flicker, assumes reductions based on probability of the sun shining and the wind turbine operating in a direction to cause flicker at the house.

Two occupied residences are predicted to exceed 30 hours of shadow flicker per year. If these two residences continue to exceed the 30 hour threshold when the final Project layout is modeled, Aurora will obtain shadow flicker acknowledgments from the homeowners, or will employ measures to ensure that the occupied residences experience no more than 30 hours per year of shadow flicker.

6.7 Cultural and Archaeological Resources

The following sections describe existing cultural and archaeological resources, potential impacts, and proposed mitigation.

6.7.1 Existing Conditions

During a January 23, 2018, meeting between State Historical Society of North Dakota (SHSND), representatives from Aurora Wind, and their cultural resources consultant (Burns & McDonnell), SHSND requested that Aurora Wind conduct a Class I Literature Review and a Class III Intensive Cultural Resources Pedestrian Survey of all previously un-surveyed areas potentially subject to direct impacts. The area of potential effect (APE) subject to the Class III Pedestrian Survey was defined as any ground surface area that has the potential to be disturbed by any construction or installed activities associated with the wind farm. The SHSND recommends a 50-foot buffer, or larger, around recorded archaeological sites that are recommended for avoidance.

Additionally, during the January 23, 2018, meeting, the SHSND requested a Class II Architectural History Survey within a 2-mile visual APE of the turbine array. The 2-mile visual APE for the Class II Architectural History Survey included documentation of all buildings, structures, and objects 50 years of age or older from the Project's anticipated n-service date.

Burns & McDonnell conducted a Class I Literature Review of the Study Area, plus a 1-mile buffer at the SHSND on January 11, 2018. The literature review revealed 45 previously recorded cultural resources located within the Study Area and 1-mile buffer:[10]

- 4 archaeological sites;
- 4 archaeological isolated find leads;
- 15 archaeological site leads;
- 2 historic/architectural sites;
- 1 historic/archaeological site;
- 8 architectural sites;
- 1 architectural site lead;
- 7 historic sites; and
- 3 historic lead sites.

The Class II Architectural History reconnaissance survey, in compliance with NDCC Chapter 55-02-07, was conducted in September 2018 to identify historic-age non-archaeological resources within a 2-mile visual APE, as proscribed by the North Dakota State Historic Preservation Office (SHSND) for the proposed Project. The survey identified 161 properties, including domestic, agricultural, religious, and educational resources that meet the age criterion for National Register of Historic Places (NRHP) consideration. There were also 16 properties within the visual APE that were not accessible from the public ROW and could not be evaluated for NRHP significance. Of the 161 accessed properties, 18 appear to have marginal significance and could qualify for NRHP designation. These include a number of barns, four churches, and four schoolhouses. Despite their potential significance, the resources either lack integrity of setting or setting does not represent one of their character-defining features. As they would not be impacted directly by Project construction, a recommendation of no adverse effect will accompany future SHSND submittals.

A Class III Intensive Cultural Resources Pedestrian Inventory of the APE was conducted beginning on July 24, 2018 and continues as of September 2018 with approximately one mile or linear facilities still to survey. Twenty-two newly recorded archaeological sites and three isolated finds/site leads were documented in the Project Area. Twenty of the sites dated to the historic period and included eleven dumpsites/artifact scatters, a single historic feature site, and eight farmsteads. All of these sites are recommended as not eligible for listing on the NRHP. The other two sites recorded were rock feature sites

[10] As outlined in Chapter 55 of the North Dakota Century Code (NDCC), distribution of cultural resource data is prohibited. Therefore, additional details regarding the locations of these resources is not provided in this document.

of unknown prehistoric cultural affiliation. One of these sites contained five rock circles and a cairn. The other site included only a single rock circle. Both of these sites remain unevaluated for the NRHP and may be traditional cultural properties (TCP). These sites are recommended to be avoided, with a 50-foot buffer, during the project construction. A small amount of survey work was delayed until after landowners completed harvest of canola and is currently being completed. Pending weather delays, the survey work is anticipated to be completed by the end of October 2018, and results will be provided to SHSND and the Commission.

Aurora Wind and Burns & McDonnell will prepare an Unanticipated Discoveries Plan. The Plan will detail a process for prompt communication and action regarding the discovery of previously unknown archaeological resources or human remains, should they be encountered during construction. The Unanticipated Discoveries Plan will be submitted to the SHSND prior to the construction start date.

At the recommendation of the North Dakota Indian Affairs, consultation with Tribal Historic Preservation Officers (THPOs) of the Mandan-Arikara-Hidatsa/Three Affiliated Tribes and Turtle Mountain Band of the Chippewa was initiated. A scoping package was sent to THPOs of the Mandan-Arikara-Hidatsa/Three Affiliated Tribes and Mountain Band of the Chippewa on March 13, 2018, requesting comments or information regarding traditional cultural properties or other important resources near the Project. In addition, a meeting regarding the Project was offered as part of the scoping package at the recommendation of the Commissioner of North Dakota Indian Affairs. As of the date of this Application, no response from either party has been received.

6.7.2 Cultural and Archaeological Resources Impacts/Mitigation

Any ground disturbing activity within the Project Area can potentially impact known or unknown cultural resources. The SHSND recommends a 50-foot buffer, or larger, around recorded archaeological sites that are recommended for avoidance. There may also be possible concerns regarding visual impacts to historic properties within and adjacent to the Project Area.

Wind turbines, access roads, and associated facilities have been sited to avoid significant archeological sites identified from the Class I Literature Review and Class III Pedestrian Survey.

The Class III report and site forms will be completed for the 22 sites within the Project Area and coordination with SHSND will be on-going. The Class III survey work will be completed by the end of October 2018, and the report will be provided to SHSND for evaluation.

Aurora Wind and Burns & McDonnell will prepare an Unanticipated Discoveries Plan. The plan will detail a process for prompt communication and action regarding the discovery of previously unknown archaeological resources or human remains, should they be encountered during construction.

6.8 Recreational Resources

The following sections describe existing recreational resources in the Study Area, potential impacts, and proposed mitigation.

6.8.1 Existing Conditions

There are no designated recreation areas, public or private parks, or designated trails located in the Project Area. The nearest recreational opportunity is the Tioga Country Club, located 3.91 miles southeast of the Project Area at the nearest point.

6.8.2 Recreational Resources Impacts/Mitigation

No impacts to Tioga Country Club are expected. The closest wind turbine would be over 5 miles from the Country Club.

6.9 Effects on Land-Based Economics

The following sections describe existing conditions, potential impacts, and proposed mitigation for agriculture and woodlands.

6.9.1 Existing Conditions

The following sections describe existing agriculture and woodlands in the Study Area.

6.9.1.1 Agriculture

According to the USDA 2012 Census of Agriculture, Williams County contains 758 farms, which primarily produce wheat, durum and cattle, ranking 25th out of 53 North Dakota counties (USDA, 2014). The market value of all agricultural products sold in Williams County was $178.7 million, with a per farm average of $235,756.

Prime farmland is the land that has the best combination of physical and soil characteristics for producing food, feed, forage, fiber, and oilseed crops. The NRCS also identifies farmland of statewide and local importance, which is land that is important for the production of food, feed, fiber, forage and oilseed crops. Generally, additional farmlands of statewide or local importance include those that are nearly prime and that produce high yields of crops in an economic manner when treated and managed according to acceptable farming methods. Some may produce as high a yield as prime farmland soils if conditions

are favorable. Table 6-3 provides the acreage contained within each NRCS farmland classification, and the representative acreage anticipated to be temporarily and permanently impacted within each NRCS farmland classification by the Project. Refer to Exhibit 9 in Appendix A for Prime and Unique Farmlands within the Project Area.

Table 6-3: NRCS Farmland Classification

Natural Resources Conservation Service (NRCS) Farmland Classification	Acres Within Study Area	Acres Within Project Area	Temporary Impact Area Acreage	Permanent Impact Area Acreage
Prime[a]	3,120	1,289	29	6
Statewide Importance	64,831	30,460	999	80
Not Prime	32,821	11,418	267	23

Source: NRCS 2017
*Includes areas that are categorized by the NRCS as Category (i) and (ii).

6.9.1.2 Woodlands

Wooded areas within the Study Area consist of shelter belts and wooded ravines. Woodlands comprise less than 1 percent of the total Project Area and consist of wooded draws and planted hardwood shelterbelts for wind protection around farmsteads or in cropland fields (refer to Table 6-2).

6.9.2 Land Based Economics Impacts/Mitigation

The following sections describe impacts and proposed mitigation to agriculture and woodlands.

6.9.2.1 Agriculture

Construction of the proposed Project would result in the permanent conversion and the temporary conversion of agricultural land into a renewable, alternative energy source. The Project will permanently impact 86 acres or less of prime farmland or farmland of statewide importance. Any temporary impacts to prime farmland or farmland of statewide importance will be reclaimed and the area will be able to be used for its same purposes as before construction.

Long-term benefits would be seen in the form of profits associated with lease payments from the Project. This additional income would also be reflected as an increase to the county tax base. Additional money brought into the community would likely result in increased spending at local businesses and improvements to the communities and counties.

6.9.2.2 Woodlands

Impacts to woodlands from the placement of wind turbines and associated facilities are anticipated to be minor in nature considering only 14 acres of woodlands were identified within the Project Area (refer to

Table 6-2). Tree removal and replacement would be coordinated with landowners and conducted in accordance with the Commission's tree and shrub mitigation specifications.

6.10 Soils

The following sections describe existing soil conditions in the Study Area, potential impacts, and proposed mitigation.

6.10.1 Existing Conditions

There are 48 soil types found within the Study Area and 41 within the Project Area, as shown in Table 6-4 (NRCS, 2017b). The majority of these soil types are loamy soils. Loamy soils are a broad textural class of soils that contain a mixture of sand, silt, and clay particles. While most soils contain some mixture of these three particles, an ideal loam exhibits the properties of sand, silt, and clay in approximately equal proportions (not equal amounts). The presence of clay in a soil has a greater influence on a soil than the presence of silt or sand; therefore, a soil name can include the modifier "clay" with as little as 20 percent clay, while a soil must contain at least 40 percent sand or 45 percent silt in order to contain those respective modifiers in its name. Soils identified as sandy loams have moderately coarse textures, silt loams have medium textures, and clay loams have moderately fine textures. Soil types located within the Project Area include loams, silt loams, sandy loams, and clay loams.

Prime farmland is the land that has the best combination of physical and soil characteristics for producing food, feed, forage, fiber, and oilseed crops. The USDA NRCS has two classifications for prime farmland: (i) where all areas of the soil series are classified prime farmland; and (ii) where only the drained areas of the soil series are prime farmland. The NRCS also identifies farmland of statewide and local importance, which is land that is important for the production of food, feed, fiber, forage, and oilseed crops. Generally, additional farmlands of statewide or local importance include those that are nearly prime and that produce high yields of crops in an economic manner when treated and managed according to acceptable farming methods. Some may produce as high of a yield as prime farmland soils if conditions are favorable.

Of the 48 soil types within the Study Area, four soil types are classified by the NRCS as prime farmland, 12 are classified as farmland of statewide importance and 32 are not classified as prime farmland or farmland of statewide importance. Table 6-4 provides the major soil types and the NRCS farmland classification associated with each soil type.

Table 6-4: Soils Summary

Map Unit Symbol	Soil Type[a]	Acres in Study Area	Acres in Project Area	Prime Farmland	Farmland of Statewide Importance	Not Prime or Farmland of Statewide Importance
C132B	Williams-Zahl loams, 3 to 6 percent slopes	6,957	2,679		X	
C132C	Williams-Zahl-Zahill complex, 6 to 9 percent slopes	5,853	3,021			X
C135C	Zahl-Williams-Zahill complex, 6 to 9 percent slopes	6,676	2,131			X
C135D	Zahl-Williams loams, 9 to 15 percent slopes	1,868	639			X
C148C	Williams-Zahl-Parnell complex, 0 to 9 percent slopes	3,537	898			X
C153E	Zahl-Max loams, 15 to 25 percent slopes	8	-			X
C155F	Zahl-Max-Arnegard loams, 15 to 60 percent slopes	103	-			X
C156F	Zahl-Max-Bowbells loams, 6 to 35 percent slopes	99	15			X
C165F	Zahl-Max-Parnell complex, 0 to 35 percent slopes	190	41			X
C210A	Williams-Bowbells loams, 0 to 3 percent slopes	18,922	8,253		X	
C210B	Williams-Bowbells loams, 3 to 6 percent slopes	32,536	17,470		X	
C272A	Hamerly-Tonka complex, 0 to 3 percent slopes	1,246	330			X
C2A	Tonka silt loam, 0 to 1 percent slopes	1,154	351			X
C313B	Lihen-Blanchard loamy fine sands, 0 to 6 percent slopes	48	-			X
C313D	Lihen-Blanchard loamy fine sands, 6 to 15 percent slopes	4	-			X

Map Unit Symbol	Soil Type[a]	Acres in Study Area	Acres in Project Area	Prime Farmland	Farmland of Statewide Importance	Not Prime or Farmland of Statewide Importance
C317B	Lihen-Telfer loamy fine sands, 0 to 6 percent slopes	280	201			X
C360B	Livona fine sandy loam, 0 to 6 percent slopes	236	88		X	
C368C	Livona-Zahl-Zahill complex, 6 to 9 percent slopes	34	9			X
C380A	Dooley fine sandy loam, 0 to 3 percent slopes	454	66			X
C380B	Dooley fine sandy loam, 3 to 6 percent slopes	21	-			X
C3A	Parnell silty clay loam, 0 to 1 percent slopes	3,295	1,079			X
C400A	Bearden silt loam, 0 to 2 percent slopes	164	56	X		
C415A	Tansem loam, 0 to 2 percent slopes	3,305	796		X	
C418B	Tansem-Sakakawea loams, 2 to 6 percent slopes	567	153		X	
C419A	Wildrose silty clay, 0 to 2 percent slopes	1,624	321	X		
C424A	Nutley silty clay, low precipitation, 0 to 2 percent slopes	1,037	601		X	
C451A	Arnegard loam, 0 to 2 percent slopes	1,315	903	X		
C451B	Arnegard loam, 2 to 6 percent slopes	17	9	X		
C480A	Shambo loam, 0 to 2 percent slopes	64	65		X	
C491A	Straw-Fluvaquents channeled, complex, 0 to 2 percent slopes, frequently flooded	798	471			X
C526B	Daglum-Rhoades silt loams, 2 to 6 percent slopes	2	-			X
C580A	Harriet-Regan-Stirum complex, 0 to 2 percent	125	61			X

Map Unit Symbol	Soil Type[a]	Acres in Study Area	Acres in Project Area	Prime Farmland	Farmland of Statewide Importance	Not Prime or Farmland of Statewide Importance
	slopes, occasionally flooded					
C5A	Southam silty clay loam, 0 to 1 percent slopes	2,026	184			X
C667A	Williams-Niobell loams, 0 to 3 percent slopes	83	5		X	
C667B	Williams-Niobell loams, 3 to 6 percent slopes	28	9		X	
C75A	Vallers loam, moderately saline, 0 to 1 percent slopes	960	331			X
C767B	Parshall-Tally fine sandy loams, 0 to 6 percent slopes	567	150		X	
C800B	Appam sandy loam, 2 to 6 percent slopes	1,041	464			X
C810A	Bowdle loam, 0 to 2 percent slopes	529	191		X	
C816B	Lehr loam, 2 to 6 percent slopes	1,333	586			X
C818B	Lehr-Williams loams, 0 to 6 percent slopes	712	143			X
C825A	Divide loam, 0 to 2 percent slopes	606	331			X
C870E	Wabek-Lehr-Appam complex, 9 to 25 percent slopes	87	27			X
C874B	Wabek-Appam complex, 2 to 6 percent slopes	54	13			X
C874C	Wabek-Appam complex, 6 to 9 percent slopes	38	5			X
C877B	Wabek-Lehr complex, 2 to 6 percent slopes	129	-			X
C877C	Wabek-Lehr complex, 6 to 9 percent slopes	17	16			X
C990F	Pits, gravel and sand, 0 to 60 percent slopes	23	5			X

(a) Not including Soil Map Unit “Water”

Approximately 3 percent of the Project Area is comprised of soils classified as prime farmland, and approximately 70 percent of the Project Area is comprised of soils classified as of statewide importance (Table 6-4; Exhibit 10 in Appendix A).

6.10.2 Soils Impacts/Mitigation

Surface disturbance caused by construction of the wind turbines and infrastructure improvements would result in the soil surface becoming more prone to erosion and the use of heavy equipment could result in soil compaction. However, any such impacts to site soils will be localized and BMPs will be implemented to minimize these impacts. These BMPs may include the use of erosion and sediment control during and after construction, noxious weed control, segregating topsoil from subsurface materials, reseeding of disturbed areas, the use of construction equipment appropriately sized to the scope and scale of the Project, ensuring access road grades fit closely with the natural terrain, proper on-site disposal of soil cuttings from turbine foundation construction and maintaining proper drainage. Silt fencing would be utilized in areas under construction as needed to control erosion and storm water runoff. Surface flows would be directed away from cut-and-fill slopes and into ditches that discharge to natural drainages. All roads, pads, and trenched areas would be regularly inspected and maintained to minimize erosion.

The Project is proposed to permanently impact less than 1 percent of the total land in the Project Area that could be considered prime farmland or farmland of statewide importance. As such, the acreage of prime farmland and farmland of statewide importance removed from use for the life of the Project will have a negligible impact on agricultural production. Therefore, in accordance with NDAC Section 69-06-08-01(1)(d), Aurora Wind requests that the Commission determine that a prime farmland exclusion shall not apply to the Project.

Existing access roads will be used to the extent practicable to prevent further soil disturbance and fragmentation on the landscape. Additionally, all areas of temporary disturbance will be reclaimed with vegetation consistent with the surrounding vegetation types including a seed mixture approved by NRCS and the landowner. Wetland impacts will be avoided to the extent practicable and USFWS wetland easement basins will also be avoided. Any impacts to USACE jurisdictional waters will be permitted and mitigated in accordance with Section 404 of the CWA. To minimize the impacts of surface water runoff which could impact sediment reaching aquatic habitat, BMP’s in accordance with a SWPPP will be implemented including use of silt fencing to control erosion and storm water runoff and directing surface flow away from cut-and-fill slopes and into ditches that discharge to natural drainages. All roads, pads, and trenched areas will be regularly inspected and maintained to minimize erosion. In addition, if more

than 1,320 gallons of oil storage occurs on-site during construction, the Project will complete and implement a SPCC Plan.

6.11 Geologic and Groundwater Resources

The following sections describe existing geologic and groundwater resources, potential impacts, and proposed mitigation.

6.11.1 Existing Conditions

The Study Area is located in a region of North Dakota known as the Missouri Coteau, which was formed when glaciers that were moving across the state became stagnant, depositing rock debris, gravel, and fine-grained sediments intermixed with large ice chunks. When the large ice chunks melted, wetlands were created resulting in what is commonly referred to as the "prairie pothole region." Surface geology within the Study Area is considered part of the Coleharbor Formation, which consists of glacial till approximately 100 feet thick with large pockets of cross bedded sands and gravels.

According to the publicly available Sole Source Aquifer Geographic Information System (GIS) database and the North Dakota GIS Hydrography layer, there are two shallow glacial drift aquifers within the Study Area (EPA, 2016). Approximately 28.8 square miles of the southwest portion of the Study Area overlays the Ray Aquifer, and approximately 1.25 square miles of the northwest portion of the Study Area overlays the West Wildrose Aquifer. No sole source aquifers occur within the Study Area (Appendix A, Exhibit 11, Geologic & Groundwater Resources).

In addition to groundwater resources, the Study Area lies atop the Bakken and Three Forks Formations, geologic formations rich in oil and gas deposits. In April 2013, the U.S. Geological Survey (USGS) estimated there are approximately 3.7 billion barrels of recoverable oil in each of the formations, for a total of 7.38 billion barrels of recoverable oil. Existing oil and gas development infrastructure within the Project Area consist of above ground facilities such as well pads and tank batteries, and underground flowlines and gathering lines. Aurora Wind is in the process of communicating and coordinating with oil and gas companies regarding the Project layout. Oil and gas wells located within the Study and Project Area are discussed in Section 6.2, Land Use.

6.11.2 Geologic and Groundwater Impacts/Mitigation

Impacts to geologic formations and/or groundwater resources are not anticipated during construction and operation of the Project. Water will be used during construction for concrete manufacturing and dust control. This water will be obtained through agreements with local landowners or other entities.

Oil and gas and wind development have co-existed in the same areas successfully for many years across the United States. Tradewind has extensive experience developing wind projects in areas of high oil and gas production. In some of the most prominent oil and gas fields in Kansas and Oklahoma, Tradewind-developed projects alone have resulted in nearly 500 wind turbines and associated wind energy facilities being successfully installed amongst existing oil and gas facilities. In each of those projects, oil and gas leasing, drilling, and operations continued throughout construction and operation of the wind projects.

Aurora Wind continues to coordinate with oil and gas companies regarding the Project layout. A one-call locate ticket was filed in March 2018 to confirm the location of surface and subsurface oil and gas facilities in the Project Area. Aurora Wind's Project design takes the identified locations of the facilities into account so that no problems arise during construction or operations of the Project. Additionally, Aurora Wind committed to a voluntary 500-foot setback of turbines from all existing and active above ground oil and gas wellhead and tank battery locations. Prior to and during construction, Aurora Wind will continue to coordinate with oil and gas companies in or near the Project Area to allow for the continued development of both the mineral and surface estates.

6.12 Surface Water and Floodplain Resources

The following sections describe existing surface water and floodplain resources in the Study Area, potential impacts, and proposed mitigation.

6.12.1 Existing Conditions

The Study Area is located in the Lake Sakakawea Watershed Basin, which is located in the large prairie pothole region of North Dakota. This region contains wetland basins of various sizes and water regimes. In addition, smaller streams, drainages, and a few larger unnamed perennial water bodies occur within the Study Area (Appendix A, Exhibit 12, Surface Waters & USFWS National Wetlands Inventory [NWI] Wetlands). These water complexes may be used for hunting, bird watching, and potentially fishing purposes; however, they are likely not utilized for boating activities other than occasional occurrences of smaller watercraft associated with hunting or fishing.

Correspondence received from the NDSWC dated February 7, 2018, confirmed the Project Area is not in an identified floodplain area (Appendix D, Agency Scoping Package and Responses). Federal Emergency Management Agency is in the process of performing floodplain delineation studies for Williams County, which should be completed in approximately 2021.

6.12.2 Surface Water and Floodplain Resources Impacts/Mitigation

Project facilities have been designed to avoid or minimize impacts to surface water resources. Wind turbines will be built on uplands to avoid surface water resources in the lower elevations to the extent practicable. However, Project facilities, such as underground electrical collection lines, access roads, turbine pads and the substation, will impact land and; therefore, could potentially impact surface water runoff within the Project Area. These impacts will be avoided and/or minimized through use of BMPs. In addition, if, during construction, more than 1,320 gallons of oil storage occurs on-site, the Project will complete and implement a SPCC Plan.

The Project will comply with EPA regulations regarding storm water runoff, including the creation of a SWPPP. This plan will address the construction-related, temporary measures and permanent restoration methods to slow storm water runoff and avoid sediment reaching streams and rivers. Silt fencing will be utilized in areas under construction, as needed, to control erosion and storm water runoff. Surface flows will be directed away from cut-and-fill slopes and into ditches that discharge to natural drainages. All roads, pads, and trenched areas will be regularly inspected and maintained to minimize erosion.

6.13 Wetlands

The following sections describe existing wetlands in the Study Area, potential impacts, and proposed mitigation.

6.13.1 Existing Conditions

Wetlands are defined both in the 1977 Executive Order 11990, Protection of Wetlands, and in Section 404 of the Clean Water Act (CWA) of 1986, as those areas that are inundated by surface or groundwater with a frequency to support and, under normal circumstances, do or would support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Three parameters that define a wetland, as outlined in the Federal Manual for Delineating Jurisdictional Wetlands (U.S. Army Corps of Engineers [USACE], 2010), are hydric soils, hydrophytic vegetation, and hydrology. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands are important natural resources that often serve many functions, such as providing habitat for wildlife, storing floodwaters, recharging groundwater, and improving water quality through purification.

The Study Area is located in the Lake Sakakawea Watershed Basin, which is located in the large prairie pothole region of North Dakota. This region contains wetland basins of various sizes and water regimes. According to the USFWS NWI, approximately 4,986 acres of wetlands are scattered throughout the Study Area, of which approximately 1,329 acres lie within the Project Area (Appendix A, Exhibit 12).

A field wetland delineation was completed on July 19 to 26, 2018, to determine if these wetlands fall under USACE jurisdiction. A total of 131 wetlands spanning a total area of approximately 51.64 acres were delineated within a survey corridor that included any ground surface area that has the potential to be disturbed by any construction or installed activities associated with the wind farm (Appendix K, Wetland Delineation Summary). Several wetland basins protected by USFWS as wetland easements were identified near the Project Area, as mentioned in Section 6.2, Land Use; however, these areas will be avoided.

6.13.2 Wetland Impacts/Mitigation

Wetland impacts will be avoided to the extent practicable and USFWS wetland easement basins will also be avoided (Appendix A, Exhibit 4, Avoidance Areas). Coordination with USFWS is ongoing with respect to potential impacts to USFWS wetland easements. Due to the nature and location of wetlands identified within the Project Area, some collection lines will need to be bored underneath wetland basins.

The Project has communicated with the USACE, North Dakota Regulatory Office, as part of pre-construction due diligence. The USACE noted that if the Project results in work over, in, or under navigable waters (Section 10 of the Rivers and Harbors Act) or the discharge of dredged or fill materials into water of the United States (Section 404 CWA), a Section 10 and/or Section 404 permit will need to be acquired from the North Dakota Regulatory Office. No Section 10 waters are located in the Project Area. Aurora Wind anticipates that impacts to USACE jurisdictional waters will be permitted under the Nationwide Permit program.

6.14 Vegetation

The following sections describe existing vegetation, potential impacts, and proposed mitigation.

6.14.1 Existing Conditions

The Project is within the Northwestern Glaciated Plains Level III Ecoregion which was originally characterized by grasslands, tall and short-grass prairie, scattered mixed trees and shrubs, and seasonal wetlands, but is now primarily cultivated cropland (Griffith, 2010) (Appendix L, Site Characterization Study). Most of the Project Area is cultivated cropland; however, there are some open water, shrub/scrub, wetlands, deciduous forest, and low intensity developed areas. Cultivated cropland makes up 83 percent of the Study Area and 87 percent of the Project Area.

Approximately 8 percent of the Study Area and 6 percent of the Project Area consists of grassland. In addition, two grassland easements located in the Study Area (but outside of the Project Area) are

protected by the USFWS, as discussed in Section 6.2, Land Use. Woodlands comprise less than 1 percent of the total Project Area and are discussed in Section 6.9, Effects on Land-Based Economics.

NDCC Ch. 4.1-4.7 identifies 11 plant species and noxious weeds: absinth wormwood (*Artemisia absinthium*), Canada thistle (*Cirsium arvense*), dalmation toadflax (*Linaria dalmatica*), diffuse knapweed (*Centaurea diffusa*), leafy spurge (*Euphorbia esula*), musk thistle (*Carduus nutans*), purple loosestrife (*Lythrum salicaria*), Russian knapweed (*Acroptilon repens*), spotted knapweed (*Centaurea maculosa*), yellow toadflax (*Linaria vulgaris*), and salt cedar (*Tamarix* spp.). Cities and counties are also able to list additional noxious weeds for control within their jurisdiction. Correspondence received from the Williams County Department of Weed Control indicated that Williams County has not listed any additional species currently, but is in the process of adding carelessweed (*Amaranthus palmeri*), narrowleaf hawksbeard (*Crepis tectorum*), and houndstongue, pending approval from the North Dakota Department of Agriculture. According to the 2017 Annual Weed Board Report, Williams County reported occurrences of Canada thistle, leafy spurge, and houndstongue.

6.14.2 Vegetation Impacts/Mitigation

The USFWS grassland easements are not within the Project Area; therefore, they will not be impacted. Woodland impacts were previously addressed in Section 6.9.2 (also reference Appendix A, Exhibit 4 and Exhibit 6).

Aurora Wind seeks to minimize disruptions to both cropland and grasslands to the extent practicable by coordinating the location of roads with landowners utilizing existing roads, driveways, edge of field lines, or other previously disturbed areas for proposed facility access road locations to the extent possible. Aurora Wind will seek to locate subsurface utilities adjacent to access roads or as otherwise reviewed with landowners. Following construction, the temporarily disturbed areas will be re-vegetated with a seed mixture consistent with the surrounding vegetation and free of noxious weeds. Once re-vegetated, these areas will be available for their present use (e.g., cultivation, grazing, and prairie).

6.15 Wildlife and Wildlife Impacts

Aurora Wind conducted numerous wildlife studies over the course of 2 years to help evaluate potential impacts to species of concern as well as to aid in siting to avoid and minimize those impacts. As part of the wildlife assessment, Aurora Wind met with the USFWS and NDGFD to review survey study methods, results of those studies, and how the results were applied to Project siting. Overall, the agencies determined that the Project was well sited within primarily tilled agricultural lands, and impacts would be similar to other projects in the region. The USFWS and NDGFD agreed that the overall Project was well sited during

an August 16, 2018, meeting. In addition, Aurora Wind agreed to provide NDGFD and USFWS the turbine array. Aurora Wind provided the array to both agencies on September 21 2018, and will arrange to meet with NDGFD in advance of the public hearing.

A review of the desktop and field surveys is included below.

6.15.1 Existing Conditions

The following sections describe avian species, mammals, and bat species in the Study Area.

6.15.1.1 Avian Species

Protection is provided for 1,005 species of migratory birds, some of which are legally hunted (e.g., waterfowl, doves) by the Migratory Bird Treaty Act (MBTA) of 1918. Bald and golden eagles are further protected through the Bald and Golden Eagle Protection Act (BGEPA) of 1940. Both laws are intended to prohibit "take" of and regulate impacts to eagles and other migratory birds from direct mortality, habitat degradation, and/or displacement of individual birds without appropriate permits.

To determine the presence of bird species that may occur within the Study Area, preconstruction baseline avian surveys were conducted to identify avian species and identify and assess the potential risk of adverse impacts to those species, especially eagles and federally listed and sensitive avian species (Appendix M, Avian Use Study Report). The study was consistent with USFWS's *Eagle Conservation Plan Guidance, Module 1 – Land Based Wind Energy Guidance* and *Final Land-Based Wind Energy Guidelines* (USFWS, 2012). The first year of study was conducted between May 24, 2016, and May 7, 2017, at 33 fixed point count location and resulted in a total of 345 hours of survey. A second year of study was conducted from August 11, 2017 – July 26, 2018, and resulted in a total of 355 hours of survey.

For the first year of study, a total of 8,702 bird observations within 953 separate groups were recorded. The first year of study recorded 65 bird species, the majority of which were waterfowl. No federally listed species were observed incidentally or during scheduled avian use surveys.

. A total of 9,313 bird observations within 1,479 separate groups were recorded during the second year of study. The second year of study recorded 95 bird species. The most commonly recorded bird type during the second year of study was passerine, the majority of which were horned larks. Overall, avian use during both years of study are consistent with an agricultural setting in northwestern North Dakota; primarily waterfowl and passerines. Eagle use was low during both years of study and population impacts to either bald or golden eagles are not expected. Whooping cranes were observed migrating above the rotor swept areas. These observations are consistent with understanding that the Project Area is within the

whooping crane migration, and it is expected that whooping cranes could fly over during the migration periods. Waterfowl

The Study Area lies within the Central Flyway of North America, a bird migration route following the Great Plains of the U.S. and Canada. Within the Central Flyway lies the prairie pothole region, which provides migration and breeding habitat in the form of agricultural lands, abundant grasslands, and wetland basins for many waterfowl species. Waterfowl was the most commonly recorded bird type during the first year of avian use study (38 percent), the majority of which were Canada geese. In year two of the avian use study, waterfowl were the second most commonly recorded group.

Shorebirds

Shorebirds, like waterfowl, are also associated with the Central Flyway of North America and prairie pothole region. The prairie pothole region provides migration and breeding habitat in the form of agricultural lands, abundant grasslands, and wetland basins for shorebird species. Two species which utilize this habitat include, whooping crane and sandhill crane. During the second year of avian use study, a total of 12 whooping cranes were observed in two groups (a group of 2 and group of 10) on April 24, 2018, migrating with flocks of sandhill cranes. Other shorebird species may also be observed in the Project, including upland sandpiper (*Bartramia longicauda*) and Sprague's pipit (*Anthus spragueii*).

Prairie Grouse Species

Sharp-tailed grouse lek surveys were completed 3 times during the spring, from April 9 to May 11, 2018. Surveys occurred within larger grassland tracts (80 acres or larger) within the Project Area and transmission line corridor, based on consultation with the NDGFD (Appendix P, 2018 Sharp-Tailed Grouse Lek Surveys: Final Report). Fifty-two points located along public roads and trails around those larger grasslands were selected for surveys. One potential lek was identified within the Project Area during the three surveys. This was documented as a potential lek as courtship behavior was observed only one time at this location (Moratz et al., 2018).

Raptors

Aerial raptor nest surveys were conducted in the Project Area and surrounding 1-mile and 10-mile buffers, as described in Appendix N, 2017 and 2018 Raptor Nest Survey Report. No bald eagle nests were observed within the Project Area or 10-mile buffer. In 2017, 24 occupied/active raptor nests representing three raptor species were identified during aerial surveys, 10 within the Project Area and 14 within the 1-mile buffer. These occupied/active nests included: 12 red-tailed hawk nests, 7 great horned owl nests, and

5 ferruginous hawk nests. In 2018, 16 occupied/active raptor nests representing three raptor species were identified during the 2018 surveys, 8 within the Project Area and 8 within the 1-mile buffer. These occupied/active nests included: seven red-tailed hawk nests, seven great horned owl nests, one ferruginous hawk nest, and one unknown species nests. In addition, 29 and 27 unoccupied/inactive unknown raptor nests were documented in 2017 and 2018, respectively. None of these nests were consistent with the size and structure of eagle nests.

No federally listed species were observed nesting within the Project Area or buffers. However, ferruginous hawk nests were recorded. Ferruginous hawks are, a Level 1 Species of Conservation Priority in North Dakota. A Level 1 Species are defined as species which are in decline and receive little or no monetary support or conservation efforts (SCP) in North Dakota. Review of bald and golden eagle habitat revealed that overall, the Project Area lacks significant eagle habitat. The Project Area is largely outside of the breeding range of the golden eagle; however, there were two observations of golden eagles within the Project Area in the fall 2017 migration period. In addition, there was one bald eagle observation in 2017 and three bald eagle observations in 2018.

One USGS Breeding Bird Survey (BBS) route, the Wild Rose BBS route, runs through the Project Area. Information gathered from the survey of this route provides information about what species may occur in the Project Area. Between 2012 and 2017, 89 species were observed along the Wild Rose BBS route, including four raptor species: red-tailed hawk, northern harrier, Swainson's hawk and short-eared owl. No bald or golden eagles were observed. There are no bald or golden eagle nests within the Project Area or within 10 miles, per communication with NDGFD as well as aerial nest surveys for the Project completed in 2017 and 2018.

To date, no important eagle use areas or migration concentration sites have been documented or are thought to occur within the Project Area (Appendix O, Stage I Eagle Assessment). The important bald eagle use areas and migration concentration sites are located approximately 16 miles south of the Project Area along the Missouri River.

Species of habitat fragmentation concern (SHFC) find "that separation of their habitat into smaller blocks reduces connectivity such that the individuals in the remaining habitat segments may suffer from effects such as decreased survival, reproduction, distribution, or use of the area (USFWS, 2013)." Based on the USFWS North Dakota Field Office information on SHFC, as of February 2013, 11 SHFC occurred in the state (USFWS, 2013). Nine of these SHFC have the potential to occur within the Project Area based on their distribution ranges and recent (within the last 5 years) records along the Wild Rose BBS Route

(Pardieck et al., 2018; Table 6.5); however, given the majority of the Project would be located on tilled agricultural lands, impacts to these species will be largely avoided. Furthermore, the Project Area is already considerably fragmented by farming practices such as row crop agriculture and grazing as well as oil and gas development. As noted in Table 6.2, 87 percent of land within the Project Area is cultivated.

Table 6-5: Species of Habitat Fragmentation Concern[a]

Species	Recorded along Breeding Bird Survey (BBS) Route	Habitat Preference	Potential for Occurrence of Preferred Habitat with the Project
Baird's sparrow (*Ammodramus bairdii*)	Yes	Large tracts of native mixed-grass prairie or lightly grazed pastures.	Suitable habitat for this species may be present in the larger tracts of herbaceous vegetation, limited to the northern portion of the Project area. Project falls within the species' primary distribution range.
Bobolink (*Dolichonyx oryzivorus*)	Yes	Tall and mixed-grass prairie, hayland, and planted grasslands.	Suitable habitat for this species may be present in the grassland and herbaceous areas scattered throughout the Project area. Project falls within the species' primary distribution range.
Chestnut-collared longspur (*Calcarius ornatus*)	Yes	Grazed or hayed mixed-grass and shortgrass prairie.	Suitable habitat for this species may be present in the grassland and herbaceous areas scattered throughout the Project area. Project falls within the species' primary distribution range.
Grasshopper sparrow (*Ammodramus savannarum*)	Yes	Tall or mixed-grass prairie, hayfields, and shrub prairie meadows.	Suitable habitat for this species may be present in the wetland, grassland, and herbaceous areas scattered throughout the Project area. Project falls within the species' primary distribution range.
Greater prairie chicken (*Tympanuchus cupido*)	No	Native tallgrass prairie in association with cropland.	Project area not likely to contain suitable habitat for this species. Project falls outside the species' primary distribution range.
Greater sage-grouse (*Centrocercus urophasianus*)	No	Sagebrush ecosystem	Project area not likely to contain suitable habitat for this species. Project falls outside the species' primary distribution range.
Northern harrier (*Circus cyaneus*)	Yes	Open grasslands, wet meadows, marshes, and areas not heavily grazed.	Suitable habitat for this species may be present in the wetland, grassland, and herbaceous areas scattered throughout the Project area. Project falls within the species' primary distribution range.

Species	Recorded along Breeding Bird Survey (BBS) Route	Habitat Preference	Potential for Occurrence of Preferred Habitat with the Project
Sedge wren (*Cistothorus platensis*)	Yes	Tall, dense grass/sedge vegetation in wet meadows, hayfields, edges of wetlands, and lightly grazed pasture.	Suitable habitat for this species may be present in the wetland, grassland, and herbaceous areas scattered throughout the Project area. Project falls within the species' secondary distribution range.
Sharp-tailed grouse (*Tympanuchus phasianellus*)	Yes	Mixed-grass prairie interspersed with shrubs.	Suitable habitat for this species may be present in the grassland and herbaceous areas scattered throughout the Project area. Project falls within the species' primary distribution range.
Sprague's pipit (*Anthus spragueii*)	Yes, last recorded in 2013	Large areas of native mixed-grass prairie.	Suitable habitat for this species may be present in the larger tracts of herbaceous vegetation, limited to the northern portion of the Project area. Project falls within the species' primary distribution range.
Upland sandpiper (*Bartramia longicauda*)	Yes	Dry, open mixed-grass prairie.	Suitable habitat for this species may be present in the grassland and herbaceous areas scattered throughout the Project area. Project falls within the species' primary distribution range.

Sources: Dyke et al., 2015; NatureServe, 2017; Western EcoSystems Technology, Inc. (WEST), 2017; Pardieck et al., 2018
(a) SHFC based on USFWS, 2013a

6.15.1.2 Mammals

Common mammals that may occur within the Study Area include white-tailed deer, coyote, red fox, white-tailed jackrabbit, raccoon, badger, and striped skunk. All of these species can be found throughout North Dakota and do not require special habitat types. All of these species are habitat generalists whose ranges coincide with the Project Area. If Project construction were to impact these species' habitat, these species could readily relocate to adjacent unaffected areas and continue to thrive.

6.15.1.3 Bat Species

According to a study of bat distribution and habitat use conducted by Gillam and Barnhart (2010), 11 bat species are found in North Dakota. Areas of highest bat diversity contain a range of elevations, vegetation types, and roost types (rock crevices and trees), such as the Badlands, Missouri River Valley, and the Turtle Mountains. The Study Area generally lacks trees for roosting and consists of gently rolling hills.

While bat species may use the Study Area for foraging or during migration, potential hibernacula (usually a cave or mine that provides a constant temperature and protection for winter hibernation) and roosting sites are not known to occur in the Project Area or vicinity.

Additionally, acoustic monitors were placed on two temporary MET towers within the Project Area from April 18 and 19 through October 31, 2017 (Appendix Q, 2017 Acoustic Bat Report Summary). The monitors were intended to document the prevalence of bat species within the Project Area near ground level (3 meters AGL) and within the proposed rotor-swept area (55 meters AGL) (Layne, 2017). It is possible that up to ten different bat species could potentially occur within the Project based on historical ranges and North Dakota county records (Dyke et al., 2015; Harvey et al., 2011; Reid, 2006). Of these species, four are state-listed SCP Level 1 (considered to be of declining status or the core of the species breeding range is in North Dakota), and three are SCP Level 3 (believed to be in the peripheral of the distribution or non-breeding in the state). One of the SCP species, northern long-eared bat (*Myotis septentrionalis*, [NLEB]), is also federally-listed as threatened. SCP Level 1 and federally-listed species are discussed Section 6.16. Potential bat species with no special status but potentially occurring in the Project Area include, eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivigians*).

Bat activity during the survey within the Project peaked between late-July and mid-September, and the highest passage rate was in August, coinciding with timing of fall migration. Based on the survey results, bat activity at the Project is lower than expected for the Great Plains region, but is consistent with peak activity coinciding with fall migration. Acoustic data are being collected at the Project from spring through fall for the 2018 survey season.

6.15.2 Wildlife Impacts/Mitigation

The following sections describe potential impacts and proposed mitigation for avian species, mammals, and bat species.

6.15.2.1 Avian Species

Potential impacts to avian species from the construction of the Project include turbine rotor strikes, direct impacts to nests or individuals during construction of the Project, as well as the removal, degradation, and fragmentation of habitat. No significant impacts to avian species, including waterfowl, shorebirds, prairie grouse, nesting raptors, eagles, or federally listed species are anticipated through the implementation of mitigation and BMPs outlined below. Significant impacts to SHFC are not anticipated given the already

fragmented landscape within the Project Area. Impacts to avian species are being minimized by siting most turbines and infrastructure within tilled agricultural lands.

To reduce the potential for bird strikes with electric lines, all Project collector lines will be buried underground to the extent practicable. To minimize degradation of habitat, a majority of the turbines have been sited on existing cropland to avoid disturbing grassland habitats. Additionally, all areas of temporary disturbance will be reclaimed with vegetation consistent with the surrounding vegetation types, including a seed mixture approved by NRCS and the landowner. Tree impacts will be mitigated on a 2:1 basis, as approved by the landowner and consistent with the Commission's tree and shrub mitigation specifications. To prevent further fragmentation on the landscape, existing access roads will be used to the extent practicable.

Coordination to date with the USFWS and NDGFD have concluded that the Project has been sited well in a fragmented landscape, with most infrastructure planned for tilled lands. Coordination and discussions regarding mitigation/minimization measures are ongoing with USFWS and NDGFD (Appendix D, Agency Scoping Package and Responses). Aurora Wind is preparing a Bird and Bat Conservation Strategy (BBCS) which will outline specific mitigation measures.

Bald and golden eagles have the potential to occur in the Project Area during all seasons, but will likely occur in low numbers. Based on available information, it is not likely that eagle populations will be significantly adversely impacted by development of the Project.

6.15.2.2 Mammals

Ground clearing activities associated with construction of the turbines and associated facilities would result in the direct conversion of habitat, as well as the degradation and fragmentation of habitat for ground dwelling mammals and other wildlife species. The white-tailed deer, coyote, red fox, white-tailed jackrabbit, raccoon, striped skunk, and badger discussed in the previous section are habitat generalists and can readily relocate to adjacent unaffected areas and continue to thrive.

Turbines and access roads have been sited to avoid wooded draws and shelterbelts to the extent practicable and minimal tree removal is expected. To minimize degradation of habitat, Aurora Wind will reclaim all areas of temporary disturbance with vegetation consistent with the surrounding vegetation types and approved by the landowner. The Project will work with NRCS on an appropriate seed mixture for reclamation and will implement as approved by the landowner. Additionally, tree impacts will be

mitigated, as approved by the landowner and consistent with the Commission's tree and shrub mitigation specifications.

6.15.2.3 Bat Species

Potential impacts to bat species from the construction of the Project include turbine rotor strikes, as well as the removal, degradation, and fragmentation of a small amount of foraging habitat. Turbines and access roads have been sited to avoid wooded draws and shelterbelts to the extent possible and minimal tree removal is expected.

To minimize degradation of habitat, all areas of temporary disturbance will be reclaimed with vegetation consistent with the surrounding vegetation types and in accordance with NRCS recommendations, unless otherwise specified by the landowner and approved by the Commission. Additionally, tree impacts will be mitigated on a 2:1 basis, as approved by the landowner and consistent with the Commission's tree and shrub mitigation specifications. Minimization measures will be documented in and implemented per the BBCS.

6.16 Rare and Unique Natural Resources

The following sections describe existing conditions, potential impacts, and proposed mitigation for rare and unique natural resources.

6.16.1 Existing Conditions

The following sections describe federally listed species, state listed species, and associated critical habitat.

6.16.1.1 Federally Listed Species

Under the Endangered Species Act (ESA) of 1973, 50 Code of Federal Regulations (CFR) Part 402, an endangered species is one which is in danger of extinction throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future. A proposed species is one that is officially proposed in the Federal Register to be listed under Section 4 of the ESA. The USFWS has one year after a species is proposed for listing under the ESA to make a final determination whether to list a species as threatened or endangered. A candidate species is a plant or animal for which the USFWS has sufficient information on its biological status and threats to propose it as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. While candidate species are not legally protected under the ESA, it is within the spirit of the ESA to consider said species as having significant value and being worth protecting. Finally, critical habitat includes specific areas that are occupied by a species at the

time of listing or unoccupied areas that are considered essential to the conservation of a species. Critical habitat must contain physical or biological features essential to conservation of the species and may require special management considerations or protection.

Federally listed species may occur in Williams County, including the interior least tern, NLEB, pallid sturgeon, piping plover, rufa red knot, and whooping crane (Appendix L, Site Characterization Study). Each of these species is addressed in more detail below.

Aurora Wind has coordinated with the USFWS regarding the Project, including having a briefing meeting with the USFWS in February 2017 to discuss the Project survey data collection and plans for future efforts. A follow up discussion in August 2018 was held to review the results of the surveys and steps the Project has taken to minimize potential impacts.

6.16.1.1.1 Interior Least Tern (*Sterna antillarum*)

In North Dakota, the interior least tern is known to breed on the sparsely vegetated sandbars of the Yellowstone and Missouri River systems, as well as the shoreline of Lake Sakakawea, between mid-May to mid-August. Nesting adults usually forage in wetlands or riverine habitat within one mile of nest sites; however, they have been documented to travel up to 3 miles to forage (Carreker, 1985). According to the USACE Missouri River Recovery Least Tern and Piping Plover Data Management System, historical least tern sightings have occurred along the shoreline of Lake Sakakawea, approximately 16 miles south of the Study Area and Project Area at the closest point.

There is some potential for the interior least tern to migrate through or utilize wetlands and waterbodies within and around the Project for stopover habitat. There is one documented occurrence in Williams County and four documented observations in adjacent counties.

6.16.1.1.2 Northern Long-Eared Bat (*Myotis septentrionalis*)

The NLEB has been listed as threatened, effective May 4, 2015 (Federal Register April 2, 2015; [USFWS, 2015]). The Western Population of NLEBs occurs partially in North Dakota, where the bats have been observed during the summer in the Turtle Mountains, Missouri River Valley and the Badlands. NLEBs spend winter months hibernating in caves and mines (hibernacula) and the summer/fall months roosting in trees or snags. Preferred hibernacula include large caves or mines with large passages and entrances; constant, cooler temperatures (32 to 48 degrees Fahrenheit); and high humidity with no air currents. No hibernacula are known to exist in the state; however, this may be a function of lack of adequate survey data.

Suitable habitat for summer maternity/non-maternity activities, as well as spring staging/fall swarming includes forests and woodlots, as well as fencerows, riparian forests and other wooded corridors. Density and canopy cover is variable within these forested habitats, which may be interspersed with wetlands, agricultural or fallow fields, or pastures. Potential roost sites include live trees or snags that are greater than or equal to three inches diameter at breast height and may include the following: exfoliating bark, cracks, crevices, or cavities. Isolated trees may be potential roost sites if they exhibit the characteristics described above and are less than 1,000 feet from the nearest roosting site or suitable forested habitat.

Habitat for NLEB is limited in the Project Area given the limited amount of woodland cover. More suitable habitat exists outside of the Project Area along the White Earth and Missouri Rivers.

6.16.1.1.3 Pallid Sturgeon (*Scaphirhynchus albus*)

In North Dakota, the pallid sturgeon has been documented in the Missouri River downstream from the Fort Peck Dam, Montana to the headwaters of Lake Sakakawea, North Dakota and downstream from the Garrison Dam, North Dakota to the headwaters of Lake Oahe, North Dakota. Preferred habitat for the pallid sturgeon includes the bottom of silty river systems, which provide a wide range of depths and flow velocities. Potential habitat associated with Lake Sakakawea is located approximately 16 miles south of the Study Area and Project Area at the closest point.

6.16.1.1.4 Piping Plover (*Charadrius melodus*)

In western North Dakota, suitable habitat for the piping plover occurs along the Missouri and Yellowstone rivers in the form of riverine sandbars, gravel beaches and flat, sandy beaches with little vegetation. Suitable habitat also consists of alkali areas of wetlands, which are scattered in North Dakota. According to the USACE Missouri River Recovery Least Tern and Piping Plover Data Management System, historical piping plover sightings have occurred along the shoreline of Lake Sakakawea, approximately 16 miles south of the Study Area at the closest point (Appendix L, Site Characterization Study). The USFWS NWI identifies approximately 1,329 acres of wetlands that occur within the Project Area, which could provide potential habitat for the piping plover if such wetlands have alkali areas (Appendix A, Exhibit 12). There is potential for piping plovers to utilize wetlands and waterbodies near or within the Project Area and/or to migrate through the Project. However, no potential habitat within the Project Area has been designated as critical habitat for the piping plover.

Designated critical habitat for the Northern Great Plains population of piping plovers has been designated on alkali lakes and wetlands and the Yellowstone and Missouri Rivers in North Dakota, including Williams County (Appendix L, Site Characterization Study). As stated previously, the shoreline of Lake

Sakakawea (part of the Missouri and Yellowstone River systems) is located approximately 16 miles south of the Study Area at the closest point. Due to the distance to the Project Area and nature of the Project, no impacts to designated critical habitat are anticipated.

6.16.1.1.5 Rufa Red Knot (*Calidris canutus rufa*)

The rufa red knot migrates during the spring and fall between breeding grounds in northern Canada and wintering grounds in the Southeast U.S., the Northeast Gulf of Mexico, northern Brazil and Tierra del Fuego in South America. While a majority of red knots follow migration routes along the east and west coast of the US, small numbers of this species follow an inland migration route across the Midwest along the Great Lakes. Preferred stopover habitat in North America includes sandy or gravely beaches, tidal mudflats, salt marshes, shallow coastal impoundments and peat banks. Preferred prey found in non-breeding habitats including snails, mollusks and insect larvae. There is some potential for the rufa red knot to migrate through the Project or to utilize wetlands and waterbodies for stopover habitat. However, there are no documented occurrences within Williams County, and no impacts to the species are anticipated.

6.16.1.1.6 Whooping Crane (*Grus americana*)

The whooping crane was listed as a federally endangered species in 1967 due to declines in populations from alteration and destruction of habitat from widespread agricultural activities and hunting pressures. Currently, the only self-sustaining population of whooping cranes consists of the Aransas-Wood Buffalo Population, which migrates during spring and fall through a 2,400-mile long by 200-mile wide corridor spanning Saskatchewan, eastern Montana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma and Texas. In North Dakota, the migratory corridor extends approximately 220 miles wide from east to west; however, 75 percent of the sightings occur within an 80-mile wide band centered within the larger corridor.

Whooping cranes use shallow, seasonally and semi-permanently flooded palustrine (marshy) wetlands for roosting and various cropland (grains) and emergent wetlands for feeding. Suitable stopover habitat for whooping cranes includes areas of shallow water without visual obstructions and slight slopes (less than five percent). Feeding and palustrine roosting locations for whooping cranes are typically less than 0.5 mile apart; however, distance from feeding to roosting sites can be separated by more than one mile.

The Study Area is located in the portion of the whooping crane migration corridor in which 75 percent of whooping crane sightings have occurred. The Whooping Crane Habitat Assessment report in Appendix R provides the location of the migration corridor in the vicinity of the Project. According to the 2017

National Agricultural Statistics Service (NASS) data, potential whooping crane habitat exists in the Project Area in the form of wetlands, grasslands and croplands, which could be used for feeding (USDA, 2017).

A whooping crane habitat review and analysis was conducted for the Project (Appendix R, Whooping Crane Habitat Assessment). As part of this analysis, USGS data concerning whooping crane stopover sites was analyzed. Specifically, the USGS has recently determined whooping crane stopover sites and their intensity of use within the Great Plains from radio telemetry information. Stopover sites and their use intensity are based on 20-kilometer square grid cells. According to the USGS study, the Project Area was within an "unoccupied" area, which the USGS describes as "lacking evidence of use." Based on historic USFWS data, only one whooping crane has been sighted within the Project Area. There are six confirmed sightings within one mile of the Project Area's boundary. Additionally, a total of 12 whooping cranes were observed migrating over the Project during surveys in spring 2018 above the rotor swept height.

Overall, although there is potential whooping habitat within the Project Area, this habitat is not unique compared to adjacent areas. Given that no whooping cranes have been documented as fatalities at wind facilities and no sandhill cranes (a species often used as a surrogate for whooping cranes) have been documented as fatalities within the migration corridor, taken together with low use of the Project Area and vicinity, impacts to the species are not anticipated.

6.16.1.2 State Species of Concern

The State of North Dakota does not have a state threatened and endangered species list; instead, the NDGFD maintains a list of SCP (Dyke et al., 2015). Species are classified into three levels according to their conservation need. Level I species are the highest level of conservation priority. Level II species are of a moderate level of conservation priority. Level III species are also of a moderate level of conservation priority, but are thought to be peripheral or non-breeding in North Dakota (Dyke et al., 2015) (Table 6-6; Appendix L). Level I species are those that have a high conservation need because of declining population within North Dakota or are declining over the species' range and the core of their breeding population occurs in North Dakota. Level II species have a moderate conservation need or are high priority species without available funding for protection.

Table 6-6: State Species of Conservation Priority, with Known or Potential Occurrence in Williams County, North Dakota[a]

Species	Status[b]	Habitat	Potential Occurrence within the Project
Mammals			
Big brown bat (*Eptesicus fuscus*)	Species of Conservation Priority (SCP) Level I	Uses standing snags and hollow trees of coniferous and deciduous forests. Also uses bridges, buildings, and tunnels.	The Study Area may contain suitable habitat for this species.
Little brown bat (*Myotis lucifugus*)	SCP Level I	Generally uses buildings as roosts that are near feeding areas with flying insects.	The Study Area may contain suitable habitat for this species.
Townsend's big-eared bat (*Corynorhinus townsendii*)	SCP Level I	Forest and riparian areas during the summer months, caves and mines as winter hibernacula.	The Study Area is not likely to habitat for this species due to no hibernacula identified to date for this species in North Dakota and lack of forested habitat; however, this species is newly documented in the state.
Northern long-eared bat (*Myotis septentrionalis*)	FT; SCP Level I	Roosts and forages during spring and summer in mature forest interior and riparian areas. May roost in old buildings; typically avoids open habitats. Congregates in wooded areas surrounding caves and mines in autumn, and hibernates in caves and mines.	The Study Area is not likely to contain habitat for northern long-eared bat (NLEB), although the winter distribution of NLEB reaches into Williams County.
Birds			
American bittern (*Botaurus lentiginosus*)	SCP Level I	Utilizes a variety of wetlands, but usually larger wetlands with tall emergent vegetation.	The Study Area may contain suitable habitat for this species.
Baird's sparrow (*Ammodramus bairdii*)	SCP Level I	Large tracts of native mixed-grass prairie or pastures.	The Study Area may contain suitable habitat for this species.
Black tern (*Chlidonias niger*)	SCP Level 1	Uses shallow wetland complexes, usually larger than 20	The Study Area may contain suitable habitat for this species.

Species	Status[b]	Habitat	Potential Occurrence within the Project
		hectares, with open water and emergent vegetation.	
Black-billed cuckoo (*Coccyzus erythropthalmus*)	SCP Level 1	Nests in trees and brush. Uses riparian zones, shelterbelts, and wooded areas.	The Study Area may contain suitable habitat for this species.
Chestnut-collared longspur (*Calcarius ornatus*)	SCP Level 1	Mixed-grass and shortgrass prairie.	The Study Area may contain suitable habitat for this species.
Ferruginous hawk (*Buteo regalis*)	SCP Level 1	Large areas of native prairie.	Species confirmed in Study Area.
Franklin's gull (*Leucophaeus pipixcan*)	SCP Level 1	Large wetlands; often feeds in tilled agricultural fields.	The Study Area may contain suitable habitat for this species.
Grasshopper sparrow (*Ammodramus savannarum*)	SCP Level 1	Tall or mixed-grass prairie, hayfields, and meadows.	The Study Area may contain suitable habitat for this species.
Greater sage-grouse (*Centrocercus urophasianus*)	SCP Level 1	Sagebrush ecosystem.	The Study Area does not contain suitable habitat for this species.
Horned grebe (*Podiceps auratus*)	SCP Level 1	Wetlands and ponds with emergent vegetation and open area.	The Study Area may contain suitable habitat for this species.
Lark bunting (*Calamospiza melanocorys*)	SCP Level 1	Sagebrush ecosystems or mixed-grass prairie with shrubs and cropland interspersed	The Study Area may contain suitable habitat for this species.
Least tern – interior population (*Sternula antillarum*)	FE; SCP Level II	Nests on barren to sparsely vegetated sandbars along rivers, sand and gravel pits, and lake and reservoir shorelines.	The Study Area is unlikely to contain suitable nesting habitat for the species. Least terns may pass through during migration.
Long-billed curlew (*Numenius americanus*)	SCP Level I	Shrub-steppe prairie or short-grass prairie	The Study Area is on the edge of this species' range; therefore, the Project is not likely to contain suitable habitat for this species.
Marbled godwit (*Limosa fedoa*)	SCP Level I	Utilize a variety of wetlands and nest in grazed native prairie.	The Study Area may contain suitable habitat for this species.

Species	Status[b]	Habitat	Potential Occurrence within the Project
Nelson's sparrow (*Ammodramus nelsoni*)	SCP Level I	Use shallow marshes, fens, and wet meadows.	The Study Area is on the edge of this species' range; therefore, the Study Area is not likely to contain suitable habitat for this species.
Red-headed woodpecker (*Melanerpes erythrocephalus*)	SCP Level I	Natural stands of mature deciduous trees.	The Project Area may contain suitable habitat for this species.
Sprague's pipit (*Anthus spragueii*)	SCP Level I	Large areas of native mixed-grass prairie.	The Study Area may contain suitable habitat for this species.
Swainson's hawk (*Buteo swainsoni*)	SCP Level I	Utilizes grassland and cropland with wooded thickets interspersed.	Species confirmed in the Study Area.
Wilson's phalarope (*Phalaropus tricolor*)	SCP Level I	Mudflats and shallow wetlands.	The Study Area may contain suitable habitat for this species.
Yellow rail (*Coturnicops noveboracensis*)	SCP Level I	Wet meadows and fens.	The Study Area may contain suitable habitat for this species.
Piping plover (*Charadrius melodus*)	FT; SCP Level II	In the Midwest, breeds on sparsely vegetated beaches of large lakes or sand spits.	The Study Area may contain suitable habitat for this species, and piping plovers may pass through during migration.
Rufa red knot (*Calidris canutus rufa*)	FT; SCP Level III	May occasionally be found on mudflats, sandbars, shallowly flooded areas, and pond margins along the Missouri River.	The Study Area is not likely to contain suitable habitat for this species, although rufa red knots may pass through during migration.
Whooping crane (*Grus americana*)	FE; SCP Level III	Herbaceous wetlands and grasslands.	The Study Area is within the known migration corridor for whooping cranes and have been observed migrating through the Study Area; therefore, occurrence within the Project Area is possible.
Amphibians			
Canadian toad (*Anaxyrus hemiophrys*)	SCP Level I	Prairies with relatively soft soil in or near water.	The Study Area likely contains suitable habitat for this species.
Plains spadefoot (*Spea bombifrons*)	SCP Level I	Dry grasslands with gravelly or sandy soil.	The Study Area may contain suitable habitat for this species.
Reptiles			

Species	Status[b]	Habitat	Potential Occurrence within the Project
Plains hog-nosed snake (*Heterodon nasicus*)	SCP Level I	Dry grasslands with gravelly or sandy soil.	The Study Area may contain suitable habitat for this species.
Smooth green snake (*Opheodrys vernalis*)	SCP Level I	Grasslands and upland hills.	The Study Area may contain suitable habitat for this species.
Fish			
Blue sucker (*Cycleptus elongatus*)	SCP Level I	Large rivers and lower parts of major tributaries.	The Study Area may contain suitable habitat for this species.
Sicklefin chub (*Marcrhybopsis meeki*)	SCP Level I	Primary channels of turbid, large rivers.	The Study Area likely contains suitable habitat for this species.
Sturgeon chub (*Marcrhybopsis gelida*)	SCP Level I	Medium to large, turbid rivers.	The Study Area is not likely to contain suitable habitat for this species.
Insects			
Monarch butterfly (*Danaus plexippus*)	SCP Level I	Open fields and meadows with milkweed.	The Study Area likely contains suitable habitat for this species.

Source: Dyke et al., 2015; USFWS, 2016b
(a) Likelihood of occurrence within the Study Area is based on distribution ranges and habitat preferences.
(b) FE = Federally listed endangered; FT = Federally listed threatened species. North Dakota SCP: Level I = Highest Level of Priority; Level II = Moderate Level of Priority; Level III = Lower Level of Priority.

Aurora Wind has been coordinating with the NDGFD. This coordination has included requesting and receiving eagle nest information in 2017 and 2018, meeting with the NDGFD February 8, 2017, and August 16, 2018, and receiving a letter from the NDGFD dated January 8, 2018. Through this coordination, Aurora Wind has been incorporating guidance, as applicable, into the Project. In the January 8, 2018, letter and during the August 16, 2018, meeting, the NDGFD commended Aurora Wind on the overall siting of the Project within a relatively low sensitive area with respect to native habitat. Based on the surveys completed for the Project and in discussions with federal and state wildlife agencies, significant impacts to SCP are not anticipated.

6.16.2 Rare and Unique Natural Resources Impacts/Mitigation

The following sections describe potential impacts to federally listed species, state listed species, and associated critical habitat.

6.16.2.1 Federally Listed Species

Impacts and mitigation for federally listed species identified for the Project are discussed below.

6.16.2.1.1 Interior Least Tern

There is some potential for the interior least tern to migrate through or utilize wetlands and waterbodies within and around the Study Area for stopover habitat. There is one documented occurrence in Williams County and four documented observations in adjacent counties. No impacts to least terns from the Project are anticipated.

6.16.2.1.2 Northern Long-Eared Bat

While the Project Area is within the overall range of the species, occurrence is unlikely given lack of suitable and no impacts are anticipated. Habitat for this species is limited in the Project Area given the limited amount of woodland cover. Turbines and access roads have been sited to avoid wooded draws and shelterbelts to the extent possible and minimal tree removal is expected. Further, if a species is detected during operations, Aurora Wind will coordinate with the USFWS on continued operational criteria. These measures will be included in the BBCS.

6.16.2.1.3 Pallid Sturgeon

Potential habitat associated with Lake Sakakawea is located approximately 16 miles south of the Study Area at the closest point. No potential habitat occurs within the Project Area and no impacts are anticipated.

6.16.2.1.4 Piping Plover

There is potential for piping plovers to utilize wetlands and waterbodies near or within the Project area and/or to migrate through the Project. However, no potential habitat within the Study Area or Project Area has been designated as critical habitat for the piping plover. Designated critical habitat for the Northern Great Plains population of piping plovers has been designated on alkali lakes and wetlands and the Yellowstone and Missouri Rivers in North Dakota, including Williams County. As stated previously, the shoreline of Lake Sakakawea (part of the Missouri and Yellowstone River systems) is located approximately 16 miles south of the Study Area at the closest point. Due to the distance to the Project Area and nature of the Project, no impacts to designated critical habitat are anticipated.

6.16.2.1.5 Rufa Red Knot

There is some potential for the rufa red knot to migrate through the Project or to utilize wetlands and waterbodies for stopover habitat. However, there are no documented occurrences within Williams County and no impacts to the species are anticipated.

6.16.2.1.6 Whooping Crane

Overall, although there is potential whooping habitat within the Project Area, this habitat is not unique compared to adjacent areas. Given that no whooping cranes have been documented as fatalities at wind facilities and no sandhill cranes (a species often used as a surrogate for whooping cranes) have been documented as fatalities within the migration corridor, taken together with low use of the Project Area and vicinity, impacts to the species are not anticipated.

Aurora Wind is engaged in ongoing coordination with USFWS to determine potential mitigation/minimization measures with respect to whooping cranes, including turbine curtailment if whooping cranes observed within 2 miles of the Project, operations personnel training on whooping crane identification, burying all collector lines within the Project, and marking of the above ground transmission line. Minimization measures will be included in the BBCS.

6.16.2.2 State Species of Concern

Impacts to State SCP would be similar to those identified in Section 6.15.1 for wildlife. Potential impacts to avian species from construction of the Project includes turbine rotor strikes, direct impacts to nests or individuals during construction of the Project, as well as the removal, degradation, and fragmentation of habitat. To reduce the potential for bird strikes with electric lines, all Project collector lines will be buried underground to the extent practicable. To minimize degradation of habitat, a majority of the turbines have been sited on existing cropland to avoid disturbing grassland habitats.

Potential impacts to bat species from the construction of the Project include turbine rotor strikes, as well as the removal, degradation, and fragmentation of foraging habitat.

Impacts to bats and birds as a result of the Project would be minimized by mitigating impacts to trees, as approved by the landowner and consistent with the Commission’s tree and shrub mitigation specifications. Turbines and access roads have been sited to avoid wooded draws and shelterbelts to the extent practicable and minimal tree removal is expected. Coordination and discussions regarding mitigation/minimization measures are ongoing with USFWS. Aurora Wind will prepare a BBCS which will outline specific mitigation measures. Minimization measures will be implemented per the BBCS.

Ground clearing activities during construction of the turbines and associated facilities would result in the direct conversion of habitat in the limited areas not currently within tilled agriculture, as well as the degradation of habitat for ground dwelling mammals, reptiles, and amphibians which are SCP. Most of these species can readily relocate to adjacent unaffected areas and continue to thrive.

Significant impacts to SCP are not anticipated. Surveys have indicated use is predominately that of common species groups (e.g., waterfowl and passerines). Most construction activities will occur within already tilled landscapes, avoiding and minimizing risks to Species of Conservation Priority. This conclusion was supported by the NDGFD in meetings as well as their January 8, 2018, letter. Existing access roads will be used to the extent practicable to prevent further fragmentation on the landscape.

Significant impacts to SCP are not anticipated due to Project siting within a region of North Dakota with low intact, native habitat. The majority of turbines have been sited on existing cropland, avoiding grassland habitats. Finally, to the extent practicable, Project collector lines will be buried to eliminate the risk for bird strikes.

6.17 Summary of Impacts and Mitigation

Table 6-7 provides a summary of Project impacts and proposed mitigation.

Table 6-7: Summary of Impact and Mitigation

Resource	Potential Impact	Proposed Mitigation	Section
Demographics	Profits to landowners from part ownership in the Project may increase per capita income within the Project Area and surrounding counties. No long-term changes to demographics are anticipated.	No mitigation is proposed.	6.1
Land Use	The Project will convert approximately 120 acres of land in the Project Area into a renewable, alternative energy source for the life of the Project. The proposed Project would also result in approximately 1,353 acres of temporary impacts.	Lease payments will be made to landowners for placement of Project facilities. Aurora Wind will coordinate with local landowners with respect to any areas of CRP land that cannot be avoided to determine seeding specifications for the reclamation of temporarily impacted land and payment requirements for permanently disturbed land.	6.2

Resource	Potential Impact	Proposed Mitigation	Section
	Conservation Reserve Program (CRP) lands could also be impacted.		
Public Services	Construction of the Project will temporarily increase traffic on haul roads. Additionally, electric, telephone, and fiber optic lines may be impacted during construction.	Local utility companies will be contacted prior to construction. Aurora Wind will utilize North Dakota One Call prior to construction to identify existing utilities. Roadways will be returned to pre-existing conditions unless otherwise requested by County authorities during coordination. All applicable road permits will be obtained from Williams County and townships. Aurora Wind will enter into a road use and maintenance agreement with Williams County and applicable townships, if needed.	6.3
Human Health and Safety	No adverse impacts are anticipated.	Wind turbines have been set back at least a distance of 3 times the height of the turbine (approximately 1,900 feet) from occupied residences and collection lines will be buried to a depth of at least four feet. The Project will also meet the Commission's sound avoidance requirements and applicable voluntary shadow flicker goal.	6.4
Sound	A sound assessment was completed and, using the turbine model with the highest sound emission level and modeling for ground attenuation, sound levels were below 50 decibels (dBA) within 100 feet of any inhabited residences.	NA	6.5
Visual	The Project will have visual and potential aesthetic impacts. A detailed shadow flicker analysis was performed and indicated that, if the turbine with the maximum shadow flicker potential is used, two residences are	Use of setbacks and minimum Federal Aviation Administration (FAA) lighting and marking requirements are anticipated to minimize visual impacts. For the two residences modeled as having the potential to experience more than 30 hours of shadow flicker per year, Aurora Wind has obtained one shadow flicker acknowledgment/waiver and will	6.6

Resource	Potential Impact	Proposed Mitigation	Section
	modeled as having the potential to experience more than 30 hours of shadow flicker per year.	either obtain a waiver at the second residence or take operational steps to reduce shadow flicker to 30 hours per year or less.	
Cultural and Archaeological Resources	Identified cultural resource sites recommended for avoidance will be avoided; therefore, no historic properties will be affected.	A Class III Pedestrian Survey has been initiated and wind turbines, access roads, and associated facilities will be sited to avoid known/existing archaeological sites. In addition, an Unanticipated Discoveries Plan will be completed. If cultural resources are discovered during construction or operation, work shall immediately be stopped, the affected site secured, and State Historical Society (SHSND) notified.	6.7
Recreational Resources	There are no designated recreation areas, public or private parks or designated trails in the Project Area.	No mitigation.	6.8
Land Based Economics	Conversion for the life of the Project and temporary conversion of land that would consist of farmland, rangeland and potentially prime farmland.	Areas of temporary disturbance will be re-vegetated or available for agricultural purposes, following construction. Economic loss to producers due to land conversion will be minor in comparison to additional income provided by wind farm.	6.9
Soils	May cause soil surface to become more prone to wind and water erosion and may result in soil compaction and the spread of noxious weeds.	Erosion and sediment control measures will be utilized during and after construction including segregation of topsoil, noxious weed control and the use of construction equipment appropriately sized for the scope of the work. Additionally, Aurora Wind will verify that access road grades fit closely with the natural terrain, soil cuttings are properly disposed of, and proper drainage is maintained.	6.10
Geologic and Groundwater Impacts	No adverse impacts anticipated.	No mitigation is proposed.	6.11

Resource		Potential Impact	Proposed Mitigation	Section
Surface Water and Floodplain Resources		No adverse impacts anticipated.	The Project will use Best Management Practices (BMPs) such as silt fence, straw wattles, earth berms, retention ponds, and/or rock check dams to avoid or minimize impacts.	6.12
Wetlands and Woodlands		Impacts to wetland basins under U.S. Fish and Wildlife Service (USFWS) easements will be avoided. The Project may need to bore some collection lines underneath basins but neither the act of boring nor the installation of collection lines will permanently impact the hydrology of the wetland.	Any impacts to U.S. Army Corps of Engineers (USACE) jurisdictional waters will be permitted and mitigated for in accordance with Section 404 of the Clean Water Act (CWA). Coordination with USFWS regarding wetland easements is ongoing.	6.13, 6.14
Vegetation		The Project will result in temporary and permanent vegetation impacts.	Following construction, temporarily disturbed areas will be reclaimed with vegetation consistent with the surrounding vegetation types and in accordance with NRCS recommendations, unless otherwise specified by the landowner and approved by the Commission. Seed mixtures will be free of noxious weeds.	6.14
Wildlife	**Mammal Species**	The Project will impact potential habitat for ground dwelling mammals and increased potential for bat strikes with the turbine rotors.	Turbines and access roads have been sited to avoid wooded draws and shelterbelts and minimal tree removal is expected. Direct habitat conversion has been avoided by siting turbines and facilities within tilled agriculture lands. Existing access roads will be utilized to the extent practical. Temporary disturbed areas will be re-vegetated, as appropriate, with vegetation consistent with surrounding vegetation types. A BBCS will be prepared prior to operation of the Project that outlines proposed mitigation measures which will be implemented.	6.15.1.2, 6.15.2.2,
	Avian Species	The Project may result in impacts to avian species	The Project has been sited primarily within tilled and agricultural land to	6.15.1.1, 6.15.2.1

Resource		Potential Impact	Proposed Mitigation	Section
		through increasing the potential for bird strikes with the turbine rotors and habitat fragmentation.	avoid impacts. Existing access roads will be used to the extent practical. All collector lines will be buried to avoid potential for bird strikes. Temporarily disturbed areas will be reclaimed with vegetation consistent with surrounding vegetation. Tree impacts will be mitigated on a 2:1 basis, as approved by the landowner and consistent with the Commission's specifications. Coordination with the USFWS is ongoing regarding potential mitigation measures. A BBCS will be prepared prior to operation of the Project that outlines proposed mitigation measures and will be implemented during the Project.	
Rare and Unique Natural Resources	**Threatened and Endangered Species**	The Project may result in impacts to avian species through increasing the potential for bird strikes with the turbine rotors and habitat fragmentation.	Project facilities have been sited to avoid wooded draws and shelterbelts; and direct conversion of habitat. All collection lines will be buried to avoid potential bird strikes. Existing access roads will be used to the extent practical. Temporarily disturbed areas will be reclaimed with vegetation consistent with surrounding vegetation. Tree impacts will be mitigated on a 2:1 basis. A BBCS will be prepared prior to operation of the Project that outlines proposed mitigation measures and will be implemented during the Project. Coordination with the USFWS is ongoing regarding potential mitigation measures, including those regarding whooping crane (e.g., turbine curtailment, personnel training, and those above). A BBCS will be prepared prior to operation of the Project that outlines proposed mitigation measures.	6.16
	State Species of Concern	Habitat loss and fragmentation, direct mortality or injury due to collisions with vehicles, equipment, and turbines, degradation of aquatic	Turbines and access roads have been sited to avoid wooded draws and shelterbelts and minimal tree removal is expected. Direct habitat conversion has been avoided by siting turbines and facilities within tilled agriculture lands. Existing access roads will be utilized to	6.16.1.2, 6.16.2.2

Resource		Potential Impact	Proposed Mitigation	Section
		habitat due to spills or sediment loading	the extent practical. Collector lines will be buried to avoid bird strikes. Temporary disturbed areas will be re-vegetated, as appropriate, with vegetation consistent with surrounding vegetation types. A BBCS will be prepared prior to operation of the Project that outlines proposed mitigation measures which will be implemented. Coordination with the USFWS is ongoing regarding mitigation and minimization measures.	

7.0 IDENTIFICATION OF POTENTIAL PERMITS/APPROVALS

The Table 7-1 is a permitting matrix below identifying potential federal, state, and local permits that may be needed for the Project.

Table 7-1: Potential Permits/Approvals

Agency	Permit	Applicability	Permit Status and Timing
Federal Aviation Administration (FAA)	Notice of Proposed Construction or Alteration (Form 7460-1)	• Construction or alteration of structures standing higher than 200 feet above ground level • Construction or alteration of structures near airports; 14 Code of Federal Regulations (CFR) 77.13 provides details • Siting within radar line-of-sight of an air defense facility	The Project has filed Form 7460-1 Notice of Proposed Construction with the FAA for representative turbine locations within the Project Area and has received Determinations of No Hazard for those locations. After Project design is finalized, the Project will submit additional Form 7460-1 Notices of Proposed Construction, as necessary.
	Notice of Actual Construction or Alteration (Form 7460-2)	Supplemental notice provided to FAA in advance of beginning construction.	To be provided in advance of or after commencing construction, as appropriate.
U.S. Army Corps of Engineers (USACE)	Section 404 Permit	Dredging or filling jurisdictional waters of the United States.	Anticipated that Project will qualify under a Nationwide Permit; will verify coverage, as needed, prior to construction in jurisdictional wetlands.
U.S. Environmental Protection Agency (EPA)	SPCC Plan	Required if any facility associated with the Project (substation) has oil storage of more than 1,320 gallons.	To be prepared prior to construction, if necessary.
U.S. Fish and Wildlife Service (USFWS)	Consultation pursuant to Endangered Species Act (ESA) Section 10	Regulates a wide range of non-federal activities affecting plants and animals designated as endangered or threatened, and the habitats upon which they depend.	In progress.
U.S. Department of Agriculture (USDA)-Natural	Farmland Impact Conversion Rating Form AD-1006	Conversion of prime or unique farmland (only for Projects with federal involvement).	Not anticipated at this time.

Agency	Permit	Applicability	Permit Status and Timing
Resources Conservation Service (NRCS)			
North Dakota Public Service Commission (Commission)	Certificate of Site Compatibility	Construction of energy conversion facility.	In process.
North Dakota Department of Health (NDDH)	North Dakota Pollutant Discharge Elimination System (NDPDES) General Permit for Stormwater Discharge Related to Construction (includes Storm Water Pollution Prevention Plan [SWPPP])	For stormwater discharges from construction activities with disturbances greater than one acre.	To be obtained prior to construction activities for which the permit is required.
	401 Water Quality Certification	Required for filling in jurisdictional waters of United States.	Individual 401 Water Quality Certification not anticipated to be required.
	Air Quality Permit (Concrete Batch Plant)	Requested by NDDH.	Obtain prior to use of concrete batch plant, if necessary.
	Potable/Wastewater Permit	Required for installation of septic system.	To be obtained prior to construction of the septic system, if necessary.
North Dakota State Water Commission (NDSWC)	Drain Permit	Required for any pond, slough, lake or sheetwater drainage for areas with a watershed of 80 acres or more.	Not anticipated at this time.
North Dakota Highway Patrol	Oversize/Overweight Permit	Required to transport oversize loads on state-maintained roads.	To be obtained prior to transport of oversize/overweight loads.
North Dakota State Electrical Board	Electrical Permit	Installation of electrical facilities.	To be obtained if needed.
North Dakota Department of Trust Lands (NDTL)	Site Plan Approval	Construction of Project facilities.	To be obtained prior to construction on NDTL managed lands.

Agency	Permit	Applicability	Permit Status and Timing
Williams County	Approach Permits	Installation of approach roads.	To be obtained prior to installation of approaches, as needed.
	Building Permits	Construction of infrastructure.	To be obtained prior to construction.
	Conditional Use Permit	Siting of turbines on property not zoned for such a use.	Obtained.
	Haul Road Permits	Using local roadways for haul roads.	To be obtained as necessary prior to use of haul roads.
	Utility Crossing Permits	Encroaching on roadways.	To be obtained prior to construction work in roadway right-of-way (ROW).
Townships	Approach Permits	Installation of approach roads.	To be obtained prior to installation of approaches, as needed.
	Haul Road Permits	Using local roadways for haul roads.	To be obtained as necessary prior to use of haul roads.
	Utility Crossing Permits	Encroaching on roadways.	To be obtained prior to construction work in road ROW as needed.

8.0 FACTORS CONSIDERED

The Siting Act (see NDCC Section 49-22-09) lists the following factors to guide the Commission in assessing and designating the site for the proposed facility.

8.1 Public Health and Welfare, Natural Resources, and the Environment

The preceding sections of this Application provide the research and investigations relating to the Project's potential impacts on public health and welfare, natural resources, and the environment. In addition, Section 6.17 provides a summary of impacts and proposed mitigation measures to minimize these impacts.

8.2 Minimizing Adverse Environmental Effects

Aurora Wind has utilized or will utilize the most current technologies available to site, construct, and operate the Project so as to optimize wind resources, while minimizing potential adverse environmental impacts. Mitigation and minimization measures associated with various resources are identified in their corresponding sections within Section 6.0, Environmental Analysis.

8.3 Potential for Beneficial Uses of Waste Energy

Since wind energy does not create waste energy, there would be no use of waste energy associated with this Project.

8.4 Unavoidable Adverse Environmental Effects

Unavoidable adverse environmental effects are described for each resource area in Section 6.0. Unavoidable permanent ground disturbance will include the permanent conversion of land to a renewable energy generation resource and alteration of the visual landscape through construction and lighting of turbines for the life of the Project. Any additional acreage that will be temporarily impacted during construction will be restored to its original condition to the extent practicable following construction. Aurora Wind selected its site so as to minimize unavoidable environmental impacts and will implement appropriate mitigation measures throughout Project development.

8.5 Alternatives to the Proposed Site

As discussed in Section 2.2, wind energy is the most cost-effective and beneficial option of potential energy alternatives. After considering the initial Project Area and evaluating data received through agency feedback, landowner coordination, literature reviews and site studies, Aurora Wind believes that the proposed site is the best possible location for the Project.

8.6 Irreversible and Irretrievable Commitment of Natural Resources

With a renewable energy project, such as the proposed Project, there are relatively few irreversible and irretrievable commitments of natural resources. Project construction activities are expected to be the primary source of the irreversible and irretrievable commitment of natural resources. Natural resources will be used in the fabrication and preparation of construction materials, such as concrete, steel, and aggregate, and the vehicles traveling to and from the site during construction will use hydrocarbon fuel. While these materials may not be retrievable after use, these materials are not in short supply, and their use will not have an adverse effect on the availability of these resources. Further, the anticipated benefits will balance the irretrievable commitment of resources for the Project.

8.7 Direct and Indirect Economic Impacts

The direct economic impacts resulting from the Project will be primarily positive. The Project will result in land use conversion; however, the majority of the Project Area will still be available for agricultural practices and landowners will be compensated for the land occupied by the wind turbines and associated facilities.

The Project may also indirectly benefit economies in surrounding communities due to wages and salaries paid to local hires and increased spending at local businesses. Further, long-term benefits to the Williams County tax base resulting from the Project will improve the local economy. Continuing to establish North Dakota as a producer of renewable energy may spur the development of related businesses in the area, which will contribute to the economic growth in the region.

8.8 Existing Development Plans of the State, Local Government, and Private Entities at or in the Vicinity of the State

No conflicts with the existing development plans of state, local, or private entities within the Project Area are anticipated. The Project will comply with applicable provisions of the Williams County Zoning Ordinance.

8.9 Effect of Site on Cultural Resources

Wind turbines, access roads, and associated facilities will be sited to avoid archaeological sites and traditional cultural properties; historic resources have also been considered. If additional cultural resources are discovered, Aurora Wind will work with SHSND to avoid or mitigate impacts. Aurora Wind will prepare an Unanticipated Discoveries Plan, for approval by SHSND. The plan details a process for prompt communication and action regarding the discovery of previously unknown cultural resources

or human remains, should they be encountered during construction. See Section 6.7 for further discussion of cultural resource survey efforts and SHSND consultation.

8.10 Effect of Site on Biological Resources

Efforts would be made to avoid or minimize impacts to biological resources during and after construction. Wildlife impacts are anticipated to be minimal; however, the potential for avian and bat collisions with the wind turbines exists. The site is designed to minimize impacts to avian and bat species. Aurora Wind is committed to working with USFWS and NDGFD regarding potential mitigation measures for threatened and endangered species and other protected species.

9.0 AGENCY COMMENTS

On December 21, 2017, Burns & McDonnell distributed a scoping package to 36 local, state, and federal agencies and other interested parties, including all agencies and officers designated for notice pursuant to NDAC Section 69-06-01-05. In addition, a scoping package was sent to the Three Affiliated Tribes and the Turtle Mountain Band of Chippewa on March 13, 2018. These scoping packages provided information on the Project, including Project maps.[11] Responses received are summarized below. Appendix D provides copies of the scoping letter, mailing list, and responses.

9.1 U.S. Department of the Air Force – Minot Air Force Base North Dakota

In e-mail correspondence dated December 20, 2017, Minot Air Force Base stated it had reviewed the proposed Project and did not identify any proposed issues. The Minot Air Force Base requested that the Project be registered with the Department of Defense (DoD) Siting Clearinghouse.

As discussed further below, the Project initiated a DoD Siting Clearinghouse review. Additionally, the Project has filed 7460-1 Notice of Proposed Construction with the FAA for wind turbines on the Project Area and received Determinations of No Hazard for the entire Wind Project on September 25, 2018..

9.2 U.S. Department of Defense

In an e-mail dated January 8, 2018, the DoD Siting Clearinghouse indicated that it had received the scoping letter and requested additional location information needed to complete an Informal Review of the Project. Aurora Wind provided the requested location information and, per an e-mail from DoD dated January 18, 2018, and received an Informal Review response dated March 19, 2018. This response requested additional contact with the Chief of the NORAD Radar Interference Branch. This concluded the Informal Review by DoD. On July 16, 2018, Aurora Wind initiated formal review with the FAA, which includes formal review by the DoD Siting Clearinghouse.

9.3 U.S. Department of Defense – U.S. Army Corps of Engineers, North Dakota Regulatory Office

In a letter dated January 9, 2018, the USACE noted that it administers Section 404 of the CWA, which regulates the discharge of dredge or fill material in waters of the United States. The USACE also provided information regarding Nationwide Permit 12, Utility Line Activities. The USACE indicated that if a

[11] Due to refinement of the Project location, the current Project Area is only portion of the Project area depicted in the maps provided with the scoping packages.

Section 404 permit is required for the Project, then an application should be submitted to the North Dakota Regulatory Office.

The Project has completed a field assessment for wetlands under the USACE survey protocol. Information gathered during this field assessment was included in the Project design to avoid or minimize impacts to wetlands. If wetlands within the jurisdiction of the USACE cannot be completely avoided, the Project will obtain the appropriate permit from the USACE.

9.4 U.S. Department of Commerce – National Telecommunications and Information Administration

In response to a request made by Aurora Wind on May 1, 2018, the National Telecommunications and Information Administration (NTIA) provided information about the Project to the federal agencies represented in the Interdependent Radio Advisory Committee (IRAC). After a 45+ day review period, no agencies identified any concerns regarding radio frequency blockage. NTIA provided a letter to Aurora Wind on July 12, 2018, documenting this review.

9.5 U.S. Department of Interior – U.S. Fish and Wildlife Service

Aurora Wind is coordinating with the USFWS regarding federally regulated wildlife in the Project Area, as well as potential USFWS easement interests in the Project Area. The Project met with the USFWS on February 8, 2017 and again on August 16, 2018 to discuss the Project. In addition, the USFWS reviewed the overall proposed Project on August 23, 2018, and determined no easement protected wetlands or grasslands, or WPAs are impacted. The USFWS identified two areas on land subject to wetland easements that may or may not be actual wetlands which could potentially be impacted by an access road, collection line or crane path. It was requested once staking of access roads is complete, USFWS be permitted to review these sites in the field. A memo providing an update on Project surveys was also sent to USFWS on August 13, 2018, regarding implementation of Tier 2 and 3 actions as described in the USFWS Wind Energy Guidelines (WEG) and USFWS Eagle Conservation Planning Guidance (ECPG) and future efforts for the Project. As final design for the Wind Project is completed, the Project will continue to consult with USFWS on placement of facilities.

9.6 North Dakota Aeronautics Commission

In a letter dated March 12, 2018, the North Dakota Aeronautic Commission found two private and/or public use airports within the Project boundary, including the Tioga Municipal Airport in Tioga, North Dakota, and an unknown airport near Alamo, North Dakota. The North Dakota Aeronautics Commission recommended submitting FAA Form 7460-1 when the turbine locations have been finalized.

9.7 North Dakota Department of Health

In a letter dated January 9, 2018, the NDDH stated that it believes the environmental impacts from the proposed construction will be minor and can be controlled by proper construction methods. These methods included minimizing adverse effects to water bodies, obtaining a NDPDES storm water permit, and avoiding spills of materials that may have an adverse effect on groundwater quality. Included in the letter were NDDH's construction and environmental disturbance requirements. NDDH further stated that it owns no land in or adjacent to the Project Area, does not have any projects scheduled in the area, and it believes the Project is consistent with the State Implementation Plan for the Control of Air Pollution for the State of North Dakota.

If oil storage in excess of 1,320 gallons of petroleum products is located on-site, Aurora Wind will complete a SPCC plan. Project access roads and permanent facilities are designed to avoid existing water bodies, wetlands, and streams to the extent practicable. The Project will comply with EPA regulations regarding storm water runoff, including the creation of a SWPPP as administered by North Dakota. Aurora Wind will also comply with the requirements of the NDDH's construction and environmental disturbance requirements.

9.8 North Dakota Department of Trust Lands

In a letter dated January 12, 2018, the NDTL stated that common schools trust fund surface interests that are managed by the NDTL on behalf of the Board are present within the Project Area. The NDTL noted that it received Aurora Wind's application for a Wind Farm Easement Agreement in September 2016, and that a separate application would need to be submitted for the Transmission Line. The NDTL also stated that the Board would not move forward with completion of easement agreements until a site inspection and review has been completed, and all local and state approvals have been obtained.

As noted above, Aurora Wind has submitted an application to acquire the necessary easements covering the NDTL-managed parcels within the Wind Project Area. On April 2, 2018, NDTL sent letters to lessees notifying them of Aurora Wind's applications and that NDTL, in conjunction with Aurora Wind, would be conducting guided inspections for siting purposes during the upcoming field season.

In a letter dated April 4, 2018, NDTL notified Aurora Wind that it had received Aurora Wind's applications for a Wind Energy Easement Agreement and Electric Transmission Easement Agreement. NDTL further stated that the Board discussed the Project at its March 29, 2018, meeting. NDTL explained that, upon local, county, and state regulatory approval, the Board will consider a Wind Energy Easement Agreement and Electric Transmission Line Easement with Aurora Wind for the use of trust

land. The Board understands that Aurora Wind's applications for local, county, and state regulatory approval will include the NDTL tracts within the Project Area that it manages.

9.9 North Dakota Game & Fish Department

In a letter dated January 8, 2018, NDGFD stated that its primary concern with regard to wind development is disturbance of unbroken, native habitats. NDGFD recommended that these grasslands be avoided to the extent possible. NDGFD also recommended that any disturbance to wetlands that reduces the value and/or hydrological function be avoided to the extent possible, and that no alternations be made to existing drainage patterns. Additionally, NDGFD noted it had received a request from WEST, an environmental consultant for the Project, on January 2, 2018, for eagle nest and other sensitive species within 10 miles of the Project Area, and that its database contained no known locations of eagle nests or grouse leks. However, the NDGFD recommended conducting raptor nest and sharp-tailed grouse lek surveys within the Project Area. The NDGFD also recommended working with USFWS. Overall, based on its initial review, the NDGFD commended Aurora Wind and Tradewind on the Project having relatively low sensitive areas with respect to native habitats, but requested continued updates on the placement of facilities.

Aurora Wind conducted an aerial raptor nest survey for the Project Area, plus a one-mile buffer for all raptors and a 10-mile buffer for eagles in 2017 and 2018. No bald eagle nests were observed within the Project Area or associated buffers, and no federally-listed raptor species were observed nesting within the Project Area or buffers. The eagle assessment completed January 2018 indicated no eagle observations within the Project and no bald or golden eagle nests within the Project or within 10 miles per communication with NDGFD. The Project is lacking significant eagle habitat, use areas or migration concentration sites, but some potential habitat occurs in the open water/wetland complexes and herbaceous grasslands.

Sharp-tailed grouse lek surveys were conducted this spring, and the survey protocol was reviewed and approved by NDGFD. One lek was confirmed within the Project during the surveys, but only courtship behavior was observed during the second survey period. As discussed with USFWS and NDGFD in an August 16, 2018 meeting, Aurora Wind has moved turbine locations to be more than one mile from the identified lek location. This information has been and will continue to be used, in siting and assessing impact from development and operation of the proposed Project.

A memo providing an update on Project surveys was also sent to NDGFD on August 13, 2018 regarding implementation of Tier 2 and 3 actions as described in the USFWS WEG and USFWS ECPG and future

efforts for the Project. The Project met with the NDGFC on February 8, 2017 and again on August 16, 2018 to discuss the Project. The USFWS and NDGFD agreed that the overall Project was well sited during an August 16, 2018, meeting.

9.10 North Dakota State Water Commission

In a letter dated January 10, 2018, the NDSWC stated that: initial review indicates water appropriation permits are not required, and recommended consultation with the Water Appropriations Division of the Office of the State Engineer if surface water or groundwater would be diverted for Project construction; observation wells are located across the state, and the NDSWC should be contacted if a well is encountered during Project activities and must be removed; and no identified or mapped floodplains are present in the Project Area. Aurora Wind requested the observation well data from the NDSWC and has incorporated this data into Project design.

9.11 North Dakota Industrial Commission – Oil and Gas Division

In a letter dated January 19, 2018, the Oil & Gas Division of the North Dakota Industrial Commission provided a GIS shapefile identifying 79 wells in the combined Project and associated transmission line vicinity. The GIS shapefile well data has been accounted for in the Project design. In addition, Aurora Wind filed a one-call locate ticket with the North Dakota One-Call System in March 2018 to confirm the location of surface and subsurface infrastructure in the vicinity of the Project and coordinate with infrastructure owners. Electronic and verbal communications with local infrastructure owners is ongoing and additional data continues to be collected as well as incorporated into the design. Information received as of May 7, 2018, has been incorporated into the preliminary design. An on-site meeting will also be conducted with Project representatives and local infrastructure owners.

9.12 North Dakota Department of Transportation

In a letter dated January 24, 2018, the NDDOT stated that the Project should have no adverse effect on NDDOT highways. It noted that appropriate permits and risk management documents must be obtained if any work needs to be done on NDDOT highway right-of-way.

9.13 North Dakota Geological Survey

In a letter dated January 8, 2018, the North Dakota Geological Survey (NDGS) stated that it does not have any properties under ownership or of interest in the Project Area. NDGS also stated that a few localized landslide areas have been identified in the vicinity of the Project Area and they provided information on where landslide maps and additional data can be obtained on its website. Aurora Wind requested the above information and confirmed the localized landslide areas are outside the Project Area.

9.14 State Historical Society of North Dakota

In a letter dated January 3, 2018, the SHSND recommended that a Class I Cultural Resource File Search, a Class III Archaeological Survey and a Class II Architectural Survey be completed for the Project. Project representatives met with SHSND staff on January 23, 2018, to discuss the scope of recommended surveys for the Project.

The Project has completed a Class I Cultural Resource File Search and will complete the Class III Archaeological Survey and Class II Architectural History Survey prior to construction. Aurora Wind will submit the results of all surveys to the SHSND for review and concurrence on the findings. Aurora Wind will prepare an Unanticipated Discoveries Plan. The Plan will detail a process for prompt communication and action regarding the discovery of previously unknown archaeological resources or human remains, should they be encountered during construction.

9.15 Williams County

Pursuant to Section 2-2-14(2) of the Williams County Zoning Ordinance and Subdivision Regulations, high voltage electrical lines located in the Agricultural District are a conditional use requiring a permit. Aurora Wind submitted an application for a Conditional Use Permit (CUP) with variances to the Williams County Planning and Zoning Administrator on May 10, 2018. On June 21, 2018, Aurora Wind presented the Project to the Williams County Planning and Zoning Commission and answered questions from both the public and the Williams County Planning and Zoning Commission. The Williams County Planning and Zoning Commission recommended to the Williams County Board of County Commissioners (Williams County Commissioners) that the Project be approved. On July 2, 2018, Aurora Wind presented the Project to the Williams County Commissioners and answered questions from both the public and the Williams County Commissioners. The Williams County Commissioners voted to approve Aurora Wind's application and granted a CUP with variances as requested (Appendix C, Williams County CUP).

9.16 City of Tioga

Aurora Wind provided the City of Tioga with information concerning the Project in a letter dated April 10, 2018. Aurora Wind noted that the Project is approximately 6.7 miles from the City of Tioga. As of September 26, 2018, Aurora Wind has not received further correspondence from the City of Tioga.

In addition, Aurora Wind and/or Williams County has provided or will provide information concerning the Project to townships within the Project Area. Aurora Wind met with representatives of Big Stone, Big Meadow, Hazel, and South Meadow Townships in January 2018. A letter of support was provided by

South Meadow Township to Aurora Wind and Williams County. Aurora Wind will continue coordination with all townships within the Project going forward.

Aurora Wind also met with representatives from the Tioga Airport Authority on January 24, 2018, to discuss the Project. At the meeting, the representative of the Tioga Airport Authority reviewed the Project boundary map showing the proposed location of the Project. In a letter signed by the president of the Tioga Airport Authority on March 19, 2018, the Tioga Airport Authority confirmed that it did not have any formal objection to the Project as long as the FAA determined there is no impact to the Tioga Airport's current approach paths or operations.

9.17 Community Meetings

Project representatives held landowner informational meetings on June 21, 2016 at the Neset Consulting Service building in Tioga, North Dakota and January 22, 2018, in Ray, North Dakota. A community informational meeting was held on January 23, 2018, in Ray, North Dakota. Project details were on display, and Project representatives were available to answer questions. Community outreach will continue throughout Project development.

In addition, the Project permitted six temporary METs in Williams County in 2016 which included a presentation and hearing in front of the Williams County Planning and Zoning Commission on November 17, 2016 and the Williams County Commissioners on December 6, 2016. As part of this process, public notifications were published in advance of both hearings. The Williams County Commissioners approved CUPs for the temporary METs on December 6, 2016.

10.0 QUALIFICATIONS OF CONTRIBUTORS TO SITING STUDY

Table 10-1 identifies the contributors to this siting study and their qualifications.

Table 10-1: Qualifications of Contributors

Name and Project Role	Education and Professional Experience
Dave Iadarola	Dave Iadarola has over 10 years of experience working in the energy industry. He has developed over 1,000 MW's of energy projects across the United States, India and Philippines since 2006. Dave Iadarola has a Masters in Public Administration from the University of Colorado and Bachelor of Arts in Political Science and Economics from Colorado State University.
Jennifer Dean	Jennifer Dean has over 11 years of experience working in the wind and renewable energy industry and over 15 years in the environmental field. She has been managing permitting and environmental work for Tradewind Energy, Inc. since 2007 including coordinating with federal, state and local agencies regarding wildlife and permitting requirements. Jenni has a B.S. in Environmental Biology from Emporia State University.
Jonathan Dimitriou, EIT Project Engineer Tradewind Energy, Inc.	Jonathan Dimitriou has 3 years of engineering experience relating to the utility and renewables industries. His experience includes design and engineering of transmission power line facilities, siting and design of early stage wind project facilities, acquisition of construction permits, and logistical planning of engineering related deliverables. Jonathan has a Bachelor of Science in Civil Engineering from Iowa State University.
Brandon Storm, PhD, Senior Meteorologist, Tradewind Energy, Inc.	Dr. Brandon Storm has over 10 years of experience working in the wind energy industry. He has prepared sound and shadow flicker studies for several regulatory bodies and used to conduct training courses for the windPRO software, which is used to analyze sound and shadow flicker. Dr. Storm has a PhD in Wind Science and Engineering from Texas Tech University, a Master of Science in Geosciences from University of Nebraska-Lincoln, and Bachelor of Science in Atmospheric Science from Iowa State University.
Justin Bailey Project Manager Burns & McDonnell	Justin Bailey has 16 years of experience participating in, leading, and coordinating complex environmental field and permitting efforts with a focus in wetland science and mitigation. He has managed environmental studies and permitting efforts for wind projects throughout the Midwest and Great Plains since 2007. Justin has a B.S. in Environmental Science and Policy from Drake University.
Jennifer Bell Siting Specialist Burns & McDonnell	Jennifer Bell has 11 years of experience conducting environmental studies and permitting for a wide variety of projects. She has prepared state public utilities commission siting applications for multiple power generation and electric transmission projects. Jennifer has a B.S. in Environmental Studies from the University of Kansas and a Master of Urban and Regional Planning from Portland State University.

Name and Project Role	Education and Professional Experience
Crystal Bravo-Cogar, Environmental Specialist, Burns & McDonnell	Crystal Bravo-Cogar has 17 years of environmental consulting experience performing field surveys, monitoring, and review/preparation of environmental documents and reports. She has conducted these activities for a variety of projects including transmission lines, solar and wind energy, water infrastructure, and telecommunications. Crystal has a B.A. in Biology from West Virginia University.
Ryann Williams, Environmental Specialist, Burns & McDonnell	Ryann Williams has 8 years of experience in various environmental fields including wetland delineations, remote sensing and Geographic Information Systems (GIS), groundwater sampling and statistical analysis of hazardous waste, and geologic mapping. Ryann has led wetland delineations and prepared reports and documents for wetland permitting for the past 4 years, working mostly with wind farms, pipelines, and transmission lines. Ryann has a B.S. in Geology from the University of Missouri – Kansas City.
Mark Latham Cultural Resource Specialist Burns & McDonnell	Mark Latham has 28 years of cultural resources consulting experience performing field surveys, National Register of Historic Places evaluations, data recovery excavations, construction monitoring, tribal consultation, archival studies and reviews, and review/preparation of cultural resources documents and reports. He has conducted these investigations and services for a wide variety of projects including transmission lines, power generation facilities, wind energy, highway/road construction, and various other linear utilities. Mark has a B.A. in History from Sterling College and a M.A. in Anthropology from Wichita State University.
Clayton Derby, Chief Operating Officer	Clayton Derby is the Chief Services Officer and a Senior Manager at Western EcoSystems Technology, Inc. Clayton has been a consultant and involved in wind/wildlife related projects for over 23 years. During this time, he has been involved in approximately 30 wind energy projects in North Dakota. Clayton has a Bachelor's degree in biology from Moorhead State University and a Master's degree in Zoology and Physiology from the University of Wyoming.
Mollie Smith Attorney at Law Fredrikson & Byron, P.A.	Mollie Smith assists clients with wind farm, transmission line, and pipeline permitting matters in North Dakota, South Dakota, and Minnesota. At the state level, Mollie represents clients in certificate of corridor compatibility, route permit, certificate of site compatibility and rulemaking proceedings before the North Dakota Public Service Commission; energy facility permit proceedings before the South Dakota Public Utilities Commission; and certificate of need, route permit and site permit proceedings before the Minnesota Public Utilities Commission. At the local level, Mollie advises and assists clients with a variety of permitting-related matters, including obtaining conditional use/special exception permits, variances and subdivision approvals, and participating in zoning ordinance amendment processes. Mollie has a B.A. in English from Northern State University, Aberdeen, SD; a M.A. in Literature from Colorado State University, Fort Collins, CO; and a J.D. from the University of Minnesota Law School, Minneapolis, MN.

11.0 REFERENCES

Burns & McDonnell and WEST, Inc. 2018. *Environmental Study Report -Aurora Wind Project, LLC, Williams County, North Dakota*. 46 pp.

Carreker, R. G. 1985. Habitat suitability index models: least tern. Biol. Report 82 (10.103), USFWS, Washington, D.C.

CivicDashboards. 2018. *Rental Vacancy Rate for Williams County, North Dakota*. Accessed online August 23, 2018 at: http://www.civicdashboards.com/county/williams-county-nd-05000US38105/rental_vacancy_rate.

Comsearch. 2018. *Wind Power GeoPlanner – Land Mobile & Emergency Services Report*: Aurora Wind Project. May 3, 2018. 10pp.

DOE. WINDExchange. 2010. North Dakota 80-meter Wind Resource Map. Accessed online at: https://windexchange.energy.gov/files/u/visualization/pdf/nd_80m.pdf.

Dyke, S. R., S. K. Johnson, and P.T. Isakson. 2015. *North Dakota State Wildlife Action Plan*. North Dakota Game and Fish Department. Bismarck, North Dakota. Available online at: https://gf.nd.gov/wildlife/swap.

EPA. 2016. EPA Sole Source Aquifers – Publicly Available Data. October 14, 2016. Accessed online at: https://www.epa.gov/dwssa.

FAA. 2015. *Obstruction Marking and Lighting*. Advisory Circular - U.S. Department of Transportation. December 04, 2015. Accessed online September 10, 2018 at: https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_70_7460-1L_.pdf.

Fortin, Patricia, et al. 2013. *Wind Turbines and Health.* Accessed online at: http://www.ncceh.ca/sites/default/files/Wind_Turbines_Feb_2013.pdf.

Gillam, E. and M. Barnhart. 2010. *Distribution and Habitat Use of the Bats of North Dakota*. Final Report. North Dakota State University, Department of Biological Sciences. Fargo, ND. 42 pp.

Griffith, G. 2010. Level III North American Terrestrial Ecoregions: United Stated Descriptions. Prepared for North American Commission for Environmental Cooperation.

Harvey, M. J., J.S. Altenbach, and T.L. Best. 2011. *Bats of the United States and Canada*. Baltimore: Johns Hopkins University Press.

Layne, Jason. 2017. *2017 Acoustic Bat Monitoring Survey Summary for the Aurora Wind Project, Williams and Mountrail Counties, North Dakota*. Letter report dated December 12, 2017.

Lazard. 2017. Levelized Cost of Energy Analysis Version 11.0. November 2017. https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf.

Moratz, K., T. Thorn, and C. Derby. 2018. Baseline Wildlife Studies, Aurora Wind Energy Project, Williams and Mountrail counties, North Dakota. *2018 Sharp-Tailed Grouse Lek Surveys*. Final

Report. Prepared for Aurora Wind Project, LLC. Prepared by WEST, Bismarck, North Dakota. August 3, 2018.

NRCS. 2017a. USDA, Geospatial Data Gateway. Retrieved from: https://datagateway.nrcs.usda.gov/.

NRCS. 2017b. USDA. Web Soil Survey. Accessed online August 2018 at: http://websoilsurvey.nrcs.usda.gov/.

NatureServe. 2017. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: April 26, 2018).

NDDOT. 2017. Traffic Information and Counts. 2017 Traffic Counts. Accessed online at: https://gis.dot.nd.gov/external/ge_html/?viewer=ext_transinfo.

Pardieck, K.L., D.J. Ziolkowski Jr., M. Lutmerding and M.A.R. Hudson. 2018. North American Breeding Bird Survey Dataset 1966 - 2017, version 2017.0. U.S. Geological Survey, Patuxent Wildlife Research Center. https://doi.org/10.5066/F76972V8.

Reid, F.A. 2006. *Mammals of North America*. Boston: Houghton Mifflin Company.

Statistical Atlas. 2015. Industries in Williams County, North Dakota. Last updated April 17, 2015. Accessed online August 23, 2018 at: https://statisticalatlas.com/county/North-Dakota/Williams-County/Industries.

USACE. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

U.S. Census Bureau. 2017. American Fact Finder, Williams County, North Dakota. Accessed online August 22 at: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

USDA. 2014. *2012 Census of Agriculture*. USDA Census of Agriculture. May 2, 2014. Accessed online August 2018 at: https://agcensus.usda.gov/Publications/2012/#subject_series.

USDA. 2017. Imagery Programs - National Agriculture Imagery Program. USDA, FSA, Aerial Photography Field Office, Salt Lake City, Utah. Accessed November 2017. Information online: https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/index.

USDA. National Agricultural Statistics Program. 2017. Cropland Data Layer. North Dakota Cropland Data Layer. Retrieved from http://nassgeodata.gmu.edu/CropScape/.

USFWS. 2012. *Land-Based Wind Energy Guidelines*. U.S. Department of Interior, USFWS. 82 pp. http://www.fws.gov/windenergy/.

USFWS. 2013. *Species of Habitat Fragmentation Concern*. North Dakota Field Office, Mountain- Prairie Region, USFWS. Updated February 19, 2013. Available online at: http://www.fws.gov/northdakotafieldoffice/species_of_habitat_fragmentation.htm.

USFWS. 2015. Endangered and Threatened Wildlife and Plants; *Threatened Species Status for the Northern Long-Eared Bat with 4(d) Rule*. Docket No. FWS-R5-ES-2011-0024. 80 Federal Register No 63. April 2, 2015.

USFWS. 2016a. National Wetlands Inventory website. U.S. Department of the Interior, USFWS, Washington, D.C. Accessed online at: http://www.fws.gov/wetlands/.

UFWS. 2016b. Species by County Report. Environmental Conservation Online System (ECOS). Accessed December 2016. Williams County report available online at: https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=38105.

WEST. 2017. *Site Characterization Study for the Aurora Wind Energy Project, Williams County, North Dakota*. Prepared for Tradewind Energy, Lenexa, Kansas. Prepared by WEST, Bismarck, North Dakota. August 25, 2017.

APPENDIX A - EXHIBITS

APPENDIX B - AURORA WIND TEN-YEAR PLAN

APPENDIX C - WILLIAMS COUNTY CUP

APPENDIX D - AGENCY SCOPING PACKAGE AND RESPONSES

APPENDIX E - MICROWAVE PATH ANALYSIS

APPENDIX F - LAND MOBILE & EMERGENCY SERVICES REPORT

APPENDIX G - OFF-AIR TV ANALYSIS

APPENDIX H - COMMUNICATION TOWER STUDY

APPENDIX I - AM AND FM RADIO REPORT

APPENDIX J - SOUND AND SHADOW FLICKER ANALYSIS REPORT

APPENDIX K WETLAND DELINEATION SUMMARY

APPENDIX L - SITE CHARACTERIZATION STUDY

APPENDIX M - AVIAN USE STUDY REPORT

APPENDIX N - 2017 RAPTOR NEST SURVEY REPORT

APPENDIX O - STAGE I EAGLE ASSESSMENT

APPENDIX P - 2018 SHARP-TAILED GROUSE LEK SURVEYS: FINAL REPORT

APPENDIX Q - 2017 ACOUSTIC BAT REPORT SUMMARY

APPENDIX R - WHOOPING CRANE HABITAT ASSESSMENT

APPENDIX S – POLICIES AND COMMITMENTS STATEMENT

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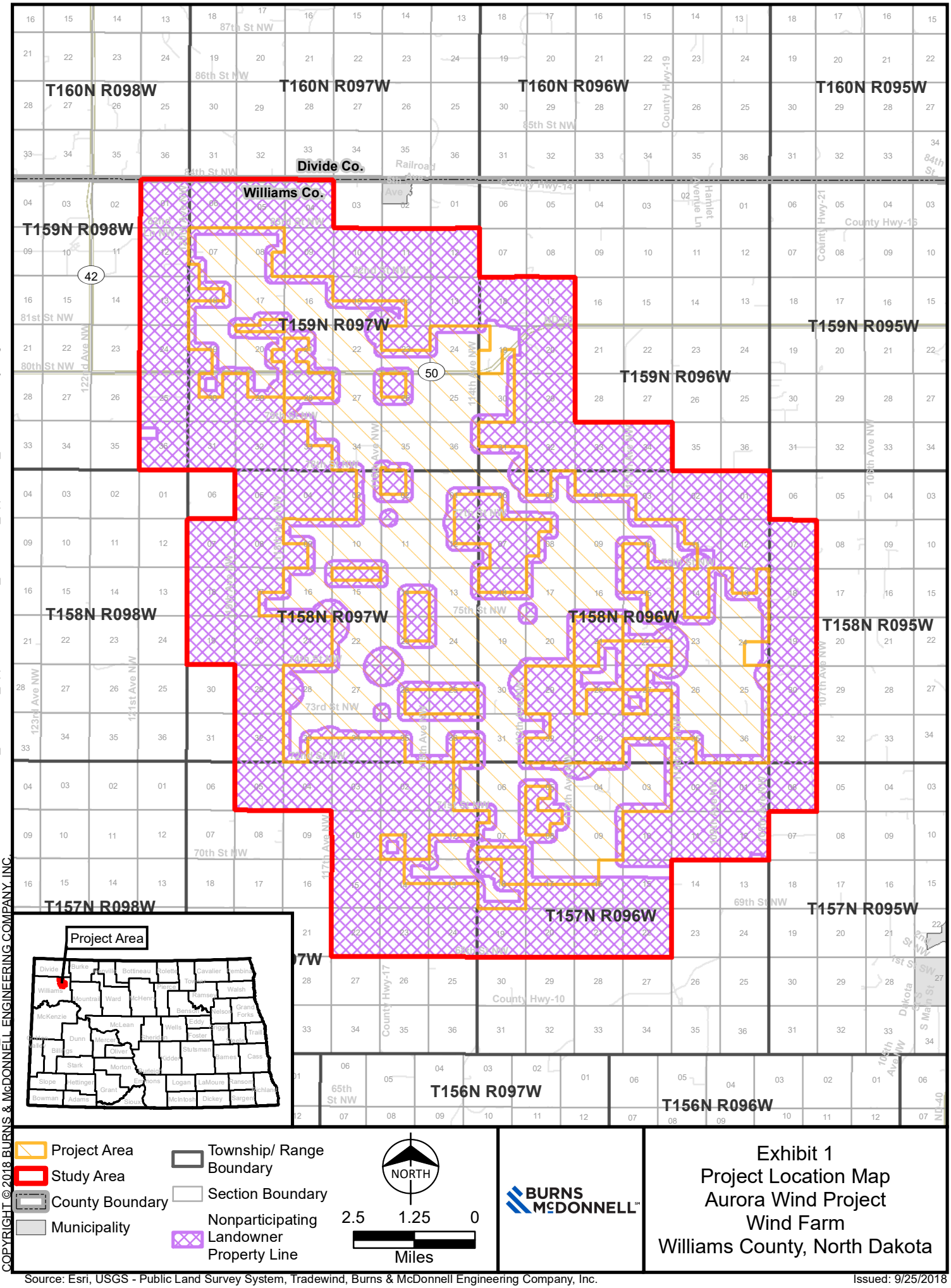

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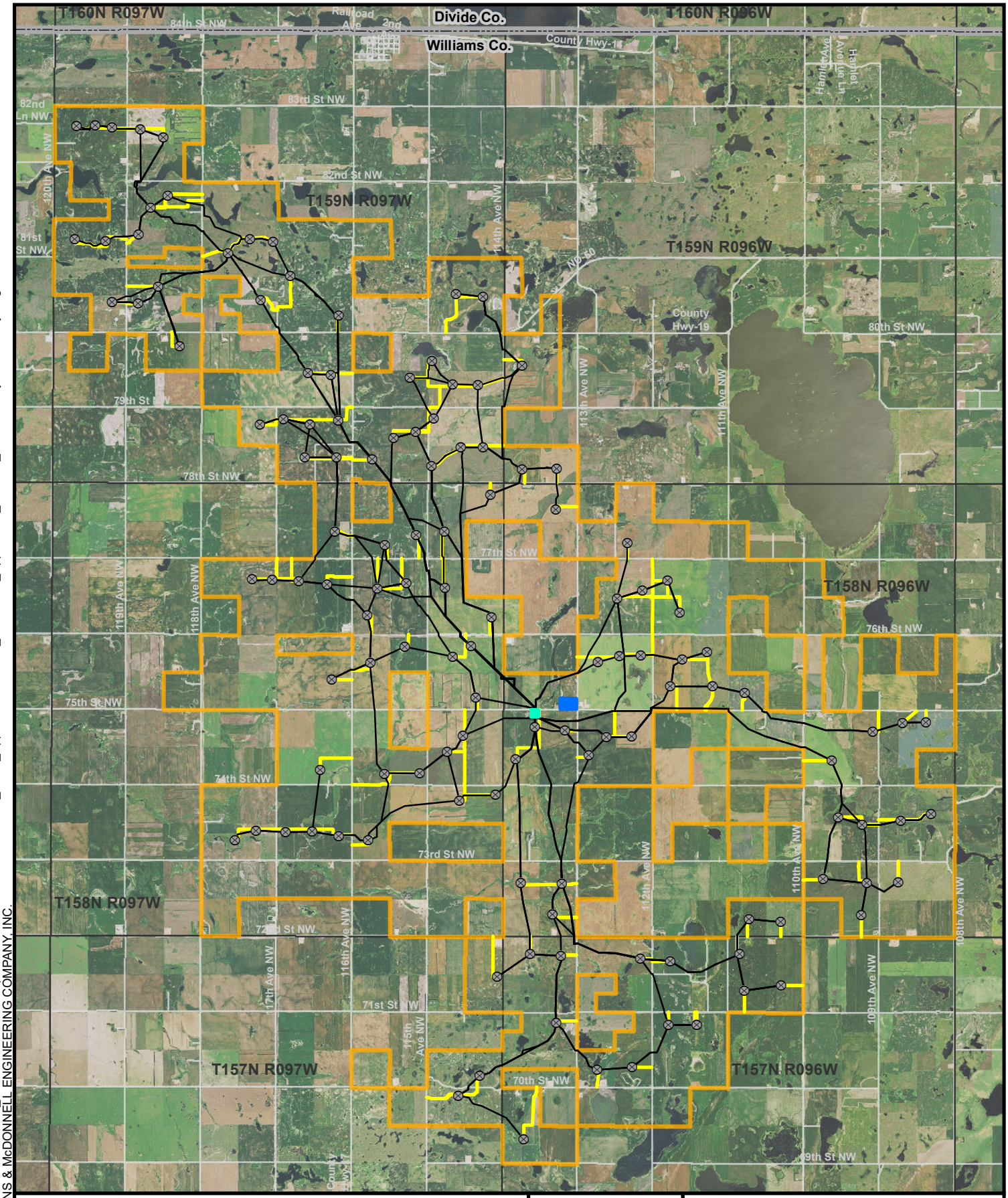

Turbine
Project Area
Collection Line
Access Road
Laydown Yard
Substation

Township/Range Boundary
County Boundary

NORTH

Turbines are not to scale

0 4,500 9,000
Feet

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Exhibit 2
Facilities Layout
Aurora Wind Project
Wind Farm
Williams County, North Dakota

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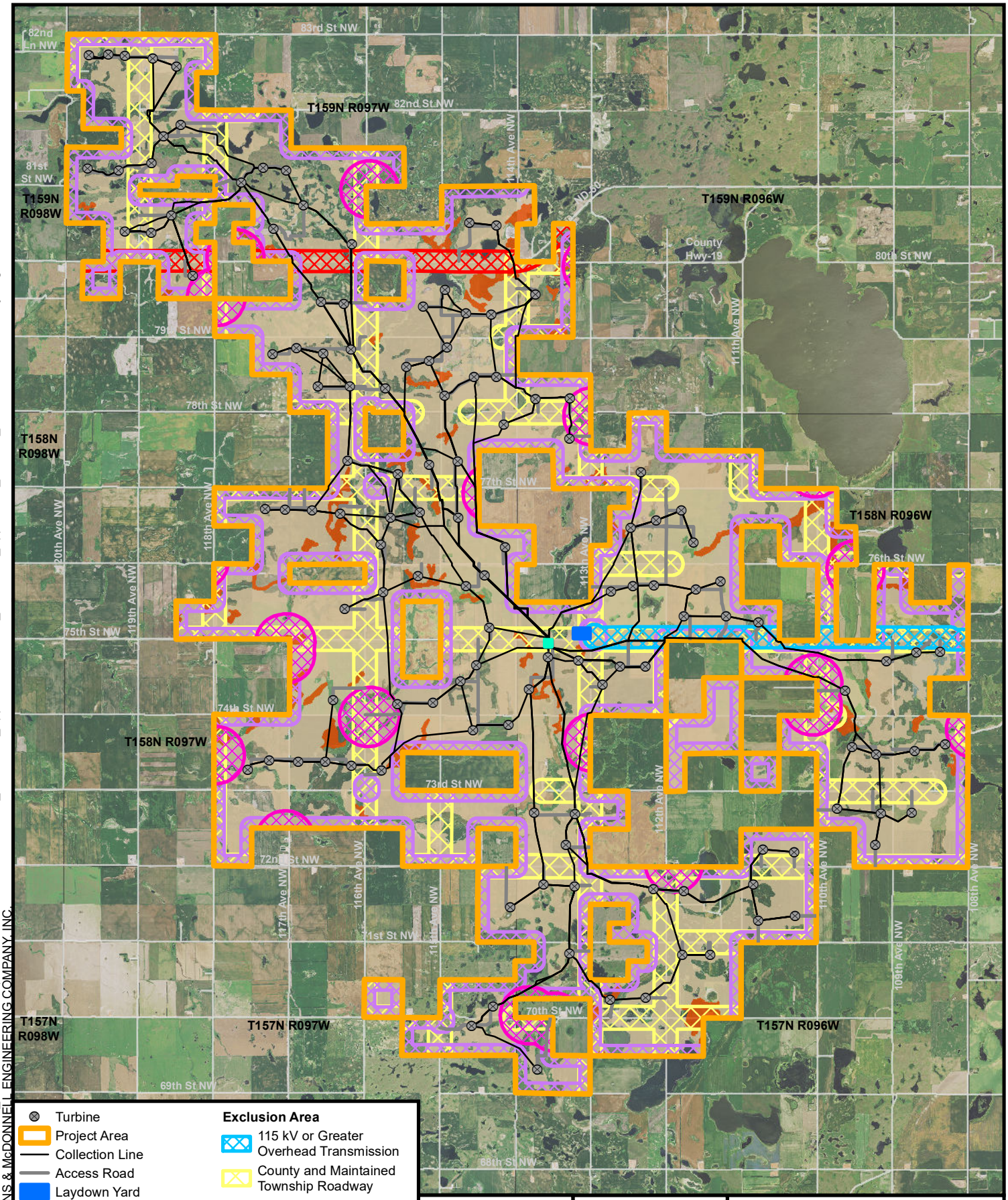

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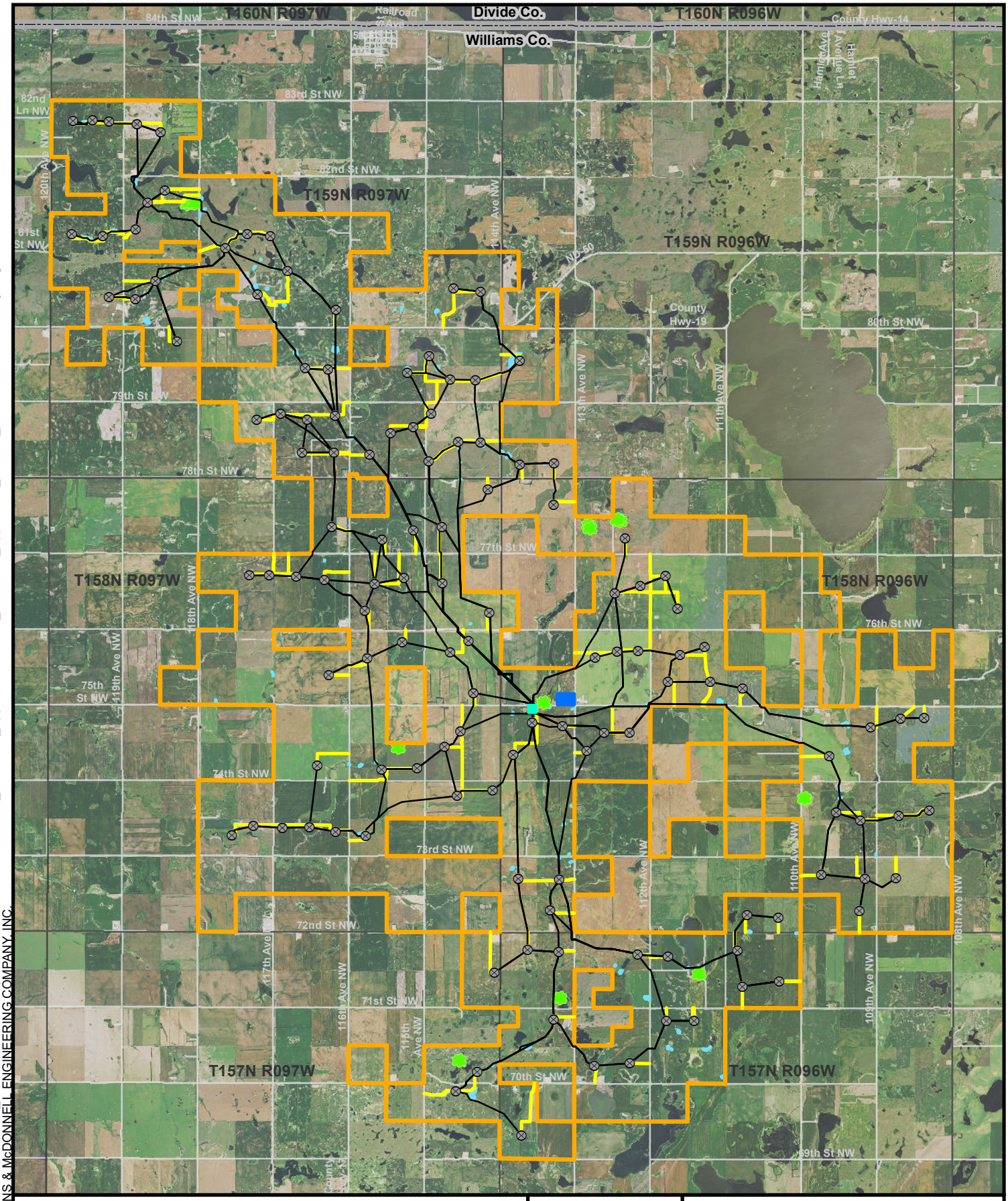
T160N R097W
T160N R096W
Divide Co.
Williams Co.
T159N R097W
T159N R096W
T158N R097W
T158N R096W
T157N R097W
T157N R096W
84th St NW
83rd St NW
82nd St NW
81st St NW
82nd Ln NW
120th Ave NW
114th Ave NW
ND-50
County Hwy-14
Hamlet Avenue
Hamlet Avenue Ln
County Hwy-19
80th St NW
79th St NW
78th St NW
77th St NW
76th St NW
75th St NW
74th St NW
73rd St NW
72nd St NW
71st St NW
70th St NW
69th St NW
113th Ave NW
111th Ave NW
118th Ave NW
119th Ave NW
112th Ave NW
110th Ave NW
108th Ave NW
117th Ave
116th Ave NW
115th Ave NW
109th Ave NW
County Hwy-13
Turbine
Project Area
Collection Line
Access Road
Laydown Yard
Substation
County Boundary
Township/Range Boundary
Woodland
Wetland
NORTH
0
4,500
9,000
Feet
Turbines are not to scale
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Exhibit 4
Avoidance Areas
Aurora Wind Project
Wind Farm
Williams County, North Dakota
Path: Z:\Clients\ENS\TradewindEnr\104200_Aurora\Studies\Geospatial\DataFiles\ArcDocs\NDPSC_WindFarm_Application\NDPSC_WindFarm_Application_Exhibit4_Avoidance Areas.mxd jdringman 9/26/2018
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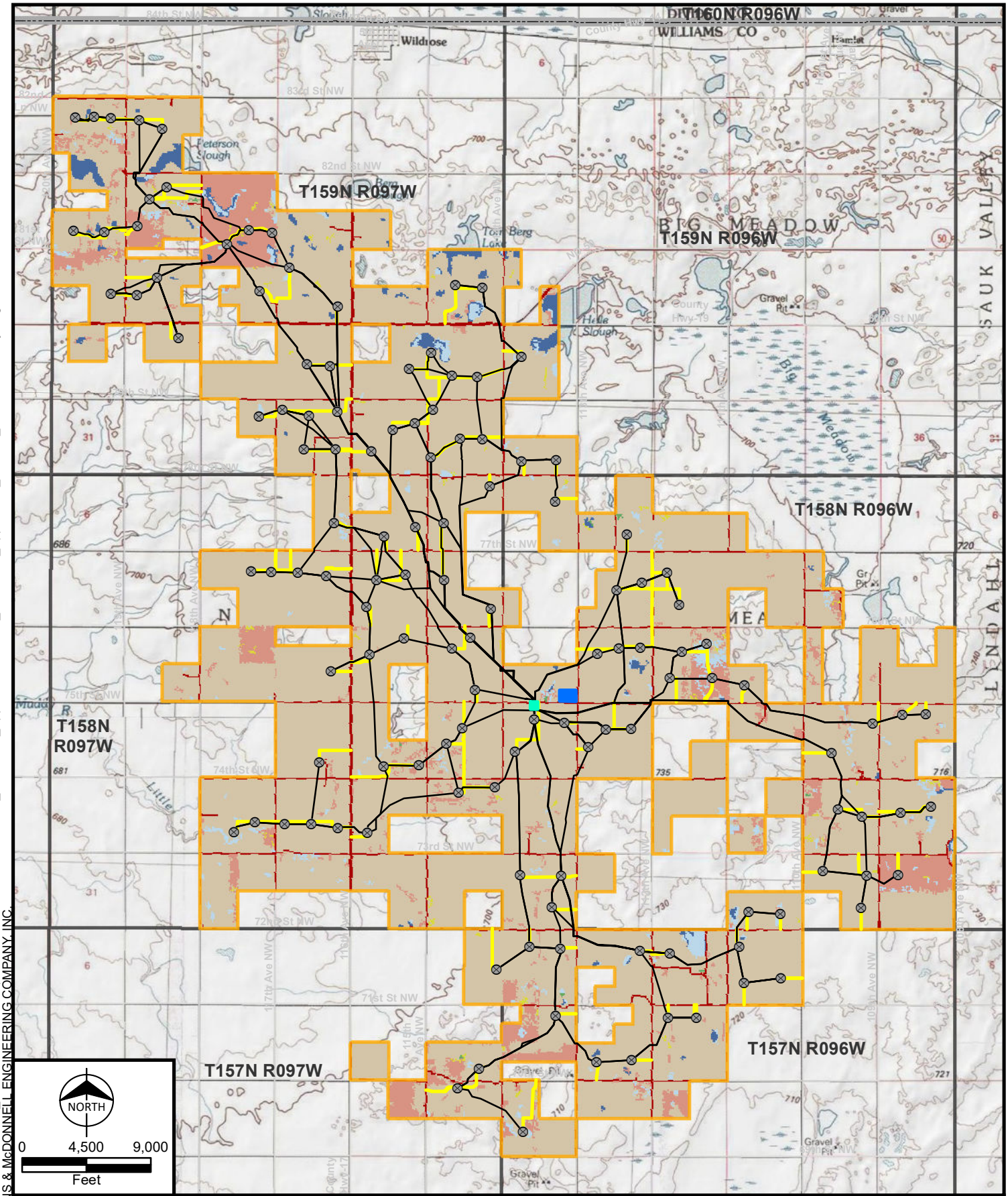

Turbine
Project Area
Collection Line
Access Road
Laydown Yard
Substation
Cultivated Crops
Woodland
Developed
Wetland
Grassland
Water
Shrubland
County Boundary
Township/Range

Turbines are not to scale

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Exhibit 5
Land Use
Aurora Wind Project
Wind Farm
Williams County, North Dakota

Source: Esri, NLCD, NASS, Tradewind, Burns & McDonnell Engineering Company, Inc.

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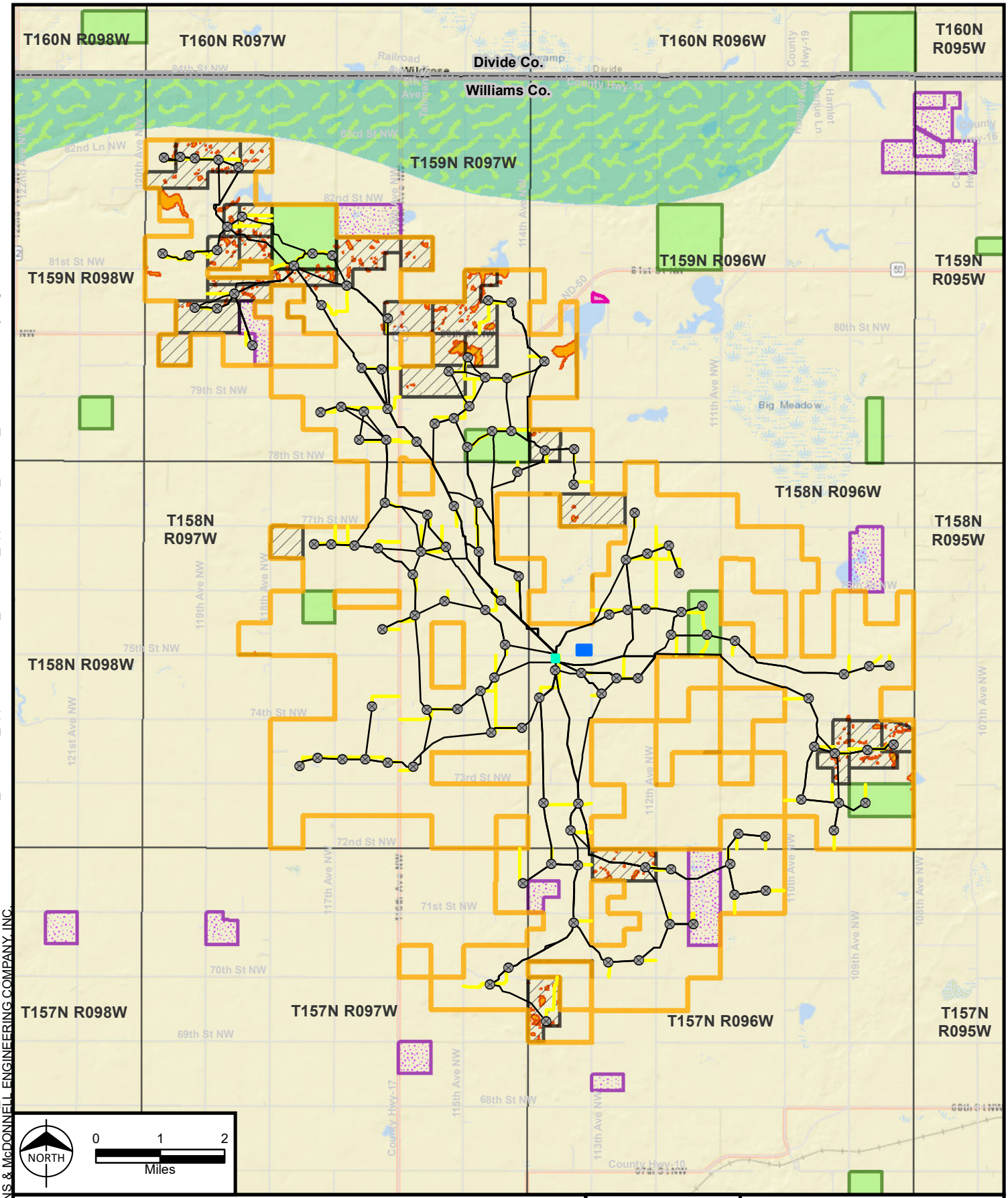

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Exhibit 6
Public Lands and Easements
Aurora Wind Project
Wind Farm
Williams County, North Dakota

Source: Esri, USGS, USFWS, NDGFD, Tradewind, Burns & McDonnell Engineering Company, Inc.

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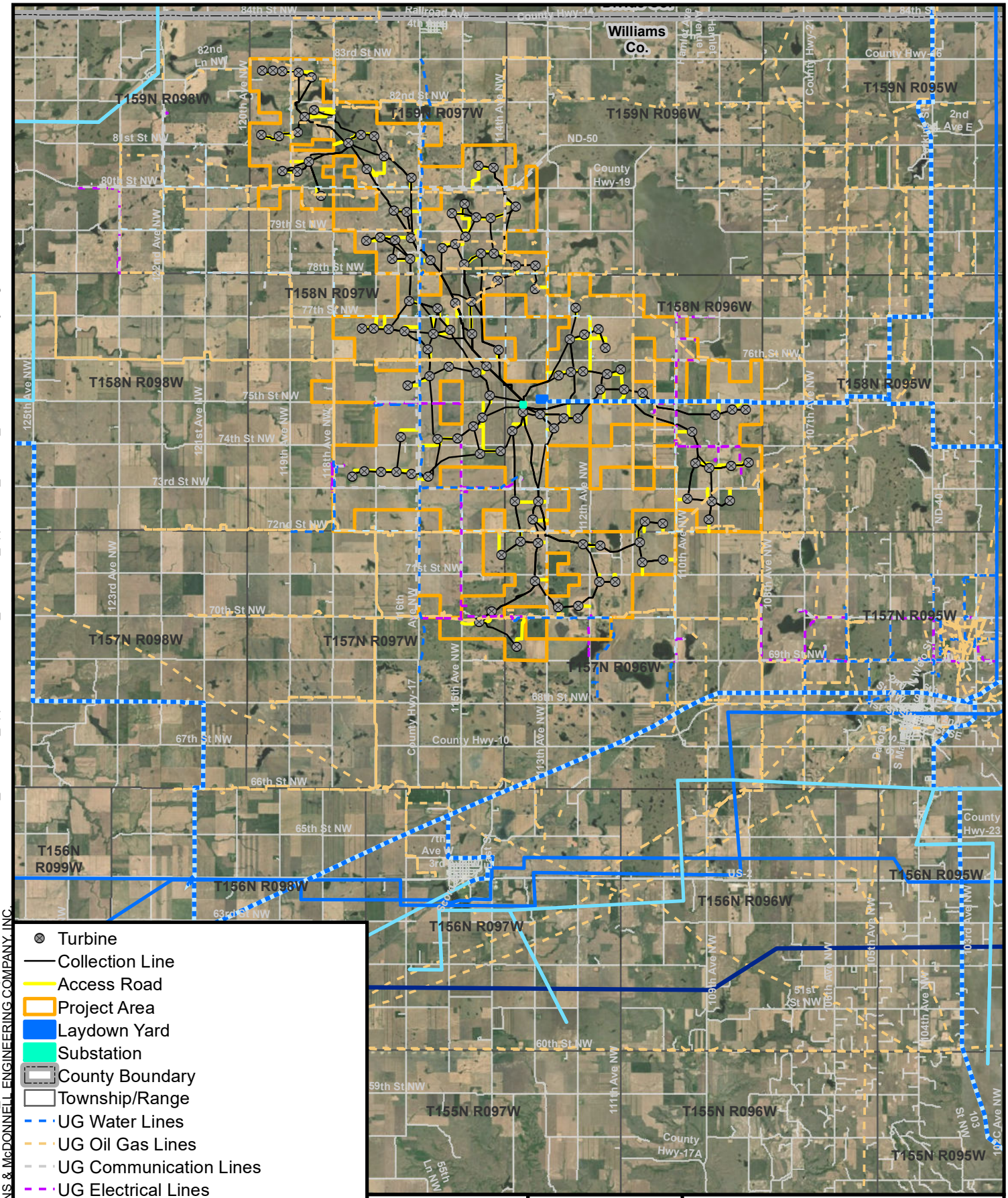
Williams Co.
T159N R098W
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T156N R098W
T156N R097W
T156N R096W
T156N R095W
T155N R097W
T155N R096W
T155N R095W
County Hwy-10
County Hwy-17
County Hwy-19
County Hwy-23
ND-50
ND-46
US-2
84th St NW
83rd St NW
82nd St NW
81st St NW
80th St NW
79th St NW
78th St NW
77th St NW
76th St NW
75th St NW
74th St NW
73rd St NW
72nd St NW
71st St NW
70th St NW
69th St NW
68th St NW
67th St NW
66th St NW
65th St NW
63rd St NW
60th St NW
59th St NW
51st St NW
120th Ave NW
114th Ave NW
107th Ave NW
125th Ave NW
121st Ave NW
119th Ave NW
118th Ave NW
112th Ave NW
110th Ave NW
106th Ave NW
123rd Ave NW
116th Ave NW
115th Ave NW
113th Ave NW
109th Ave NW
108th Ave NW
104th Ave NW
103rd Ave NW
111th Ave NW
82nd Ln NW
55th Ln NW
2nd Ave E
7th Ave W
3rd St W
Railroad Ave
4th St W
Hamlet Ave
Hamlet St
Parkins St
S Main St
S Dakota St
S Mesa Dr
Dakota Dr SE
Turbine
Collection Line
Access Road
Project Area
Laydown Yard
Substation
County Boundary
Township/Range
UG Water Lines
UG Oil Gas Lines
UG Communication Lines
UG Electrical Lines
Overhead Distribution Lines
Overhead Transmission Lines
< 115 kV
115 kV
230 kV
345 kV
Turbines are not to scale
NORTH
0
1.5
3
Miles
BURNS McDONNELL
Exhibit 7
Infrastructure
Aurora Wind Project
Wind Farm
Williams County, North Dakota
Path: Z:\Clients\ENS\TradewindEnr\104200_Aurora\Studies\Geospatial\DataFiles\ArcDocs\NDPSC_WindFarm_Application\NDPSC_WindFarm_Application_Exhibit7_Infrastructure.mxd jdringman 9/26/2018
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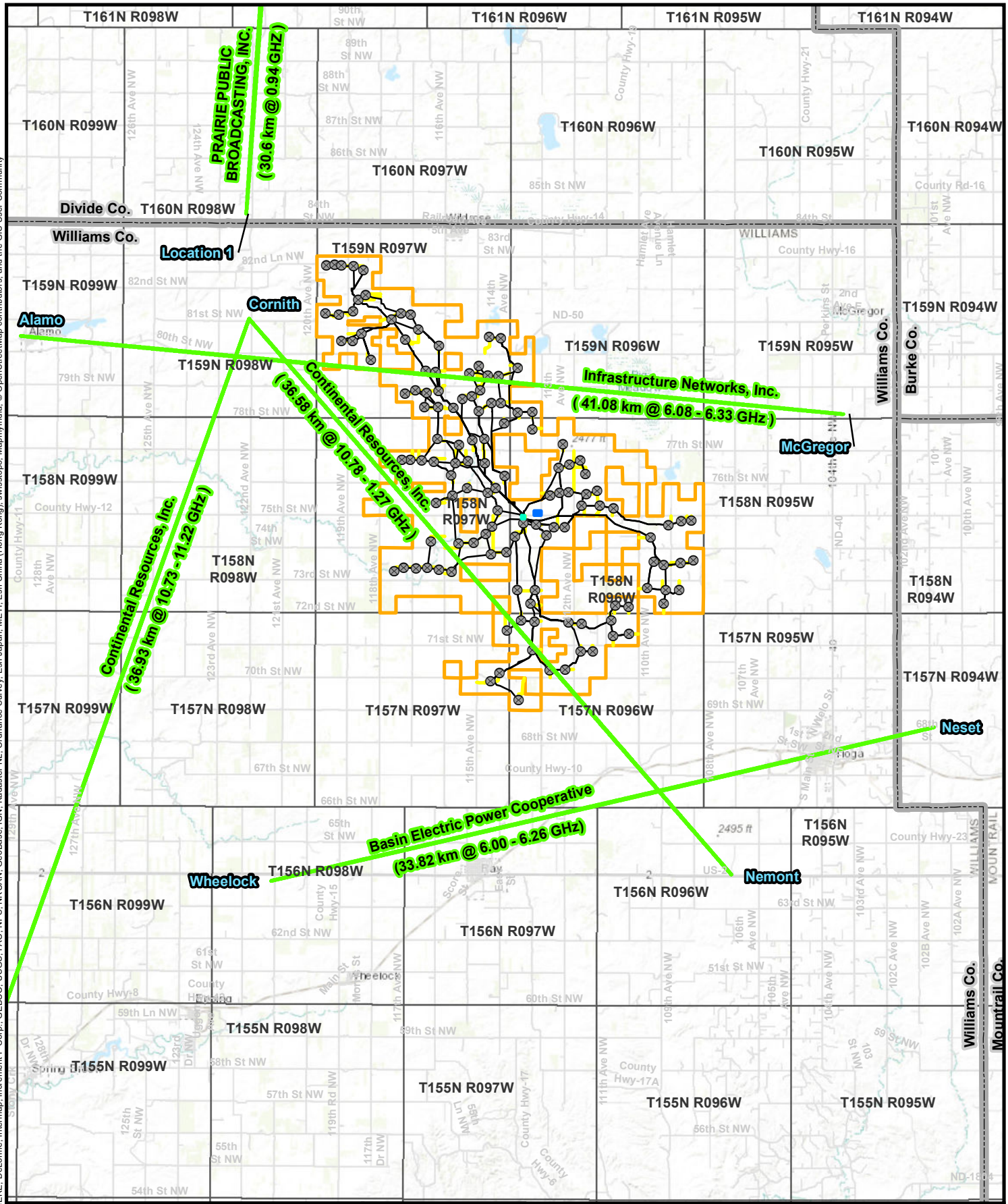

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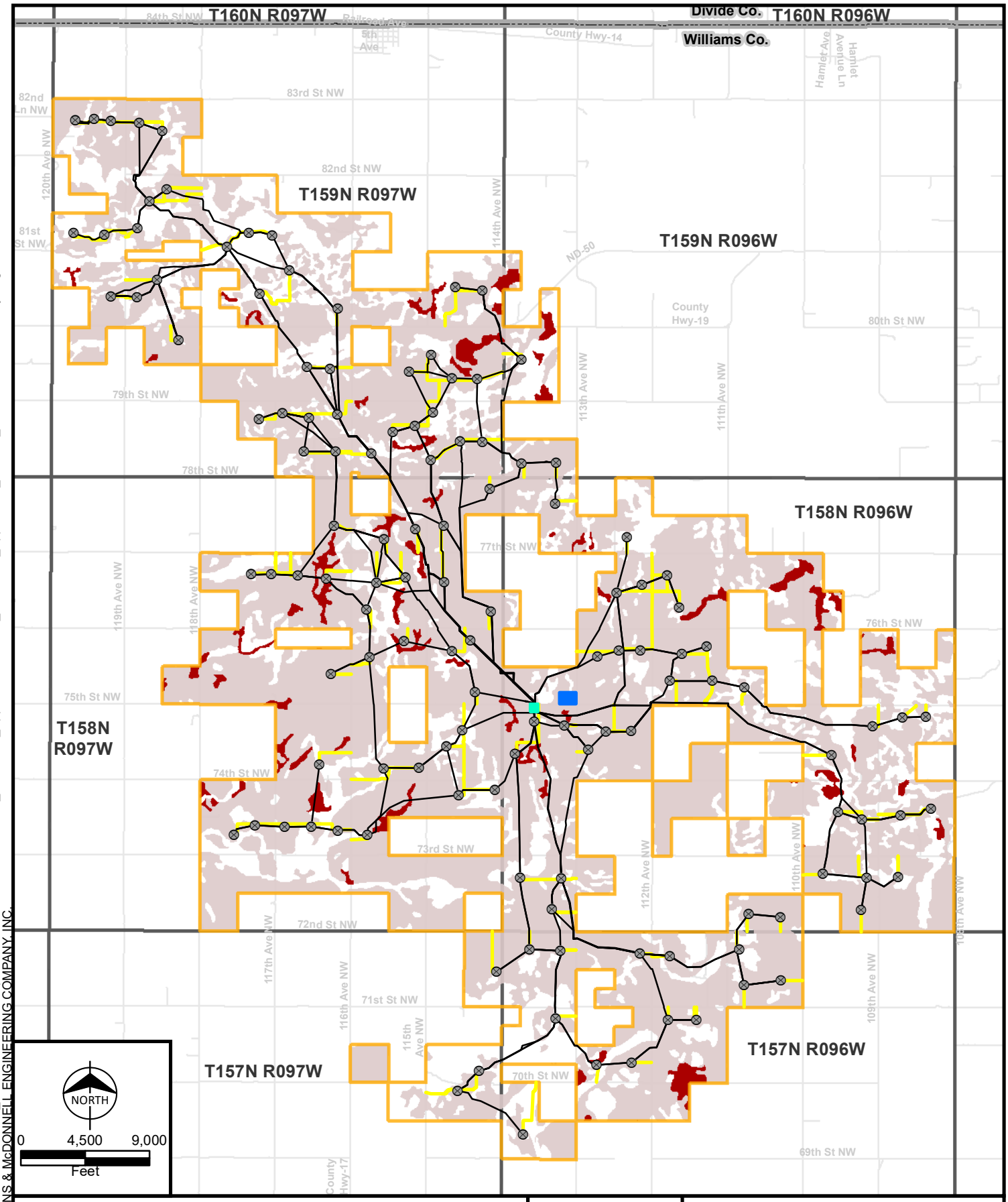

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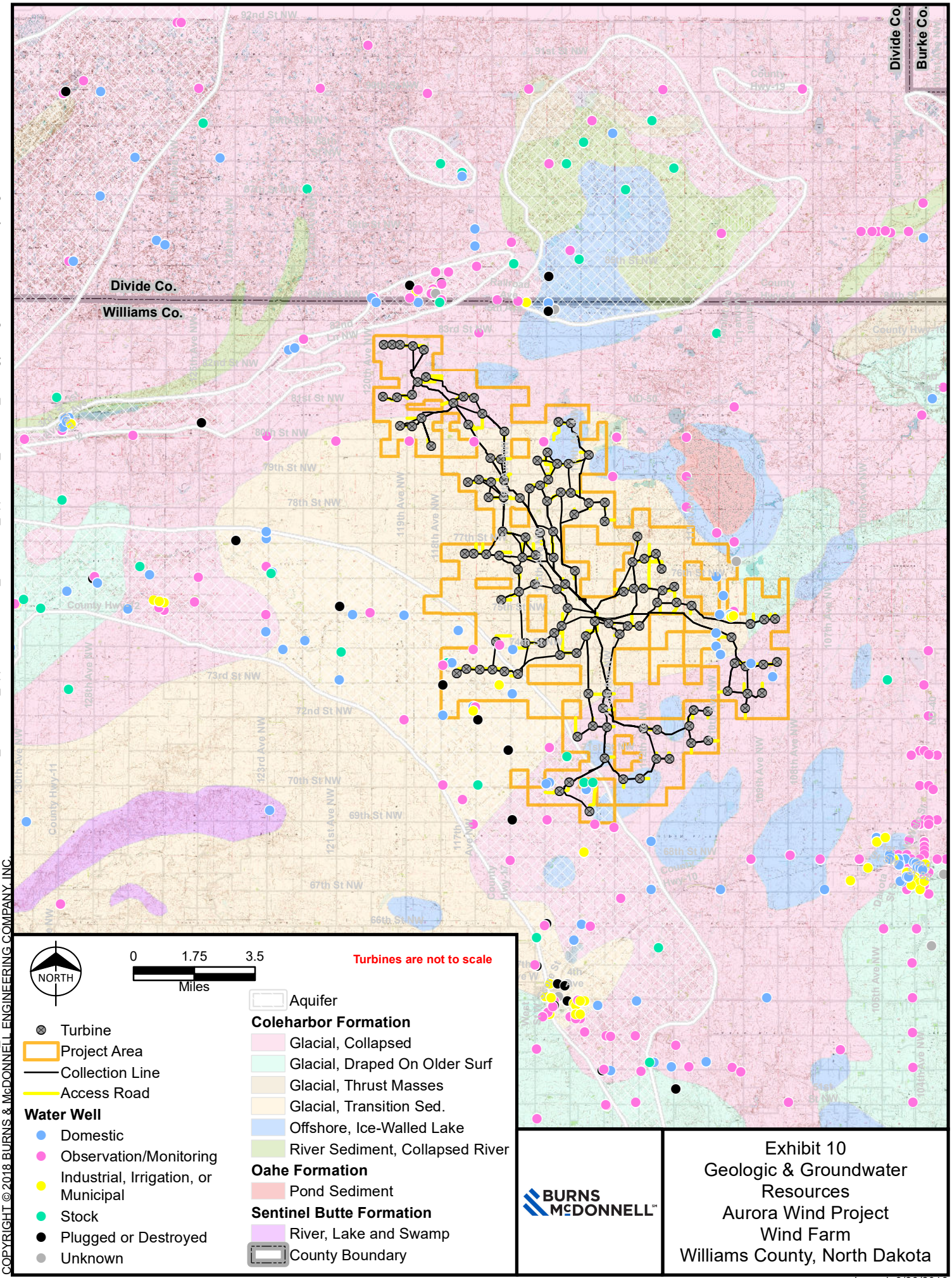

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Exhibit 10
Geologic & Groundwater Resources
Aurora Wind Project
Wind Farm
Williams County, North Dakota

Issued: 9/26/2018

Source: Esri, ND ITD, USGS Topo 7.5-minute map for Alamo N.E., Bright Water Lake, Smokey Butte (1948), Blacktail, Marmon SE (1959), Big Meadow, Brush Lake, Hamlet, McGregor, Tom Berg Lake, Twin Lakes, Wildrose (1974), Alamo, Appam (1977), Corinth, Epping, Epping NE, Epping NW, Ray, Ray NW, Ray SE, Springbrook, Temple (1978), Tioga, Tioga SW, ND (1979), Tradewind, Burns & McDonnell Engineering Company, Inc.

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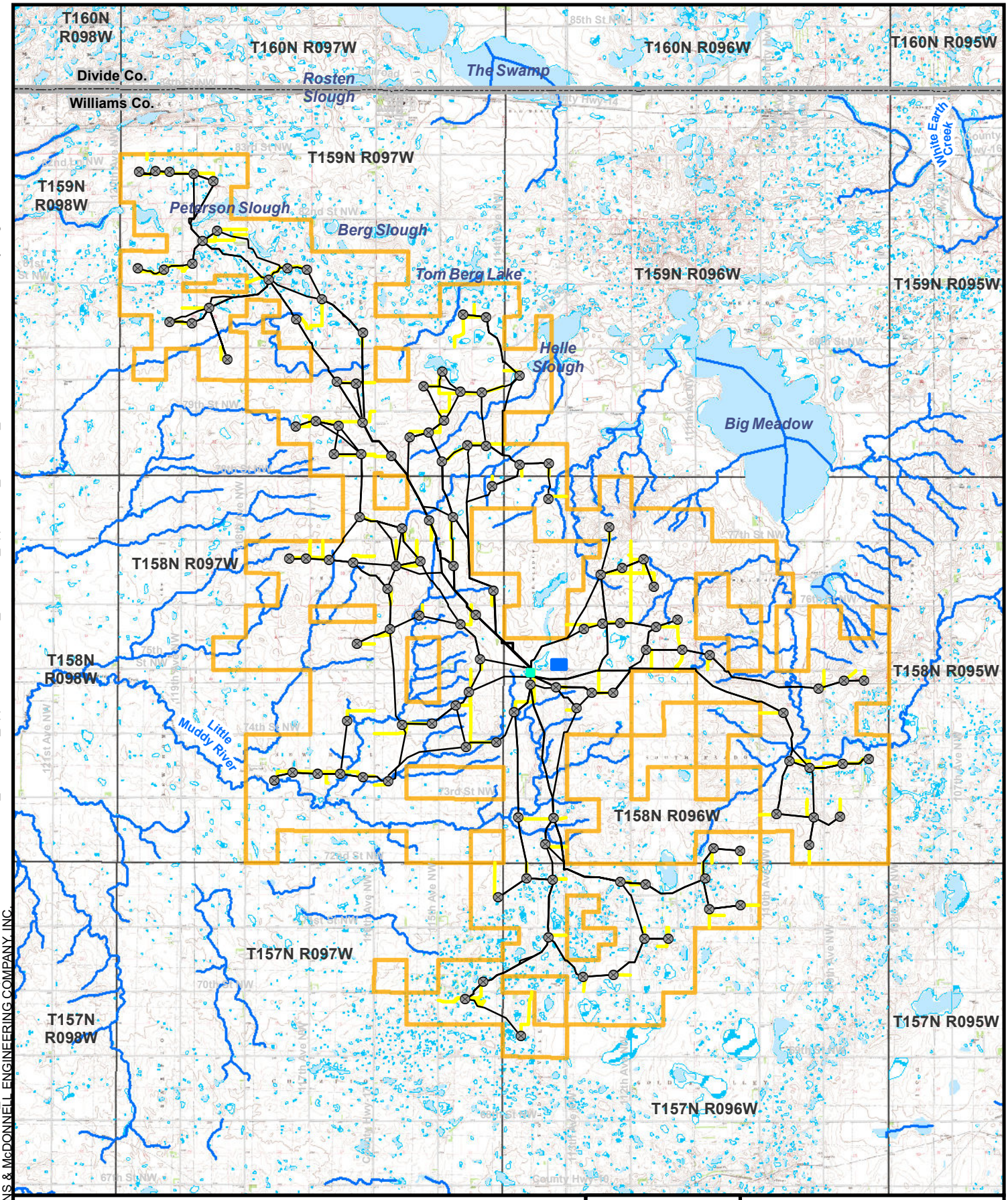

Turbine
Project Area
Collection Line
Access Road
Substation
Laydown Yard
County Boundary
Township/ Range Boundary
NWI Wetland
NHD Lake/Pond
NHD Stream

NORTH

0 1 2
Miles

Turbines are not to scale

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Exhibit 11
Surface Waters and NWI Wetlands
Aurora Wind Project
Wind Farm
Williams County, North Dakota

Source: Esri, NWI, NHD, Tradewind, Burns & McDonnell Engineering Company, Inc.

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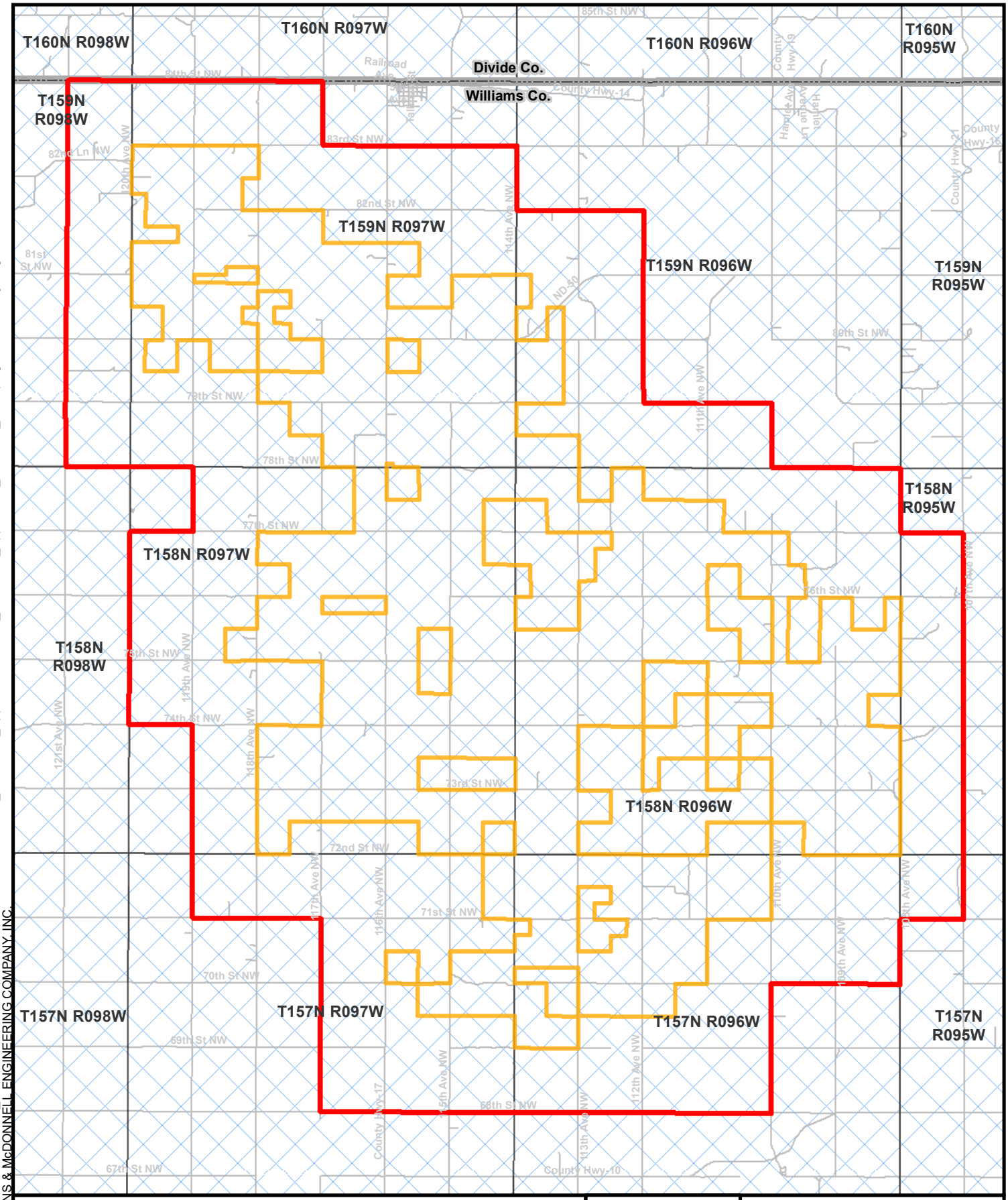

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Exhibit 12
Whooping Crane Corridor
Aurora Wind Project
Wind Farm
Williams County, North Dakota

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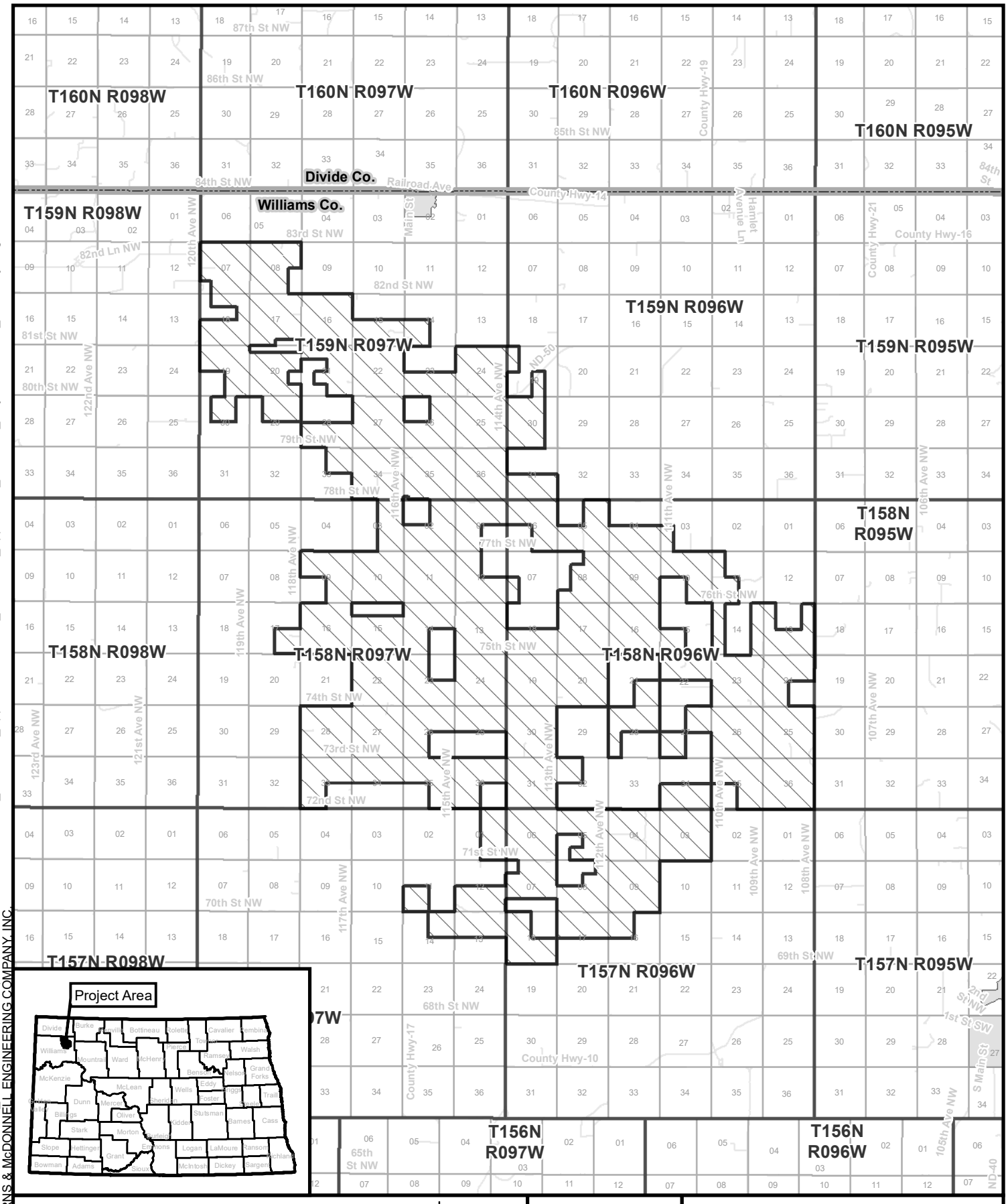

Exhibit 13
Project Location Map
Aurora Wind Project
Wind Farm
Williams County, North Dakota

Source: Esri, USGS - Public Land Survey System, Tradewind, Burns & McDonnell Engineering Company, Inc.

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Fredrikson & BYRON, P.A.

June 29, 2018

VIA E-MAIL AND FEDERAL EXPRESS

Mr. Darrell Nitschke
Executive Secretary
North Dakota Public Service Commission
600 E. Boulevard, Dept. 408
Bismarck, ND 58505-0480

RE: Aurora Wind Project, LLC's Ten Year Plan for 2018-2028
Case No. PU-18-____

Dear Mr. Nitschke:

Enclosed for filing are originals of the following documents:

1. Aurora Wind Project, LLC's Ten Year Plan: 2018-2028;
2. Notice of Filing Ten Year Plan: 2018-2028; and
3. Certificate of Service.

Electronic copies of the enclosed documents were filed with the Commission today via e-mail. If you have any questions, please let me know.

Sincerely,

Mollie M. Smith

MOLLIE M. SMITH

MMS/bd
Enclosures

cc: Beth M. Innis, Williams County Auditor (w/encls.)
Stephanie Pappa, Mountrail County Auditor (w/encls.)

64285312.1

Attorneys & Advisors
main 612.492.7000
fax 612.492.7077
fredlaw.com

Fredrikson & Byron, P.A.
200 South Sixth Street, Suite 4000
Minneapolis, Minnesota
55402-1425

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TEN YEAR PLAN: 2018-2028
Aurora Wind Project, LLC

June 2018

In accordance with N.D.C.C. § 49-22-04 and N.D.A.C. Ch. 69-06-02, Aurora Wind Project, LLC ("Aurora Wind"), submits the following Ten Year Plan for years 2018 through 2028.

(1) A description of the general location, size, and type of all facilities to be owned or operated by the utility during the ensuing ten years, as well as those facilities to be removed from service during the ten-year period.

Aurora Wind is a Delaware limited liability company, authorized to do business in the State of North Dakota. Aurora Wind is developing an up to 300 megawatt ("MW") wind energy conversion facility known as the Aurora Wind Project ("Wind Project") and an associated 345-kilovolt ("kV") transmission line to connect the Wind Project to the grid ("Transmission Line"). The Wind Project will be located approximately 5.6 miles west-northwest of the City of Tioga in Williams County, North Dakota. The Transmission Line will be approximately 22 miles in length and extend from the Wind Project substation to the point of interconnection to the grid at the existing Basin Electric Power Cooperative Tande 345 kV Substation, located in the Northeast Quarter of Section 29, Township 157 North, Range 94 West, Mountrail County, North Dakota. On June 25, 2018, the Mountrail County Planning and Zoning Commission approved issuance of a Conditional Use Permit for the Transmission Line. Conditional Use Permit applications are currently pending before Williams County for both the Wind Project and the Transmission Line. Aurora Wind plans to commence construction of the Wind Project and Transmission Line as early as Second Quarter 2019 and achieve commercial operation by the end of 2020.

Other than the Wind Project and Transmission Line, Aurora Wind does not have any transmission or generation facilities located in North Dakota, and the projects will have an estimated life of greater than 10 years. As such, Aurora Wind does not have any plans to decommission any transmission or generation facilities within the timeframe of this plan.

(2) An identification of the location of the tentative preferred site for all energy conversion facilities and the tentative location of all transmission facilities on which construction is intended to be commenced within the ensuing five years and such other information as may be required by the commission. The site and corridor identification shall be made in compliance with the criteria published by the commission pursuant to section 49-22-05.1.

As noted above, Aurora Wind is pursuing development of the above-referenced Wind Project and Transmission Line, and proposes to have both projects constructed and in-service by the end of 2020. The proposed Wind Project footprint is located west-northwest of the City of Tioga in Williams County, North Dakota. The anticipated route for the Transmission Line will extend from the Wind Project substation to its planned point of interconnection to the grid at the existing Basin Electric Power Cooperative Tande 345 kV Substation, located in the Northeast Quarter of Section 29, Township 157 North, Range 94 West, Mountrail County, North Dakota.

Aurora Wind has retained qualified environmental consulting firms to evaluate the proposed Wind Project site and Transmission Line corridor and route so as to ensure compliance with the exclusion and avoidance area criteria referenced in N.D.C.C. § 49-22-05.1 and identified in N.D.A.C. Ch. 69-06-08. Maps depicting the study areas for the Wind Project and the Transmission Line are attached as **Exhibit A**.

(3) A description of the efforts by the utility to coordinate the plan with other utilities so as to provide a coordinated regional plan for meeting the utility needs of the region.

Aurora Wind is in the process of identifying an offtaker for the Wind Project's output. Energy produced by the Wind Project may help local utilities to continue to meet applicable renewable energy standards.

Additionally, Aurora Wind and the Southwest Power Pool ("SPP") have completed studies addressing the potential interconnection of the Wind Project at the interconnection point discussed above, and Aurora Wind is in discussions with both SPP and Basin Electric Power Cooperation regarding execution of an interconnection agreement.

(4) A description of the efforts to involve environmental protection and land-use planning agencies in the planning process, as well as other efforts to identify and minimize environmental problems at the earliest possible stage in the planning process.

Aurora Wind has engaged the services of qualified environmental consulting firms to study and identify avoidance and exclusion areas within the proposed Wind Project site and Transmission Line corridor and route, in accordance with N.D.C.C. Ch. 49-22 and N.D.A.C. Ch. 69-06-08. As discussed above, on June 25, 2018, the Mountrail County Planning and Zoning Commission approved issuance of a Conditional Use Permit for the Transmission Line, and Conditional Use Permit applications are pending before Williams County. Aurora Wind has consulted with applicable local, state, and federal agencies and entities in connection with siting and development of the Wind Project and Transmission Line, and Aurora Wind will continue to coordinate with agencies and entities, as appropriate, throughout the development, construction, and operation of the Wind Project and Transmission Line.

(5) A statement of the projected demand for the service rendered by the utility for the ensuing ten years and the underlying assumptions for the projection, with that information being as geographically specific as possible, and a description of the manner and extent to which the utility will meet the projected demands.

As discussed above, Aurora Wind is in the process of identifying an offtaker for the Wind Project's output. However, given the Wind Project's location in the heart of the Bakken oil production region, the Wind Project is anticipated to meet area demand for electricity resulting from ongoing oil and gas activities in the Bakken and the region's homes and businesses. In addition, energy produced by the Project may help local utilities to continue to meet applicable renewable energy goals and/or standards.

In 2007, the North Dakota Legislature enacted a statutory provision adopting the national "25x25" initiative, which establishes a goal of having not less than twenty-five percent of the total energy consumed within the United States come from renewable resources by January 1, 2025.[1] Additional renewable resources will be needed to meet the 25x25 initiative.

A need also exists for renewable energy produced in North Dakota to meet state renewable portfolio standards. Eleven of the Midcontinent Independent System Operator ("MISO") states currently have either mandated or voluntary renewable portfolio standards or policies.[2] Under current state standards, total United States renewable portfolio standard demand will increase from 235 terawatt hours ("TWh") in 2016 to 450 TWh in 2030.[3] Given existing renewable energy capacity, an additional 150 TWh increase in renewable resources will be required to meet demand through 2030.[4] In addition, the regional transmission grid is being expanded to deliver wind generation in a cost-effective manner; specifically, MISO's Multi-Value Project ("MVP") Portfolio enables 41 million megawatt hours ("MWh") of wind energy per year to meet renewable energy mandates and goals.[5]

In summary, the renewable energy produced by Aurora Wind's proposed Wind Project and transmitted to the grid via Aurora Wind's proposed Transmission Line will help meet the national 25x25 initiative and the regional need for renewable energy.

64267701.2

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[1] *See* N.D.C.C. § 17-01-01.
[2] *MTEP17 MISO Transmission Expansion Plan*, at 76.
[3] Lawrence Berkeley National Laboratory, *U.S. Renewable Portfolio Standards 2017 Annual Status Report* (July 2017), at 21.
[4] *Id.* at 22.
[5] *MTEP17 MISO Transmission Expansion Plan*, at 193.

Project Overview Map

tradewind energy

EXHIBIT A

Project Overview Map

Legend

- Wind Project Boundary
- Transmission Line Corridor
- Municipal Boundary
- Section
- Township
- County
- State Highway

N

0 1 2 4 Miles

Scale: 1:150,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

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The following companies and organizations provided data that contributed to the production of this map.

U.S. Geological Survey (USGS)
Environmental Systems Research Institute (ESRI)
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

STATE OF NORTH DAKOTA

PUBLIC SERVICE COMMISSION

Case No. PU-18-___

IN THE MATTER OF THE FILING OF A TEN YEAR PLAN BY AURORA WIND PROJECT, LLC

CERTIFICATE OF SERVICE

Mollie M. Smith, being first duly sworn, does depose and state that on June 29, 2018, she served the following document:

Ten Year Plan: 2018-2028

by placing a true and correct copy of said document in envelopes addressed as follows:

Ms. Beth M. Innis
Williams County Auditor
Williams County Administration Building, First Floor
206 E. Broadway
PO Box 2047
Williston, ND 58802-2047

Ms. Stephanie Pappa
Mountrail County Auditor
PO Box 69
Stanley ND 58784-0069

and depositing the same, with postage prepaid, in the United States mail at Minneapolis, Minnesota.

Mollie M. Smith

64285341.1

Williams COUNTY

July 5, 2018

Aurora Wind Project, LLC
c/o Tradewind Energy, Inc.
Attn: David Iadarola
16105 W 113th St, Suite 105
Lenexa, Kansas 66219

LU-0072-18 A Conditional Use Permit for a Wind Energy Facility at the request of Aurora Wind Project, LLC. The site is approximately 48,000 acres located across multiple sections and parcels within Big Meadow (159N 96W), Champion (157N 97W), Golden Valley (157N 96W), Hazel (159N R97W), New Home (158N 97W), and South Meadow (158N 96W) Townships. The properties are currently zoned Agricultural. Big Meadow, Champion, Golden Valley, Hazel, New Home, and South Meadow Townships.

Dear Applicant:

On July 3, 2018 the Williams County Board of County Commissioners granted this request provided you comply with the following special conditions and restrictions:

1. Complete Lindahl project 100% prior to any approvals for Aurora project,
2. Provide civil plans, obtain approval prior to any permits,
3. Provide bond estimate for any improvements and all haul roads,
4. Any changes to approved plans – submit change and obtain approval prior to any installation,
5. Obtain Water Board approval,
6. Buildings permits and inspections shall be obtained as required by the current Building Code as adopted by Williams County,
7. Applicant shall work with Highway Department and Townships to document road conditions both before and after use, and
8. Any improvements required to roads for the project shall be completed at the applicant's expense.

Please contact the Planning and Zoning Division should you have any questions or concerns.

Thank you,

Kameron Hymer
Development Services Director

Williams COUNTY

July 5, 2018

Aurora Wind Project, LLC
c/o Tradewind Energy, Inc.
Attn: David Iadarola
16105 W 113th St, Suite 105
Lenexa, Kansas 66219

LU-0073-18 A Variance from the requirement for a 1400 foot setback from existing structures at the request of Aurora Wind Project, LLC. The site is approximately 48,000 acres located across multiple sections and parcels within Big Meadow (159N 96W), Champion (157N 97W), Golden Valley (157N 96W), Hazel (159N R97W), New Home (158N 97W), and South Meadow (158N 96W) Townships. The properties are currently zoned Agricultural. Big Meadow, Champion, Golden Valley, Hazel, New Home, and South Meadow Townships.

Dear Applicant:

On July 3, 2018 the Williams County Board of County Commissioners granted this request provided you comply with the following special conditions and restrictions:

1. Obtain approval from all owners prior to approval in all cases,
2. Compliance with the Building Code currently adopted by Williams County throughout the construction of new structures, and
3. Variance shall only apply to distances from unoccupied structures.

Please contact the Planning and Zoning Division should you have any questions or concerns.

Thank you,

Kameron Hymer
Development Services Director

Williams COUNTY

July 5, 2018

Aurora Wind Project, LLC
c/o Tradewind Energy, Inc.
Attn: David Iadarola
16105 W 113th St, Suite 105
Lenexa, Kansas 66219

LU-0074-18 A Conditional Use Permit for a 345 Kilovolt High Voltage Transmission Line at the request of Aurora Wind Project, LLC. The site is approximately 48,000 acres located across multiple sections and parcels within Big Meadow (159N 96W), Champion (157N 97W), Golden Valley (157N 96W), Hazel (159N R97W), New Home (158N 97W), and South Meadow (158N 96W) Townships. The properties are currently zoned Agricultural. Big Meadow, Champion, Golden Valley, Hazel, New Home, and South Meadow Townships.

Dear Applicant:

On July 3, 2018 the Williams County Board of County Commissioners granted this request provided you comply with the following special conditions and restrictions:

1. Provide Certificate of Survey showing all recorded easements. Certificate of Survey will need to show easements for transmission lines, overhead power, underground power, and ingress/egress easements that are required for the project. Please note that the Certificate of Survey is not limited to those easements as noted, and
2. Applicant shall work with Highway Department and Townships to document road conditions both before and after use of the roads to assess repair needs.

Please contact the Planning and Zoning Division should you have any questions or concerns.

Thank you,

Kameron Hymer
Development Services Director

Williams COUNTY

July 5, 2018

Aurora Wind Project, LLC
c/o Tradewind Energy, Inc.
Attn: David Iadarola
16105 W 113th St, Suite 105
Lenexa, Kansas 66219

LU-0075-18 18 A Variance for turbine blade clearance from the required 75 feet to 40 feet at the request of Aurora Wind Project, LLC. The site is approximately 48,000 acres located across multiple sections and parcels within Big Meadow (159N 96W), Champion (157N 97W), Golden Valley (157N 96W), Hazel (159N R97W), New Home (158N 97W), and South Meadow (158N 96W) Townships. The properties are currently zoned Agricultural. Big Meadow, Champion, Golden Valley, Hazel, New Home, and South Meadow Townships.

Dear Applicant:

On July 3, 2018 the Williams County Board of County Commissioners granted this request provided you comply with the following special conditions and restrictions:

1. Obtain approval from all owners prior to approval in all cases, and
2. Compliance with the Building Code currently adopted by Williams County throughout the construction of new structures.

Please contact the Planning and Zoning Division should you have any questions or concerns.

Thank you,

Kameron Hymer
Development Services Director

AGENCY SCOPING LETTER

December 21, 2017

Addressee Name
Addressee Title
Organization
Address Line 1
City, State Zip Code

Re: Information Request for the Proposed Aurora Wind Project and Associated Transmission Line in Williams and Mountrail Counties, ND

Dear Recipient:

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) has been contracted by Aurora Wind Project, LLC (Aurora), a subsidiary of Tradewind Energy, Inc. (Tradewind), to assist with obtaining permits from the North Dakota Public Service Commission (NDPSC) for the proposed Aurora Wind Project (Wind Project) in Williams County, North Dakota, and an associated transmission line (Transmission Line Project) in Williams and Mountrail Counties, North Dakota. Two separate NDPSC applications will be prepared: (1) an Application for a Certificate of Site Compatibility for the proposed Wind Project; and (2) a Consolidated Application for a Certificate of Corridor Compatibility and Route Permit for the proposed Transmission Line Project.

The proposed Wind Project would be approximately 300 megawatts (MW); the proposed location of specific infrastructure has not yet been determined. The Wind Project would interconnect to the electrical grid via the existing Basin Electric Power Cooperative Tande 345-kilovolt (kV) Substation (Tande Substation), located in the Northeast Quarter of Section 29, Township 157 North, Range 94 West, Mountrail County, North Dakota. The current potential development area for the Wind Project is shown in the attached Figure 1.

The Wind Project area includes portions of the following tracts:

County	Township	Range	Sections
Williams	157 N	95 W	6, 7
Williams	157 N	96 W	1-18
Williams	157 N	97 W	1, 11-14
Williams	158 N	95 W	31
Williams	158 N	96 W	5-9, 15-22, 27-36
Williams	158 N	97 W	1-16, 22-28, 33-36
Williams	158 N	98 W	1, 4, 5

9400 Ward Parkway \ Kansas City, MO 64114
O 816-333-9400 \ F 816-333-3690 \ burnsmcd.com

County	Township	Range	Sections
Williams	159 N	96 W	31
Williams	159 N	97 W	14-36
Williams	159 N	98 W	13-15, 21-29, 32-36

The proposed Transmission Line Project would extend from the Wind Project substation in Williams County to the point of interconnection at the Tande Substation in Mountrail County. The Transmission Line would consist of approximately 25 miles of 345-kV overhead transmission line. The current potential development area and potential route for the Transmission Line Project are shown in the attached Figure 2.

The Transmission Line area includes the following tracts:

County	Township	Range	Sections
Mountrail	157 N	94 W	7, 8, 17-20, 29
Williams	157 N	95 W	7-18
Williams	157 N	96 W	3-16
Williams	158 N	96 W	19, 29-32
Williams	158 N	97 W	1, 2, 11-14, 23-26, 36

In conjunction with preparing the referenced applications, we are seeking input from your agency or entity regarding any sensitive resources, current or planned development, or property interests your agency or entity may have in or around the Project Areas that Aurora should consider as it moves forward with development. In addition, we ask that you provide information regarding any applicable permits that may be required from your office. At this point, the Project is not anticipated to require federal funding or to otherwise have a federal nexus. For your information, we have sent similar query letters to other agencies and entities, including, but not limited to, the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and North Dakota Game and Fish Department.

We would appreciate a response by January 21, 2018. Please contact me at (303) 474-2229 or jbell@burnsmcd.com if you have any questions. Thank you for your assistance.

Sincerely,

Jennifer Bell
Senior Environmental Scientist
Burns & McDonnell
9785 Maroon Circle, Suite 400
Centennial, CO 80112

Attachment
cc: Jennifer Dean, Vice President, Environmental Studies & Permitting, Tradewind

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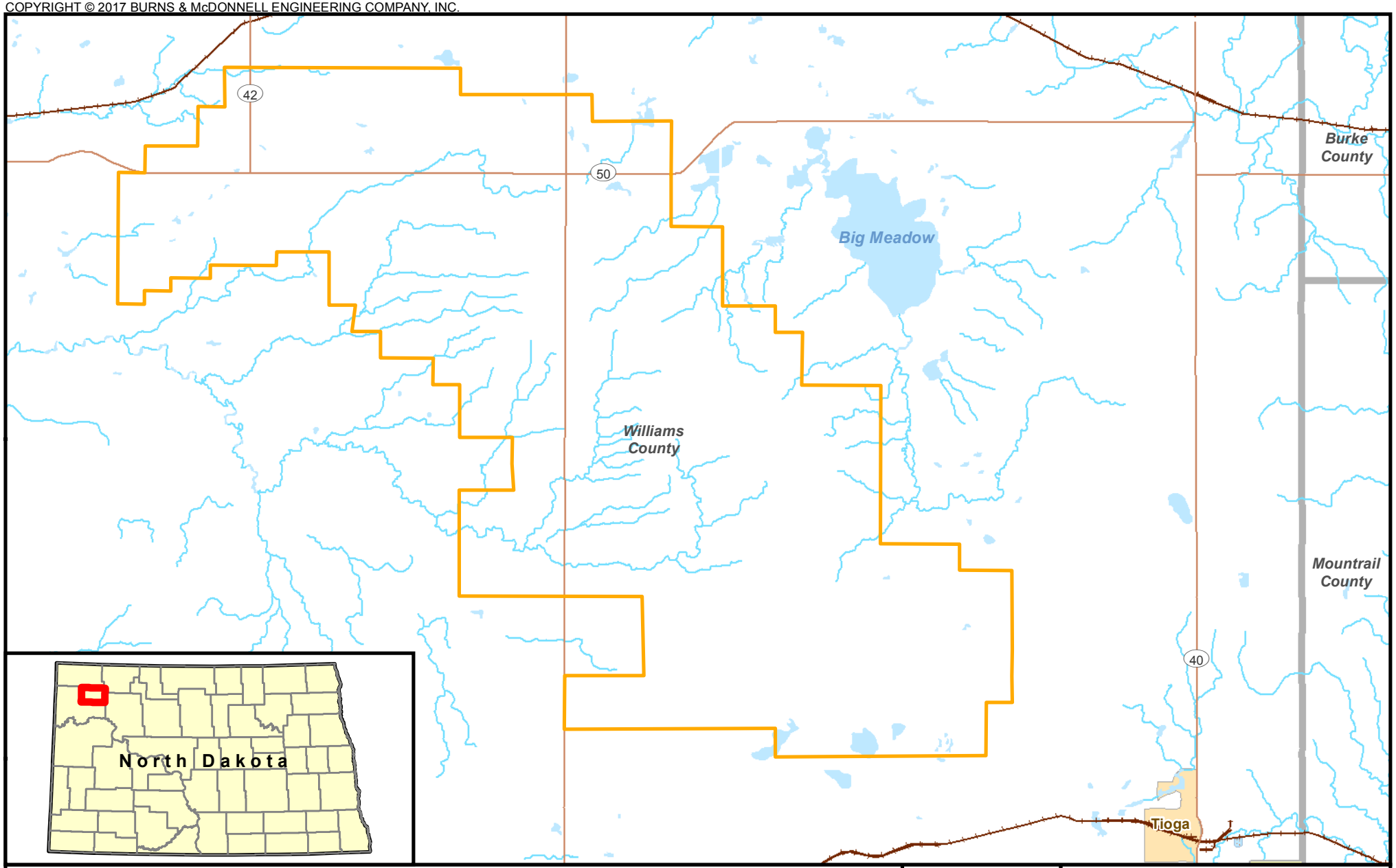

Figure 1
Project Location Map
Aurora Wind Project
Aurora Wind Project, LLC
Williams Co., ND

Source: Esri, Burns & McDonnell Engineering Company, Inc.

Issued: 12/21/2017

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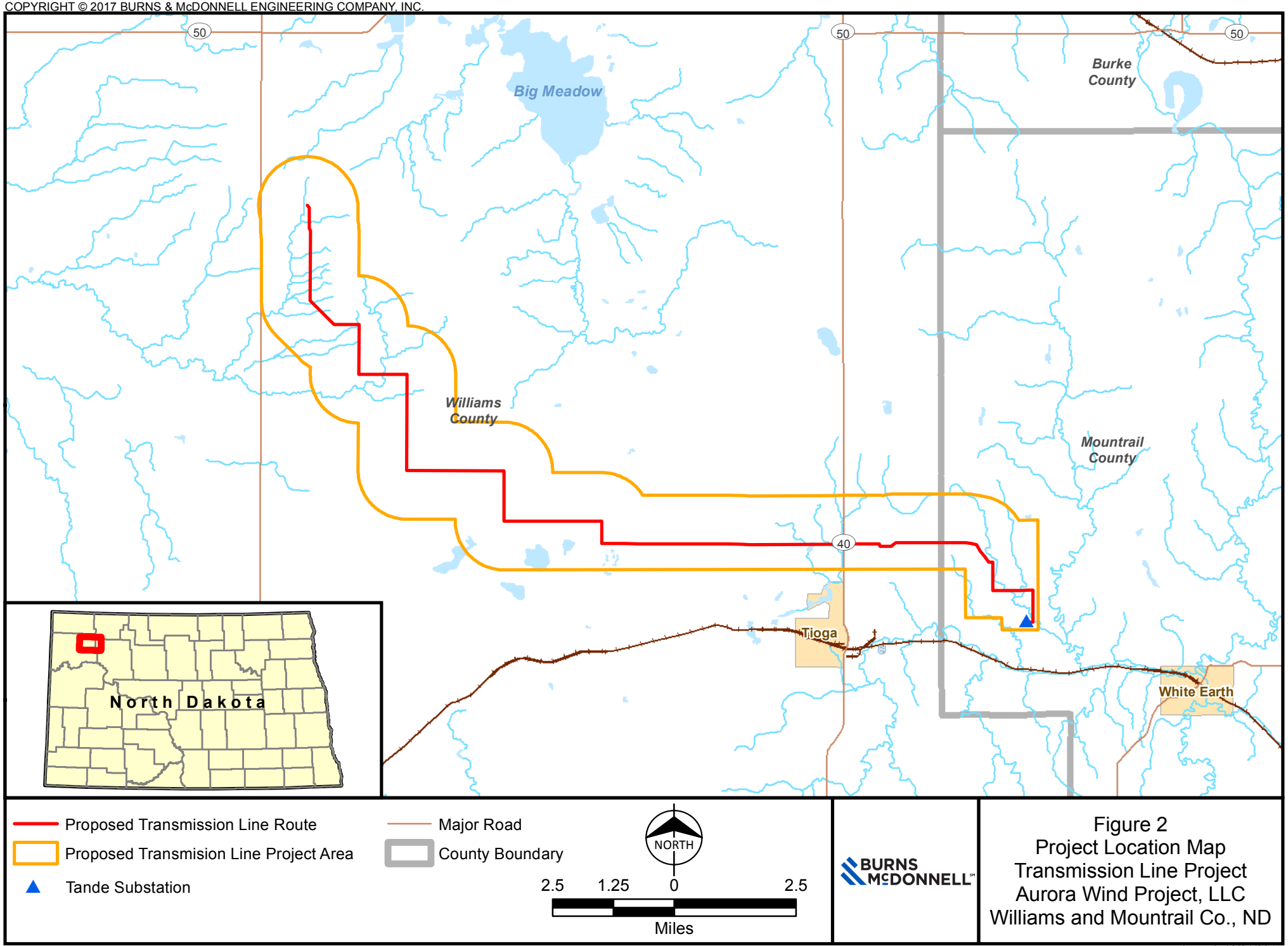


Figure 2
Project Location Map
Transmission Line Project
Aurora Wind Project, LLC
Williams and Mountrail Co., ND

Source: Esri, Burns & McDonnell Engineering Company, Inc.

Issued: 12/21/2017

Type	Title	First	Last	Title	Agency	Address	PO Box	City	State	Zip	Date Sent	Response	Date Received
State	Mr.	Jared	Wingo	Airport Planner	North Dakota Aeronautics Commission	2301 University Drive, Bldg. 22	PO Box 5020	Bismarck	ND	58502-5020	12/21/2017	Y	3/12/2018
State	Mr.	Wayne	Stenehjem	Attorney General	North Dakota Attorney General's Office	600 East Boulevard Avenue, Dept. 125		Bismarck	ND	58505-0040	12/21/2017	N	
State	Mr.	Doug	Goehring	Agriculture Commissioner	North Dakota Department of Agriculture	600 East Boulevard Avenue, Dept. 602		Bismarck	ND	58505-0020	12/21/2017	N	
State	Mr.	David	Glatt	Chief, Environmental Health Section	North Dakota Department of Health	918 E. Divide Avenue		Bismarck	ND	58501-1947	12/21/2017	Y	1/9/2018
State	Mr.	Jonathan	Alm	Executive Director	North Dakota Department of Human Services	600 East Boulevard Avenue, Dept. 325		Bismarck	ND	58505-0250	12/21/2017	Y	2/27/2018
State	Ms.	Michelle	Kommer	Labor Commissioner	North Dakota Department of Labor and Human Rights	600 East Boulevard Avenue, Dept. 406		Bismarck	ND	58505-0340	12/21/2017	Y	2/28/2018
State	Mr.	Wayne	Kutzer	Director & Executive Officer	North Dakota Department of Career & Technical Education	600 East Boulevard Avenue, Dept. 270		Bismarck	ND	58505-0610	12/21/2017	N	
State	Ms.	Sandra	McMerty	Deputy Commissioner	North Dakota Department of Commerce	1600 E. Century Avenue, Suite 2		Bismarck	ND	58503	12/21/2017	Y	3/5/2018
State	Mr.	Lance	Gaebe	Director	Energy Infrastructure & Impact Office	1707 North 9th Street	PO Box 5523	Bismarck	ND	58506-5523	12/21/2017	N	
State	Mr.	Greg	Link	Chief, Conservation & Communications	North Dakota Game and Fish Department	100 N. Bismarck Expressway		Bismarck	ND	58501-5095	12/21/2017	Y	1/8/2018
State	Mr.	Todd	Holweger	Permit Manager	North Dakota Industrial Commission	600 East Boulevard Avenue, Dept. 405		Bismarck	ND	58505-0840	12/21/2017	Y	1/19/2018
State	Governor	Doug	Burgum		North Dakota Office of the Governor	600 East Boulevard Avenue		Bismarck	ND	58505-0100	12/21/2017	N	
State	Mr.	Robert	Fode	Director	North Dakota Department of Transportation	608 East Boulevard Avenue		Bismarck	ND	58505-0700	12/21/2017	Y	1/24/2018
State	Ms.	Claudia	Berg	Director	North Dakota State Historical Society	612 East Boulevard Avenue		Bismarck	ND	58505	12/21/2017	Y	1/3/2018
State	Mr.	Scott	Davis	Executive Director	North Dakota Indian Affairs Commission	600 East Boulevard Avenue, Room 117		Bismarck	ND	58505	12/21/2017	Y	2/9/2018 (phone call)
State	Ms.	Michelle	Kommer	Labor Commissioner	Job Service North Dakota		PO Box 5507	Bismarck	ND	58506-5507	12/21/2017	Y	3/1/2018
State	Ms.	Jodi	Smith	Commissioner	North Dakota Department of Trust Lands	1707 North 9th Street	PO Box 5523	Bismarck	ND	58506-5523	12/21/2017	Y	4/4/2018
State	Mr.	Micael	Humann	Surface Division Manager	North Dakota Department of Trust Lands	1707 North 9th Street	PO Box 5523	Bismarck	ND	58506-5523	12/21/2017	Y	1/12/2018
State	Ms.	Melissa	Baker	Director	North Dakota Parks & Recreation	1600 E. Century Avenue, Suite 3	PO Box 5594	Bismarck	ND	58506-5594	12/21/2017	N	
State	Mr.	Bruce	Schmidt	Chair	North Dakota State Soil Conservation	2718 Gateway Avenue, Suite 304		Bismarck	ND	58503	12/21/2017	Y	2/27/2018
State	Mr.	Patrick	Fridgen	Director	North Dakota State Water Commission	900 East Boulevard Avenue, Dept. 770		Bismarck	ND	58505-0850	12/21/2017	Y	1/10/2018
State				Director	North Dakota Transmission Authority	600 East Boulevard Avenue, Dept. 405		Bismarck	ND	58505-0840	12/21/2017	N	
State				Director	North Dakota Pipeline Authority	600 East Boulevard Avenue, Dept. 405		Bismarck	ND	58505-0840	12/21/2017	N	
State	Mr.	Fred	Anderson	Geologist	North Dakota Geological Survey	600 East Boulevard Avenue, Dept. 405		Bismarck	ND	58505-0840	12/21/2017	Y	1/8/2018
Federal	Ms.	Christina	Adkins	Office of Assistant Secretary of Defense	U.S. Department of Defense	1400 Defense Pentagon		Washington	DC	20301-1400	12/21/2017	Y	1/8/2018
Federal	Ms.	Rhiannon	Scanlon	Office of Assistant Secretary of Defense	U.S. Department of Defense	1400 Defense Pentagon		Washington	DC	20301-1400	12/21/2017	Y	3/21/2018
Federal	Ms.	Steve	Sample	Deputy Director	U.S. Department of Defense	1400 Defense Pentagon		Washington	DC	20301-1400	12/21/2017	Y	3/19/2018
Federal	Mr.	Peter	Tenhula	Deputy Associate Administratory	U.S. Department of Commerce - National Telecommunications and Information Administration			Washington	DC	20230	12/21/2017	Y	7/12/2018
Federal	Mr.	Kory	Richardson	Refuge Manager	U.S. Fish and Wildlife Service, North Dakota Field Office	3425 Miriam Avenue		Bismarck	ND	58501-4481	12/21/2017	Y	4/24/2018
Federal	Ms.	Patricia	McQueary	Program Manager	U.S. Army Corps of Engineers, North Dakota Regulatory Office	3319 University Drive		Bismarck	ND	58504	12/21/2017	Y	1/9/2018
Federal	Mr.	Mark	Holzer	Program Manager	Federal Aviation Administration, Dakota-Minnesota Airports District	2301 University Drive, Bldg. 23B		Bismarck	ND	58504	12/21/2017	Y	2/27/2018
County	Mr.	Donald	Longmuir	Interim Planning & Zoning Administrator	Mountrail County Planning & Zoning Board		PO Box 248	Stanley	ND	58784-0248	12/21/2017	Y	10/4/2017
County	Mr.	Daniel	Uran	Mountrail County Commissioner			PO Box 1169	New Town	ND	58763-0875	12/21/2017	N	
County	Mr.	Arlo	Borud	Mountrail County Commissioner		309 3rd Street, SE	PO Box 542	Stanley	ND	58784-0542	12/21/2017	N	
County	Ms.	Trudy	Ruland	Mountrail County Commissioner		9380 33rd Lane NW		New Town	ND	58763-9536	12/21/2017	N	
County	Mr.	Wayne	Olson	Mountrail County Commissioner		4510 65th Avenue NW		Plaza	ND	58771	12/21/2017	N	
County	Mr.	Garry	Jacobson	Mountrail County Commissioner		6090 Old Highway 2		Berthold	ND	58718-9007	12/21/2017	N	
County	Mr.	Sam	Henderson	Planning & Zoning Division							12/21/2017	Y	2/7/2018
County	Mr.	Martin	Hanson	Williams County Commissioner		7853 139th Ave NW		Zahl	ND	58856	12/21/2017	N	
County	Mr.	Steve	Kemp	Williams County Commissioner		206 East Broadway		Williston	ND	58801	12/21/2017	N	
County	Mr.	Wayne	Aberle	Williams County Commissioner		1003 Sioux St		Williston	ND	58801	12/21/2017	N	
County	Mr.	David	Montgomery	Williams County Commissioner		222 14th St E		Williston	ND	58801	12/21/2017	N	
County	Mr.	Barry	Ramberg	Williams County Commissioner			PO Box 854	Tioga	ND	58852	12/21/2017	N	

OTHER SCOPING LETTERS

Jennifer Dean

From: WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENM <samuele.warren.1@us.af.mil>
Sent: Wednesday, December 20, 2017 4:09 PM
To: Jennifer Dean
Subject: RE: Aurora Wind Project, LLC - Williams County, ND

Minot has reviewed and sees no issues with your proposal. If your proposal changes please let us know and will review. Thanks/

sam

Sam Warren, CIV, DAF
Chief of SABER /Construction Management
General Engineer, Supervisor
DSN: 453-4894
Comm: 701-723-4894

From: Jennifer Dean [mailto:jdean@tradewindenergy.com]
Sent: Wednesday, December 20, 2017 3:50 PM
To: WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENM <samuele.warren.1@us.af.mil>
Subject: [Non-DoD Source] RE: Aurora Wind Project, LLC - Williams County, ND

We plan to file a conceptual array with the FAA in early 2018. Review by the DoD Clearinghouse will be included with that effort and before we receive Determinations of No Hazard.

Jennifer Dean
Vice President, Environmental Studies & Permitting | Tradewind Energy, Inc.
P: 913.322.7428 | M: 913.219.5004

From: WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENM [mailto:samuele.warren.1@us.af.mil]
Sent: Wednesday, December 20, 2017 12:52 PM
To: Jennifer Dean
Subject: RE: Aurora Wind Project, LLC - Williams County, ND

Thanks Jennifer. Will take a look at the area. My initial look is that the area will be outside of our area of responsibilities. If there is an issue will get back with you.

I would like you to register your project with the DoD Siting Clearinghouse. This would help with any other military actions in the area that I may not know about. Here is the website.

https://www.acq.osd.mil/dodsc/

sam

Sam Warren, CIV, DAF
Chief of SABER /Construction Management
General Engineer, Supervisor

DSN: 453-4894
Comm: 701-723-4894

From: Jennifer Dean [mailto:jdean@tradewindenergy.com]
Sent: Wednesday, December 20, 2017 10:14 AM
To: WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENM <samuele.warren.1@us.af.mil>
Subject: [Non-DoD Source] Aurora Wind Project, LLC - Williams County, ND

Mr. Warren:

Tradewind Energy, Inc. is continuing development of the Aurora Wind Project in Williams County, North Dakota. You may recall we provided you some information last December regarding the general location of the Project area as well as information on the temporary meteorological towers that have a Conditional Use Permit through Williams County and have been filed with the FAA and with the North Dakota Aeronautics Commission.

We wanted to provide you with an updated Project area map, including the locations of the temporary meteorological towers. We have revised the Project boundary slightly. The location of the proposed transmission line extends into Mountrail County approximately 2 miles though the route is still in in the process of being finalized; however, all wind energy turbines will be located northwest of the City of Tioga and entirely within Williams County.

Please let us know if you have any questions or need additional information.

Thank you,
Jenni

Jennifer Dean
Vice President, Environmental Studies & Permitting | Tradewind Energy, Inc.
P: 913.322.7428 | M: 913.219.5004

Jennifer Dean

From: Jennifer Dean
Sent: Monday, December 12, 2016 11:54 AM
To: 'WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENM'
Cc: SPECHT, JOEY R GS-12 USAF AFGSC 5 CES/CENP
Subject: RE: Aurora Wind Project, LLC - Williams County, ND
Attachments: Aurora - Project area map - Dec12 2016.pdf

The Aurora project will be entirely within Williams County. Attached is a map of our general project area for Aurora in green. For reference, the Lindahl project is noted as well in the orange boundary.

Jennifer Dean
Vice President, Environmental Studies & Permitting | Tradewind Energy, Inc.
P: 913.322.7428 | M: 913.219.5004

From: WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENM [mailto:samuele.warren.1@us.af.mil]
Sent: Monday, December 12, 2016 11:26 AM
To: Jennifer Dean
Cc: SPECHT, JOEY R GS-12 USAF AFGSC 5 CES/CENP
Subject: RE: Aurora Wind Project, LLC - Williams County, ND

Jenni,

Thanks for forwarding the information to me it is very much appreciated. I would also ask you to file any proposal you have with the DoD Siting Clearinghouse as they over look at the impact of energy development to the nation's defense mission.

http://www.acq.osd.mil/dodsc/

Will this development start impacting in Mountrail County or Burke Counties?

sam

Sam Warren, CIV, DAF
Chief of SABER /Construction Management
General Engineer, Supervisor
DSN: 453-4894
Comm: 701-723-4894

From: Jennifer Dean [mailto:jdean@tradewindenergy.com]
Sent: Monday, December 12, 2016 11:10 AM
To: WARREN, SAMUELE M CIV USAF AFGSC 5 CES/CENM <samuele.warren.1@us.af.mil>
Subject: Aurora Wind Project, LLC - Williams County, ND

Mr. Warren:

Tradewind Energy, Inc. is in the process of developing the Aurora Wind Project, LLC in Williams County, North Dakota. You may recall that we also developed the Lindahl Wind Project, LLC, currently under construction in eastern Williams County.

Last week, the Williams County Commissioners granted Conditional Use Permits to install six temporary meteorological towers. The data collected by these towers will be used to support further development of a possible future wind energy facility in this general location. The locations for all six temporary meteorological towers have been filed with the North Dakota Aeronautics Commission (see attached). Though the height of the towers are below 200', once the temporary towers are installed, the final locations will also be filed with the FAA.

As development of the project continues, we will keep Minot AFB informed of our progress. Please let us know if you have any questions at this time. If you are not the appropriate contact, please forward this information and let me know to update my information.

We appreciate your time.

Thanks,
Jenni

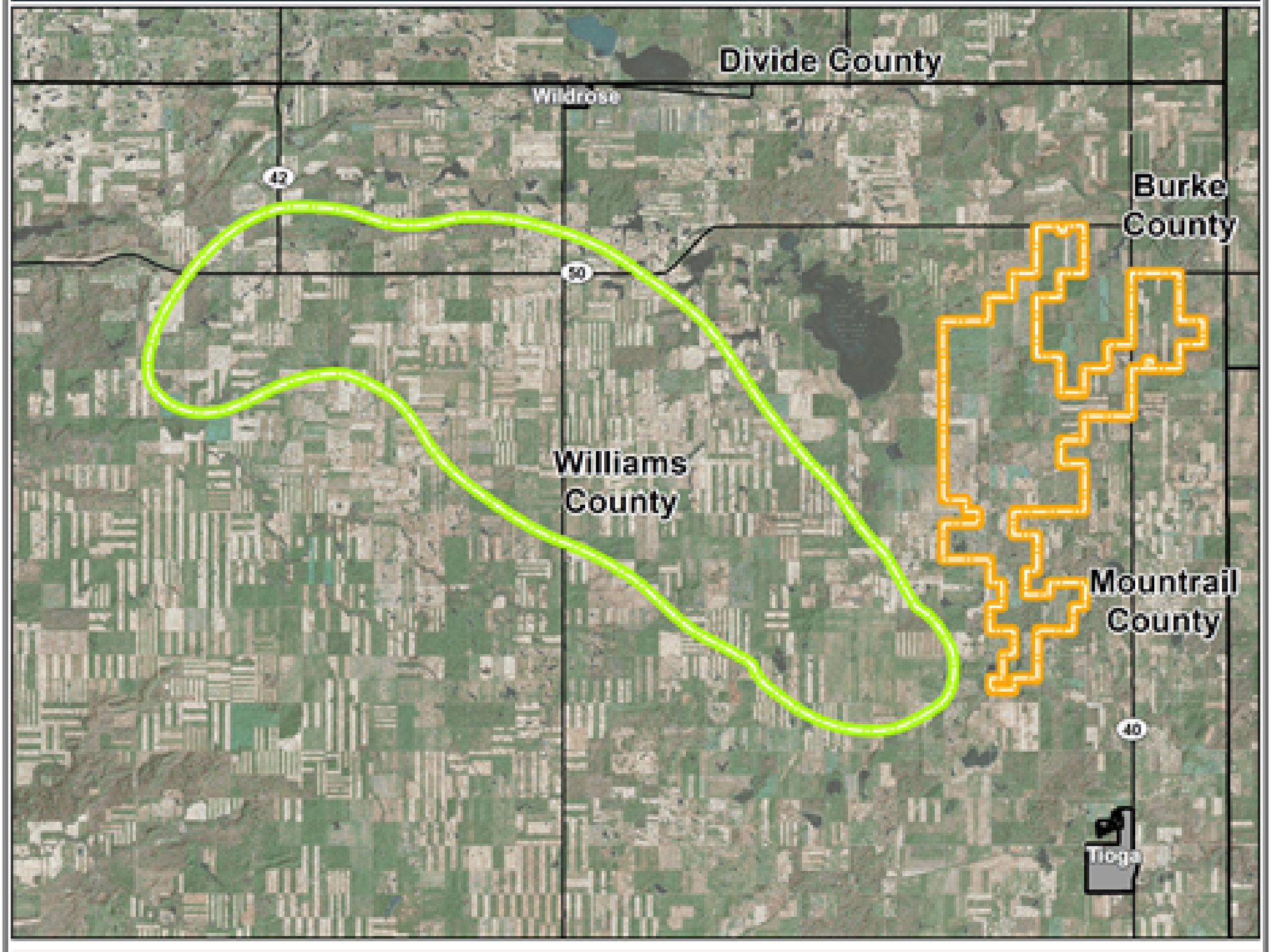
tradewind energy

Jennifer Dean

Vice President, Environmental Studies & Permitting | Tradewind Energy, Inc.

P: 913.322.7428 | M: 913.219.5004

Aurora Wind Project



Legend

- Lindahl Wind Project
- General Project Location

tradewind energy

The following components and organizations provided data that contributed to the production of this map.

U.S. Geological Survey (USGS)
Environmental Systems Research Institute (ESRI)
U. S. Department of Agriculture (USDA)
WhiteStar Corporation

N

0 1 2 4
Miles

Scale: 1:200,000

Date: 6/21/2016

Coordinate System:
NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Jennifer Dean

From: Don Longmuir <DonL@co.mountrail.nd.us>
Sent: Wednesday, October 04, 2017 10:04 AM
To: Jennifer Dean
Subject: FW: letter
Attachments: Tradewind Energy.doc

Importance: High

From: Don Longmuir
Sent: Wednesday, October 04, 2017 10:00 AM
To: 'Dave Iadarola'; 'jdean@tradwindenergy.com'
Cc: Nathan Sem; Liz Hollowell; Wade Enget
Subject: letter
Importance: High

Please see attached letter. Sorry for the delay in getting this to you.
don

Donald W. Longmuir Jr.

Donald W. Longmuir Jr., AICP
Interim Planing & Zoning Administrator
Interim Disaaster Emergency Coordinator
P.O. Box 248
8103 61st Street NW
Stanley, ND 58784-0248

PLANNING & ZONING BOARD
COUNTY OF MOUNTRAIL
PO Box 248
Stanley, North Dakota 58784-0248
(701) 628-2909
donl@co.mountrail.nd.us
nathans@co.mountrail.nd.us
lizh@co.mountrail.nd.us

Board Members:
TOM BIERI
ARLO BORUD
JOAN HOLLEKIM
ROGER HOVDA
BILL KLUG
TRUDY RULAND
CHARLIE SORENSON
GARY WEISENBERGER
LINDA WIENBAR

October 4, 2017

Jennifer Dean
Vice President, Environmental Studies & Permitting
Dave Iadarola,
Development Manager
Tradewind Energy
16105 West 113th Street, Suite 105
Lenexa, KS 66219

Dear Ms. Dean & Mr. Iadarola:

As a follow up to our meeting held on Tuesday, September 19th I providing the following information:

- Bicker Township (Township 158 North, Range 94 West) has their own planning & zoning authority and you will need to contact Jerome Rice, Chairman, 701.664.2381 (home) 701.641.3239 (cell), 7531 101st Avenue NW, Tioga, ND 58852-9670 or Roger Blestrud, Clerk/Treasurer, 701.664.2381 (home), 701.648.9674 (cell), 10175 74th Street NW, Tioga, ND 58852-9688;
- The non-refundable application fee for your project would be $25,000 for up to twenty-five (25) towers plus $1,000 per each proposed tower site beyond twenty-five (25);
- The collection boxes which were discussed would require a building permit for each structure;
- Article XI, Section L, Paragraph 2 line 3 on page 31 of the Mountrail County Zoning Ordinance Paragraph 2, line 3 contains a typographical error. This should read :...Turbines must be set back at least 1.5 times the turbine height form each antenna, tower, unoccupied structure or improvement with an estimated value over $25,000.....";
- Article XI, Section V on page 34 of the Mountrail County Zoning Ordinance requires a cash bond or letter of credit in the amount of $250,000 for the project. There is no $25,000 per tower requirement.

If you have any further questions please contact our office.

Sincerely,

Donald W. Longmuir Jr.

Donald W. Longmuir Jr., AICP
Interim Planning & Zoning Administrator

AURORA WIND PROJECT, LLC
a wholly-owned subsidiary of
Tradewind Energy, Inc.
16105 West 113th Street, Suite 105
Lenexa, Kansas 66219

April 10, 2018

Tioga City Commission
City Hall
16 1st St NE
Tioga, ND 58852

RE: Aurora Wind Project, LLC's Conditional Use Permit and Variance Request Applications for the Aurora Wind Project and Associated Transmission Line

Dear Tioga City Commission:

Aurora Wind Project, LLC ("Aurora"), a wholly owned subsidiary of Tradewind Energy, is developing the proposed Aurora Wind Project ("Wind Project") and an associated 345 kilovolt ("kV") transmission line ("Transmission Line") to be located in Williams County, North Dakota (collectively, the "Project"). Aurora plans to file applications for conditional use permits and associated variances for the Project (the "Application") with the Williams County Planning and Zoning Division in the near future.

The Wind Project will produce up to 300 megawatts of wind energy, and components will include wind turbines, collection and communication systems, a substation, an operations and maintenance facility, access roads, and permanent meteorological towers. The associated Transmission Line will be approximately 22.9 miles long (with approximately 19.4 of those miles located in Williams County), and components will include single-pole steel structures, overhead electric conductors, overhead communication cables, and a switching station (located in Mountrail County). The Transmission Line will facilitate interconnection of the Wind Project to the electrical grid at the existing Basin Electric Power Cooperative Tande 345-kV Substation, located in the Northeast Quarter of Section 29, Township 157 North, Range 94 West, Mountrail County, North Dakota.

Enclosed is a map showing the proposed location of the Project in Williams County. As shown on the map, the Wind Project is approximately 6.70 miles from the City of Tioga, and the Transmission Line is (at its closest point) approximately 0.64 miles from the City of Tioga.

If you have any questions or comments regarding the Project or the Application, please feel free to contact me at (720)732-3154 or at diadarola@tradewindenergy.com.

Sincerely,

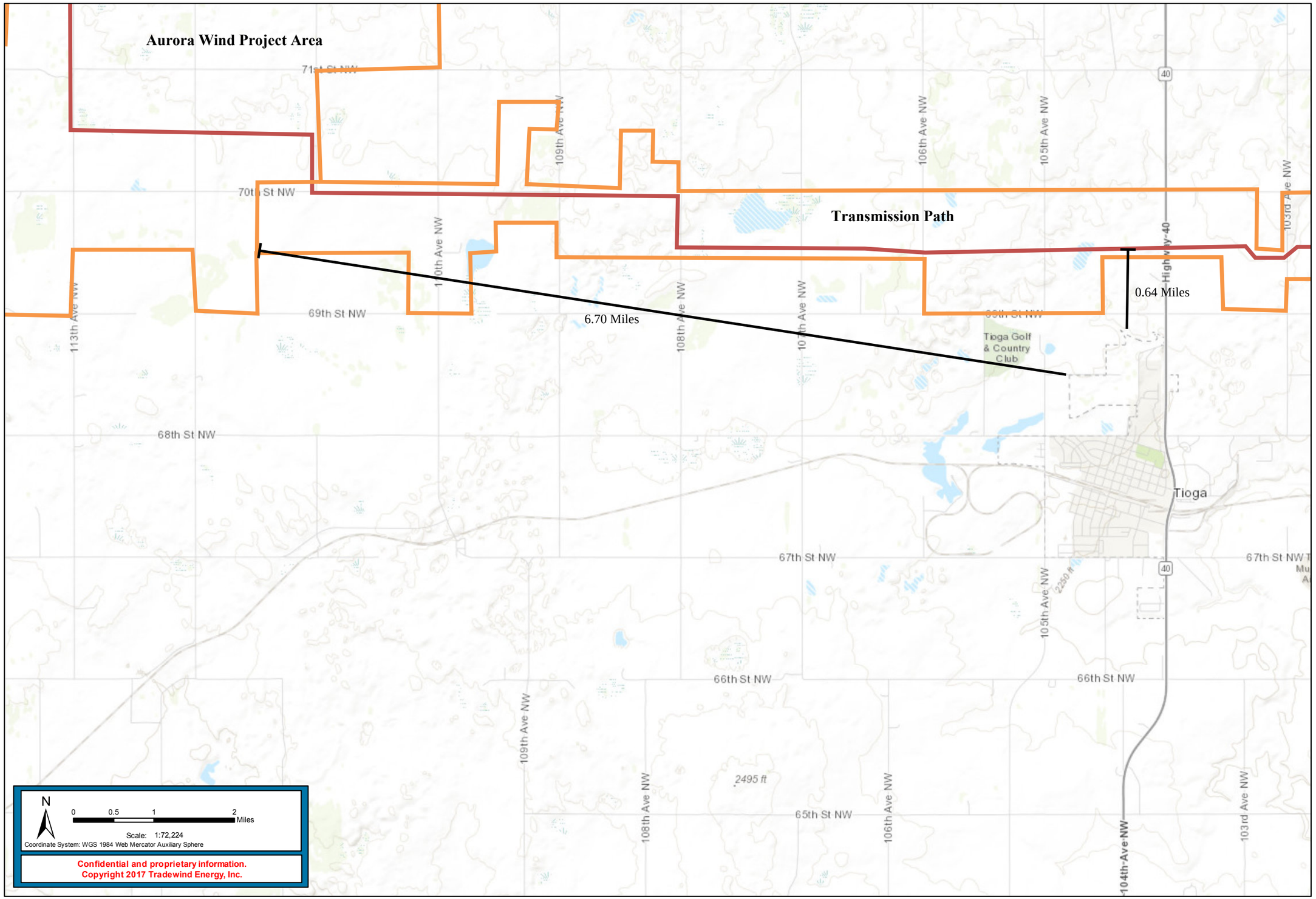
Dave Iadarola
Development Manager
Tradewind Energy Inc

Enclosure

cc: Jennifer Dean, Tradewind Energy

Aurora - City of Tioga

tradewind energy



N

0 0.5 1 2 Miles

Scale: 1:72,224

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere

Confidential and proprietary information.
Copyright 2017 Tradewind Energy, Inc.

Transmission Line

Project Boundary

The following companies and organizations provided data that contributed to the production of this map.
U.S. Geological Survey (USGS)
Environmental Systems Research Institute (ESRI)
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
Corelogic Solutions, LLC
WhiteStar Corporation
Ventyx Inc.

Printed Date: 4/10/2018

AURORA WIND PROJECT, LLC
a wholly-owned subsidiary of
Tradewind Energy, Inc.
16105 West 113th Street, Suite 105

March 16, 2018

Tioga Airport Authority
Chris Norgaard
322 2nd Street SE

Subject: Request for Tioga Airport Authority Letter - Aurora Wind Project

Dear Mr. Norgaard,

As discussed in our meeting on January 24th, 2018, Aurora Wind Project, LLC ("Aurora") is developing the proposed Aurora Wind Project ("Wind Project") to be located in Williams County, North Dakota and an associated 345 kilovolt ("kV") transmission line ("Transmission Line") to be located in Williams County and Mountrail County, North Dakota. Williams County has suggested the Wind Project document our meeting on January 24th, 2018 to discuss the potential Aurora Wind Project. At the meeting reviewed the project boundary map showing the proposed location of the Wind Project and the Transmission Line (collectively, the "Project") in Williams County and Mountrail County, including the townships in which the Project may be located.

The Wind Project will potentially produce up to 300 megawatts of wind energy, which will include components similar to the existing Lindahl Wind Project. The associated Transmission Line would be approximately 25 miles long and components would include single-pole steel structures, overhead electric conductors, overhead communication cables, and a switching station (located in Mountrail County). As we discussed in our meeting, Aurora plans to file applications for conditional use permits and associated variances for the Project with the Williams County Planning and Zoning Division in 2018.

As part of the permitting process, I respectfully request confirmation of our meeting regarding the project from the Tioga Airport Authority and in that meeting and upon initial review the Tioga Airport Authority did not have any formal objection to the project as long as the FAA determined there is no impact to the Tioga Airport's current approach paths or operational impacts to the Tioga Airport. If the above is accurate please sign below acknowledging the conversation we had on January 24th, 2018.

As we continue through the county permitting process, it is our understanding that the Tioga Airport Authority additional opportunities to provide comment on the proposed project. This initial correspondence is specifically requesting confirmation that the meeting on January 24th occurred and the above issues were discussed. If you have any questions, please do not hesitate to contact me at (720) 732-3154 or at diadarola@tradewindenergy.com.

Sincerely,

Dave Iadarola
Development Manager
Tradewind Energy, Inc.

3/19/18

Chirs Norgaard
President
Tioga Airport Authority

January 15, 2018

Kim Overdorf
South Meadow Township Chairman
11001 77TH ST NW
TIOGA, ND 58852-9447

RE: Aurora Wind Farm Project

Dear Kim:

Per previous conversations I am writing to confirm our upcoming Township meeting next week
Thursday January 25th
7:00 PM
At your residence 11001 77th ST NW Tioga, ND 58852.

If this is not correct, please let me know right away.

Also, enclosed is a letter from Tradewind Energy that they would request be completed after the township meeting.

I want to again thank you for your cooperation and look forward to our meeting. If you have any questions please do not hesitate to contact me.

Sincerely,

DIAMOND RESOURCES CO.

Glenn Boyeff
Agent Landman
Toll Free 1-866-572-4523
Cell Phone 701-570-7234
Email: glenn@diamondnd.com

GB:slw
Enc./Aurora

January 15, 2018

Kim Overdorf
South Meadow Township Chairman
11001 77TH ST NW
TIOGA, ND 58852-9447

RE: Aurora Wind Project, LLC's Conditional Use Permit and Variance Request Applications for the Aurora Wind Project and Associated Transmission Line

Dear Kim:

At a meeting held on January ___, 2018, representatives of Aurora Wind Project, LLC ("Aurora") presented information to the _____ Board of Township Supervisors ("Township Board") regarding the proposed Aurora Wind Project ("Wind Project") and an associated 345 kilovolt ("kV") transmission line ("Transmission Line") to be located in Williams County, North Dakota. Aurora provided the enclosed map, which shows the proposed location of the Wind Project and the Transmission Line (collectively, the "Project") in Williams County, including the applicable townships.

Aurora indicated that the Wind Project would produce up to 300 megawatts of wind energy and components would include wind turbines, collection and communication systems, a substation, an operations and maintenance facility, access roads, and permanent meteorological towers. Aurora indicated that the associated Transmission Line would be approximately 25 miles long and components would include single-pole steel structures, overhead electric conductors, overhead communication cables, and a switching station (located in Mountrail County). The Transmission Line would facilitate interconnection of the Wind Project to the electrical grid at the existing Basin Electric Power Cooperative Tande 345-kV Substation, located in the Northeast Quarter of Section 29, Township 157 North, Range 94 West, Mountrail County, North Dakota.

Aurora informed the Township Board that it plans to file applications for conditional use permits and associated variances for the Project (collectively, the "Application") with the Williams County Planning and Zoning Division ("Planning and Zoning"). We understand the variances may include, among others, a variance from the turbine setback of 1,400 feet from structures, with the exception of existing occupied residences, on parcels owned by Project participants; and a variance to reduce the minimum turbine blade clearance requirement.

Aurora requested that we provide comments to Planning and Zoning regarding the proposed Project and the planned Application. Therefore, pursuant to a decision made by the Township Board at its January ___, 2018 meeting, the Township Board provides the following comments regarding the proposed Project and the planned Application:

_____
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_____

If you have any questions, please let us know.

Sincerely,

_____
_____ Board of Township Supervisors, Chair

March 20, 2018

Mr. Sam Henderson
Williams County Planning and Zoning
206 East Broadway, 2nd Floor
Williston, ND 58801

RE: Aurora Wind Project, LLC's Conditional Use Permit and Variance Request Applications for the Aurora Wind Project and Associated Transmission Line

Dear Mr. Henderson:

At a meeting held on February 22, 2018, representatives of Aurora Wind Project, LLC ("Aurora") presented information to the South Meadow Board of Township Supervisors ("Township Board") regarding the proposed Aurora Wind Project and an associated 345 kilovolt ("kV") transmission line ("Project") to be located in Williams County, North Dakota. Aurora explained that a portion of the Project would be located in South Meadow Township. Aurora also informed the Township Board that it plans to file applications for conditional use permits and associated variances for the Project (the "Application") with the Williams County Planning and Zoning Division ("Planning and Zoning").

Aurora requested that we provide comments to Planning and Zoning regarding the proposed Project and the planned Application. Therefore, we are providing this letter to Planning and Zoning to document that at the February 22, 2018 meeting, the Township Board voted 3-0 to support the Project.

If you have any questions, please let us know.

Sincerely,

Kim Overdahl, Board of Township Supervisors, Chair

Scott Smith, Board of Township Supervisor

Sam Sagaser, Board of Township Supervisor

January 15, 2018

James Salveson
Hazel Township Chairman
11532 Hwy. 50
Wildrose, ND 58795

RE: Aurora Wind Farm Project

Dear James:

Per previous conversations I am writing to confirm our upcoming Township meeting next week

Thursday January 25th
1:00 PM
Wildrose Fire Hall.

If this is not correct, please let me know right away.

Also, enclosed is a letter from Tradewind Energy that they would request be completed after the township meeting.

I want to again thank you for your cooperation and look forward to our meeting. If you have any questions please do not hesitate to contact me.

Sincerely,

DIAMOND RESOURCES CO.

Glenn Boyeff
Agent Landman
Toll Free 1-866-572-4523
Cell Phone 701-570-7234
Email: glenn@diamondnd.com

GB:slw
Enc./Aurora

January 15, 2018

James Salveson
Hazel Township Chairman
11532 Hwy. 50
Wildrose, ND 58795

RE: Aurora Wind Project, LLC's Conditional Use Permit and Variance Request Applications for the Aurora Wind Project and Associated Transmission Line

Dear Mr. Salveson:

At a meeting held on January ___, 2018, representatives of Aurora Wind Project, LLC ("Aurora") presented information to the _____ Board of Township Supervisors ("Township Board") regarding the proposed Aurora Wind Project ("Wind Project") and an associated 345 kilovolt ("kV") transmission line ("Transmission Line") to be located in Williams County, North Dakota. Aurora provided the enclosed map, which shows the proposed location of the Wind Project and the Transmission Line (collectively, the "Project") in Williams County, including the applicable townships.

Aurora indicated that the Wind Project would produce up to 300 megawatts of wind energy and components would include wind turbines, collection and communication systems, a substation, an operations and maintenance facility, access roads, and permanent meteorological towers. Aurora indicated that the associated Transmission Line would be approximately 25 miles long and components would include single-pole steel structures, overhead electric conductors, overhead communication cables, and a switching station (located in Mountrail County). The Transmission Line would facilitate interconnection of the Wind Project to the electrical grid at the existing Basin Electric Power Cooperative Tande 345-kV Substation, located in the Northeast Quarter of Section 29, Township 157 North, Range 94 West, Mountrail County, North Dakota.

Aurora informed the Township Board that it plans to file applications for conditional use permits and associated variances for the Project (collectively, the "Application") with the Williams County Planning and Zoning Division ("Planning and Zoning"). We understand the variances may include, among others, a variance from the turbine setback of 1,400 feet from structures, with the exception of existing occupied residences, on parcels owned by Project participants; and a variance to reduce the minimum turbine blade clearance requirement.

Aurora requested that we provide comments to Planning and Zoning regarding the proposed Project and the planned Application. Therefore, pursuant to a decision made by the Township Board at its January ___, 2018 meeting, the Township Board provides the following comments regarding the proposed Project and the planned Application:

_____
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If you have any questions, please let us know.

Sincerely,

_____
_____ Board of Township Supervisors, Chair

January 15, 2018

Arlon Peterson
Big Stone Township Chairman
12115 81st St. NW
Alamo, ND 58830-9350

RE: Aurora Wind Farm Project Township Meeting

Dear Arlon:

Per previous conversations I am writing to confirm our upcoming Township meeting next week

Wednesday January 24th
9:00 AM
Mr. Wayne Deering's residence: 7826 125th Ave NW Alamo ND 58830-9332

If this is not correct, please let me know right away.

Also, enclosed is a letter from Tradewind Energy that they would request be completed after the township meeting.

I want to again thank you for your cooperation and look forward to our meeting. If you have any questions please do not hesitate to contact me.

Sincerely,

DIAMOND RESOURCES CO.

Glenn Boyeff
Agent Landman
Toll Free 1-866-572-4523
Cell Phone 701-570-7234
Email: glenn@diamondnd.com

GB:slw
Enc./Aurora

January 15, 2018

Arlon Peterson
Big Stone Township Chairman
12115 81st St. NW
Alamo, ND 58830-9350

RE: Aurora Wind Project, LLC's Conditional Use Permit and Variance Request Applications for the Aurora Wind Project and Associated Transmission Line

Dear Mr. Peterson:

At a meeting held on January ___, 2018, representatives of Aurora Wind Project, LLC ("Aurora") presented information to the _____ Board of Township Supervisors ("Township Board") regarding the proposed Aurora Wind Project ("Wind Project") and an associated 345 kilovolt ("kV") transmission line ("Transmission Line") to be located in Williams County, North Dakota. Aurora provided the enclosed map, which shows the proposed location of the Wind Project and the Transmission Line (collectively, the "Project") in Williams County, including the applicable townships.

Aurora indicated that the Wind Project would produce up to 300 megawatts of wind energy and components would include wind turbines, collection and communication systems, a substation, an operations and maintenance facility, access roads, and permanent meteorological towers. Aurora indicated that the associated Transmission Line would be approximately 25 miles long and components would include single-pole steel structures, overhead electric conductors, overhead communication cables, and a switching station (located in Mountrail County). The Transmission Line would facilitate interconnection of the Wind Project to the electrical grid at the existing Basin Electric Power Cooperative Tande 345-kV Substation, located in the Northeast Quarter of Section 29, Township 157 North, Range 94 West, Mountrail County, North Dakota.

Aurora informed the Township Board that it plans to file applications for conditional use permits and associated variances for the Project (collectively, the "Application") with the Williams County Planning and Zoning Division ("Planning and Zoning"). We understand the variances may include, among others, a variance from the turbine setback of 1,400 feet from structures, with the exception of existing occupied residences, on parcels owned by Project participants; and a variance to reduce the minimum turbine blade clearance requirement.

Aurora requested that we provide comments to Planning and Zoning regarding the proposed Project and the planned Application. Therefore, pursuant to a decision made by the Township Board at its January ___, 2018 meeting, the Township Board provides the following comments regarding the proposed Project and the planned Application:

_____
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If you have any questions, please let us know.

Sincerely,

_____
_____ Board of Township Supervisors, Chair

January 15, 2018

Richard Skor and Jennifer Skor
Big Meadow Township Chairman and Clerk
8 Hamlet Ave.
Wildrose, ND 58795-9400

RE: Aurora Wind Farm Project Township Meeting

Dear Richard and Jennifer:

Per previous conversations I am writing to confirm our upcoming Township meeting next week,

Wednesday January 24th
4:00 PM
Wildrose Fire Hall.

If this is not correct, please let me know right away.

Also, enclosed is a letter from Tradewind Energy that they would request be completed after the township meeting.

I want to again thank you for your cooperation and look forward to our meeting. If you have any questions please do not hesitate to contact me.

Sincerely,

DIAMOND RESOURCES CO.

Glenn Boyeff
Agent Landman
Toll Free 1-866-572-4523
Cell Phone 701-570-7234
Email: glenn@diamondnd.com

GB:slw
Enc./Aurora

January 15, 2018

Richard Skor and Jennifer Skor
Big Meadow Township Chairman
8 Hamlet Ave.
Wildrose, ND 58795-9400

RE: Aurora Wind Project, LLC's Conditional Use Permit and Variance Request Applications for the Aurora Wind Project and Associated Transmission Line

Dear Richard & Jennifer:

At a meeting held on January ___, 2018, representatives of Aurora Wind Project, LLC ("Aurora") presented information to the _____ Board of Township Supervisors ("Township Board") regarding the proposed Aurora Wind Project ("Wind Project") and an associated 345 kilovolt ("kV") transmission line ("Transmission Line") to be located in Williams County, North Dakota. Aurora provided the enclosed map, which shows the proposed location of the Wind Project and the Transmission Line (collectively, the "Project") in Williams County, including the applicable townships.

Aurora indicated that the Wind Project would produce up to 300 megawatts of wind energy and components would include wind turbines, collection and communication systems, a substation, an operations and maintenance facility, access roads, and permanent meteorological towers. Aurora indicated that the associated Transmission Line would be approximately 25 miles long and components would include single-pole steel structures, overhead electric conductors, overhead communication cables, and a switching station (located in Mountrail County). The Transmission Line would facilitate interconnection of the Wind Project to the electrical grid at the existing Basin Electric Power Cooperative Tande 345-kV Substation, located in the Northeast Quarter of Section 29, Township 157 North, Range 94 West, Mountrail County, North Dakota.

Aurora informed the Township Board that it plans to file applications for conditional use permits and associated variances for the Project (collectively, the "Application") with the Williams County Planning and Zoning Division ("Planning and Zoning"). We understand the variances may include, among others, a variance from the turbine setback of 1,400 feet from structures, with the exception of existing occupied residences, on parcels owned by Project participants; and a variance to reduce the minimum turbine blade clearance requirement.

Aurora requested that we provide comments to Planning and Zoning regarding the proposed Project and the planned Application. Therefore, pursuant to a decision made by the Township Board at its January ___, 2018 meeting, the Township Board provides the following comments regarding the proposed Project and the planned Application:

_____
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If you have any questions, please let us know.

Sincerely,

_____
_____ Board of Township Supervisors, Chair

Jennifer Dean

From: Latham, Mark <mlatham@burnsmcd.com>
Sent: Tuesday, March 13, 2018 5:03 PM
To: redhawk@mhanation.com
Cc: Dave Iadarola; Jennifer Dean; msmith@fredlaw.com; Bailey, Justin; Fulmer, John
Subject: Aurora wind project
Attachments: Aurora CR 3 Tribes Letter & Maps 03-18-2018.pdf

Dear Mr. Crowsbreast,

Please find attached a letter and map introducing the proposed Aurora wind project in Williams County, North Dakota. We would greatly appreciate your comments or input on this project. Hard copies of the letter and map have also been sent by mail.

Sincerely,

Mark

Mark A. Latham \ Burns & McDonnell
Senior Cultural Resource Specialist \ Environmental Studies & Permitting Group
O 816-822-3912 \ M 517-425-1338
mlatham@burnsmcd.com \ burnsmcd.com
9400 Ward Parkway \ Kansas City, MO 64114

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March 13, 2018

Elgin Crows Breast
Tribal Historic Preservation Officer (THPO)
Mandan, Hidatsa, and Arikara Tribes / Three Affiliated Tribes
404 Frontage Road
New Town, ND 58763

Re: Aurora Wind Project

Dear Mr. Crows Breast:

Aurora plans to construct the Aurora Wind Project in Williams County, North Dakota, and an associated 345 kilovolt (kV) transmission line in Williams County and Mountrail County, North Dakota (see enclosed project location maps). The Project will be located within an approximately 60,000-acre project area, and the transmission line will be located along an approximately 26-mile-long route that terminates in western Mountrail County. The Project is designed to produce environmentally friendly and cost-effective energy for the region.

We are respectfully requesting that you review the enclosed information and provide your input regarding traditional cultural properties or other resources important to you in or near the project area so that potential impacts to these resources may be avoided or mitigated during the project planning process. No federal permits apply to this project at this time, and we are not seeking to establish formal tribal consultation required by any law. Rather, this outreach is a result of Aurora's desire to include interested tribes in the early stages of the project and to seek their input.

Please review this information and notify us of any constraints or concerns that you may have regarding this project. We would greatly appreciate your input regarding not only this project but also sites or properties in the immediate area that might be of cultural or religious significance to your Tribe. The Executive Director of the North Dakota Indian Affairs Commission has kindly offered to host a meeting about the project at his office in Bismarck for any tribes interested in the Project. Please let us know if you would like us to arrange that meeting.

If you have any questions or need additional information, please contact me at (816) 822-3912.

Sincerely,

Mark A. Latham
Senior Archaeologist
Burns & McDonnell

Enclosure: Project Maps

9400 Ward Parkway \ Kansas City, MO 64114
O 816-333-9400 \ F 816-333-3690 \ burnsmcd.com

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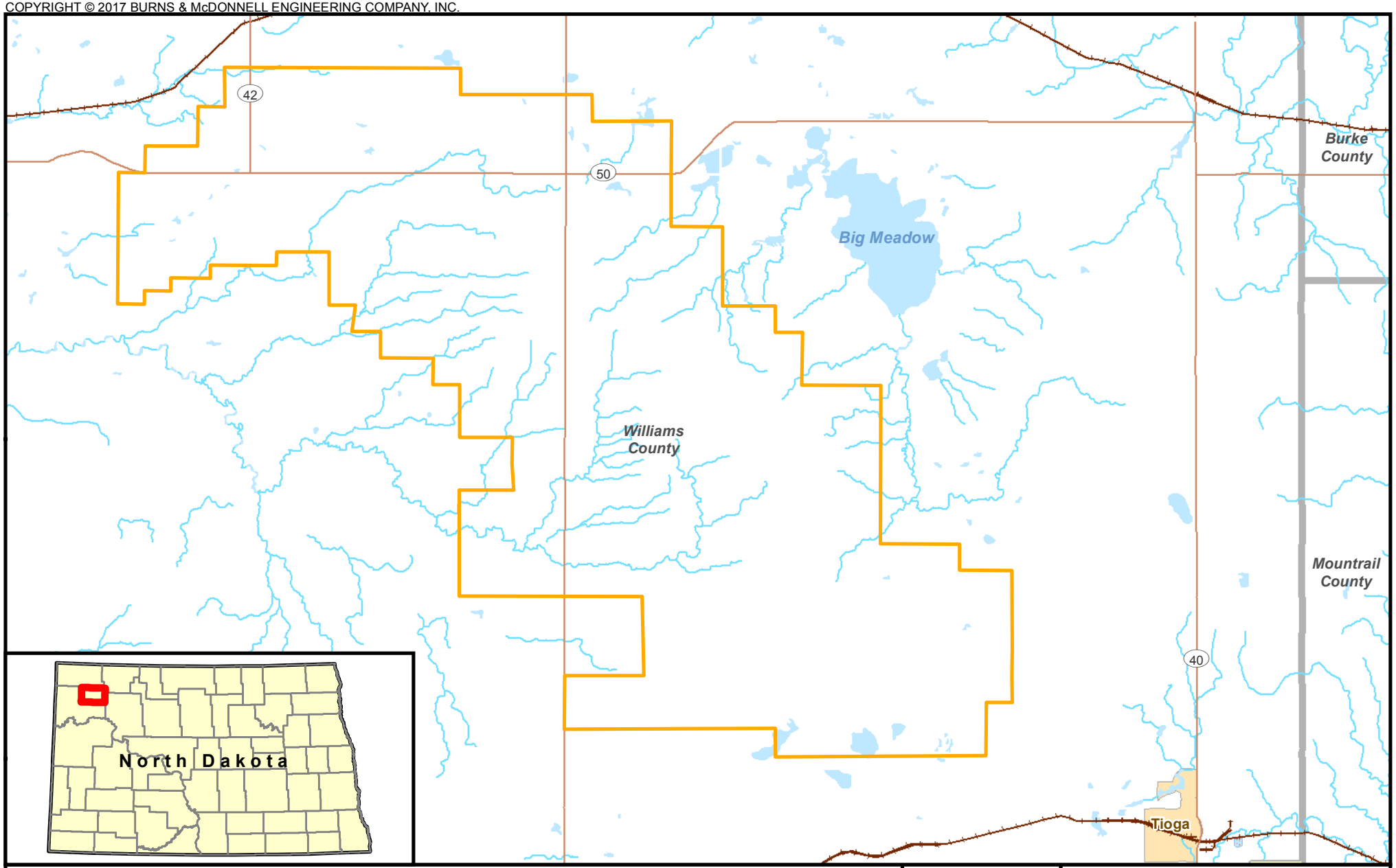

Figure 1
Project Location Map
Aurora Wind Project
Aurora Wind Project, LLC
Williams Co., ND

Source: Esri, Burns & McDonnell Engineering Company, Inc.

Issued: 12/21/2017

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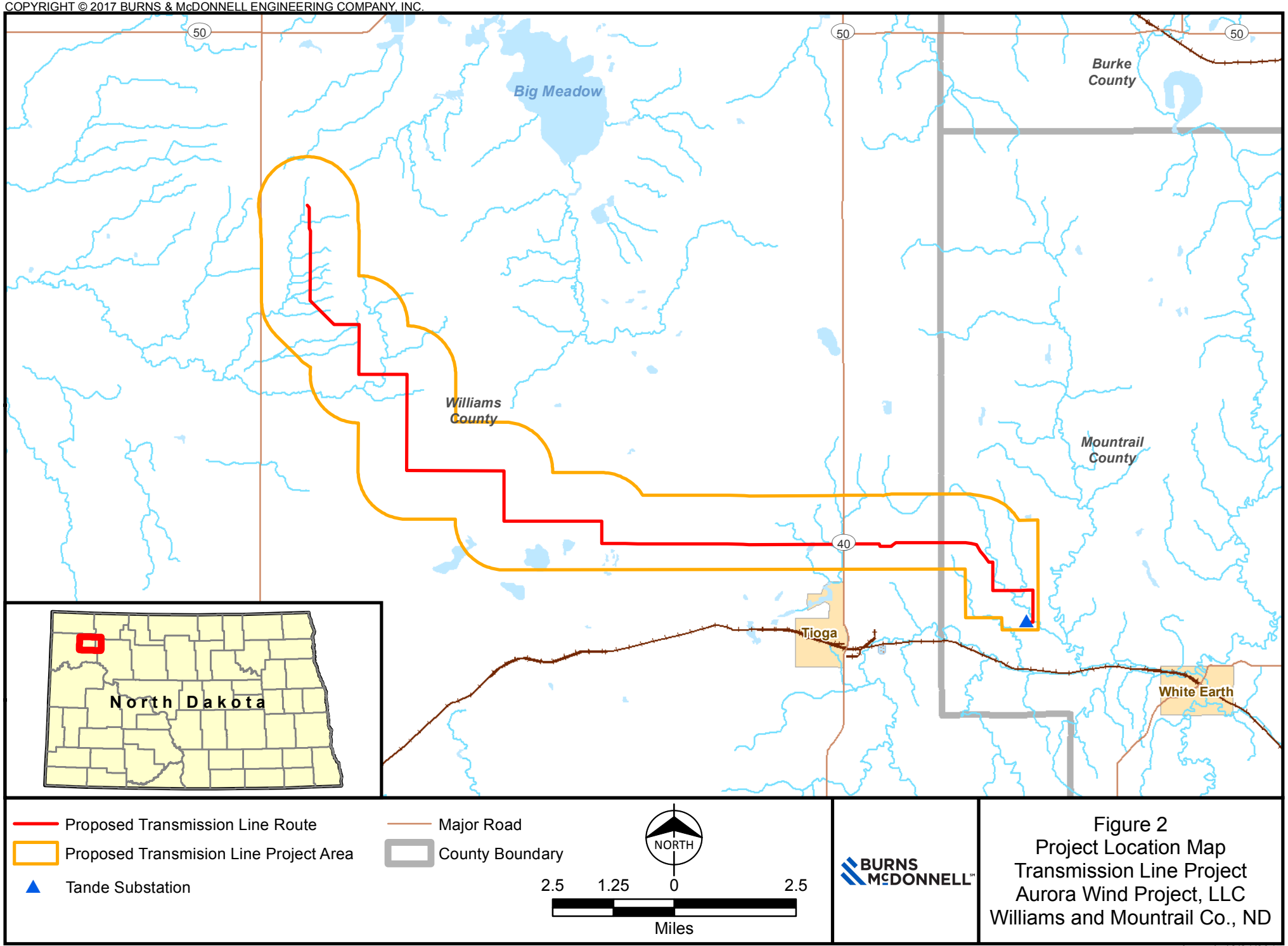

Figure 2
Project Location Map
Transmission Line Project
Aurora Wind Project, LLC
Williams and Mountrail Co., ND

Source: Esri, Burns & McDonnell Engineering Company, Inc.

Issued: 12/21/2017

Jennifer Dean

From: Latham, Mark <mlatham@burnsmcd.com>
Sent: Tuesday, March 13, 2018 5:01 PM
To: desjarlais.jeffery@yahoo.com
Cc: Dave Iadarola; msmith@fredlaw.com; Jennifer Dean; Bell, Jennifer; Bailey, Justin; Fulmer, John
Subject: Aurora Wind Project
Attachments: Aurora CR Turtle Mountain Letter & Maps 03-18-2018.pdf

Dear Mr. Desjarlais

Please find attached a letter and map introducing the proposed Aurora wind project in Williams County, North Dakota. We would greatly appreciate your comments or input on this project. Hard copies of the letter and map have also been sent by mail.

Sincerely,

Mark

Mark A. Latham \ Burns & McDonnell
Senior Cultural Resource Specialist \ Environmental Studies & Permitting Group
O 816-822-3912 \ M 517-425-1338
mlatham@burnsmcd.com \ burnsmcd.com
9400 Ward Parkway \ Kansas City, MO 64114

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BURNS McDONNELL

March 13, 2018

Jess Desjarlais, Jr.
Tribal Historic Preservation Officer
Turtle Mountain Band of the Chippewa
PO Box 900
Belcourt, North Dakota 58316

Re: Aurora Wind Project

Dear Mr. Desjarlais:

Aurora plans to construct the Aurora Wind Project in Williams County, North Dakota, and an associated 345 kilovolt (kV) transmission line in Williams County and Mountrail County, North Dakota (see enclosed project location map). The Project will be located within an approximately 60,000-acre project area, and the transmission line will be located along an approximately 26-mile-long route that terminates in western Mountrail County. The Project is designed to produce environmentally friendly and cost-effective energy for the region.

We are respectfully requesting that you review the enclosed information and provide your input regarding traditional cultural properties or other resources important to you in or near the project area so that potential impacts to these resources may be avoided or mitigated during the project planning process. No federal permits apply to this project at this time, and we are not seeking to establish formal tribal consultation required by any law. Rather, this outreach is a result of Aurora's desire to include interested tribes in the early stages of the project and to seek their input.

Please review this information and notify us of any constraints or concerns that you may have regarding this project. We would greatly appreciate your input regarding not only this project but also sites or properties in the immediate area that might be of cultural or religious significance to your Tribe. The Executive Director of the North Dakota Indian Affairs Commission has kindly offered to host a meeting about the project at his office in Bismarck for any tribes interested in the Project. Please let us know if you would like us to arrange that meeting.

If you have any questions or need additional information, please contact me at (816) 822-3912.

Sincerely,

Mark A. Latham
Senior Archaeologist
Burns & McDonnell

Enclosure: Project Maps

9400 Ward Parkway \ Kansas City, MO 64114
O 816-333-9400 \ F 816-333-3690 \ burnsmcd.com

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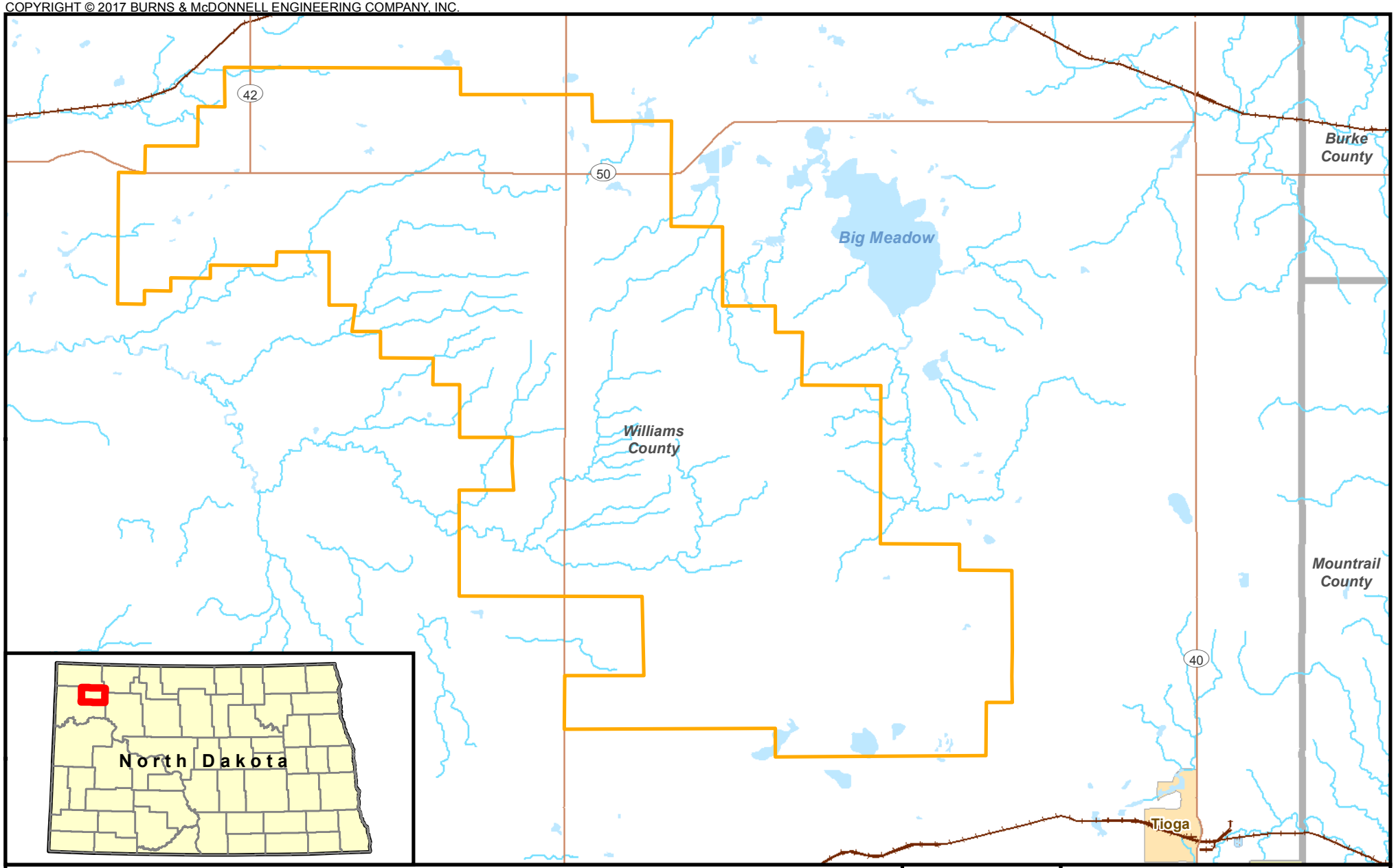

Figure 1
Project Location Map
Aurora Wind Project
Aurora Wind Project, LLC
Williams Co., ND

Source: Esri, Burns & McDonnell Engineering Company, Inc.

Issued: 12/21/2017

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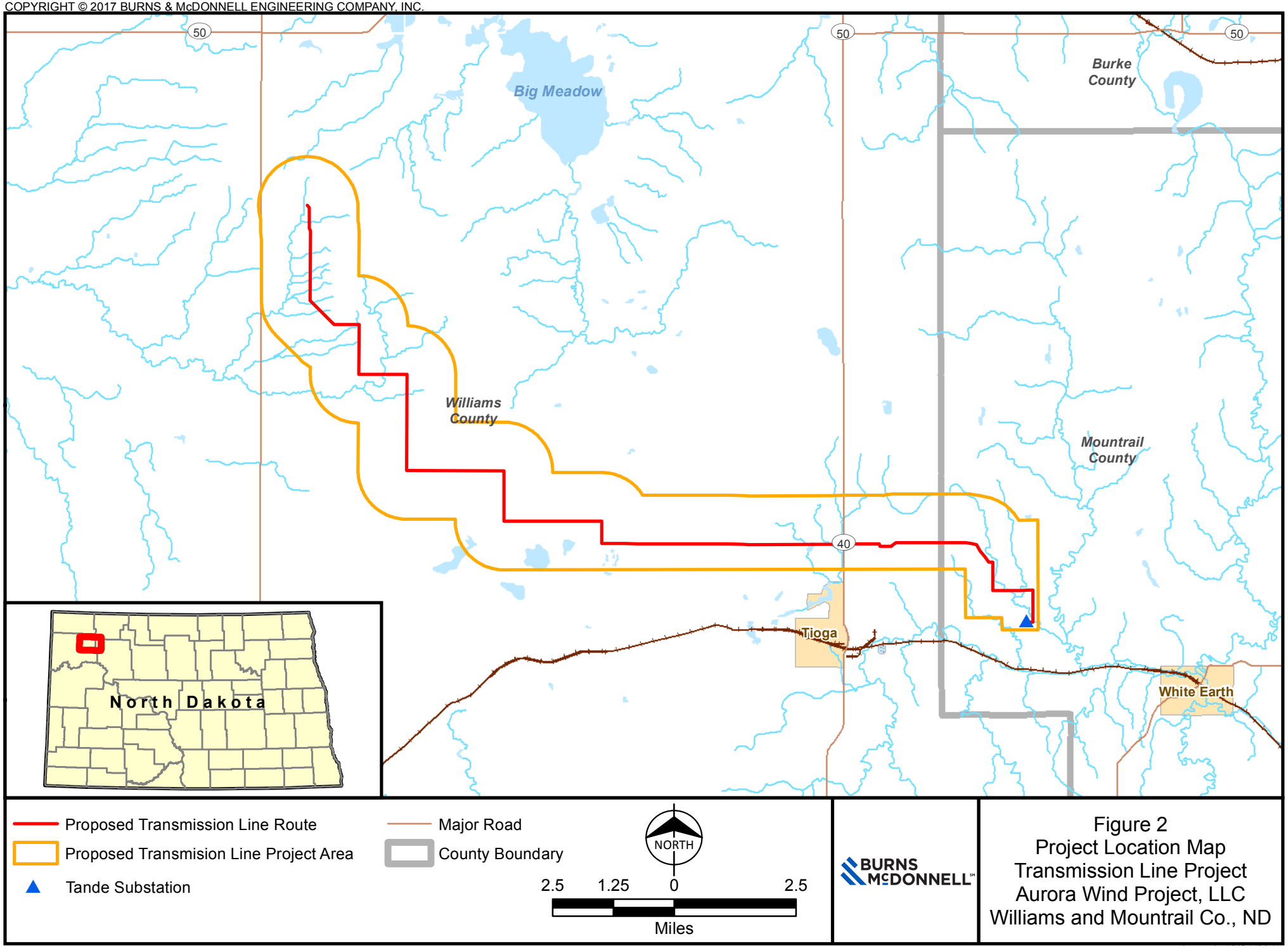

Figure 2
Project Location Map
Transmission Line Project
Aurora Wind Project, LLC
Williams and Mountrail Co., ND

Source: Esri, Burns & McDonnell Engineering Company, Inc.

Issued: 12/21/2017

NORTH DAKOTA AERONAUTICS COMMISSION

12 March 2018

Jennifer Bell
Senior Environmental Scientist, Burns & McDonnell
9785 Maroon Circle, Ste. 400
Centennial, CO 80112

Dear Ms. Bell,

I am writing in response to the invitation for comments concerning Project: PROPOSED AURORA WIND PROJECT AND ASSOCIATED TRANSMISSION LINE IN WILLIAMS AND MOUNTRAIL COUNTIES, NORTH DAKOTA

Upon review of the proposed project sketch, the North Dakota Aeronautics Commission (NDAC) found two private and/or public use airports within the projects boundary. At this time, the NDAC recommends submitting FAA Form 7460-1s when turbine locations have been finalized. The two private and/or public use airports are as follows:

Tioga Municipal Airport – Tioga, ND (Verified Usage)
Unknown Airport near Alamo, ND – Alamo, ND (Unverified Usage)

Please give the NDAC a call if you have any comments, concerns, and/or questions.

Sincerely,

Jared L. Wingo
Airport Planner
North Dakota Aeronautics Commission
Office: (701) 328-9655
Email: jwingo@nd.gov

Federal Aviation Administration

« OE/AAA

Project Submission Success
Project Name: AUROR-000452811-18

Project AUROR-000452811-18 has been submitted successfully to the FAA.

Your filing is assigned Aeronautical Study Number (ASN):

2018-WTE-744-OE
2018-WTE-745-OE
2018-WTE-746-OE
2018-WTE-747-OE
2018-WTE-748-OE
2018-WTE-749-OE
2018-WTE-750-OE
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2018-WTE-889-OE

Please refer to the assigned ASN on all future inquiries regarding this filing.

Please return to the system at a later date for status updates.

It is the responsibility of each e-filer to exercise due diligence to determine if coordination of the proposed construction or alteration is necessary with their state aviation department. Please use the link below to contact your state aviation department to determine their requirements:
State Aviation Contacts

To ensure e-mail notifications are delivered to your inbox please add noreply@faa.gov to your address book. Notifications sent from this address are system generated FAA e-mails and replies to this address will NOT be read or forwarded for review. Each system generated e-mail will contain specific FAA contact information in the text of the message.

NORTH DAKOTA DEPARTMENT OF HEALTH

NORTH DAKOTA
DEPARTMENT *of* HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

January 9, 2018

Ms. Jennifer Bell
Senior Environmental Scientist
Burns & McDonnell
9785 Maroon Circle, Suite 400
Centennial, CO 80112

Re: Proposed Aurora Wind Project and Associated Transmission Line
Williams and Mountrail Counties in North Dakota

Dear Ms. Bell:

This department has reviewed the information concerning the above-referenced project submitted under date of December 21, 2017, with respect to possible environmental impacts.

This department believes that environmental impacts from the proposed construction will be minor and can be controlled by proper construction methods. With respect to construction, we have the following comments:

1. Care is to be taken during construction activity near any water of the state to minimize adverse effects on a water body. This includes minimal disturbance of stream beds and banks to prevent excess siltation, and the replacement and revegetation of any disturbed area as soon as possible after work has been completed. Caution must also be taken to prevent spills of oil and grease that may reach the receiving water from equipment maintenance, and/or the handling of fuels on the site. Guidelines for minimizing degradation to waterways during construction are attached.

2. Projects disturbing one or more acres are required to have a permit to discharge storm water runoff until the site is stabilized by the reestablishment of vegetation or other permanent cover. Further information on the storm water permit may be obtained from the Department's website or by calling the Division of Water Quality (701-328-5210). Also, cities may impose additional requirements and/or specific best management practices for construction affecting their storm drainage system. Check with the local officials to be sure any local storm water management considerations are addressed.

3. Some areas within the proposed construction area overly the Ray and West Wildrose glacial drift aquifers. In addition, several domestic and stock water supply wells may lie in close proximity to construction activities depending on specific locations within the extent of the project. Care should be taken to avoid spills of any materials that may have an adverse

effect on groundwater quality. All spills must be immediately reported to this Department and appropriate remedial actions performed.

The department owns no land in or adjacent to the proposed improvements, nor does it have any projects scheduled in the area. In addition, we believe the proposed activities are consistent with the State Implementation Plan for the Control of Air Pollution for the State of North Dakota.

If you have any questions regarding our comments, please feel free to contact this office.

Sincerely,

L. David Glatt, P.E., Chief
Environmental Health Section

LDG:cc
Attach.

NORTH DAKOTA
DEPARTMENT *of* HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

Construction and Environmental Disturbance Requirements

These represent the minimum requirements of the North Dakota Department of Health. They ensure that minimal environmental degradation occurs as a result of construction or related work which has the potential to affect the waters of the State of North Dakota. All projects will be designed and implemented to restrict the losses or disturbances of soil, vegetative cover, and pollutants (chemical or biological) from a site.

Soils

Prevent the erosion of exposed soil surfaces and trapping sediments being transported. Examples include, but are not restricted to, sediment dams or berms, diversion dikes, hay bales as erosion checks, riprap, mesh or burlap blankets to hold soil during construction, and immediately establishing vegetative cover on disturbed areas after construction is completed. Fragile and sensitive areas such as wetlands, riparian zones, delicate flora, or land resources will be protected against compaction, vegetation loss, and unnecessary damage.

Surface Waters

All construction which directly or indirectly impacts aquatic systems will be managed to minimize impacts. All attempts will be made to prevent the contamination of water at construction sites from fuel spillage, lubricants, and chemicals, by following safe storage and handling procedures. Stream bank and stream bed disturbances will be controlled to minimize and/or prevent silt movement, nutrient upsurges, plant dislocation, and any physical, chemical, or biological disruption. The use of pesticides or herbicides in or near these systems is forbidden without approval from this Department.

Fill Material

Any fill material placed below the high water mark must be free of top soils, decomposable materials, and persistent synthetic organic compounds (in toxic concentrations). This includes, but is not limited to, asphalt, tires, treated lumber, and construction debris. The Department may require testing of fill materials. All temporary fills must be removed. Debris and solid wastes will be removed from the site and the impacted areas restored as nearly as possible to the original condition.

Telephone Memo

BURNS McDONNELL

Called:	Jeff Thomas
Organization:	North Dakota Department of Energy Services/Division of Homeland Security
Caller:	Ryann Williams
Organization:	Burns and McDonnell Engineering Inc
Subject of Call:	Tier II Hazardous Site Locations
Call Date:	2/7/2018
Call Time:	10:32 AM
Phone No. Called:	701-328-8216
Project Name:	Aurora Wind Project
Project No.:	104200
Memo Prepared By:	Ryann Williams
Date Memo Issued:	2/8/2018

Summary:

Requested site location information (latitude and longitude points) for Tier II Hazardous Waste Sites in Williams and Mountrail Counties, ND. The requested information was provided via email (rewilliams@burnsmcd.com) shortly after the conversation ended.

NORTH DAKOTA DEPARTMENT OF HUMAN SERVICES

Bailey, Justin

From: Alm, Jonathan E. <jealm@nd.gov>
Sent: Tuesday, February 27, 2018 1:50 PM
To: Bravo-Cogar, Crystal G
Subject: RE: response follow up

Follow Up Flag: Follow up
Flag Status: Flagged

The North Dakota Department of Human Services (Department) will not be providing any input regarding the Aurora Wind Project Areas. The Department does not require any applicable permits regarding the project.

Thank you,

Jonathan Alm

From: Bravo-Cogar, Crystal G [mailto:cbravocogar@burnsmcd.com]
Sent: Tuesday, February 27, 2018 11:49 AM
To: -Info-DHS Executive Office
Subject: response follow up

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Dear Mr. Christopher Jones,

Good morning. This email is a follow up with you regarding a letter Burns & McDonnell mailed to the North Dakota Department of Human Services requesting input on any sensitive resources, current or planned development, or property interests your agency or entity may have in or around the Aurora Wind Project Areas. Our inquiry also included a request for information regarding any applicable permits that may be required from your office in consideration of the project. A copy of the letter is attached for your reference.

We want to ensure your input is considered as development moves forward. Please let us know whether or not you will be responding to this request. It would be greatly appreciated and we look forward to your response.

Sincerely,

Crystal G. Bravo-Cogar

Crystal Bravo Cogar \ Burns & McDonnell
Senior Environmental Specialist
O 303-474-2247 \ M 702-501-7735
cbravocogar@burnsmcd.com \ burnsmcd.com
9785 Maroon Circle, Suite 400 \ Centennial, CO 80112

NORTH DAKOTA DEPARTMENT OF LABOR AND HUMAN RIGHTS

Bailey, Justin

From: -Info-Labor Dept. <labor@nd.gov>
Sent: Wednesday, February 28, 2018 7:51 AM
To: Bravo-Cogar, Crystal G
Subject: RE: response follow up

The North Dakota Department of Labor and Human Rights does not have any information to provide.
We do not have any required permits.

Loni G.
Administrative Officer
Phone: 701.328.2660
Fax: 701.328.2031
North Dakota Department of Labor and Human Rights

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From: Bravo-Cogar, Crystal G [mailto:cbravocogar@burnsmcd.com]
Sent: Tuesday, February 27, 2018 11:57 AM
To: -Info-Labor Dept. <labor@nd.gov>
Subject: response follow up

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Dear Ms. Michelle Kommer,

Good morning. This email is a follow up with you regarding a letter Burns & McDonnell mailed to the North Dakota Department of Human Services requesting input on any sensitive resources, current or planned development, or property interests your agency or entity may have in or around the Aurora Wind Project Areas. Our inquiry also included a request for information regarding any applicable permits that may be required from your office in consideration of the project. A copy of the letter is attached for your reference.

We want to ensure your input is considered as development moves forward. Please let us know whether or not you will be responding to this request. It would be greatly appreciated and we look forward to your response.

Sincerely,

Crystal G. Bravo-Cogar

Crystal Bravo Cogar \ Burns & McDonnell
Senior Environmental Specialist
O 303-474-2247 \ **M** 702-501-7735
cbravocogar@burnsmcd.com \ burnsmcd.com

NORTH DAKOTA DEPARTMENT OF COMMERCE

Bailey, Justin

From: McMerty, Sandra L. <smcmerty@nd.gov>
Sent: Monday, March 5, 2018 8:36 AM
To: Bravo-Cogar, Crystal G
Cc: Schneider, John F.; Schuler, Jay P.
Subject: FW: response follow up
Attachments: TWEAurora Department of Commerce.pdf; ATT00001.htm

Follow Up Flag: Follow up
Flag Status: Flagged

Crystal,

Thank you for your inquiry regarding input on any sensitive resources, current or planned development, or property interests our agency might have with interest on the Aurora Wind Project Areas. We don't have knowledge of any projects that are in conflict, but recommend visiting with the Williams and Mountrail economic development offices if you have not already.

There are no permits required by our agency for your projects at this time. However, if you wish to seek certain tax incentives from the state of North Dakota, a primary sector certification may be necessary and can be sought from this agency. More information about incentives and primary sector certification can be found at: https://www.business.nd.gov/finance/TaxIncentives

Thank you for your patience in our response and please let me know if you have any further questions.

Sandy

Sandra McMerty
Deputy Commissioner/Senior Marketing & Communications Manager
NORTH DAKOTA DEPARTMENT OF COMMERCE
p: 701-328-5371 / smcmerty@nd.gov / www.NDCommerce.com

Begin forwarded message:

> **From:** "Bravo-Cogar, Crystal G" <cbravocogar@burnsmcd.com>
> **Date:** February 27, 2018 at 11:24:02 AM MST
> **To:** "jpschuler@nd.gov" <jpschuler@nd.gov>
> **Subject: response follow up**
>
> **CAUTION:** This email originated from an outside source. Do not click links or open attachments unless you know they are safe.
>
> Dear Mr. Schuler,

Good morning. This email is a follow up with you regarding a letter Burns & McDonnell mailed to the North Dakota Department of Commerce requesting input on any sensitive resources, current or planned development, or property interests your agency or entity may have in or around the Aurora Wind Project Areas. Our inquiry also included a request for information regarding any applicable permits that may be required from your office in consideration of the project. A copy of the letter is attached for your reference.

We want to ensure your input is considered as development moves forward. Please let us know whether or not you will be responding to this request. It would be greatly appreciated and we look forward to your response.

Sincerely,

Crystal G. Bravo-Cogar

Crystal Bravo Cogar \ Burns & McDonnell
Senior Environmental Specialist
O 303-474-2247 \ **M** 702-501-7735
cbravocogar@burnsmcd.com \ burnsmcd.com
9785 Maroon Circle, Suite 400 \ Centennial, CO 80112

NORTH DAKOTA GAME AND FISH DEPARTMENT

GOVERNOR, Doug Burgum
DIRECTOR, Terry Steinwand
DEPUTY, Scott A. Peterson

"VARIETY IN HUNTING AND FISHING"

NORTH DAKOTA GAME AND FISH DEPARTMENT
100 NORTH BISMARCK EXPRESSWAY BISMARCK, NORTH DAKOTA 58501-5095 PHONE 701-328-6300 FAX 701-328-6352

8 January 2018

Jennifer Bell
Senior Environmental Scientist
Burns & McDonnell
9785 Maroon Circle, Suite 400
Centennial, CO 80112

Dear Ms. Bell:

RE: Information Request for the Proposed Aurora Wind Project and Associated Transmission Line in Williams and Mountrail Counties, ND

As the pressures of energy development on North Dakota's landscape increase, the North Dakota Game and Fish Department (Department) has taken an active role with the U.S. Fish and Wildlife Service and Energy partners in developing voluntary state specific wind energy guidelines. The purpose of these guidelines is to ensure only environmentally responsible and sustainable projects that benefit both our local communities and our wildlife are pursued, while also providing improved predictability in the permitting process. During this transition, the Department has committed to assisting each individual developer with incorporating these new guidelines.

The primary concern with wind power development, and the force driving the creation of new guidelines, is the disturbance of unbroken, native habitats associated with the construction of turbines, access roads, and other associated facilities. Native prairie is the most endangered ecosystem in North Dakota and the majority of our native species, in particular, our species of conservation concern, are linked to prairie. Disturbance, fragmentation, and the loss of native prairie have adversely impacted a wide variety of North Dakota's wildlife and these negative impacts will only continue to compound as more development takes place on the landscape. The remaining tracts of unbroken prairie are becoming more and more vital to many declining bird and pollinator species and we highly recommend avoiding these grasslands to the extent possible.

Prairie Pothole wetlands are the most productive wildlife habitat in North Dakota and, thus, must also be considered during the planning and siting of a project. A significant number of waterfowl, shorebirds, and whooping cranes utilize the resources in the region of the Aurora Project. Because these wetlands are of such considerable value to many different species, any disturbance that reduces the value and/or hydrological function should also be avoided to the extent possible. We also recommend that no alterations be made to existing drainage patterns.

The Department has a number of resources available for the benefit of the developer and consultant, including maps and information on native habitats, priority areas, and sensitive species. The Department received a data request for eagle nests and other sensitive species within 10 miles of the project area from your consulting firm, WEST, Inc. on December 21, 2017. On January 2, 2018, the Department queried the database and there were no known locations of eagle nests or grouse leks. However, nesting bald eagles are increasing significantly in North Dakota and leks are only surveyed by Department staff in designated census blocks. Therefore, the Department highly recommends that surveys be conducted for raptor nests and sharp-tailed grouse leks within the project area. Core native habitat layers are available via Esri REST Services https://gf.nd.gov/maps/data then selecting North Dakota Game and Fish Department Species Range and Habitats. Finally, the Department also recommends working with the U.S. Fish and Wildlife Service, as any state guidelines do not relieve the developer of its obligations to comply with any applicable federal regulations.

In our initial review of the project, we would like to commend Aurora Wind Project, LLC and Tradewind Energy, Inc., as the majority of the project appears to be within a relatively low sensitive area with respects to native habitats. However, depending on the placement of turbines, roads, and associated infrastructure, there may still be a need to develop an offset plan for the direct and indirect impacts due to disturbance of unbroken, native prairie and wetland habitats. The Department would appreciate being kept informed as the project progresses and, if possible, we would like the spatial data for roads and turbine locations after the site has been established. Please contact Sandra Johnson, Conservation Biologist at 701-328-6327 for any other data requests.

Sincerely,

Greg Link
Chief, Conservation & Communications Division

em

cc: Kevin Shelley, US Fish and Wildlife Service ESA

Jennifer Dean

From: Clayton Derby <cderby@west-inc.com>
Sent: Tuesday, January 02, 2018 10:30 AM
To: Jennifer Dean
Subject: Fwd: Eagle Nest Locations

Hi Jenni

Happy New Year!

See below regarding no known bald or golden eagle nests within 10 miles of the Aurora project.

Clayton Derby
CSO / Wildlife Biologist

Western Ecosystems Technology, Inc.
Environmental & Statistical Consultants
4007 State Street, Suite 109
Bismarck, ND 58503
(701) 250-1756
(701) 426-5072 Cell
(701) 250-1761 Fax
cderby@west-inc.com
www.west-inc.com

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---------- Forwarded message ----------
From: **Johnson, Sandra K.** <sajohnson@nd.gov>
Date: Tue, Jan 2, 2018 at 9:35 AM
Subject: RE: Eagle Nest Locations
To: Clayton Derby <cderby@west-inc.com>

Clayton,

There are no known bald or golden eagle nests within 10 miles of the project area. We do not have a grouse census block in this area so there are no known leks in the database.

Native or unbroken prairie is present in the project area and these areas should be avoided or minimized to the extent possible to preclude impacts to species of conservation priority.

Sandy

Sandy Johnson

Conservation Biologist

North Dakota Game and Fish Department

100 N. Bismarck Expwy.

Bismarck, ND 58501-5095

Phone: 701-328-6382

sajohnson@nd.gov

http://gf.nd.gov/

From: Clayton Derby [mailto:cderby@west-inc.com]
Sent: Friday, December 22, 2017 9:27 AM
To: Johnson, Sandra K. <sajohnson@nd.gov>
Subject: Re: Eagle Nest Locations

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Someday maybe I will remember that!

See attached.

Clayton Derby

CSO / Wildlife Biologist

Western Ecosystems Technology, Inc.
Environmental & Statistical Consultants

4007 State Street, Suite 109

Bismarck, ND 58503

(701) 250-1756

(701) 426-5072 Cell

(701) 250-1761 Fax
cderby@west-inc.com

www.west-inc.com

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On Fri, Dec 22, 2017 at 7:04 AM, Johnson, Sandra K. <sajohnson@nd.gov> wrote:

> Darn state email system…can you please send unzipped or change extension to .piz.
>
> Thanks,
>
> Sandy
>
> *Sandy Johnson*
>
> *Conservation Biologist*
>
> *North Dakota Game and Fish Department*

100 N. Bismarck Expwy.

Bismarck, ND 58501-5095

Phone: 701-328-6382

sajohnson@nd.gov

http://gf.nd.gov/

From: Clayton Derby [mailto:cderby@west-inc.com]
Sent: Thursday, December 21, 2017 3:22 PM
To: Johnson, Sandra K. <sajohnson@nd.gov>
Subject: Eagle Nest Locations

An attachment has been removed from this message in accordance with the State of North Dakota Information Technology Department's Email Service Level Agreement (https://www.nd.gov/itd/services/email/email-service-level-agreement**). The attachment is NOT recoverable.**

Please contact your IT support staff or the ITD Service Desk with any concerns. You can submit an incident ticket to ITD via the web at www.nd.gov/itd/support **or by phone at 701-328-4470.**

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Hello Sandy

Hope you are well.

Attached please find a shapefile of the proposed Aurora Wind Project near Tioga. I am requesting a search of your database for any eagle nest locations within 10 miles, as well as other locational information on other sensitive species, that can help in project siting to avoid and minimize impacts.

If needed, please provide me a copy of your data sharing agreement for signature.

Thank you

Clayton Derby

CSO / Wildlife Biologist

Western Ecosystems Technology, Inc.
Environmental & Statistical Consultants

4007 State Street, Suite 109

Bismarck, ND 58503

(701) 250-1756

(701) 426-5072 Cell

(701) 250-1761 Fax
cderby@west-inc.com

www.west-inc.com

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Jennifer Dean

From: Clayton Derby <cderby@west-inc.com>
Sent: Monday, August 13, 2018 12:02 PM
To: Kevin Shelley; JOHN SCHUMACHER
Cc: Jennifer Dean; Katherine Moratz
Subject: Re: Aurora Meeting Materials
Attachments: Aurora_Aug 16 2018_Agency Memo Final.pdf

With attachment this time.

Clayton Derby
CSO / Wildlife Biologist

Western EcoSystems Technology, Inc.
Environmental & Statistical Consultants
4007 State Street, Suite 109
Bismarck, ND 58503
(701) 250-1756
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On Mon, Aug 13, 2018 at 11:21 AM, Clayton Derby <cderby@west-inc.com> wrote:

> Hello Kevin and John
>
> Attached please find a summary memo and a few figures to help lead the Aurora Wind Project meeting at 1 pm this Thursday, August 16. Please note that the meeting will be at the NDGFD office.
>
> See you on Thursday.
>
> **Clayton Derby**
> **CSO / Wildlife Biologist**

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ENVIRONMENTAL & STATISTICAL CONSULTANTS

4007 State Street, Suite 109, Bismarck, ND 58503
Phone: 701-250-1756 ◆ www.west-inc.com ◆ Fax: 701-250-1761

TO: USFWS and NDGFD
RE: Aurora Wind Energy Project Survey Update
DATE: August 16, 2018

Western EcoSystems Technology, Inc. (WEST) has been assisting Aurora Wind Project, LLC (Aurora), a subsidiary of Tradewind Energy, Inc., in implementing Tier 2 and 3 actions as described in the USFWS Wind Energy Guidelines (WEG) and USFWS Eagle Conservation Planning Guidance (ECPG) for the proposed Aurora Wind Energy Project (Project). The Project as currently planned encompasses approximately 44,000 acres and is located in Williams and Mountrail counties, North Dakota (Figure 1). The purpose of this memo is to facilitate a discussion related to the completed Tier 2 and Tier 3 wildlife surveys and future survey work at the Project.

Tier 2 Efforts:

1. Site Characterization Study
    - Review of biological resources with respect to potential Project development
    - Anticipated low adverse impacts to bird and bat species
2. Whooping Crane Habitat Analysis
    - Assess potential suitability of wetlands within the Project
    - Project had smallest average sized wetlands and the second smallest total wetland acreage and number of basins compared to four adjacent reference areas
    - Project located with the defined whooping crane corridor but all facilities are outside the non-covered lands from WEWAG effort
    - Project falls within unoccupied stopover site use intensity cells
    - No whooping cranes documented in Project area from the USFWS sighting database. Whooping cranes observed during point counts, see Tier 3.
    - Potential to migrate over or through the Project
3. Stage 1 Site Assessment of Eagle Use/Risk
    - Assess if Project is known or likely to be used by eagles
    - Golden eagles uncommon
    - Bald eagles possible since some potential habitat exists (wetland complexes, grasslands) but overall the area lacks nesting habitat
    - NDGFD reports no known bald or golden eagle nests within 10 miles
    - No significant adverse impacts expected

Tier 3 Efforts:

1. Eagle/Avian Use Surveys
    - 2 years of surveys
    - 1 hour fixed-point surveys at 33 points
    - 700 60-minute fixed point surveys
    - 4 bald and 2 golden eagles observed during fixed-point surveys
    - Anticipated low risk
    - Do not plan to seek an eagle permit
    - Total of 12 whooping cranes observed flying above rotor swept height with flocks of sandhill cranes on April 24, 2018.
    -
2. Eagle/Raptor Nest Surveys
    - 2 years of aerial surveys
    - Meandering aerial transects of potential suitable habitat
    - Eagle nests within 10 miles and non-eagle raptors within 1 mile of boundary
    - No eagle nests observed
3. Sharp-tailed Grouse Lek Surveys
    - Road-based surveys in 2018
    - 3 surveys from early April to early May
    - Limited overall grassland blocks within and adjacent to Project (Figure 3) for lekking, brood rearing, etc.
    - 52 points along public roads/trails around grasslands >80 acres
    - 5 minutes of observations at each point
    - 3 leks observed (2 confirmed and 1 potential; Figure 3)
    - Turbines adjusted such that no leks within 1 mile of proposed turbine locations

Future Efforts:

1. Construction and Operations
    - Operations personnel training for whooping crane identification and shutdown procedures if within 2 miles of turbines.
    - Transmission line to be marked with bird diverters
    - Post-construction fatality monitoring (Tier 4 surveys)
    - Development of Bird and Bat Conservation Strategy (BBCS)

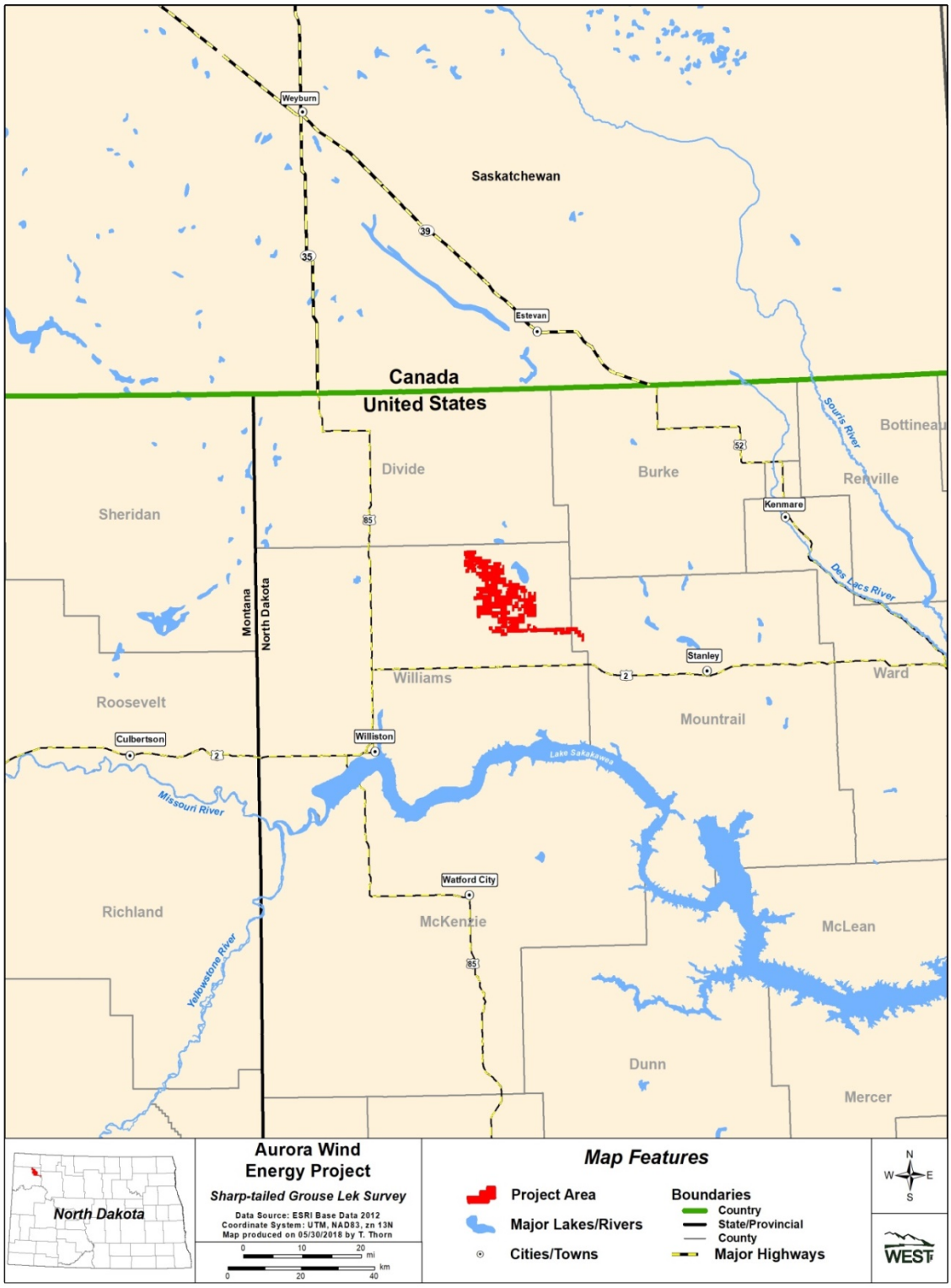

Figure 1. Location and current boundary of the Aurora Wind Energy Project in Williams and Mountrail counties, North Dakota.

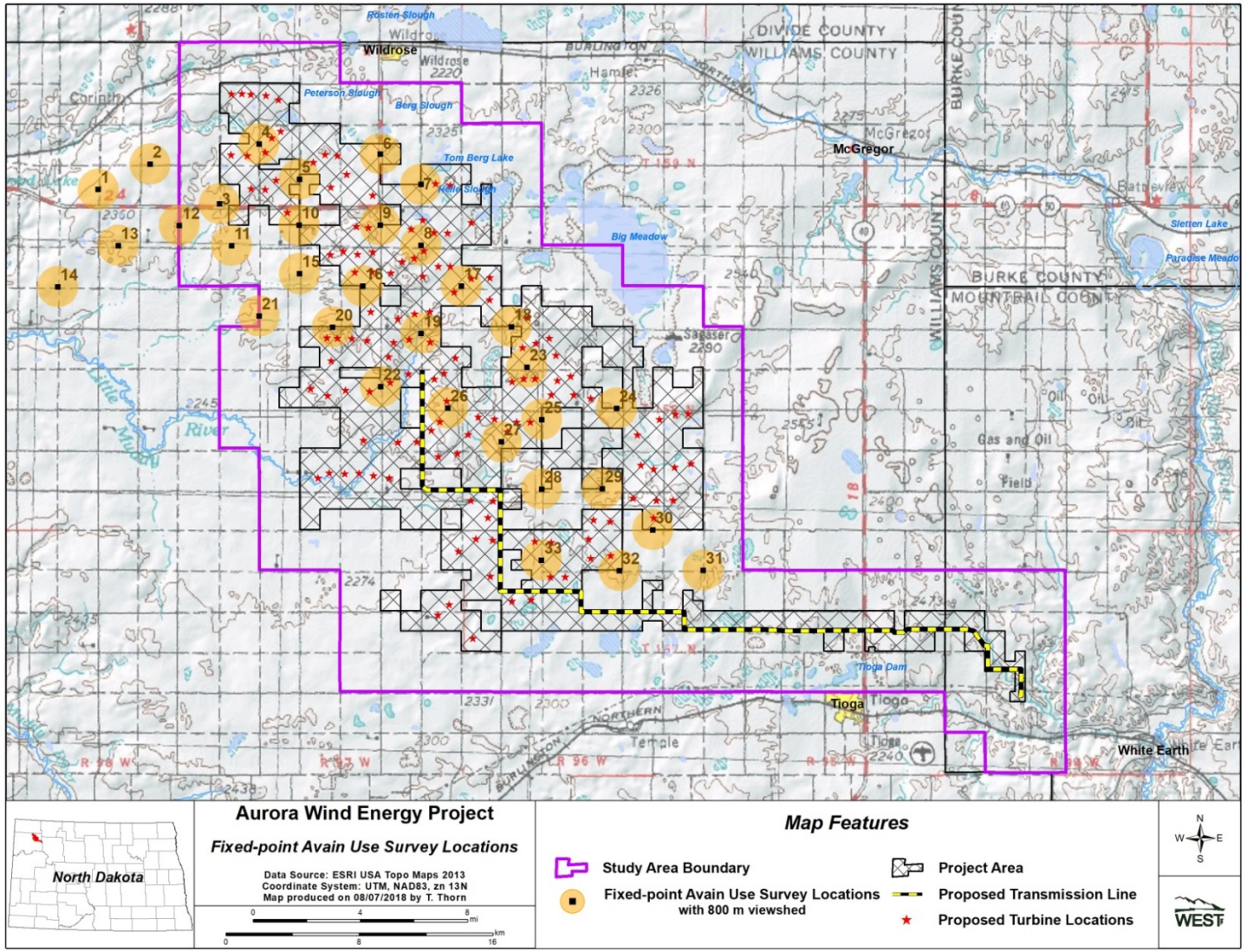

Figure 2. Fixed-point survey locations, proposed turbine locations, and proposed transmission line within the Aurora Wind Energy Project in Williams and Mountrail counties, North Dakota.

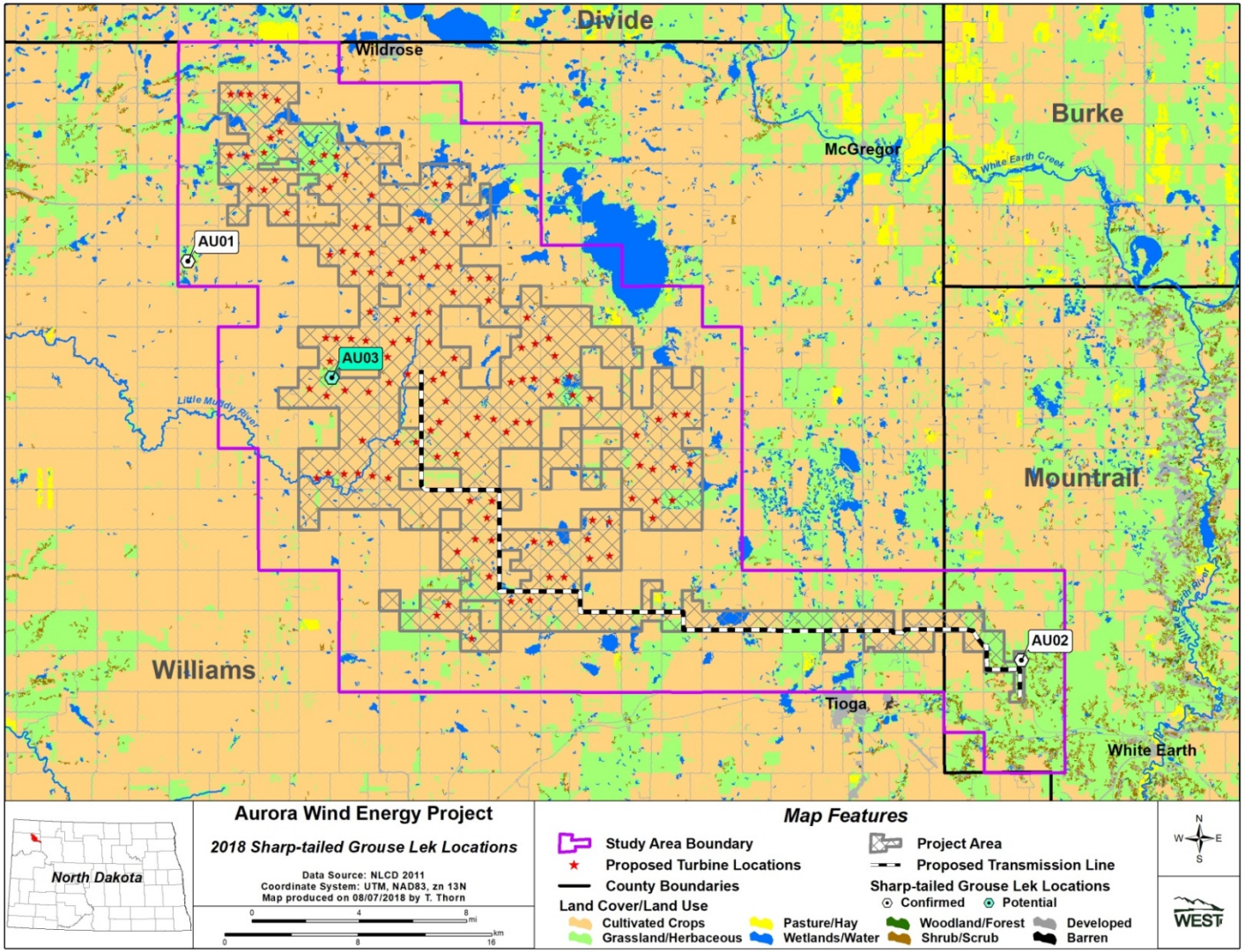

Figure 3. Sharp-tailed grouse lek locations, proposed turbine locations, and proposed transmission line within the Aurora Wind Energy Project, Williams and Mountrail counties, North Dakota.

Jennifer Dean

From: Clayton Derby <cderby@west-inc.com>
Sent: Friday, September 21, 2018 2:54 PM
To: Dyke, Steve (NDGF)
Cc: Kevin Shelley; JOHN SCHUMACHER; Jennifer Dean; Katherine Moratz; Scott_Larson@fws.gov
Subject: Re: Aurora Wind Meeting
Attachments: Aurora_USFWS-NDGFD Meeting Notes_081618 Final Update.pdf; Aurora_A031_299.9MW--GE2.5x108_GE2.3x13_2018-07-26.zip

Hello Group

Steve, thank you for the suggested additions, I have put those ideas into the discussion section. The updated notes are attached for your files.

Also attached is the final layout shapefile for your review. We would be available and open to have further discussions with the group on any letter responses developed to have a "no surprises" understanding before public hearings on the PSC applications (I believe that was the term used by Steve during the meeting?).

Have a great weekend.

Clayton Derby
CSO / Wildlife Biologist

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On Thu, Sep 13, 2018 at 2:40 PM Dyke, Steve R. <sdyke@nd.gov> wrote:

Clayton, thanks for sharing the meeting notes. I suggest for your consideration the following items for inclusion into the meeting notes.

1. Could post construction collision survey $ be better spent on offsets for habitat restoration efforts.

2. How there is a lack of 'vendors' in the state for habitat creation/restoration. The ND Natural Resource Trust might be positioned to help in that effort.

Additionally, while it may or may not have been discussed at the meeting, our agency strongly encourages the project sponsors provide us with the turbine locations and road alignments well before notice of a PSC public hearing on the project.

Steve

From: Clayton Derby <cderby@west-inc.com>
Sent: Wednesday, September 12, 2018 3:10 PM
To: Kevin Shelley <Kevin_Shelley@fws.gov>; Dyke, Steve R. <sdyke@nd.gov>; Schumacher, John D. <jdschumacher@nd.gov>
Cc: Jennifer Dean <jdean@tradewindenergy.com>; Katherine Moratz <kmoratz@west-inc.com>
Subject: Aurora Wind Meeting

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Hello

Attached please find meeting notes and referenced material from the Aurora Wind Project meeting held on August 16, 2018.

Thank you,

Clayton Derby

CSO / Wildlife Biologist

Western EcoSystems Technology, Inc.
Environmental & Statistical Consultants

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Phone: 701-250-1756 ◆ www.west-inc.com ◆ Fax: 701-250-1761

MEETING NOTES

SUBJECT: Wildlife survey result update for agencies	
PROJECT: Aurora Wind Project	**MEETING LOCATION:** NDGFD Office
MEETING DATE: August 16, 2018	**NOTES BY:** K. Moratz and C. Derby

ATTENDEES

Steve Dyke, NDGFD
John Schumacher, NDGFD
Elisha Mueller, NDGFD
Kevin Shelley, USFWS
Jennifer Dean, Aurora
Dave Iadarola, Aurora
Haileigh Shull, Aurora
Katherine Moratz, WEST
Clayton Derby, USFWS

TOPICS DISCUSSED

Project Overview

Dave Iadarola, Aurora Wind Project, LLC (Aurora), provided a brief review of the Aurora Wind Project (Project) location in northwestern North Dakota. The Project is mainly in eastern Williams County with approximately 3 miles of overhead transmission line that will connect to the existing Tande Substation in Mountrail County. The Project is anticipated to be up to 300MW and has obtained Conditional Use Permits in both Williams and Mountrail counties. The Project permitted up to 131 turbine locations which includes alternates. The 345 kV overhead transmission line is anticipated to be approximately 25 miles in total length. Jenni Dean, Aurora, briefly discussed a tentative timeline of the Public Service Commission (PSC) application for a Certificate of Site Compatibility (CSC) and Route Permit and hearings. At this time, the Project is targeting a mid to late September 2018 application submittal to the PSC for a CSC and anticipates public hearings to occur in January 2019. The Project noted it had received a letter from the North Dakota Game and Fish Department (NDGFD) in May 2018. To date, no correspondence has been received from the United States Fish & Wildlife Service (USFWS).

Tier 2 and Tier 3 Review

Clayton Derby reviewed efforts completed to date at the Project (see attached "Aurora Wind Energy Project Survey Update" memo attached and previously provided electronically to USFWS and NDGFD on August 13, 2018). This synopsis included a brief review of efforts previously discussed at the February 8, 2017, agency meeting, including the Tier 2 site characterization study, Stage 1 site assessment of eagle use and risk, and year one eagle/avian use and raptor nest surveys. Additionally, Clayton provided an update on results of the year two avian use and raptor nest surveys. Clayton also provided results of the sharp-tailed grouse lek

CONFIDENTIAL BUSINESS INFORMATION

surveys, a survey that was conducted in response to the May 22, 2018, NDGFD letter. In response to the 2018 lek survey, the Project has moved wind turbines to be more than one mile from these lek locations. In addition, wetland and cultural work is ongoing at the Project and is largely complete based in the current design. In an effort to minimize potential risk to existing avian stopover resources, the Project has analyzed the quality of wetlands into three categories: 1) all wetlands greater than 0.5 acres in size, 2) all wetlands considered to be high quality (smaller than 0.5 acres but located in non-agricultural fields and dominated by higher quality, non-invasive wetland species, and 3) all other wetlands. The Project is currently evaluating Project infrastructure as it relates to these categories of wetlands for siting. The Project has also coordinated with USFWS's easement office three times regarding information on wetland and grassland easements in the area as the Project design has evolved.

Clayton then outlined future efforts to be conducted at the Project that will be outlined in the Project's Bird and Bat Conservation Strategy (BBCS). As additional micrositing and design changes are finalized, the Project will continue to coordinate with USFWS's easement office to note protected basins and grasslands in relation to Project infrastructure. In addition to the above siting efforts, the Project and agencies noted the location of the area in regards to the migration corridor of the Whooping crane. The Project committed to marking 100% of the overhead transmission line with bird diverters. Additional monitoring efforts to minimize potential risk to migrating Whooping cranes will be noted in the BBCS. The Project committed to sharing a draft version of the BBCS with both agencies for review and comment.

Discussion

Both USFWS and NDGFD asked questions regarding the efforts completed; however questions were minimal. Questions and discussion included the future development steps for the Project and the PSC process. The group also discussed options for providing funds for habitat offsets instead of conducting expensive post-construction fatality monitoring studies, but agreement that currently there is a general lack of "vendors" in the state that can receive these funds and effectively implement habitat restoration or enhancement efforts. The North Dakota Natural Resource Trust may be one vendor that could be investigated to serve this purpose. Both agencies provided positive remarks on the siting of the Project within a fragmented landscape. All parties voiced a willingness to continue to work together as the Project continues to develop. Another agency meeting could potentially occur before the PSC hearing to discuss any additional topics regarding infrastructure placement if all parties are interested.

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NORTH DAKOTA INDUSTRIAL COMMISSION

Oil and Gas Division

Lynn D. Helms - Director Bruce E. Hicks - Assistant Director

Department of Mineral Resources

Lynn D. Helms - Director

North Dakota Industrial Commission

www.dmr.nd.gov/oilgas/

January 19, 2018

Jennifer Bell
Senior Environmental Scientist
Burns & McDonnell
9785 Maroon Circle, Suite 400
Centennial, CO 80112

RE: NDIC wells within Aurora wind project

Dear Jennifer,

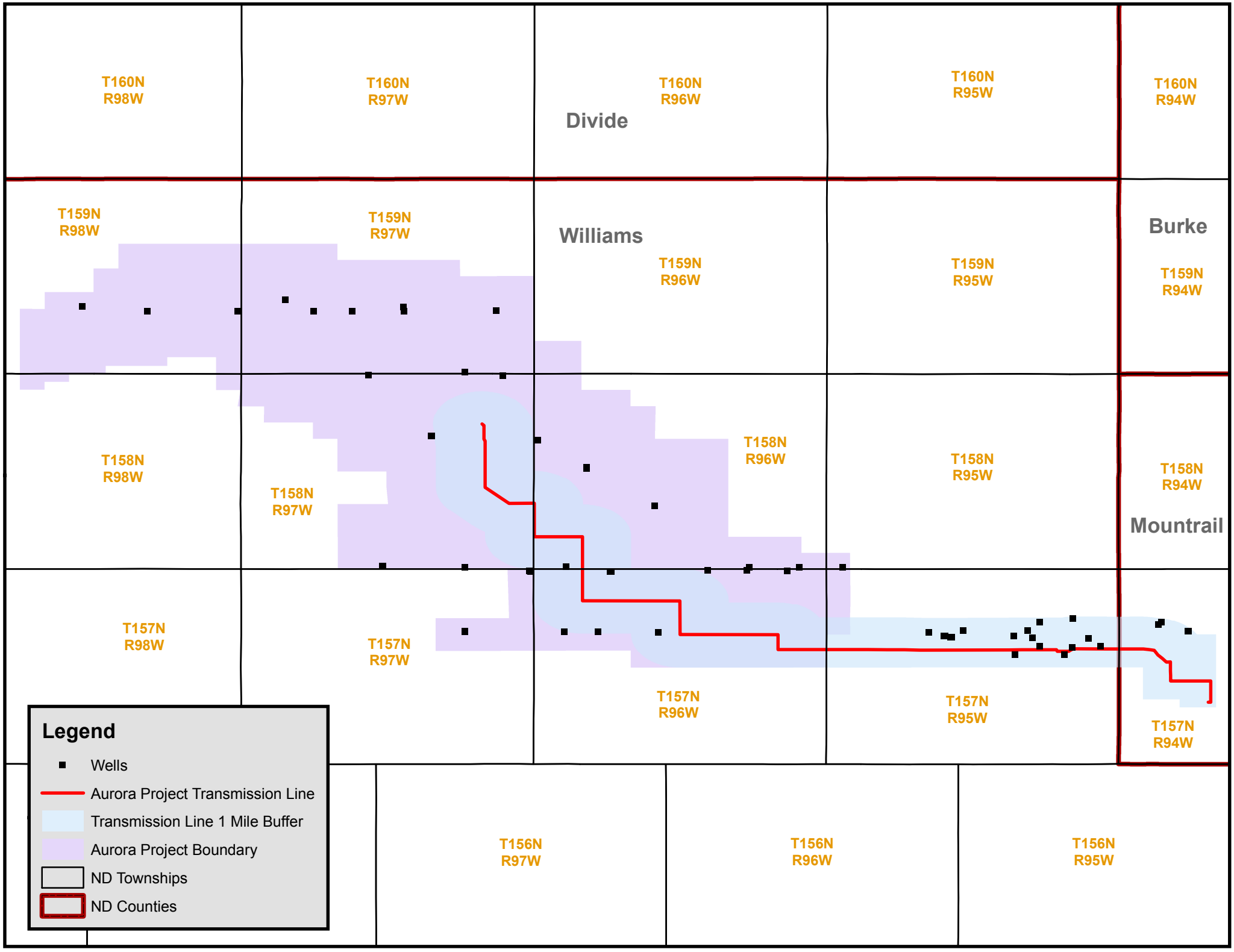
Please note the attached GIS shapefile which indicates that there are 79 wells located within the total project area. An excel workbook is also included, which should help you with additional queries.

Should you have additional questions, feel free to call.

Sincerely,

Todd L. Holweger
Permit Manager

Attachments sent via email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T157N R94W
T156N R97W
T156N R96W
T156N R95W
Legend
Wells
Aurora Project Transmission Line
Transmission Line 1 Mile Buffer
Aurora Project Boundary
ND Townships
ND Counties

Bailey, Justin

From: Bell, Jennifer
Sent: Thursday, January 4, 2018 11:23 AM
To: 'Holweger, Todd L.'
Subject: RE: NDIC info
Attachments: 2017_12_20_Aurora_A006R0_OHTransmission_export.zip; 2017_12_20_Aurora_A006R0_OHTransmission_export_1miBuffer.zip; 2017_12_20_Aurora_ProjectBdry.shp.zip

Hi Todd,

As requested, please see attached shapefiles for your use in reviewing the Aurora Wind Project and associated transmission line.

Thank you,

Jennifer Bell \ Burns & McDonnell
Senior Environmental Scientist
O 303-474-2229 \ F 303-721-0563
jbell@burnsmcd.com \ burnsmcd.com
9785 Maroon Circle \ Suite 400 \ Centennial, CO 80112

From: Holweger, Todd L. [mailto:tholweger@nd.gov]
Sent: Wednesday, January 03, 2018 10:39 AM
To: Bell, Jennifer <jbell@burnsmcd.com>
Subject: NDIC info

Jennifer;

Please send the shape files for the Figure 1 &2 “project location maps”. We will evaluate and give you our spatial info as appropriate.
Thanks,

Todd L. Holweger
Permit Manager
NDIC-DMR-OGD
(701) 328-8024

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

North Dakota Department of Transportation

Thomas K. Sorel
Director

Doug Burgum
Governor

January 24, 2018

Jennifer Bell
Senior Environmental Scientist
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114

PROPOSED AURORA WIND PROJECT AND ASSOCIATED TRANSMISSION LINE, MOUNTRAIL AND WILLIAMS COUNTIES, NORTH DAKOTA

We have reviewed your December 21, 2017, letter.

This project should have no adverse effect on the North Dakota Department of Transportation (NDDOT) highways.

However, if because of this project any work needs to be done on highway right of way, appropriate permits and risk management documents will need to be obtained from the Department of Transportation District Engineer, Joel Wilt at 701-774-2700.

Robert Fode

ROBERT A. FODE, P.E., DIRECTOR - OFFICE OF PROJECT DEVELOPMENT

57\raf\js
c: Joel Wilt, Williston District Engineer

NORTH DAKOTA STATE HISTORICAL SOCIETY

STATE HISTORICAL SOCIETY OF NORTH DAKOTA

Doug Burgum
Governor of North Dakota

North Dakota
State Historical Board

Terrance Rockstad
Bismarck - President

Gereld Gerntholz
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Calvin Grinnell
New Town

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Parks and Recreation Department

Thomas Sorel
Interim Director
Department of Transportation

Claudia J. Berg
Director

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January 3, 2018

Ms. Jennifer Bell
Senior Environmental Scientist
Burns & McDonnell
9785 Maroon Circle, Suite 400
Centennial, CO 80112

ND SHPO REF: 18-0244 ND Public Service Commission – Proposed 300 MW Aurora Wind Project & Associated Transmission Line in Williams and Mountrail Counties, North Dakota

Dear Ms. Bell,

Thank you for your preliminary information on ND SHPO REF: 18-0244 ND Public Service Commission – Proposed 300 MW Aurora Wind Project & Associated Transmission Line. We recommend survey for cultural resources as follows:

- A current Class I (file search) to determine any additional recorded cultural resources in the project area.

- A Class III (pedestrian) survey by a permitted architectural historian for standing buildings and structures (including cemeteries) over 50 years old in the visual Area of Potential Effect (APE). This is within a 2 mile radius of individual turbine locations. The purpose is to evaluate any architectural or structural features that may be eligible for nomination to the National Register of Historic Places. At least three out of the seven aspects of integrity used to evaluate historic properties could be impacted by the proposed project: the setting, feeling, and association of historic sites.

- A Class III archaeological survey of all areas of direct impact including crane paths, met towers, access roads, turbine locations and staging areas, unless the footprint has been recently surveyed for cultural resources.

We look forward to seeing project representatives here on January 23, 2018, 10:30 am, Central Time.

Thank you for the opportunity to review preliminary information on this project. If you have questions please contact or Susan Quinnell at squinnell@nd.gov or (701) 328-3576.

Sincerely,

Claudia J. Berg
Director, State Historical Society of North Dakota

Jennifer Dean

From: Fulmer, John <jfulmer@burnsmcd.com>
Sent: Monday, January 29, 2018 4:30 PM
To: Picha, Paul R.; Quinnell, Susan L.
Cc: Latham, Mark; Harris, Brandy M; Jennifer Dean; Dave Iadarola
Subject: Aurora Wind Project (NDSHS #18-0244) -- Meeting Notes from 1/23
Attachments: 2018-01-29_Aurora Wind Project SHPO Meeting Notes_BMcD_Cultural.pdf

Hi Paul and Susan –

Thank you both for taking the time to meet with Tradewind and Burns & McDonnell last week about the upcoming Aurora Wind Project. Please find attached a memo with our notes from the meeting. If we missed or misunderstood anything, please let us know and we will revise and resend the document.

Thanks again for your attention to this project. We look forward to working with you.

JF

John Fulmer
Cultural Resources Section Manager
Environmental Services
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114
Direct: 816.822.3986
Cell: 832.671.1838

Meeting Notes

BURNS McDONNELL

Meeting Subject:	Aurora Wind Project Cultural Resources Surveys: Project Introduction and Planning Meeting
Meeting Date:	January 23, 2018
Start Time:	10:30 AM
End Time:	11:30 AM
Location:	State Historical Society of North Dakota, 612 East Boulevard Avenue, Bismarck, North Dakota
Project Name:	Aurora Wind Project (NDSHS #18-0244)
Project No.:	104200

Attendees	Organization
Paul Picha	NDSHS
Susan Quinnell	NDSHS
Jennifer Dean	Tradewind Energy, Inc.
David Iadarola	Tradewind Energy, Inc.
Mark Latham	Burns & McDonnell
Brandy Harris	Burns & McDonnell

Notes Prepared By:	Brandy Harris
Date Notes Issued:	January 29, 2018

Meeting Notes:

Representatives from the project sponsor (Tradewind Energy, Inc.), their cultural resources consultant (Burns & McDonnell), and the North Dakota State Historical Society (NDSHS) were present. The purpose of the meeting was to initiate coordination regarding a proposed wind project in Williams and Mountrail Counties, North Dakota. Though there is no federal nexus for the project, compliance with North Dakota Public Service Commission requirements is required to attain state permits. Paul Picha (Chief Archaeologist) and Susan Quinnell (Review and Compliance Coordinator) were introduced to the project and asked for input regarding survey methods, report requirements, etc. The discussion is summarized below.

Archaeology

1. First step is completion of a Class I Survey according to state standards summarizing the results of the records review and identifying previously recorded resources within the project area and a larger study area. The resources will include archaeological sites, architectural resources, and previous surveys.
2. NDSHS will require 100 percent survey of all previously un-surveyed areas potentially subject to direct impacts including turbine pads, ancillary facilities, access roads, construction laydown areas, etc. Surveys conducted up to approximately 20 years ago can still be considered valid but should be coordinated with NDSHS on case-by-case basis.
3. Survey cannot occur if snow is present but is permissible if ground is still frozen.
4. Mr. Picha suggested adding buffers around the proposed project footprint to account for minor shifts or design changes and indicated survey should represent a good faith effort to

identify surface and near-surface resources. This effort would include a pedestrian survey with judgmental shovel probing in areas with low ground surface visibility. Emphasized North Dakota prefers term "shovel probe" to "shovel test." Methods for determining where to excavate shovel probes should be outlined in the report; however, Mr. Picha suggested excavating at least one shovel probe at each proposed wind turbine location.

5. No shovel probes should be excavated in or around surface rock feature sites such as stone circles and cairns.
6. If sites are located, NDSHS recommends at least a 50-foot buffer if a site is to be avoided, larger if feasible. Specifically, it is imperative to avoid any rock feature sites, even by spanning. Emphasized importance of specifically describing how site boundaries were determined (extent of surface expression, topography, shovel probes, etc.) to facilitate avoidance.
7. Use of datums to mark site locales is no longer required; sub-meter GPS is accepted instead.
8. NDSHS cannot force project proponents to consult with tribes, but encouraged coordination with the Indian Affairs Commission.
9. NDSHS never conducts eligibility testing on historic-period archaeological sites as they feel their significance is usually based on their historic associations. As a result, chain of title and archival research is required to assess their significance. Exceptions may be remnants that display distinctive architectural features associated with particular ethnic groups.
10. NDSHS prefers to allay report submittal until design is complete or near complete. They do not like receiving multiple addenda to reports. Regarding formatting, NDSHS indicated both archaeology and architectural resources can be discussed in the same report and that photographs, figures, etc. can be attached as appendices rather than imbedded in the text. A cultural history section is not required as per their standards; however, one will be included on request of Tradewind.
11. Report needs to include an unanticipated discoveries plan that addresses both archaeological sites and human remains.

Historic-Age Architectural Resources

12. Survey should document all buildings, structures, objects, etc. 50-years-of age or older from project's anticipated letting date within a 2-mile buffer.
13. Resource documentation forms only need to be completed/submitted for those resources assessed as potentially eligible for inclusion on the National Register of Historic Places (NRHP). Ms. Quinnell agreed that an interim submittal with photos and an inventory table could help facilitate accurate determinations. She emphasized that eligibility standards are different in North Dakota as historic depopulation trends mean some resources that would be ubiquitous in other areas may be distinct or rare here. Photographs of all resources should be included in the report regardless of their eligibility status.

14. Visual effects assessments are only required for the wind turbines. As a result, the 2-mile buffer can be based on that array without including the proposed transmission line.
15. For any communities that extend into the survey area, Ms. Quinnell indicated one resource form with streetscapes and overviews is acceptable rather than individual documentation of every building, structure, etc.
16. NDSHS has developed historic contexts for a number of themes and resource types; Ms. Quinnell mentioned that in addition to historic-age farm complexes, the survey should be cognizant of oil wells and other extraction related equipment, as well as iron crosses in cemeteries. The latter are considered NRHP eligible. With regard to farm complexes, the barn is likely to be the eligible component if one is present.

Action Items

a. Initiate Class I Survey once preliminary design is accomplished.
b. Get list of federally-recognized tribes that may have interest in the area from Ms. Quinnell and initiate contact with the Indian Affairs Commission.

Jennifer Dean

From: Quinnell, Susan L. <squinnell@nd.gov>
Sent: Monday, January 29, 2018 4:44 PM
To: Fulmer, John; Picha, Paul R.
Cc: Latham, Mark; Harris, Brandy M; Jennifer Dean; Dave Iadarola
Subject: RE: Aurora Wind Project (NDSHS #18-0244) -- Meeting Notes from 1/23
Attachments: Tribal Historic Preservation Officers in North Dakota.docx

Hello All,

Here is an updated list of THPO offices in North Dakota. Thank you for the meeting notes.

Susan Quinnell
Review and Compliance Coordinator
ND State Historic Preservation Office
State Historical Society of North Dakota
North Dakota Heritage Center
612 East Boulevard Avenue
Bismarck ND 58505-0830

701-328-3576
701-328-3710 FAX

From: Fulmer, John [mailto:jfulmer@burnsmcd.com]
Sent: Monday, January 29, 2018 4:30 PM
To: Picha, Paul R.; Quinnell, Susan L.
Cc: Latham, Mark; Harris, Brandy M; Jennifer Dean (jdean@tradewindenergy.com); Dave Iadarola
Subject: Aurora Wind Project (NDSHS #18-0244) -- Meeting Notes from 1/23

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Hi Paul and Susan –

Thank you both for taking the time to meet with Tradewind and Burns & McDonnell last week about the upcoming Aurora Wind Project. Please find attached a memo with our notes from the meeting. If we missed or misunderstood anything, please let us know and we will revise and resend the document.

Thanks again for your attention to this project. We look forward to working with you.

JF

John Fulmer
Cultural Resources Section Manager
Environmental Services
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114
Direct: 816.822.3986
Cell: 832.671.1838

Tribal Historic Preservation Officers in North Dakota 1/29/2018

This list does not include all tribes to be consulted on North Dakota projects, only those with lands on reservations in North Dakota. Tribes in adjacent states and beyond may also have cultural ties to project areas in North Dakota. See:

http://www.nathpo.org/aboutthpos.htm
http://www.nathpo.org
http://www.achp.gov/thpo.html
https://grantsdev.cr.nps.gov/THPO_Review/index.cfm

North Dakota

Mandan, Hidatsa & Arikara Nation
Elgin Crows Breast, THPO
404 Frontage Road
New Town, ND 58763

Tel: 701.862.2474
Fax: 701.862.2490
Email: redhawk@mhanation.com

Spirit Lake Tribe of Fort Totten
Dr. Erich Longie, THPO
PO Box 76
Fort Totten, ND 58335

FCC Compliance Tel: 701.766.4031
THPO Tel: 701.766.4032
THPO Cell 701.230.7029
Fax: 701.766.4053
Email: thpo@gondtc.com

Standing Rock Sioux Tribe
Jon Eagle, THPO
PO Box D
Fort Yates, ND 58538

Tel: 701.854.8645
Fax: 701.854.2138
Email: j.eagle@standingrock.org

Turtle Mountain Band of Chippewa
Elaine Nadeau, THPO
PO Box 900
Belcourt, ND 58316

Tel: 701.477.2640
Fax: 701.477.3593
Email: emnadeau76@gmail.com

Sisseton-Wahpeton Oyate
Dianne Desrosiers, THPO
PO Box 907
Sisseton, SD 57262

Tel: 605.698.3584
Fax: 605.698.4283
Email: dianned@swo-nsn.gov
Website: www.swo-nsn.gov

Tribal Historic Preservation Officers in North Dakota 1/29/2018

This list does not include all tribes to be consulted on North Dakota projects, only those with lands on reservations in North Dakota. Tribes in adjacent states and beyond may also have cultural ties to project areas in North Dakota. See:

http://www.nathpo.org/aboutthpos.htm
http://www.nathpo.org
http://www.achp.gov/thpo.html
https://grantsdev.cr.nps.gov/THPO_Review/index.cfm

North Dakota

Mandan, Hidatsa & Arikara Nation
Elgin Crows Breast, THPO
404 Frontage Road
New Town, ND 58763

Tel: 701.862.2474
Fax: 701.862.2490
Email: redhawk@mhanation.com

Spirit Lake Tribe of Fort Totten
Dr. Erich Longie, THPO
PO Box 76
Fort Totten, ND 58335

FCC Compliance Tel: 701.766.4031
THPO Tel: 701.766.4032
THPO Cell 701.230.7029
Fax: 701.766.4053
Email: thpo@gondtc.com

Standing Rock Sioux Tribe
Jon Eagle, THPO
PO Box D
Fort Yates, ND 58538

Tel: 701.854.8645
Fax: 701.854.2138
Email: j.eagle@standingrock.org

Turtle Mountain Band of Chippewa
Elaine Nadeau, THPO
PO Box 900
Belcourt, ND 58316

Tel: 701.477.2640
Fax: 701.477.3593
Email: emnadeau76@gmail.com

Sisseton-Wahpeton Oyate
Dianne Desrosiers, THPO
PO Box 907
Sisseton, SD 57262

Tel: 605.698.3584
Fax: 605.698.4283
Email: dianned@swo-nsn.gov
Website: www.swo-nsn.gov

NORTH DAKOTA INDIAN AFFAIRS COMMISSION

Jennifer Dean

From: Fulmer, John <jfulmer@burnsmcd.com>
Sent: Friday, February 09, 2018 5:03 PM
To: Jennifer Dean
Cc: Bailey, Justin; Latham, Mark
Subject: Aurora Wind Project -- Call with ND Indian Affairs Commission

Hi Jenni –

I had a call today at 2:30 PM with:

Scott J. Davis Sr
Commissioner
North Dakota Indian Affairs
600 E. Boulevard Ave.
1st Floor Judicial Wing, RM 117
Bismarck ND 58505-0300
Office 701-328-2428
Fax 701-328-1537
www.nd.gov/indianaffairs

The following is a summary of the main points discussed on the call:

- Scott thanked me (and TWE) for consulting with him – he said with no federal tie-in that it was not legally required to consult at all but he said it was the right thing to do and was very pleased that TWE was considering tribal consultation for the Aurora Project.
- He mentioned DAPL several times as an example of what happens when consultation is not done well or respectfully.
- He mentioned the recent NextEra project as a model of how it should be done.
- I said that for the Lindahl Project that consultation was with the Mandan-Arikara-Hidatsa and the Turtle Mountain Band of the Chippewa and asked if those would be the appropriate tribes to consult with on Aurora. He said, "Yes, that would be good."
- I asked if he thought we should consult with any other tribes. He said that the Lakota and Dakota (both are divisions of the Sioux) had been in Williams County as well and that we could consult with all of them if we wanted and he could provide all necessary contact information.
- He went on to say that there were bad players that we should avoid. He mentioned particularly Tim Mentz (if you google him you will see that he was very involved in DAPL). But also said there were other Native American firms that we should avoid and he could steer us away from the bad ones.
- He said Jon Eagle (THPO -- Standing Rock Sioux Tribe) and Elgin Crows Breast (THPO -- Mandan-Arikara-Hidatsa) were good people to deal with. He said the THPO for the Turtle Mountain Band of the Chippewa was very green and did not have a cultural resources background. He said he was going to talk to the tribe about that.
- He recommended a meeting in Bismarck with the THPOs and offered to facilitate the meeting. I told him I would talk to TWE and get back to him.

I got the impression Scott had been very instrumental in the successful NextEra project and that he was proud that almost everything had gone smoothly. He did mention that Tim Mentz had been involved in that project early on and that eventually NextEra had to ask him to leave. I also got the impression that the tribes would want to participate in

the surveys (and presumably would expect to be paid for their labor). He emphasized that a meeting up front was a very good idea. I asked if he thought someone from TWE should be there and he said that would be good.

Let me know how you want to move forward. Mark Latham has a good record of respectful and successful tribal consultation and would be a good person to be at the meeting.

Have a great weekend,

JF

John Fulmer
Cultural Resources Section Manager
Environmental Services
Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114
Direct: 816.822.3986
Cell: 832.671.1838

JOB SERVICE NORTH DAKOTA

Bailey, Justin

From: Koenig, Karla D. <kkoenig@nd.gov> on behalf of Kommer, Michelle L. <mkommer@nd.gov>
Sent: Thursday, March 1, 2018 10:15 AM
To: Bravo-Cogar, Crystal G
Subject: RE: response follow up

Ms. Bravo-Cogar,

Please accept my apologies for a delayed response. We routinely receive similar inquiries and they typically do not request an affirmative response. I am not aware of any interest either agency has in this project. I will note that if the project cost will exceed $50 million dollars, it will fall under a statutorily required Large Construction Project Risk Bond with the Unemployment Insurance program administered by Job Service North Dakota. Although this is not related to the permitting process, it is a requirement that will need to be met prior to the start of actual project construction. If you would like further information relating to this, please contact the Job Service North Dakota Tax Unit at 701-328-2814. I am not able to provide you business or legal advice as to permitting your project or operations.

Regards,

Michelle Kommer
Labor Commissioner

From: Bravo-Cogar, Crystal G [mailto:cbravocogar@burnsmcd.com]
Sent: Wednesday, February 28, 2018 1:37 PM
To: Kommer, Michelle L. <mkommer@nd.gov>
Subject: response follow up

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Dear Ms. Michelle Kommer,

Good morning. This email is a follow up with you regarding a letter Burns & McDonnell mailed to the Job Service North Dakota and North Dakota Department of Labor and Human Rights requesting input on any sensitive resources, current or planned development, or property interests your agency or entity may have in or around the Aurora Wind Project Areas. Our inquiry also included a request for information regarding any applicable permits that may be required from your office in consideration of the project. A copy of each letter is attached for your reference.

We want to ensure your input is considered as development moves forward. Please let us know whether or not you will be responding to this request. It would be greatly appreciated and we look forward to your response. Thank you in advance for your time and consideration.

Sincerely,

Crystal G. Bravo-Cogar

Crystal Bravo Cogar \ Burns & McDonnell

NORTH DAKOTA DEPARTMENT OF TRUST LANDS

1707 North 9th Street
PO Box 5523
Bismarck, ND 58506-5523
Phone: (701) 328 – 2800
Fax: (701) 328 – 3650

https://land.nd.gov

DEPARTMENT OF
ND TRUST LANDS
INVESTING FOR EDUCATION

Jodi A. Smith, Commissioner

January 12, 2018

JENNIFER BELL
SENIOR ENVIRONMENTAL SCIENTIST
BURNS & MCDONNELL
9785 MAROON CIRCLE, SUITE 400
CENTENIAL CO 80112

Re: Information Request for the Proposed Aurora Wind Project and Associated Transmission Line in Williams and Mountrail Counties, ND

Dear Ms. Bell:

We are in receipt of your December 21, 2017, letter regarding a request for information for the proposed Aurora Wind Project and associated transmission lines in Williams and Mountrail Counties, North Dakota.

There are common schools trust fund surface interests that are managed by the North Dakota Department of Trust Lands on behalf of the Board of University and School Lands which are included in the Wind Project Area. These surface interests are as follows:

County	*Township*	*Range*	*Section*	*Subdivisions*
Williams	158	96	16	NE4, SE4
Williams	158	96	36	NE4, NW4
Williams	158	97	16	NE4
Williams	159	97	16	NE4, NW4, SE4, SW4
Williams	159	97	36	SE4, SW4
Williams	159	98	16	NE4, NW4, SE4, SW4
Williams	159	98	36	NW4

The following surface interests appear to be included in the Transmission Line Area:

Williams	157	95	16	NE4, NW4, SE4, SW4

In September of 2016, an application for a Wind Farm Easement Agreement was received from Brad Peterson of Diamond Resources on behalf of Tradewind Energy for the Aurora Wind Project. The application remains in pending status until more details are received for this project. A separate application will need to be submitted for the Transmission line. None of the surface tracts within the project area have been evaluated for inclusion in the wind farm project.

Prior to the Board considering a Wind Energy Easement Agreement an onsite inspection of the trust property is required. The inspection would include review of wind tower locations, associated access road, collection lines, construction crane access paths and transmission line corridors, as well as the following items which may be considered in the review of an easement application:

1. Financial benefit to the trusts;
2. Availability of alternate encumbrance site or route;
3. The least environmentally damaging site or route regardless of property ownership;

4. Physical stability of the landscape;
5. Other potential future uses for the trust lands, including urban development;
6. Potential mineral and other material development including oil, gas, coal, cement materials, sodium sulfate, sand and gravel, road material, building stone, chemical substances, metallic ores, uranium ores, or colloidal or other clays;
7. Feasibility for reclamation;
8. Maintenance of existing wetlands and water flows;
9. Any cultural, historical, archeological, and paleontological resources;
10. Federally listed threatened and endangered species;
11. Location of the proposed route or site in relation to section lines, quarter section lines and corridors;
12. Potential liability to the trusts;
13. Applicant's past encumbrances on trust lands;
14. Applicant's financial stability; and
15. Any other information relevant to the application which would assist in the determination.

Any proposed wind tower locations would be subject to review and approval by the Board of University and School Lands. The Board of University and School Lands will not move forward with the completion of Wind Energy Easement Agreements until site inspection and review has been completed and all local and state approvals have been obtained.

If you have any questions, feel free to contact our office at 701-328-2800.

Sincerely,

Michael Humann

Michael Humann
Surface Division Manager

cc: Brad Pederson
Diamond Resources
PO Box 1938
Williston, ND 58802-1938

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AURORA WIND PROJECT, LLC
a wholly-owned subsidiary of
Tradewind Energy, Inc.
16105 West 113th Street, Suite 105
Lenexa, Kansas 66219

March 12, 2018

North Dakota Department of Trust Lands
c/o Michael Humann
Surface Division Manager
1707 N. 9th St.
Bismarck, ND 58501

RE: Aurora Wind Project, LLC's Local and State Permit Applications for the Aurora Wind Project and Associated Transmission Line

Dear Mr. Humann:

Aurora Wind Project, LLC ("Aurora") is developing the proposed 300 Megawatt (MW) Aurora Wind Project ("Wind Project") and an associated 345 kilovolt ("kV") transmission line ("Transmission Line") to be located in Williams County, North Dakota (collectively, the "Project"). Common schools trust fund surface interests that are managed by the North Dakota Department of Trust Lands ("Department") on behalf of the Board of University and School Lands ("Board") are included in the Wind Project Area. These surface interests are as follows:

County	*Township*	*Range*	*Section*	*Subdivisions*
Williams	158	96	16	NE4, SE4
Williams	158	96	36	NE4, NW4
Williams	158	97	16	NE4
Williams	159	97	16	NE4, NW4, SE4, SW4
Williams	159	97	36	SE4, SW4
Williams	159	98	16	NE4, NW4, SE4, SW4
Williams	159	98	36	NW4

In addition, the following surface interests are included only in the Transmission Line Area:

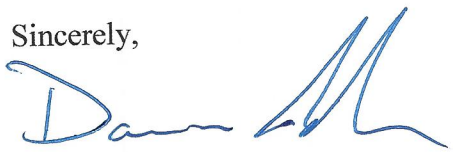
County	Township	Range	Section	Subdivisions
Williams	157	95	16	NE4, NW4, SE4, SW4

In September of 2016, an application for a Wind Farm Easement Agreement was submitted to the Department by Brad Pederson of Diamond Resources on behalf of Tradewind Energy and Aurora for the Project. The Project will submit to the Department an application for a Transmission Line Easement Agreement for the Transmission Line once the route is finalized. As we understand it, a prerequisite for further consideration of Aurora's pending applications, and completion of the requested agreements, is the Board requires the Project to have obtained all local and state approvals, and to complete a site inspection/review.

The Project has been under development since 2016 to the present. During this period the Project has been leasing, performing environmental reviews, collecting wind data, and preparing to submit permit applications to Williams County, Mountrail County and to the North Dakota Public Service Commission. If approved, the project will host approximately 150 turbines within the project area. The Project is reviewing various turbine sizes ranging from 2.0 MW machines to 4.0 MW machines. Design is not yet complete for the project area, but the Project will work to ensure production from the State Trust Lands is maximized. The Transmission Line is expected to utilize a 150' wide easement, which is anticipated to run through the NE4 and NW4 of Section 16, Township 157 North, Range 95 West.

If you have any questions or require any further information, please feel free to contact me at (720) 732-3154 or at didarola@tradewindenergy.com.

Sincerely,



Dave Iadarola
Development Manager
Tradewind Energy, Inc.

cc: Brad Pederson
Diamond Resources
PO Box 1938
Williston, ND 58802-1938

1707 North 9th Street
PO Box 5523
Bismarck, ND 58506-5523
Phone: (701) 328 – 2800
Fax: (701) 328 – 3650

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DEPARTMENT OF
ND TRUST LANDS
INVESTING FOR EDUCATION

Jodi Smith, Commissioner

April 2, 2018

KYLE OVERLAND
9540 137TH AVE NW
FORTUNA ND 58844

RE: Notification of application - **Wind Tower Site** - (ROW #7930) in:
Williams County
Township **159** North, Range **98** West
Section **36**: **NW4**

Dear **KYLE OVERLAND**:

As lessee of the above described property you are being notified that the North Department of Trust Lands has received an application from Aurora Wind Project, LLC, proposing Wind Tower Sites on the above described property.

The Department of Trust Lands is presently processing this application. As part of this process the Department of Trust Lands, in conjunction with Aurora Wind, will be conducting a guided inspection on the above listed tracts for siting purposes during the upcoming field season. This inspection process should not disrupt your management of the property.

If a Wind Energy Easement Agreement is approved as a result of this process, wind towers may be constructed on the above described property.

Sincerely,

Michael Humann
Surface Division Manager

cc: Brad Pederson
Diamond Resources
PO Box 1938
Williston ND, 58802-1938

1707 North 9th Street
PO Box 5523
Bismarck, ND 58506-5523
Phone: (701) 328 – 2800
Fax: (701) 328 – 3650

land.nd.gov

DEPARTMENT OF
ND TRUST LANDS
INVESTING FOR EDUCATION

Jodi Smith, Commissioner

April 2, 2018

CAITLIN HOLM
904 JUNIPER
OAKES ND 58474

COPY

RE: Notification of application - **Wind Tower Site** - (ROW #7930) in:
Williams County
Township **159** North, Range **97** West
Section **36**: **SE4**
Township **159** North, Range **97** West
Section **36**: **SW4**

Dear **CAITLIN HOLM**:

As lessee of the above described property you are being notified that the North Department of Trust Lands has received an application from Aurora Wind Project, LLC, proposing Wind Tower Sites on the above described property.

The Department of Trust Lands is presently processing this application. As part of this process the Department of Trust Lands, in conjunction with Aurora Wind, will be conducting a guided inspection on the above listed tracts for siting purposes during the upcoming field season. This inspection process should not disrupt your management of the property.

If a Wind Energy Easement Agreement is approved as a result of this process, wind towers may be constructed on the above described property.

Sincerely,

Michael Humann
Surface Division Manager

cc: Brad Pederson
Diamond Resources
PO Box 1938
Williston ND, 58802-1938

1707 North 9th Street
PO Box 5523
Bismarck, ND 58506-5523
Phone: (701) 328 – 2800
Fax: (701) 328 – 3650

land.nd.gov

DEPARTMENT OF
ND TRUST LANDS
INVESTING FOR EDUCATION

Jodi Smith, Commissioner

April 2, 2018

COPY

RYAN WOLLA
225 RIVER ST
TIOGA ND 58852

RE: Notification of application - **Wind Tower Site** - (ROW #7930) in:
Williams County
Township **158** North, Range **96** West
Section **16**: **NE4**
Township **158** North, Range **96** West
Section **16**: **SE4**

Dear **RYAN WOLLA**:

As lessee of the above described property you are being notified that the North Department of Trust Lands has received an application from Aurora Wind Project, LLC, proposing Wind Tower Sites on the above described property.

The Department of Trust Lands is presently processing this application. As part of this process the Department of Trust Lands, in conjunction with Aurora Wind, will be conducting a guided inspection on the above listed tracts for siting purposes during the upcoming field season. This inspection process should not disrupt your management of the property.

If a Wind Energy Easement Agreement is approved as a result of this process, wind towers may be constructed on the above described property.

Sincerely,

Michael Humann
Michael Humann
Surface Division Manager

cc: Brad Pederson
Diamond Resources
PO Box 1938
Williston ND, 58802-1938

1707 North 9th Street
PO Box 5523
Bismarck, ND 58506-5523
Phone: (701) 328 – 2800
Fax: (701) 328 – 3650

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DEPARTMENT OF
NDTRUST LANDS
INVESTING FOR EDUCATION

Jodi Smith, Commissioner

April 2, 2018

COPY

LEROY GOEBEL
607 7TH AVE W
WILLISTON ND 58801

RE: Notification of application - **Wind Tower Site** - (ROW #7930) in:
Williams County
Township **158** North, Range **97** West
Section **16**: **NE4**

Dear **LEROY GOEBEL**:

As lessee of the above described property you are being notified that the North Department of Trust Lands has received an application from Aurora Wind Project, LLC, proposing Wind Tower Sites on the above described property.

The Department of Trust Lands is presently processing this application. As part of this process the Department of Trust Lands, in conjunction with Aurora Wind, will be conducting a guided inspection on the above listed tracts for siting purposes during the upcoming field season. This inspection process should not disrupt your management of the property.

If a Wind Energy Easement Agreement is approved as a result of this process, wind towers may be constructed on the above described property.

Sincerely,

Michael Humann
Michael Humann
Surface Division Manager

cc: Brad Pederson
Diamond Resources
PO Box 1938
Williston ND, 58802-1938

1707 North 9th Street
PO Box 5523
Bismarck, ND 58506-5523
Phone: (701) 328 – 2800
Fax: (701) 328 – 3650

land.nd.gov

DEPARTMENT OF
ND TRUST LANDS
INVESTING FOR EDUCATION

Jodi Smith, Commissioner

April 2, 2018

COPY

ALDEN HEWSON
8183 119TH AVE NW
WILDROSE ND 58795

RE: Notification of application - **Wind Tower Site** - (ROW #7930) in:
Williams County
Township **159** North, Range **97** West
Section **16**: **NE4**
Township **159** North, Range **97** West
Section **16**: **NW4**
Township **159** North, Range **97** West
Section **16**: **SE4**
Township **159** North, Range **97** West
Section **16**: **SW4**

Dear **ALDEN HEWSON**:

As lessee of the above described property you are being notified that the North Department of Trust Lands has received an application from Aurora Wind Project, LLC, proposing Wind Tower Sites on the above described property.

The Department of Trust Lands is presently processing this application. As part of this process the Department of Trust Lands, in conjunction with Aurora Wind, will be conducting a guided inspection on the above listed tracts for siting purposes during the upcoming field season. This inspection process should not disrupt your management of the property.

If a Wind Energy Easement Agreement is approved as a result of this process, wind towers may be constructed on the above described property.

Sincerely,

Michael Humann
Surface Division Manager

cc: Brad Pederson
Diamond Resources
PO Box 1938
Williston ND, 58802-1938

1707 North 9th Street
PO Box 5523
Bismarck, ND 58506-5523
Phone: (701) 328 – 2800
Fax: (701) 328 – 3650

https://land.nd.gov

DEPARTMENT OF
ND TRUST LANDS
INVESTING FOR EDUCATION

Jodi A. Smith, Commissioner

April 4, 2018

DAVE IADAROLA
TRADEWIND ENERGY INC
16105 W 113TH ST SUITE 105
LENEXA KS 66219

Re: Aurora Wind Project, LLC's proposed Aurora Wind Project located in:
Williams County (ROW#7930 and ROW#8236)

Township 157 North, Range 95 West
Section 16: N2
Township 158 North, Range 96 West
Section 16: E2
Township 158 North, Range 96 West
Section 36: N2
Township 158, Range 97 West
Section 16: NE4
Township 159 North, Range 97 West
Section 16: ALL
Township 159 North, Range 97 West
Section 36: S2
Township 159 North, Range 98 Wes
Section 36: NW4

Dear Mr. Iadarola:

The Department of Trust Lands (DTL) received Aurora Wind Project, LLC's ("Aurora" or "Project") applications for a wind energy easement agreement and electric transmission line easement located in Williams County northwest of Tioga, North Dakota. We look forward to conducting an onsite inspection of the above described trust property with Aurora to review proposed wind tower locations, associated access roads, collection lines, construction crane access paths and a transmission line location.

The Project's possible location partly on State Trust Land was discussed by the Board of University and School Lands (Board) during its March 29, 2018 meeting. The Board understands that Aurora's applications for local, county, and state regulatory approval will include the above described tracts that it manages.

The Board has not yet granted Aurora easements for wind towers or appurtenances for the locations and a transmission line location, however, upon local, county and state regulatory approval the Board will consider a wind energy easement agreement and electric transmission line easement with Aurora Wind Project, LLC, regarding the location and potential use of the referenced trust land.

After the necessary permits are obtained, the DTL will evaluate and negotiate with Aurora a recommended wind energy easement and terms for Board consideration and possible approval.

If you have any questions, please contact me at (701) 328-2800 or Michael Humann at mhumann@nd.gov.

Sincerely,

Jodi Smith
Commissioner

cc: Brad Pederson
Diamond Resources
PO Box 1938
Williston ND, 58802-1938

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NORTH DAKOTA STATE SOIL CONSERVATION

Bailey, Justin

From: Schmidt, Bruce <bruce.schmidt@ndsu.edu>
Sent: Tuesday, February 27, 2018 3:24 PM
To: Bravo-Cogar, Crystal G
Subject: Re: response follow up

Thank you for the follow up email. The SSCC has no required permits for this proposed project.

Get Outlook for Android

From: Bravo-Cogar, Crystal G <cbravocogar@burnsmcd.com>
Sent: Tuesday, February 27, 2018 7:23:32 PM
To: Schmidt, Bruce
Subject: response follow up

Dear Mr. Schmidt,

Good morning. The attached letter was sent to North Dakota State Soil Conservation requesting input on any sensitive resources, current or planned development, or property interests your agency or entity may have in or around the Aurora Wind Project Areas. Our inquiry also included a request for information regarding any applicable permits that may be required from your office in consideration of the project.

I was referred to you by calling the main phone number for the State Soil Conservation office. We want to ensure your input is considered as development moves forward. Please let us know whether or not you will be responding to this request. It would be greatly appreciated and we look forward to your response.

Sincerely,

Crystal G. Bravo-Cogar

Crystal Bravo Cogar \ Burns & McDonnell
Senior Environmental Specialist
O 303-474-2247 \ **M** 702-501-7735
cbravocogar@burnsmcd.com \ burnsmcd.com
9785 Maroon Circle, Suite 400 \ Centennial, CO 80112

NORTH DAKOTA STATE WATER COMMISSION

North Dakota State Water Commission

900 EAST BOULEVARD AVENUE, DEPT 770 • BISMARCK, NORTH DAKOTA 58505-0850
(701) 328-2750 • TTY 1-800-366-6888 or 711 • FAX (701) 328-3696 • http://swc.nd.gov

January 10, 2018

Jennifer Bell
Senior Environmental Scientist
Burnes & McDonnell
9785 Maroon Circle, STE 400
Centennial, CO 80112

Dear Ms. Bell:

This is in response to your request for a review of the environmental impacts associated with the Proposed Aurora Wind Project and Associated Transmission Line located in Williams and Mountrail Counties, ND.

The proposed project has been reviewed by State Water Commission staff, and the following comments are provided:

- Initial review indicates the project does not require a conditional or temporary permit for water appropriation. However, if surface water or groundwater will be diverted for construction of the project, a water permit will be required per North Dakota Century Code (NDCC) § 61-04-02. Please consult with the Water Appropriations Division of the Office of the State Engineer (OSE) at 701-328-2754 if you have questions regarding this comment.

The State Water Commission (SWC) maintains a network of observation wells across the state for monitoring the water levels and quality in glacial and bedrock aquifers. These wells are often installed in road and highway rights-of-way to limit inconvenience to the adjacent landowners. SWC observation wells have a yellow protective casing extending between 1 and 3 feet above ground surface, and their locations are marked with a stake. If an observation well is encountered during project activities and must be removed, please contact the Water Appropriations Division. The SWC hopes to keep all observation wells, but otherwise will ensure the well is properly abandoned.

- There are no floodplains identified and/or mapped where this proposed project is to take place. A floodplain development permit would not be required relative to the National Flood Insurance Program.

Thank you for the opportunity to provide review comments. If you have any questions, please call Jared Huibregtse at 701-328-4967.

Sincerely,

Patrick Fridgen, Director
Planning and Education Division

PF:dm/1570

DOUG BURGUM, GOVERNOR
CHAIRMAN

GARLAND ERBELE, P.E.
CHIEF ENGINEER-SECRETARY

U.S. DEPARTMENT OF DEFENSE

Jennifer Dean

From: Bell, Jennifer <jbell@burnsmcd.com>
Sent: Tuesday, January 09, 2018 3:14 PM
To: Jennifer Dean
Subject: FW: Proposed Aurora Wind Project Informal Review

Jennifer Bell \ Burns & McDonnell
Senior Environmental Scientist
O 303-474-2229 \ F 303-721-0563
jbell@burnsmcd.com \ burnsmcd.com
9785 Maroon Circle \ Suite 400 \ Centennial, CO 80112

-----Original Message-----
From: Adkins, Cristina M CTR (US) [mailto:cristina.m.adkins.ctr@mail.mil]
Sent: Monday, January 08, 2018 8:40 AM
To: Bell, Jennifer <jbell@burnsmcd.com>
Subject: Proposed Aurora Wind Project Informal Review

Good Morning Ms. Bell,

My name is Cristina Adkins with the DoD Siting Clearinghouse. We received your letter regarding the Proposed Aurora Wind Project and Associated Transmission Line in Williams and Mountrail Counties, ND. We are the office within the Department of Defense that oversees the mission compatibility evaluation process for proposed energy projects submitted by developers. We will be completing an Informal Review of your project and will be providing you a preliminary determination of your projects impacts, if any, on military operations conducted in the area. Further information about our review process can be viewed at https://urldefense.proofpoint.com/v2/url?u=https-3A__www.acq.osd.mil_dodsc_index.html&d=DwICAg&c=pgTKN5yjcEYSPUPpeP-zuA&r=8mBt5lMITyn4Fz6GRtcgMtGWfEV5GSmmwdcGKt6nT68&m=Xm-z1oLK9heTpA1mLlnhrlxFUI5x6pthqlrO2el0nGI&s=73hye5T0slRZX9kvSmTW-CPsO-WoPWOeyXAS9g-J8c4&e=.

However to complete the review, we are requesting additional information/clarification. You noted the location of wind turbines have not yet been determined, however is it possible to provide a single geographic coordinate (Lat/Longs in DMS) in each county tract listed for a more accurate assessment? Is there an estimate yet on the number and height of turbines?

I will be responsible for tracking your submitted projects as it goes through the DoD Siting Clearinghouse's informal review process, so if you have any further questions on our review process or would like a status update please feel free to contact me.

V/r,

Cristina Adkins
DoD Siting Clearinghouse
Office of the Assistant Secretary of Defense (Energy, Installations & Environment)
703-571-9057

E-mail: cristina.m.adkins.ctr@mail.mil

Corporate E-mail: osd.dod-siting-clearinghouse@mail.mil

https://urldefense.proofpoint.com/v2/url?u=http-3A__www.acq.osd.mil_dodsc_&d=DwICAg&c=pgTKN5yjcEYSPUPpeP-zuA&r=8mBt5lMITyn4Fz6GRtcgMtGWfEV5GSmmwdcGKt6nT68&m=Xm-z1oLK9heTpA1mLlnhrlxFUI5x6pthqlrO2el0nGI&s=56DEhpdwXMN4m5P-8tVR1yQgc9kl8KEGxqg_ugZOrPM&e=

Bailey, Justin

From: Scanlon, Rhiannon G CTR (US) <rhiannon.g.scanlon.ctr@mail.mil>
Sent: Wednesday, March 21, 2018 10:33 AM
To: Bell, Jennifer
Subject: Informal Review Response
Attachments: IR Aurora WindTransmission Line Project - Williams County, ND - Response....pdf

Ms. Bell,

I have attached an informal review response letter for the Aurora Wind and Transmission Line project. Please feel free to contact me or Steve Sample (steven.j.sample4.civ@mail.mil) if you have any questions.

V/r,
Rhiannon Scanlon

DoD Siting Clearinghouse
571-372-6876
rhiannon.g.scanlon.ctr@mail.mil
osd.dod-siting-clearinghouse@mail.mil

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
3400 DEFENSE PENTAGON
WASHINGTON, DC 20301-3400

ENERGY,
INSTALLATIONS
AND ENVIRONMENT

March 19, 2018

Jennifer Bell
Burns & McDonnell
9785 Maroon Circle, Suite 400
Centennial, CO 80112
jbell@burnsmcd.com

Dear Ms. Bell,

As requested, the Department of Defense (DoD) Siting Clearinghouse coordinated within DoD an informal review of your company's proposed project. The results of our informal review indicated that the 300MW Aurora Wind and Transmission Line Project located in Williams and Mountrail Counties, North Dakota, as proposed, will have potential impacts on military operations conducted in this area.

I request that you contact Frederick Shepherd, Chief of the NORAD Radar Interference Branch, at 719-556-3260 or frederick.l.shepherd.civ@mail.mil, to discuss this proposed project. It is my hope that your continued cooperation will help us preserve the operational, training, and testing capabilities of our nation's Armed Forces.

Please note that this informal review by the DoD Siting Clearinghouse does not constitute an action under 49 United States Code Section 44718 and that DoD is not bound by the conclusion arrived at under this informal review. Please contact me at steven.j.sample4.civ@mail.mil or at 703-571-0076 if you have any questions.

Sincerely,

Steven J. Sample
Deputy Director
DoD Siting Clearinghouse

U.S. FISH AND WILDIFE SERVICE, NORTH DAKOTA FIELD OFFICE

Jennifer Dean

From: Clayton Derby <cderby@west-inc.com>
Sent: Tuesday, April 24, 2018 11:00 AM
To: Jennifer Dean
Subject: Fwd: [EXTERNAL] Aurora - t-line structures easement request

Hi Jenni

No easements in the t-line corridor.

Clayton Derby
CSO / Wildlife Biologist

Western Ecosystems Technology, Inc.
Environmental & Statistical Consultants
4007 State Street, Suite 109
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---------- Forwarded message ----------
From: **Richardson, Kory** <kory_richardson@fws.gov>
Date: Tue, Apr 24, 2018 at 9:26 AM
Subject: Re: [EXTERNAL] Aurora - t-line structures easement request
To: Clayton Derby <cderby@west-inc.com>
Cc: Terri Thorn <tthorn@west-inc.com>

Clayton - I have reviewed the proposed transmission line and structure placement. No easement protected wetlands or grasslands are impacted. I greatly appreciate your effort in avoiding easement protected areas. Don't hesitate to contact me as you continue to work on development of the proposed Aurora Wind Farm. Thanks.

Kory

On Tue, Apr 24, 2018 at 7:46 AM, Clayton Derby <cderby@west-inc.com> wrote:

Hello Kory

I hope that spring is going well for you in NW ND. I believe it may have finally arrived here in Bismarck.

Late 2017/early 2018 I sent you a request regarding easement information for the Aurora wind farm. Thank you for providing that information. The company has now identified a potential transmission line route, see attached map and shapefile. Can you please check you records to determine if there are any easements within the route, both grassland and wetland.

Thank you.

Clayton Derby
CSO / Wildlife Biologist

Western Ecosystems Technology, Inc.
Environmental & Statistical Consultants
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--

Kory Richardson
Refuge Manager
Lostwood WMD Complex
8315 Hwy 8
Kenmare, ND 58746

Office: 701-848-2722 x13
Fax: 701-848-2702
Cell: 701-339-1451

Jennifer Dean

From: Clayton Derby <cderby@west-inc.com>
Sent: Monday, August 13, 2018 12:02 PM
To: Kevin Shelley; JOHN SCHUMACHER
Cc: Jennifer Dean; Katherine Moratz
Subject: Re: Aurora Meeting Materials
Attachments: Aurora_Aug 16 2018_Agency Memo Final.pdf

With attachment this time.

Clayton Derby
CSO / Wildlife Biologist

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On Mon, Aug 13, 2018 at 11:21 AM, Clayton Derby <cderby@west-inc.com> wrote:

> Hello Kevin and John
>
> Attached please find a summary memo and a few figures to help lead the Aurora Wind Project meeting at 1 pm this Thursday, August 16. Please note that the meeting will be at the NDGFD office.
>
> See you on Thursday.
>
> **Clayton Derby**
> **CSO / Wildlife Biologist**

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ENVIRONMENTAL & STATISTICAL CONSULTANTS

4007 State Street, Suite 109, Bismarck, ND 58503
Phone: 701-250-1756 ◆ www.west-inc.com ◆ Fax: 701-250-1761

TO: USFWS and NDGFD
RE: Aurora Wind Energy Project Survey Update
DATE: August 16, 2018

Western EcoSystems Technology, Inc. (WEST) has been assisting Aurora Wind Project, LLC (Aurora), a subsidiary of Tradewind Energy, Inc., in implementing Tier 2 and 3 actions as described in the USFWS Wind Energy Guidelines (WEG) and USFWS Eagle Conservation Planning Guidance (ECPG) for the proposed Aurora Wind Energy Project (Project). The Project as currently planned encompasses approximately 44,000 acres and is located in Williams and Mountrail counties, North Dakota (Figure 1). The purpose of this memo is to facilitate a discussion related to the completed Tier 2 and Tier 3 wildlife surveys and future survey work at the Project.

Tier 2 Efforts:

1. Site Characterization Study
    - Review of biological resources with respect to potential Project development
    - Anticipated low adverse impacts to bird and bat species
2. Whooping Crane Habitat Analysis
    - Assess potential suitability of wetlands within the Project
    - Project had smallest average sized wetlands and the second smallest total wetland acreage and number of basins compared to four adjacent reference areas
    - Project located with the defined whooping crane corridor but all facilities are outside the non-covered lands from WEWAG effort
    - Project falls within unoccupied stopover site use intensity cells
    - No whooping cranes documented in Project area from the USFWS sighting database. Whooping cranes observed during point counts, see Tier 3.
    - Potential to migrate over or through the Project
3. Stage 1 Site Assessment of Eagle Use/Risk
    - Assess if Project is known or likely to be used by eagles
    - Golden eagles uncommon
    - Bald eagles possible since some potential habitat exists (wetland complexes, grasslands) but overall the area lacks nesting habitat
    - NDGFD reports no known bald or golden eagle nests within 10 miles
    - No significant adverse impacts expected

Tier 3 Efforts:

1. Eagle/Avian Use Surveys
    - 2 years of surveys
    - 1 hour fixed-point surveys at 33 points
    - 700 60-minute fixed point surveys
    - 4 bald and 2 golden eagles observed during fixed-point surveys
    - Anticipated low risk
    - Do not plan to seek an eagle permit
    - Total of 12 whooping cranes observed flying above rotor swept height with flocks of sandhill cranes on April 24, 2018.
    -
2. Eagle/Raptor Nest Surveys
    - 2 years of aerial surveys
    - Meandering aerial transects of potential suitable habitat
    - Eagle nests within 10 miles and non-eagle raptors within 1 mile of boundary
    - No eagle nests observed
3. Sharp-tailed Grouse Lek Surveys
    - Road-based surveys in 2018
    - 3 surveys from early April to early May
    - Limited overall grassland blocks within and adjacent to Project (Figure 3) for lekking, brood rearing, etc.
    - 52 points along public roads/trails around grasslands >80 acres
    - 5 minutes of observations at each point
    - 3 leks observed (2 confirmed and 1 potential; Figure 3)
    - Turbines adjusted such that no leks within 1 mile of proposed turbine locations

Future Efforts:

1. Construction and Operations
    - Operations personnel training for whooping crane identification and shutdown procedures if within 2 miles of turbines.
    - Transmission line to be marked with bird diverters
    - Post-construction fatality monitoring (Tier 4 surveys)
    - Development of Bird and Bat Conservation Strategy (BBCS)

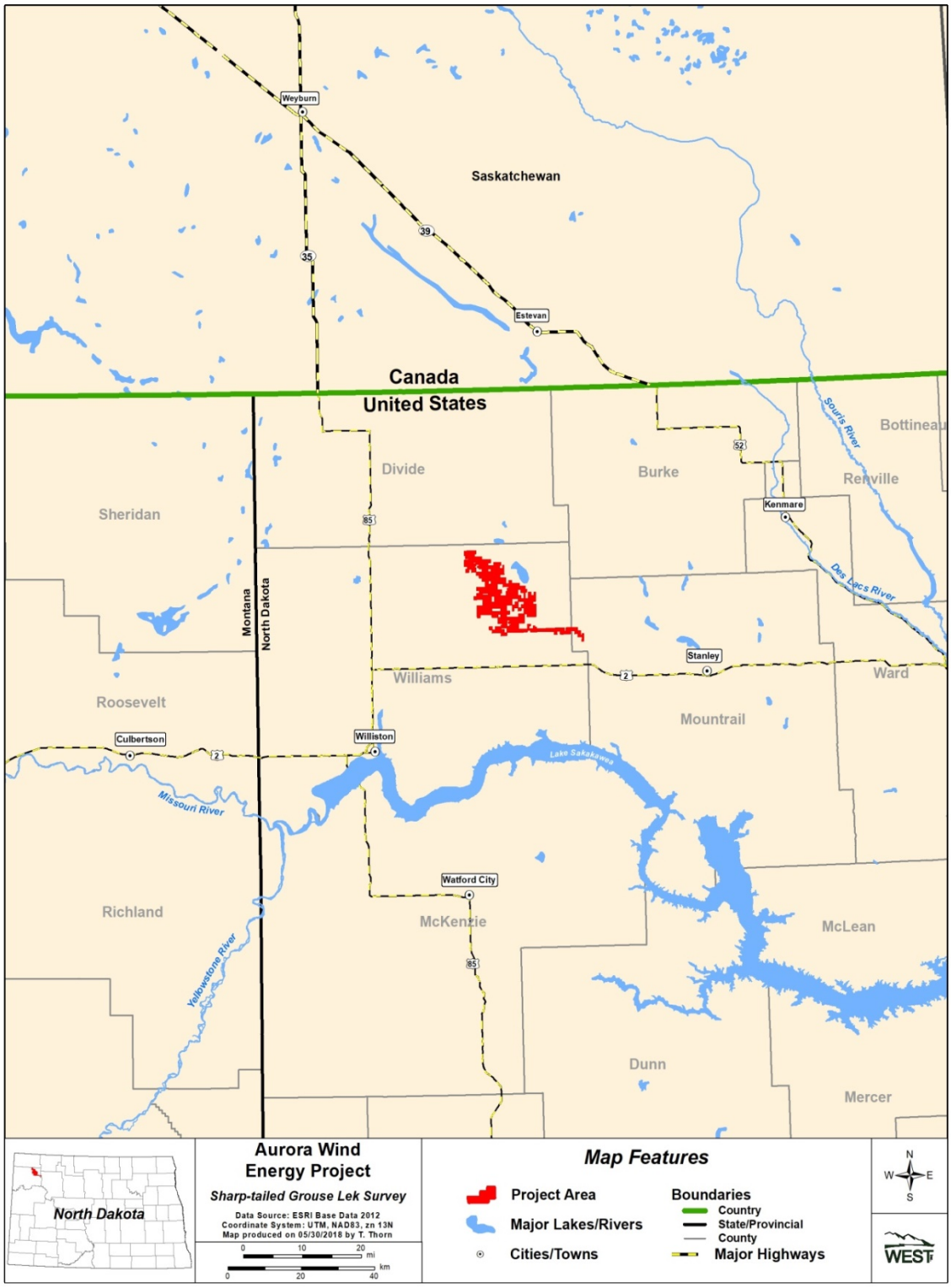

Figure 1. Location and current boundary of the Aurora Wind Energy Project in Williams and Mountrail counties, North Dakota.

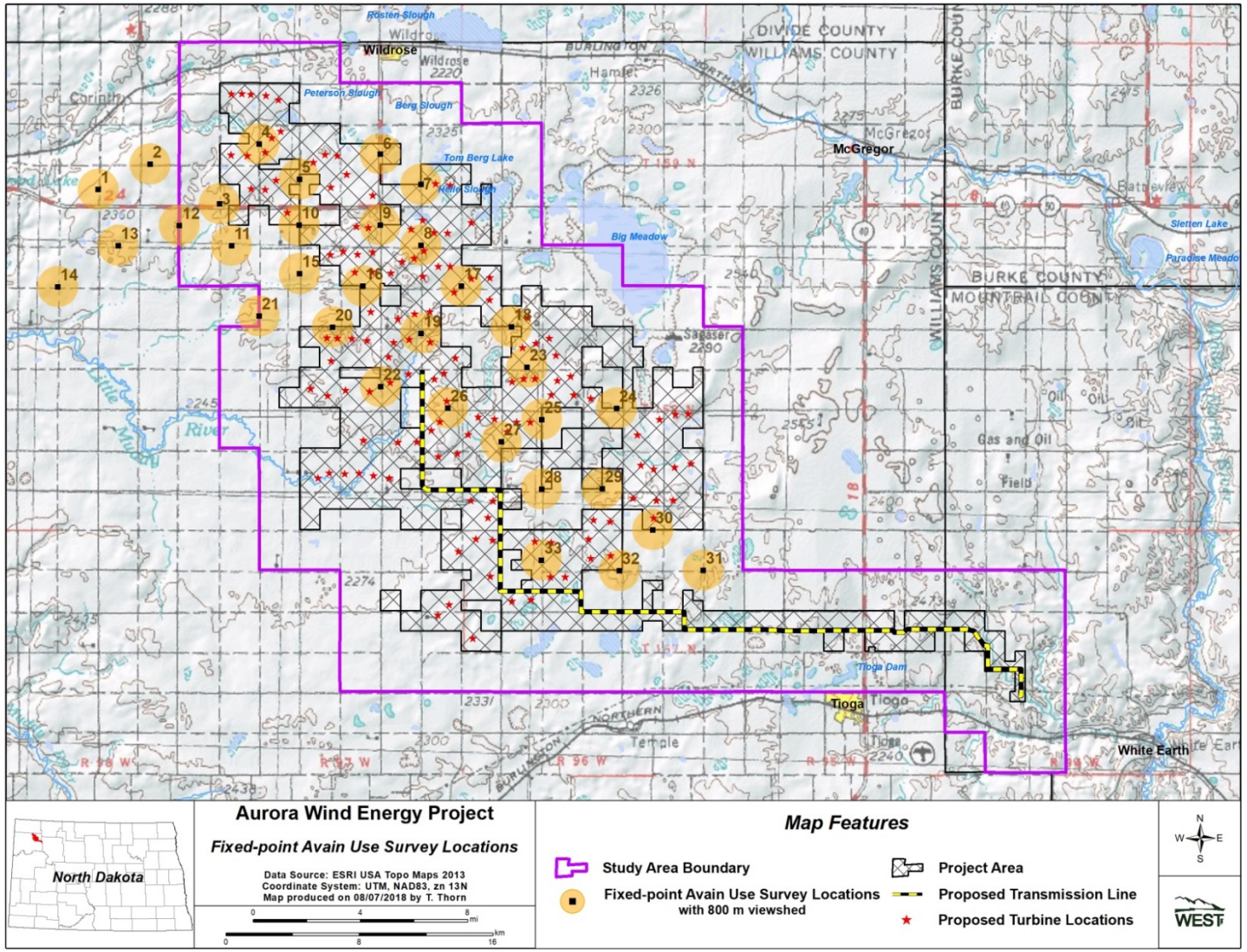

Figure 2. Fixed-point survey locations, proposed turbine locations, and proposed transmission line within the Aurora Wind Energy Project in Williams and Mountrail counties, North Dakota.

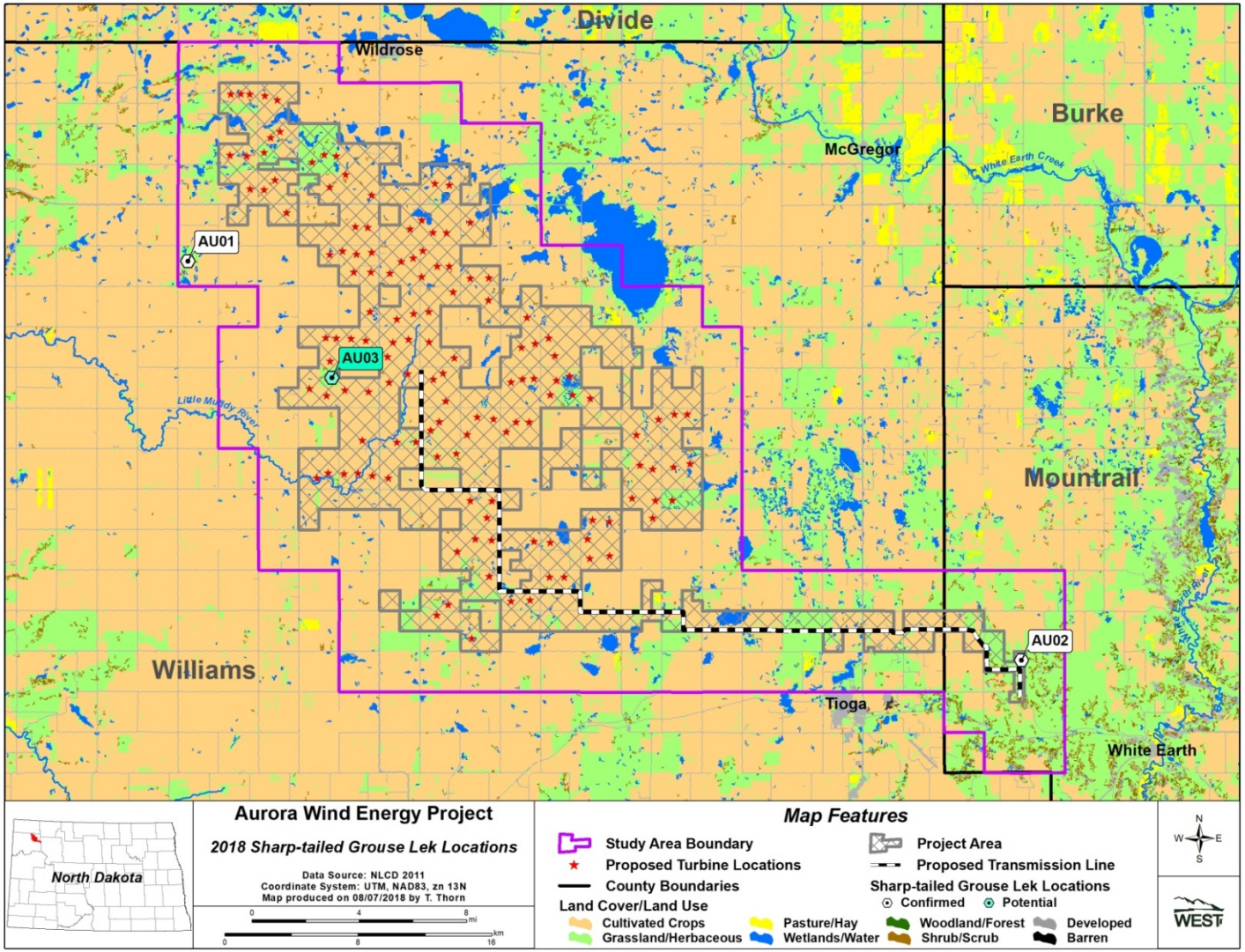

Figure 3. Sharp-tailed grouse lek locations, proposed turbine locations, and proposed transmission line within the Aurora Wind Energy Project, Williams and Mountrail counties, North Dakota.

Jennifer Dean

From: Clayton Derby <cderby@west-inc.com>
Sent: Thursday, August 23, 2018 3:55 PM
To: Jennifer Dean; Katherine Moratz
Subject: Fwd: [EXTERNAL] Fwd: Updated Aurora design

Jenni - see review of easement information from USFWS refuge office.

Clayton Derby
CSO / Wildlife Biologist

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Environmental & Statistical Consultants
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---------- Forwarded message ----------
From: **Kory Richardson** <kory_richardson@fws.gov>
Date: Thu, Aug 23, 2018 at 3:47 PM
Subject: Re: [EXTERNAL] Fwd: Updated Aurora design
To: Clayton Derby <cderby@west-inc.com>

Clayton - I have reviewed the proposed wind tower locations, access roads, crane paths, collection lines, intersections, fiber optic sections, lay down yards, substation, transmission lines and structures associated with the proposed Aurora Wind Project. I see no obvious issues or impacts to USFWS wetland and grassland easements; or Waterfowl Production Areas. A tremendous effort was obviously put forth to avoid direct impacts to USFWS property interests. I greatly appreciate your work.

I see two areas on wetland easement that may or may not be actual wetlands (I can't tell for sure from the aerial imagery etc.) that could potentially be impacted by an access road, collection line or crane path. Once staking

of access roads etc. is complete I would like to take a closer look at those "questionable" sites in the field. On area is 159-97-20, S1/2N1/2 (Williams 210X); and 159-97-21, N1/2N1/2 (Williams 142X,1).

Thank you for the opportunity to review the various components of the Aurora Wind Farm. If you have any questions or concerns please don't hesitate to contact me.

Kory

On Tue, Aug 7, 2018 at 8:05 AM Clayton Derby <cderby@west-inc.com> wrote:

> Hi Kory
>
> Thanks for the past reviews for the Aurora wind project regarding wetland and grassland easements. The project has developed a more refined layout with all the various constraints - road/house setbacks, avoidance of easements, etc. Can you please take another look at this more refined layout to confirm that it avoids all the basins within the wetland easements as well as all the grassland easements? I know that easements are always a bit in motion with new ones coming in and want to make sure a current review has been completed.
>
> Thank you,
>
> **Clayton Derby**
> **CSO / Wildlife Biologist**
>
> Western EcoSystems Technology, Inc.
> Environmental & Statistical Consultants
> 4007 State Street, Suite 109
> Bismarck, ND 58503
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>
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--
Kory Richardson
Refuge Manager
Lostwood WMD Complex
8315 Hwy 8
Kenmare, ND 58746

Office: 701-848-2722 x13
Fax: 701-848-2702
Cell: 701-339-1451

Jennifer Dean

From: Clayton Derby <cderby@west-inc.com>
Sent: Friday, September 21, 2018 2:54 PM
To: Dyke, Steve (NDGF)
Cc: Kevin Shelley; JOHN SCHUMACHER; Jennifer Dean; Katherine Moratz; Scott_Larson@fws.gov
Subject: Re: Aurora Wind Meeting
Attachments: Aurora_USFWS-NDGFD Meeting Notes_081618 Final Update.pdf; Aurora_A031_299.9MW--GE2.5x108_GE2.3x13_2018-07-26.zip

Hello Group

Steve, thank you for the suggested additions, I have put those ideas into the discussion section. The updated notes are attached for your files.

Also attached is the final layout shapefile for your review. We would be available and open to have further discussions with the group on any letter responses developed to have a "no surprises" understanding before public hearings on the PSC applications (I believe that was the term used by Steve during the meeting?).

Have a great weekend.

Clayton Derby
CSO / Wildlife Biologist

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On Thu, Sep 13, 2018 at 2:40 PM Dyke, Steve R. <sdyke@nd.gov> wrote:

Clayton, thanks for sharing the meeting notes. I suggest for your consideration the following items for inclusion into the meeting notes.

1. Could post construction collision survey $ be better spent on offsets for habitat restoration efforts.

2. How there is a lack of 'vendors' in the state for habitat creation/restoration. The ND Natural Resource Trust might be positioned to help in that effort.

Additionally, while it may or may not have been discussed at the meeting, our agency strongly encourages the project sponsors provide us with the turbine locations and road alignments well before notice of a PSC public hearing on the project.

Steve

From: Clayton Derby <cderby@west-inc.com>
Sent: Wednesday, September 12, 2018 3:10 PM
To: Kevin Shelley <Kevin_Shelley@fws.gov>; Dyke, Steve R. <sdyke@nd.gov>; Schumacher, John D. <jdschumacher@nd.gov>
Cc: Jennifer Dean <jdean@tradewindenergy.com>; Katherine Moratz <kmoratz@west-inc.com>
Subject: Aurora Wind Meeting

CAUTION: This email originated from an outside source. Do not click links or open attachments unless you know they are safe.

Hello

Attached please find meeting notes and referenced material from the Aurora Wind Project meeting held on August 16, 2018.

Thank you,

Clayton Derby

CSO / Wildlife Biologist

Western EcoSystems Technology, Inc.
Environmental & Statistical Consultants

4007 State Street, Suite 109

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4007 State Street, Suite 109, Bismarck, ND 58503
Phone: 701-250-1756 ◆ www.west-inc.com ◆ Fax: 701-250-1761

MEETING NOTES

SUBJECT: Wildlife survey result update for agencies	
PROJECT: Aurora Wind Project	**MEETING LOCATION:** NDGFD Office
MEETING DATE: August 16, 2018	**NOTES BY:** K. Moratz and C. Derby

ATTENDEES

Steve Dyke, NDGFD
John Schumacher, NDGFD
Elisha Mueller, NDGFD
Kevin Shelley, USFWS
Jennifer Dean, Aurora
Dave Iadarola, Aurora
Haileigh Shull, Aurora
Katherine Moratz, WEST
Clayton Derby, USFWS

TOPICS DISCUSSED

Project Overview

Dave Iadarola, Aurora Wind Project, LLC (Aurora), provided a brief review of the Aurora Wind Project (Project) location in northwestern North Dakota. The Project is mainly in eastern Williams County with approximately 3 miles of overhead transmission line that will connect to the existing Tande Substation in Mountrail County. The Project is anticipated to be up to 300MW and has obtained Conditional Use Permits in both Williams and Mountrail counties. The Project permitted up to 131 turbine locations which includes alternates. The 345 kV overhead transmission line is anticipated to be approximately 25 miles in total length. Jenni Dean, Aurora, briefly discussed a tentative timeline of the Public Service Commission (PSC) application for a Certificate of Site Compatibility (CSC) and Route Permit and hearings. At this time, the Project is targeting a mid to late September 2018 application submittal to the PSC for a CSC and anticipates public hearings to occur in January 2019. The Project noted it had received a letter from the North Dakota Game and Fish Department (NDGFD) in May 2018. To date, no correspondence has been received from the United States Fish & Wildlife Service (USFWS).

Tier 2 and Tier 3 Review

Clayton Derby reviewed efforts completed to date at the Project (see attached "Aurora Wind Energy Project Survey Update" memo attached and previously provided electronically to USFWS and NDGFD on August 13, 2018). This synopsis included a brief review of efforts previously discussed at the February 8, 2017, agency meeting, including the Tier 2 site characterization study, Stage 1 site assessment of eagle use and risk, and year one eagle/avian use and raptor nest surveys. Additionally, Clayton provided an update on results of the year two avian use and raptor nest surveys. Clayton also provided results of the sharp-tailed grouse lek

CONFIDENTIAL BUSINESS INFORMATION

surveys, a survey that was conducted in response to the May 22, 2018, NDGFD letter. In response to the 2018 lek survey, the Project has moved wind turbines to be more than one mile from these lek locations. In addition, wetland and cultural work is ongoing at the Project and is largely complete based in the current design. In an effort to minimize potential risk to existing avian stopover resources, the Project has analyzed the quality of wetlands into three categories: 1) all wetlands greater than 0.5 acres in size, 2) all wetlands considered to be high quality (smaller than 0.5 acres but located in non-agricultural fields and dominated by higher quality, non-invasive wetland species, and 3) all other wetlands. The Project is currently evaluating Project infrastructure as it relates to these categories of wetlands for siting. The Project has also coordinated with USFWS's easement office three times regarding information on wetland and grassland easements in the area as the Project design has evolved.

Clayton then outlined future efforts to be conducted at the Project that will be outlined in the Project's Bird and Bat Conservation Strategy (BBCS). As additional micrositing and design changes are finalized, the Project will continue to coordinate with USFWS's easement office to note protected basins and grasslands in relation to Project infrastructure. In addition to the above siting efforts, the Project and agencies noted the location of the area in regards to the migration corridor of the Whooping crane. The Project committed to marking 100% of the overhead transmission line with bird diverters. Additional monitoring efforts to minimize potential risk to migrating Whooping cranes will be noted in the BBCS. The Project committed to sharing a draft version of the BBCS with both agencies for review and comment.

Discussion

Both USFWS and NDGFD asked questions regarding the efforts completed; however questions were minimal. Questions and discussion included the future development steps for the Project and the PSC process. The group also discussed options for providing funds for habitat offsets instead of conducting expensive post-construction fatality monitoring studies, but agreement that currently there is a general lack of "vendors" in the state that can receive these funds and effectively implement habitat restoration or enhancement efforts. The North Dakota Natural Resource Trust may be one vendor that could be investigated to serve this purpose. Both agencies provided positive remarks on the siting of the Project within a fragmented landscape. All parties voiced a willingness to continue to work together as the Project continues to develop. Another agency meeting could potentially occur before the PSC hearing to discuss any additional topics regarding infrastructure placement if all parties are interested.

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U.S. ARMY CORPS OF ENGINEERS, NORTH DAKOTA REGULATORY OFFICE

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
NORTH DAKOTA REGULATORY OFFICE
3319 UNIVERSITY DRIVE
BISMARCK ND 58504-7565

January 9, 2018

NWO-2018-00069-BIS

Burns & McDonnell
Attn: Ms. Jennifer Bell
9785 Maroon Circle, Suite 400
Centennial, Colorado 80112

Dear Ms. Bell:

This is in response to your solicitation letter dated December 21, 2017, requesting Department of the Army (DA), United States Army Corps of Engineers (Corps) comments on the proposed Aurora Wind Project and Associated Transmission Line project. The project is located in Township 157 North, Range 94, 95, 96, and 97 West, Township 158 North, Range 95, 96, 97, and 98 West, and Township 159 North, Range 96, 97, and 98 West, Williams and Mountrail Counties, North Dakota.

Corps Regulatory Offices administers Section 404 of the Clean Water Act. Section 404 of the Clean Water Act regulates the discharge of dredge or fill material (temporarily or permanently) in waters of the United States. Waters of the United States may include, but are not limited to, rivers, streams, ditches, coulees, lakes, ponds, and their adjacent wetlands. Fill material includes, but is not limited to, rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mines or other excavation activities and materials used to create any structure or infrastructure in waters of the United States.

Enclosed for your information is the fact sheet for Nationwide Permit 12, Utility Line Activities. Utility lines are already authorized by Nationwide Permit 12 provided the utility line can be placed without any change to pre-construction contours and all other proposed construction activities and facilities are in compliance with the Nationwide's permit conditions and 401 Water Quality Certification. On Tribal Lands, Water Quality Certification is denied for all Nationwide Permits. Applicants must work with EPA to obtain individual water quality certification. Please note the pre-construction notification requirements on page 2 of the fact sheet. If a project involves any one of the seven notification requirements, the project proponent must submit a DA application. Furthermore, a project must also be in compliance with the "Regional Conditions for Nationwide Permits within the State of North Dakota", found on pages 18 thru 21 of the fact sheet.

Printed on Recycled Paper

In the event your project(s) requires approval from the U.S. Army Corps of Engineers and cannot be authorized by Nationwide Permit(s), a Standard or Individual Permit will be required. A project that requires a Standard or Individual Permit is intensely reviewed and will require the issuance of a public notice. A Standard or Individual Permit generally requires a minimum of 120 days for processing but based on the project impacts and comments received through the public notice may extend well beyond 120 days.

This correspondence letter does not approve the proposed construction work or does not verify the proposed project complies with the Nationwide Permit(s).

If any of these projects require a Section 404 permit, please complete and submit the enclosed Department of the Army permit application (ENG Form 4345) to the U.S. Army Corps of Engineers, North Dakota Regulatory Office, 3319 University Drive, Bismarck, North Dakota 58504 or to the email address below. If you are unsure if a permit is required, you may submit an application; include a project location map, description of work, and construction methodology.

The North Dakota Regulatory office can accept (and prefers) electronic submissions to the following email: CENWO-OD-RND@usace.army.mil.

If we can be of further assistance or should you have any questions regarding our program, please do not hesitate to contact this office by letter of phone at (701) 255-0015.

Sincerely,

Patricia L. McQueary
Regulatory Program Manager
North Dakota

Enclosure
ENG Form 4345
Permit Completion Instructions
Fact Sheet NWP 12

U.S. Army Corps of Engineers (USACE)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT

33 CFR 325. The proponent agency is CECW-CO-R.

Form Approved - OMB No. 0710-0003 Expires: 01-08-2018

The public reporting burden for this collection of information, OMB Control Number 0710-0003, is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: http://dpcld.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First - Middle - Last -	First - Middle - Last -
Company -	Company -
E-mail Address -	E-mail Address -
6. APPLICANT'S ADDRESS:	9. AGENT'S ADDRESS:
Address-	Address-
City - State - Zip - Country -	City - State - Zip - Country -
7. APPLICANT'S PHONE NOs. w/AREA CODE	10. AGENTS PHONE NOs. w/AREA CODE
a. Residence b. Business c. Fax	a. Residence b. Business c. Fax

STATEMENT OF AUTHORIZATION

11. I hereby authorize, _____ to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

_____ _____
SIGNATURE OF APPLICANT DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable)
	Address
15. LOCATION OF PROJECT	City - State- Zip-
Latitude: °N Longitude: °W	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID Municipality

Section - Township - Range -

17. DIRECTIONS TO THE SITE

18. Nature of Activity (Description of project, include all features)

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres

or

Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

24. Is Any Portion of the Work Already Complete? ☐ Yes ☐ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address-

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT DATE SIGNATURE OF AGENT DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Instructions for Preparing a
Department of the Army Permit Application

Blocks 1 through 4. To be completed by Corps of Engineers.

Block 5. Applicant's Name. Enter the name and the E-mail address of the responsible party or parties. If the responsible party is an agency, company, corporation, or other organization, indicate the name of the organization and responsible officer and title. If more than one party is associated with the application, please attach a sheet with the necessary information marked Block 5.

Block 6. Address of Applicant. Please provide the full address of the party or parties responsible for the application. If more space is needed, attach an extra sheet of paper marked Block 6.

Block 7. Applicant Telephone Number(s). Please provide the number where you can usually be reached during normal business hours.

Blocks 8 through 11. To be completed, if you choose to have an agent.

Block 8. Authorized Agent's Name and Title. Indicate name of individual or agency, designated by you, to represent you in this process. An agent can be an attorney, builder, contractor, engineer, or any other person or organization. Note: An agent is not required.

Blocks 9 and 10. Agent's Address and Telephone Number. Please provide the complete mailing address of the agent, along with the telephone number where he / she can be reached during normal business hours.

Block 11. Statement of Authorization. To be completed by applicant, if an agent is to be employed.

Block 12. Proposed Project Name or Title. Please provide name identifying the proposed project, e.g., Landmark Plaza, Burned Hills Subdivision, or Edsall Commercial Center.

Block 13. Name of Waterbody. Please provide the name of any stream, lake, marsh, or other waterway to be directly impacted by the activity. If it is a minor (no name) stream, identify the waterbody the minor stream enters.

Block 14. Proposed Project Street Address. If the proposed project is located at a site having a street address (not a box number), please enter it here.

Block 15. Location of Proposed Project. Enter the latitude and longitude of where the proposed project is located. If more space is required, please attach a sheet with the necessary information marked Block 15.

Block 16. Other Location Descriptions. If available, provide the Tax Parcel Identification number of the site, Section, Township, and Range of the site (if known), and / or local Municipality that the site is located in.

Block 17. Directions to the Site. Provide directions to the site from a known location or landmark. Include highway and street numbers as well as names. Also provide distances from known locations and any other information that would assist in locating the site. You may also provide description of the proposed project location, such as lot numbers, tract numbers, or you may choose to locate the proposed project site from a known point (such as the right descending bank of Smith Creek, one mile downstream from the Highway 14 bridge). If a large river or stream, include the river mile of the proposed project site if known

Block 18. Nature of Activity. Describe the overall activity or project. Give appropriate dimensions of structures such as wing walls, dikes (identify the materials to be used in construction, as well as the methods by which the work is to be done), or excavations (length, width, and height). Indicate whether discharge of dredged or fill material is involved. Also, identify any structure to be constructed on a fill, piles, or float-supported platforms.

The written descriptions and illustrations are an important part of the application. Please describe, in detail, what you wish to do. If more space is needed, attach an extra sheet of paper marked Block 18.

Block 19. Proposed Project Purpose. Describe the purpose and need for the proposed project. What will it be used for and why? Also include a brief description of any related activities to be developed as the result of the proposed project. Give the approximate dates you plan to both begin and complete all work.

Block 20. Reasons for Discharge. If the activity involves the discharge of dredged and/or fill material into a wetland or other waterbody, including the temporary placement of material, explain the specific purpose of the placement of the material (such as erosion control).

Block 21. Types of Material Being Discharged and the Amount of Each Type in Cubic Yards. Describe the material to be discharged and amount of each material to be discharged within Corps jurisdiction. Please be sure this description will agree with your illustrations. Discharge material includes: rock, sand, clay, concrete, etc.

Block 22. Surface Areas of Wetlands or Other Waters Filled. Describe the area to be filled at each location. Specifically identify the surface areas, or part thereof, to be filled. Also include the means by which the discharge is to be done (backhoe, dragline, etc.). If dredged material is to be discharged on an upland site, identify the site and the steps to be taken (if necessary) to prevent runoff from the dredged material back into a waterbody. If more space is needed, attach an extra sheet of paper marked Block 22.

Block 23. Description of Avoidance, Minimization, and Compensation. Provide a brief explanation describing how impacts to waters of the United States are being avoided and minimized on the project site. Also provide a brief description of how impacts to waters of the United States will be compensated for, or a brief statement explaining why compensatory mitigation should not be required for those impacts.

Block 24. Is Any Portion of the Work Already Complete? Provide any background on any part of the proposed project already completed. Describe the area already developed, structures completed, any dredged or fill material already discharged, the type of material, volume in cubic yards, acres filled, if a wetland or other waterbody (in acres or square feet). If the work was done under an existing Corps permit, identity the authorization, if possible.

Block 25. Names and Addresses of Adjoining Property Owners, Lessees, etc., Whose Property Adjoins the Project Site. List complete names and full mailing addresses of the adjacent property owners (public and private) lessees, etc., whose property adjoins the waterbody or aquatic site where the work is being proposed so that they may be notified of the proposed activity (usually by public notice). If more space is needed, attach an extra sheet of paper marked Block 24.

Information regarding adjacent landowners is usually available through the office of the tax assessor in the county or counties where the project is to be developed.

Block 26. Information about Approvals or Denials by Other Agencies. You may need the approval of other federal, state, or local agencies for your project. Identify any applications you have submitted and the status, if any (approved or denied) of each application. You need not have obtained all other permits before applying for a Corps permit.

Block 27. Signature of Applicant or Agent. The application must be signed by the owner or other authorized party (agent). This signature shall be an affirmation that the party applying for the permit possesses the requisite property rights to undertake the activity applied for (including compliance with special conditions, mitigation, etc.).

DRAWINGS AND ILLUSTRATIONS

General Information.

Three types of illustrations are needed to properly depict the work to be undertaken. These illustrations or drawings are identified as a Vicinity Map, a Plan View or a Typical Cross-Section Map. Identify each illustration with a figure or attachment number.

Please submit one original, or good quality copy, of all drawings on 8½ x11 inch plain white paper (electronic media may be substituted). Use the fewest number of sheets necessary for your drawings or illustrations.

Each illustration should identify the project, the applicant, and the type of illustration (vicinity map, plan view, or cross-section). **While illustrations need not be professional (many small, private project illustrations are prepared by hand), they should be clear, accurate, and contain all necessary information.**

FACT SHEET
NATIONWIDE PERMIT 12
(2017)

UTILITY LINE ACTIVITIES

Activities required for the construction, maintenance, repair, and removal of utility lines and associated facilities in waters of the United States, provided the activity does not result in the loss of greater than 1/2-acre of waters of the United States for each single and complete project.
Utility lines: This NWP authorizes discharges of dredged or fill material into waters of the United States and structures or work in navigable waters for crossings of those waters associated with the construction, maintenance, or repair of utility lines, including outfall and intake structures. There must be no change in pre-construction contours of waters of the United States. A ''utility line'' is defined as any pipe or pipeline for the transportation of any gaseous, liquid, liquescent, or slurry substance, for any purpose, and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone, and telegraph messages, and internet, radio, and television communication. The term ''utility line'' does not include activities that drain a water of the United States, such as drainage tile or french drains, but it does apply to pipes conveying drainage from another area. Material resulting from trench excavation may be temporarily sidecast into waters of the United States for no more than three months, provided the material is not placed in such a manner that it is dispersed by currents or other forces. The district engineer may extend the period of temporary side casting for no more than a total of 180 days, where appropriate. In wetlands, the top 6 to 12 inches of the trench should normally be backfilled with topsoil from the trench. The trench cannot be constructed or backfilled in such a manner as to drain waters of the United States (e.g., backfilling with extensive gravel layers, creating a french drain effect). Any exposed slopes and stream banks must be stabilized immediately upon completion of the utility line crossing of each waterbody.
Utility line substations: This NWP authorizes the construction, maintenance, or expansion of substation facilities associated with a power line or utility line in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not result in the loss of greater than 1/2-acre of waters of the United States. This NWP does not authorize discharges into non-tidal wetlands adjacent to tidal waters of the United States to construct, maintain, or expand substation facilities. Foundations for overhead utility line towers, poles, and anchors: This NWP authorizes the construction or maintenance of foundations for overhead utility line towers, poles, and anchors in all waters of the United States, provided the foundations are the minimum size necessary and separate footings for each tower leg (rather than a larger single pad) are used where feasible.
Access roads: This NWP authorizes the construction of access roads for the construction and maintenance of utility lines, including overhead power lines and utility line substations, in non-tidal waters of the United States, provided the activity, in combination with all other activities included in one single and complete project, does not cause the loss of greater than 1/2-acre of non-tidal waters of the United States. This NWP does not authorize discharges into non- tidal wetlands adjacent to tidal waters for access roads. Access roads must be the minimum width necessary (see Note 2, below). Access roads must be constructed so that the length of the road minimizes any adverse effects on waters of the United States and must be as near as possible to pre-construction contours and elevations (e.g., at grade corduroy roads or

geotextile/gravel roads). Access roads constructed above pre-construction contours and elevations in waters of the United States must be properly bridged or culverted to maintain surface flows. This NWP may authorize utility lines in or affecting navigable waters of the United States even if there is no associated discharge of dredged or fill material (See 33 CFR part 322). Overhead utility lines constructed over section 10 waters and utility lines that are routed in or under section 10 waters without a discharge of dredged or fill material require a section 10 permit. This NWP authorizes, to the extent that Department of the Army authorization is required, temporary structures, fills, and work necessary for the remediation of inadvertent returns of drilling fluids to waters of the United States through sub-soil fissures or fractures that might occur during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines. These remediation activities must be done as soon as practicable, to restore the affected waterbody. District engineers may add special conditions to this NWP to require a remediation plan for addressing inadvertent returns of drilling fluids to waters of the United States during horizontal directional drilling activities conducted for the purpose of installing or replacing utility lines. This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to conduct the utility line activity. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. After construction, temporary fills must be removed in their entirety and the affected areas returned to pre- construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.
Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if any of the following criteria are met: (1) The activity involves mechanized land clearing in a forested wetland for the utility line right-of-way; (2) a section 10 permit is required; (3) the utility line in waters of the United States, excluding overhead lines, exceeds 500 feet; (4) the utility line is placed within a jurisdictional area (i.e., water of the United States), and it runs parallel to or along a stream bed that is within that jurisdictional area; (5) discharges that result in the loss of greater than 1/10- acre of waters of the United States; (6) permanent access roads are constructed above grade in waters of the United States for a distance of more than 500 feet; or (7) permanent access roads are constructed in waters of the United States with impervious materials. (See general condition 32.) (Sections 10 and 404)

Note 1: Where the utility line is constructed or installed in navigable waters of the United States (i.e., section 10 waters) within the coastal United States, the Great Lakes, and United States territories, a copy of the NWP verification will be sent by the Corps to the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), for charting the utility line to protect navigation.

Note 2: For utility line activities crossing a single waterbody more than one time at separate and distant locations, or multiple waterbodies at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. Utility line activities must comply with 33 CFR 330.6(d).

Note 3: Utility lines consisting of aerial electric power transmission lines crossing navigable waters of the United States (which are defined at 33 CFR part 329) must comply with the applicable minimum clearances specified in 33 CFR 322.5(i).

Note 4: Access roads used for both construction and maintenance may be authorized, provided they meet the terms and conditions of this NWP. Access roads used solely for construction of the utility line must be removed upon completion of the work, in accordance with the requirements for temporary fills.

Note 5: Pipes or pipelines used to transport gaseous, liquid, liquescent, or slurry substances over navigable waters of the United States are considered to be bridges, not utility lines, and may require a permit from the U.S. Coast Guard pursuant to section 9 of the Rivers and Harbors Act of 1899. However, any discharges of dredged or fill material into waters of the United States associated with such pipelines will require a section 404 permit (see NWP 15).

Note 6: This NWP authorizes utility line maintenance and repair activities that do not qualify for the Clean Water Act section 404(f) exemption for maintenance of currently serviceable fills or fill structures.

Note 7: For overhead utility lines authorized by this NWP, a copy of the PCN and NWP verification will be provided to the Department of Defense Siting Clearinghouse, which will evaluate potential effects on military activities.

Note 8: For NWP 12 activities that require pre-construction notification, the PCN must include any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings that require Department of the Army authorization but do not require pre-construction notification (see paragraph (b) of general condition 32). The district engineer will evaluate the PCN in accordance with Section D, ''District Engineer's Decision.'' The district engineer may require mitigation to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see general condition 23).

Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/ or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. Navigation.

(a) No activity may cause more than a minimal adverse effect on navigation.
(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.
(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements.

No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. Spawning Areas.

Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas.

Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds.

No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material.

No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. Water Supply Intakes.

No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects from Impoundments.

If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows.

To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains.

The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment.

Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls.

Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. Removal of Temporary Fills.

Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance.

Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project.

The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers.

(a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.
(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. The permittee shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.
(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

17. Tribal Rights.

No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

18. Endangered Species.

(a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will

directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which ''may affect'' a listed species or critical habitat, unless ESA section 7 consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur.

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. If pre- construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed activity or that utilize the designated critical habitat that might be affected by the proposed activity. The district engineer will determine whether the proposed activity ''may affect'' or will have ''no effect'' to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non- Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have ''no effect'' on listed species or critical habitat, or until ESA section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species- specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the ''take'' of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with ''incidental take'' provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where ''take'' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word ''harm'' in the definition of ''take'' means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district

engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.
(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide Web pages at http://www.fws.gov/ or http:// www.fws.gov/ipac and http:// www.nmfs.noaa.gov/pr/species/esa/ respectively.

19. Migratory Birds and Bald and Golden Eagles.

The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether ''incidental take'' permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. Historic Properties.

(a) In cases where the district engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.
(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act. If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.
(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought

from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect. Where the non-Federal applicant has identified historic properties on which the activity might have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed.
(d) For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non- Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.
(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/ THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. <u>Discovery of Previously Unknown Remains and Artifacts.</u>

If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid

construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters.

Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.
(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.
(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation.

The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:
(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).
(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.
(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre- construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre- construction notification, the district engineer may determine on a case-by- case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.
(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation to ensure that the activity results in no more than minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult- to-replace resources (see 33 CFR 332.3(e)(3)).

(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. Restored riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.
(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f)).

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)).

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.

(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2- acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.
(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee- responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.
(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. Safety of Impoundment Structures.

To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality.

Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality. *Specifically for North Dakota, the North Dakota Department of Health has denied water quality certification for all projects proposed to affect Class 1 and 1A, II and Class III rivers and streams or classified lakes listed in Appendices I and II of the standards, individual certification must be obtained. For project proposed to affect any other waters, the North Dakota Department of Health has issued water quality certification provided the attached Construction and Environmental Disturbance Requirements are followed. The Standards may be found at*
http://www.legis.nd.gov/information/acdata/pdf/33-16-02.1.pdf?2016031115632
On Tribal Lands, Water Quality Certification is denied for all Nationwide Permits. Applicants must work with EPA to obtain individual water quality certification. Contact: USEPA, Region 8,

401 Certification Program – 8WP-AAP, 1595 Wynkoop Street, Denver, Colorado 80202-1129. (303-312-6909)

26. Coastal Zone Management.

In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions.

The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits.

The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications.

If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

> When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.
>
> _____ (Transferee) _____ (Date)

30. Compliance Certification.

Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:
(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;
(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and
(c) The signature of the permittee certifying the completion of the activity and mitigation. The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. Activities Affecting Structures or Works Built by the United States.

If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a ''USACE project''), the prospective permittee must submit a pre- construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. Pre-Construction Notification.

(a) Timing. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division

engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is ''no effect'' on listed species or ''no potential to cause effects'' on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Pre-Construction Notification: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

(4) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures. For single and complete linear projects, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation,

especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-Federal permittees, if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed activity or utilize the designated critical habitat that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act.

(8) For non-Federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the ''study river'' (see general condition 16); and

(10) For an activity that requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from the Corps office having jurisdiction over that USACE project.

(c) Form of Pre-Construction Notification: The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is an NWP PCN and must include all of the applicable information required in paragraphs (b)(1) through (10) of this general condition. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) Agency Coordination:

(1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) All NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of stream bed; (iii) NWP 13

activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iv) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (e.g., via email, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or email that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre- construction notifications to expedite agency coordination.

Further Information

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.
2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.
3. NWPs do not grant any property rights or exclusive privileges.
4. NWPs do not authorize any injury to the property or rights of others.
5. NWPs do not authorize interference with any existing or proposed Federal project (see general condition 31).

2017 NATIONWIDE PERMITS
REGIONAL CONDITIONS
OMAHA DISTRICT
STATE OF NORTH DAKOTA

The following Nationwide Permit Regional Conditions will be used in the State of North Dakota. Regional conditions are placed on Nationwide Permits to ensure projects result in no more than minimal adverse impacts to the aquatic environment and to address local resource concerns.

1. **Wetlands Classified as Peatlands – Revoked for use**

All Nationwide Permits, with the exception of 3, 5, 20, 32, 38 and 45, are revoked for use in peatlands. Peatlands are permanently or seasonally saturated and inundated wetlands where conditions inhibit organic matter decomposition and allow for the accumulation of peat. Under cool, anaerobic, and acidic conditions, the rate of organic matter accumulation exceeds organic decay.

2. **Wetlands Classified as Peatlands – Preconstruction Notification Requirement**

For Nationwide Permits 3, 5, 20, 32, 38 and 45 permittees must notify the Corps in accordance with General Condition 32 (Pre-Construction Notification) prior to initiating any regulated activity impacting peatlands.

3. **Waters Adjacent to Natural Springs – Preconstruction Notification Requirement**

For all Nationwide Permits permittees must notify the Corps in accordance with General Condition No. 32 (Pre-Construction Notification) for regulated activities located within 100 feet of the water source in natural spring areas. For purposes of this condition, a spring source is defined as any location where there is flow emanating from a distinct point at any time during the growing season. Springs do not include seeps and other groundwater discharge areas where there is no distinct point source.

4. **Missouri River, including Lake Sakakawea and Lake Oahe – Pre-construction Notification Requirement**

For all Nationwide Permits permittees must notify the Corps in accordance with General Condition No. 32 (Pre-Construction Notification) prior to initiating any regulated activity occurring in or under the Missouri River, including Lake Sakakawea and Lake Oahe. In addition, any activity occurring in an off channel area (marinas, bays, etc.) of any of these waterbodies, a preconstruction notification is required.

5. **Spawning Areas**

Spawning restrictions and important fish habitat areas, if applicable, can be accessed on the North Dakota Game & Fish Department's website at:

http://gf.nd.gov/gnf/conservation/docs/spawning-restriction-exclusions.pdf

No regulated activity within the Red River of the North shall occur between 15 April and 1 July. Spawning season restrictions do not apply to projects involving dredging or other discharges of less than 25 cubic yards of material in any jurisdictional water.

6. **Counter-Sinking Culverts and Associated Riprap – All Nationwide Permits**

In streams with intermittent or perennial flow and a stable stream bed, culvert stream crossings shall be installed with the culvert invert set below the natural streambed according to the table below. This regional condition does not apply in instances where the lowering of the culvert invert would allow a headcut to migrate upstream of the project into an unaffected stream reach or result in lowering the elevation of the stream reach.

Riprap inlet and outlet protection shall be placed to match the height of the culvert invert.

Culvert Type	Drainage Area	Minimum Distance Culvert Invert Shall Be Lowered Below Stream Flow Line
All culvert types	≤ 100 acres	Not required
Pipe diameter <8.0 ft	100 to 640 acres	0.5 ft
Pipe diameter <8.0 ft	>640 acres	1.0 ft
Pipe diameter ≥ 8.0 ft	All drainage sizes	1.0 ft
Box culvert	All drainage sizes	1.0 ft

REGIONAL CONDITIONS APPLICABLE TO SPECIFIC NATIONWIDE PERMITS

Nationwide Permit 7 – Outfall Structures and Associated Intake Structures and Nationwide Permit 12 – Utility Line Activities.

Intake Structures – Intake screens with a maximum mesh opening of ¼-inch must be provided, inspected annually, and maintained. Wire, Johnson-like, screens must have a maximum distance between wires of 1/8-inch. Water velocity at the intake screen shall not exceed ½-foot per second.

Pumping plant sound levels will not exceed 75 dB at 50 feet.

Intakes located in Lake Sakakawea, above river mile 1519, and on the Yellowstone River, are subject to the following conditions:

- The intakes shall be floating.
- At the beginning of the pumping season, the intake shall be placed over water with a minimum depth of 20 feet.
- If the 20-foot depth is not attainable, then the intake shall be located over the deepest water available.

- If the water depth falls below six feet, the intake shall be moved to deeper water or the maximum intake velocity shall be limited to ¼ foot per second.

Intakes located in Lake Sakakawea, below river mile 1519, and the Missouri River below Garrison Dam are subject to the following conditions:

- The intakes shall be submerged.
- At the beginning of the pumping season, the intake will be placed at least 20 vertical feet below the existing water level.
- The intake shall be elevated 2 to 4 feet off the bottom of the river or reservoir bed.
- If the 20-foot depth is not attainable, then the intake velocity shall be limited to ¼-foot per second with intake placed at the maximum practicable attainable depth.

Intakes and associated utility lines that are proposed to cross sandbars in areas designated as piping plover critical habitat are prohibited.

Utility Lines

- Any temporary open trench associated with utility lines are to be closed within 30 days of excavation. This time limit may be extended by notifying the North Dakota Regulatory Office and receiving a written response that the extension is acceptable.

Nationwide Permit 11 – Temporary Recreational Structures – Boat Docks

To ensure that the work or structure shall not cause unreasonable obstruction to the free navigation of the navigable waters, the following conditions are required:

- No boat dock shall be located on a sandbar or barren sand feature. The farthest point riverward of a dock shall not exceed a total length of 30 feet from the ordinary high watermark. Information Note: Issuance of this permit does not supersede authorization required by the North Dakota State Engineer's Office.
- Any boat dock shall be anchored to the top of the high bank.
- Any boat dock located within an excavated bay or marina that is off the main river channel may be anchored to the bay or marina bottom with spuds.

Section 10 Waters located in the State of North Dakota are:

Bois de Sioux River
James River
Missouri River
Red River of the North
Upper Des Lacs Lake
Yellowstone River

Nationwide Permit 13 – Bank Stabilization

Permittees must notify the Corps in accordance with General Condition No. 32 (Pre-Construction Notification) prior to initiating any regulated activity. The notification must also include photo evidence of erosion in the area. Prohibited materials found at

http://www.nwo.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/2034/Article/487696/prohibited-restricted-materials.aspx cannot be used in waters of the United States.

Nationwide Permit 23 – Approved Categorical Exclusions

Permittees must notify the Corps in accordance with General Condition No. 32 (Pre-Construction Notification) prior to initiating any regulated activity. In addition to information required by General Condition 32 (Pre-Construction Notification), permittees must identify the approved categorical exclusion that applies and provide documentation that the project fits the categorical exclusion.

GENERAL CONDITIONS (REGIONAL ADDITIONS)

General Condition 32 Notification– Pre-construction Notification

Prospective permittees should be aware that a field aquatic resources delineation may be required for applications where notification is required in accordance with General Condition 32 (Pre-Construction Notification) and/or mitigation may be required. Specific guidelines outlining the aquatic resources delineation process in the State of North Dakota and the Corps 1987 Wetland Delineation Manual and applicable Regional supplements to the Manual can be accessed on the North Dakota Regulatory Office's website at:
http://www.nwo.usace.army.mil/Missions/RegulatoryProgram/NorthDakota.aspx

NORTH DAKOTA
DEPARTMENT of HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

Construction and Environmental Disturbance Requirements

These represent the minimum requirements of the North Dakota Department of Health. They ensure that minimal environmental degradation occurs as a result of construction or related work which has the potential to affect the waters of the State of North Dakota. All projects will be designed and implemented to restrict the losses or disturbances of soil, vegetative cover, and pollutants (chemical or biological) from a site.

Soils

Prevent the erosion of exposed soil surfaces and trapping sediments being transported. Examples include, but are not restricted to, sediment dams or berms, diversion dikes, hay bales as erosion checks, riprap, mesh or burlap blankets to hold soil during construction, and immediately establishing vegetative cover on disturbed areas after construction is completed. Fragile and sensitive areas such as wetlands, riparian zones, delicate flora, or land resources will be protected against compaction, vegetation loss, and unnecessary damage.

Surface Waters

All construction which directly or indirectly impacts aquatic systems will be managed to minimize impacts. All attempts will be made to prevent the contamination of water at construction sites from fuel spillage, lubricants, and chemicals, by following safe storage and handling procedures. Stream bank and stream bed disturbances will be controlled to minimize and/or prevent silt movement, nutrient upsurges, plant dislocation, and any physical, chemical, or biological disruption. The use of pesticides or herbicides in or near these systems is forbidden without approval from this Department.

Fill Material

Any fill material placed below the high water mark must be free of top soils, decomposable materials, and persistent synthetic organic compounds (in toxic concentrations). This includes, but is not limited to, asphalt, tires, treated lumber, and construction debris. The Department may require testing of fill materials. All temporary fills must be removed. Debris and solid wastes will be removed from the site and the impacted areas restored as nearly as possible to the original condition.

FEDERAL AVIATION ADMINISTRATION, DAKOTA-MINNESOTA AIRPORTS DISTRICT

Bailey, Justin

From: Mark.Holzer@faa.gov
Sent: Tuesday, February 27, 2018 2:42 PM
To: Bravo-Cogar, Crystal G
Subject: RE: Message from www.faa.gov: Comment/Question For Bismarck Airports District Office

Crystal

The FAA process for filing airspace cases for Wind Turbines can be found in this link:

https://urldefense.proofpoint.com/v2/url?u=https-3A__oeaaa.faa.gov_oeaaa_external_searchAction.jsp-3Faction-3DshowWindTurbineFAQs&d=DwIGaQ&c=pgTKN5yjcEYSPUPpeP-zuA&r=hD9OpAUq6WVro9GmlIsOiyz6sOGIXMFUPLNUVMhlehE&m=gkTXpH41hp5YERWk7jG2LOgySqB1ur6Q_KduAueNxVs&s=N-3FjtZSbF6ETtZqkqqiDQnna-zNTeYPBU-NEAx76Tg&e=

Good luck in this process.

Mark J. Holzer

Program Manager

Federal Aviation Administration

Dakota Minnesota Airports District Office

2301 University Drive, Bldg 23B

Bismarck, ND 58504

701.323.7393

-----Original Message-----

From: cbravocogar@burnsmcd.com [mailto:cbravocogar@burnsmcd.com]

Sent: Tuesday, February 27, 2018 2:35 PM

To: Holzer, Mark (FAA) <Mark.Holzer@faa.gov>

Subject: Message from www.faa.gov: Comment/Question For Bismarck Airports District Office

This email was sent through the Federal Aviation Administration's public website. You have been contacted via an email link on the following page: www.faa.gov/airports/great_lakes/about_airports/dma-ado/

Message:

Hi. I believe we spoke this morning regarding scoping for a proposed wind energy facility in NW North Dakota. I am looking to send an inquiry letter to the correct person in the FAA regarding the project, including any concerns or permitting required to move the project forward. The letter was previously sent to Laurie Suttmeier, but no response was received. Would you be able to help me, please? Thank you.

Crystal

MONTRAIL COUNTY PLANNING & ZONING BOARD

Jennifer Dean

From: Don Longmuir <DonL@co.mountrail.nd.us>
Sent: Wednesday, October 04, 2017 10:04 AM
To: Jennifer Dean
Subject: FW: letter
Attachments: Tradewind Energy.doc

Importance: High

From: Don Longmuir
Sent: Wednesday, October 04, 2017 10:00 AM
To: 'Dave Iadarola'; 'jdean@tradwindenergy.com'
Cc: Nathan Sem; Liz Hollowell; Wade Enget
Subject: letter
Importance: High

Please see attached letter. Sorry for the delay in getting this to you.
don

Donald W. Longmuir Jr.

Donald W. Longmuir Jr., AICP
Interim Planing & Zoning Administrator
Interim Disaaster Emergency Coordinator
P.O. Box 248
8103 61st Street NW
Stanley, ND 58784-0248

PLANNING & ZONING BOARD
COUNTY OF MOUNTRAIL
PO Box 248
Stanley, North Dakota 58784-0248
(701) 628-2909
donl@co.mountrail.nd.us
nathans@co.mountrail.nd.us
lizh@co.mountrail.nd.us

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GARY WEISENBERGER
LINDA WIENBAR

October 4, 2017

Jennifer Dean
Vice President, Environmental Studies & Permitting
Dave Iadarola,
Development Manager
Tradewind Energy
16105 West 113th Street, Suite 105
Lenexa, KS 66219

Dear Ms. Dean & Mr. Iadarola:

As a follow up to our meeting held on Tuesday, September 19th I providing the following information:

- Bicker Township (Township 158 North, Range 94 West) has their own planning & zoning authority and you will need to contact Jerome Rice, Chairman, 701.664.2381 (home) 701.641.3239 (cell), 7531 101st Avenue NW, Tioga, ND 58852-9670 or Roger Blestrud, Clerk/Treasurer, 701.664.2381 (home), 701.648.9674 (cell), 10175 74th Street NW, Tioga, ND 58852-9688;
- The non-refundable application fee for your project would be $25,000 for up to twenty-five (25) towers plus $1,000 per each proposed tower site beyond twenty-five (25);
- The collection boxes which were discussed would require a building permit for each structure;
- Article XI, Section L, Paragraph 2 line 3 on page 31 of the Mountrail County Zoning Ordinance Paragraph 2, line 3 contains a typographical error. This should read :...Turbines must be set back at least 1.5 times the turbine height form each antenna, tower, unoccupied structure or improvement with an estimated value over $25,000.....";
- Article XI, Section V on page 34 of the Mountrail County Zoning Ordinance requires a cash bond or letter of credit in the amount of $250,000 for the project. There is no $25,000 per tower requirement.

If you have any further questions please contact our office.

Sincerely,

Donald W. Longmuir Jr.

Donald W. Longmuir Jr., AICP
Interim Planning & Zoning Administrator

WILLIAMS COUNTY PLANNING & ZONING BOARD

Telephone Memo

BURNS McDONNELL

Called:	Sam Henderson
Organization:	Williams County North Dakota Development Services Department, Planning and Zoning Division
Caller:	Ryann Williams
Organization:	Burns and McDonnell Engineering Inc
Subject of Call:	Floodplain Maps
Call Date:	2/7/2018
Call Time:	11:45 AM
Phone No. Called:	701-577-4565
Project Name:	Aurora Wind Project
Project No.:	104200
Memo Prepared By:	Ryann Williams
Date Memo Issued:	2/8/2018

Summary:

Confirmed with Sam Henderson that FEMA is in the process of mapping the floodplains in Williams and Mountrail Counties, and therefore this data cannot be currently viewed. Sam indicated that, because of this, there is no publicly accessible data and it can be assumed that the Study Area is not in an identified floodplain.

NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION

UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Washington, D.C. 20230

JUL 12 2018

Mr. Frank O'Brien
COMSEARCH
19700 Janelia Farm Blvd.
Ashburn, VA 20147

Re: Aurora Wind Project: Williams County, ND

Dear Mr. O'Brien:

In response to your request on May 1, 2018, the National Telecommunications and Information Administration provided to the federal agencies represented in the Interdepartment Radio Advisory Committee (IRAC) the plans for the Aurora Wind Project, located in Williams County, North Dakota.

After a 45 day period of review, no agencies had issues with turbine placement in this area.

While the IRAC agencies did not identify any concerns regarding radio frequency blockage, this does not eliminate the need for the wind energy facilities to meet any other requirements specified by law related to these agencies. For example, this review by the IRAC does not eliminate any need that may exist to coordinate with the Federal Aviation Administration concerning flight obstruction.

Thank you for the opportunity to review these proposals.

Sincerely,

Peter A. Tenhula
Deputy Associate Administrator
Office of Spectrum Management

NORTH DAKOTA GEOLOGIC SURVEY

North Dakota Geological Survey

Edward C. Murphy - State Geologist

Department of Mineral Resources

Lynn D. Helms - Director

North Dakota Industrial Commission

www.state.nd.us/ndgs

January 8, 2018

Jennifer Bell
Senior Environmental Scientist
Burns & McDonnel
9785 Maroon Circle, Suite 400
Centennial, CO 80112

Re: Information Request – Proposed Aurora Wind Project and Associated Transmission Line – Williams and Mountrail Co.

The North Dakota Geological Survey appreciates the notification and opportunity to review and provide comment on your upcoming project work. Your information request letter sent to us, dated December 21, 2017, was reviewed by our office on January 8, 2018. Regarding the proposed projects at and along the locations described in the letter, our agency would not have any properties in the described project areas under ownership nor of current property interest.

We have identified a few localized landslide areas in the vicinity of the proposed project areas through previous geological mapping work that should be noted.

Areas of landslide maps at the 1:100,000 and 1:24,000 scale, along with supporting GIS data, and recent LiDAR data and mapping products, are available on our website at: https://www.dmr.nd.gov/ndgs/landslides/

Please feel free to contact us at (701) 328-8000 or via email at fjanderson@nd.gov at any time if there are any additional questions or comments.

Sincerely,

North Dakota Geological Survey:

Fred J. Anderson
Geologist

FJA\

Aurora Wind Project

Tradewind Energy

Divide and Williams Counties, North Dakota

Microwave Path Analysis

April 17, 2018

Capitol Airspace Group

capitolairspace.com

(703) 256 - 2485

Capitol Airspace Group
5400 Shawnee Road, Suite 304
Alexandria, VA 22312
703-256-2485
capitolairspace.com

Summary

Capitol Airspace conducted a microwave path analysis for the Aurora wind project in Divide and Williams Counties, North Dakota. The purpose for this analysis was to identify licensed and applied coordinated non-federal microwave paths that could limit the placement of wind turbines. At the time of this analysis, individual wind turbine locations had not been identified. As a result, this analysis assessed microwave paths overlying an approximately 290 square mile study area (red outline, ***Figure 1***) to aid in identifying optimal wind turbine locations.

Point-to-point microwave transmission is a critical component of the national communications infrastructure. Microwave paths enable broadband data transmission that supports telephone, cellular, and personal communication service (PCS) networks, wireless internet providers, audio and video transmission from television studios to transmitter sites, as well as many other industry/utility applications. In order to ensure signal reliability, these paths are sited to avoid any line-of-sight obstructions. Proposed structures that create a line-of-sight obstruction can degrade signal reliability and could require revisions to the microwave system.

Five unique microwave paths overlie the Aurora wind project. Wind turbines within the associated Fresnel zones could cause signal blockage degrading link performance. However, due to the narrow widths of most Fresnel zones, micrositing wind turbines outside of these zones is often a feasible mitigation option.

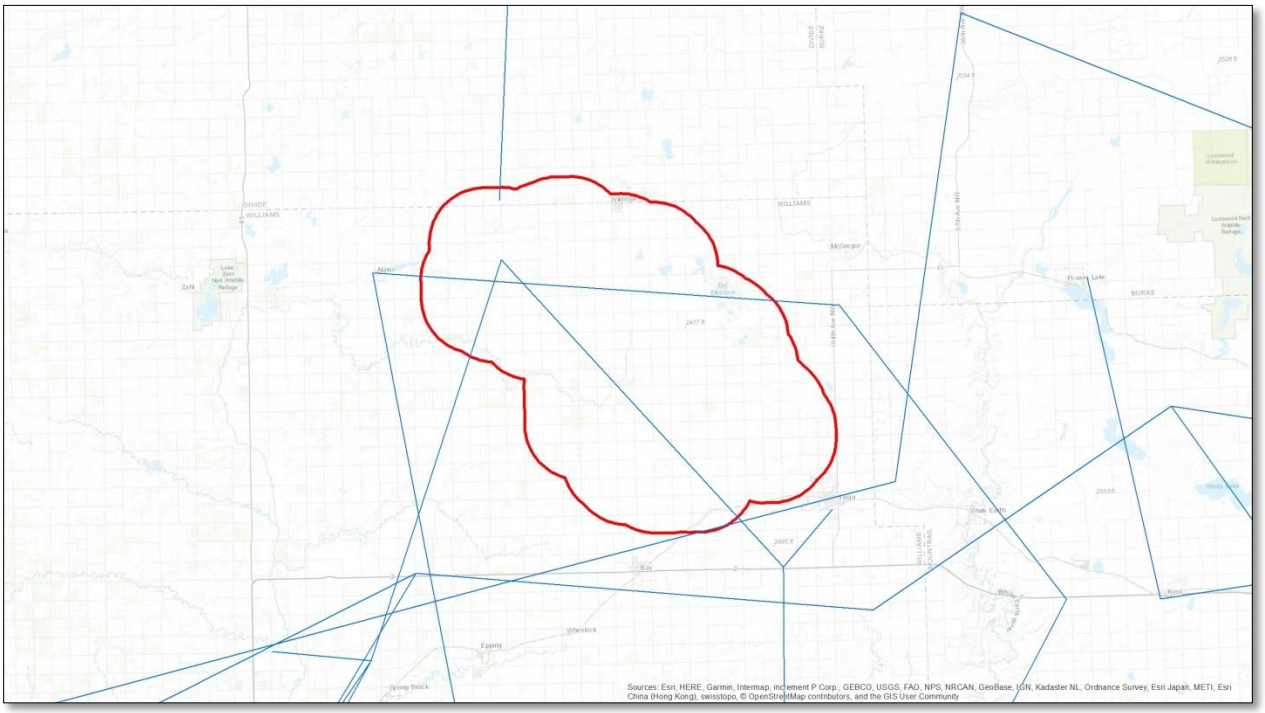

Figure 1: Licensed microwave paths (blue) in proximity to the Aurora wind project

Capitol Airspace maintains a database obtained from the FCC which is updated on a daily basis. The results of this analysis are based on the most recent data available as of the date of this report.

Methodology

Capitol Airspace studied the proposed project based upon location information provided by Tradewind Energy. Using this information, Capitol Airspace used a Geographic Information System (GIS) to determine proximity to both licensed and applied coordinated non-federal microwave paths contained in the Federal Communication Commission (FCC) Universal Licensing System (ULS) database.

This analysis considers impact on microwave paths resulting from the physical blockage of the first Fresnel zone (***Figure 2***). The first Fresnel zone is a three dimensional volume whose radius at a given point is calculated using the path frequency and distance from the transmitting and receiving antennas. The Fresnel zone radius is largest at the path midpoint (where $d_1 = d_2$). Lower frequencies result in larger Fresnel zone radii for a given path and are typically associated with longer paths. Higher frequencies result in smaller Fresnel zone radii for a given path and are typically associated with shorter paths.

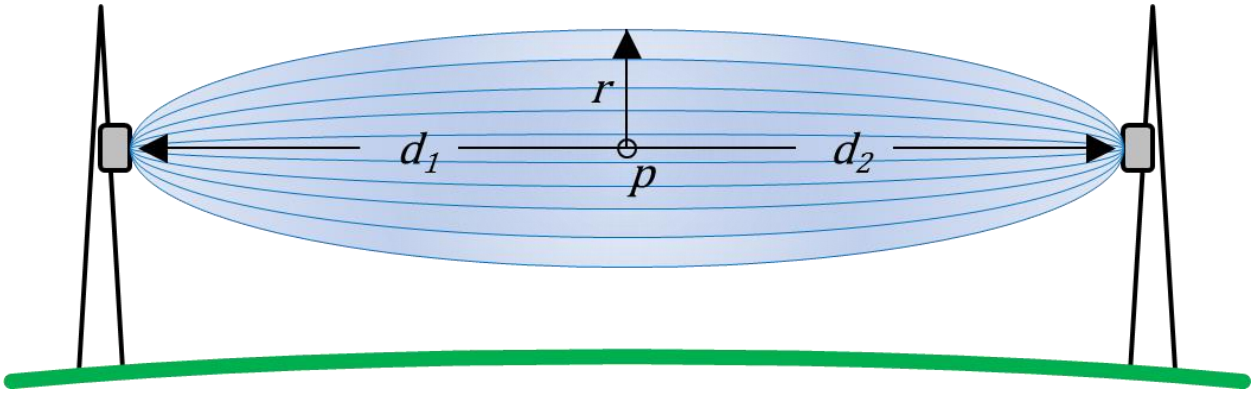

Figure 2: Fresnel zone example

In many cases, ULS database microwave transmitter and receiver antenna locations are inaccurate. Available aerial imagery including United States Geological Survey (USGS) Orthoimagery was used to improve the coordinates for locations associated with microwave paths in proximity to the defined study area.

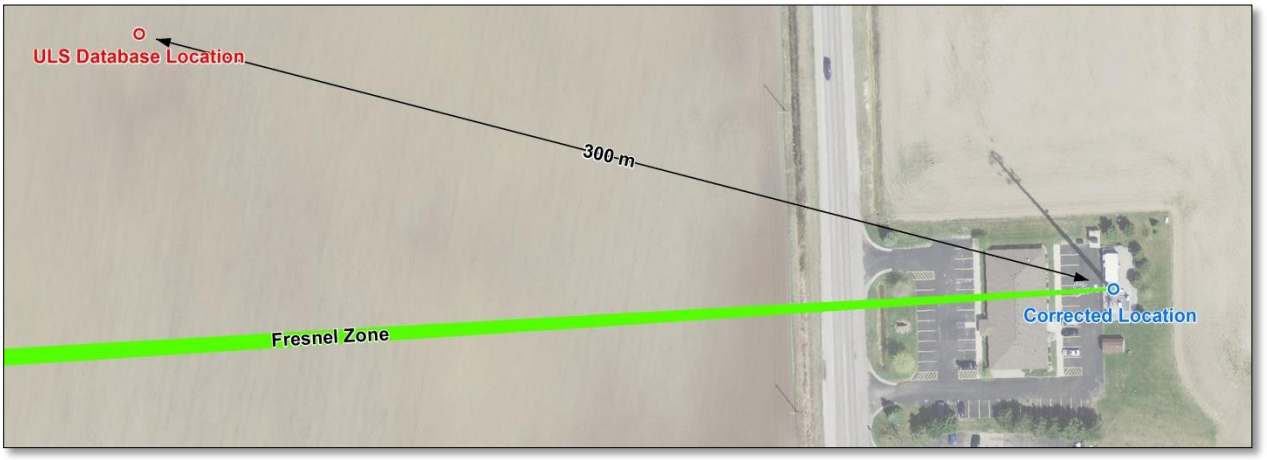

Figure 3: Example of using USGS Orthoimagery to correct erroneous ULS database antenna location

Study Findings

Nine microwave path Fresnel zones overlie the Aurora wind project (***Table 1*** & ***Figure 4***). These Fresnel zones are associated with five common paths used by Basin Electric Power Cooperative, Continental Resources, Inc., Infrastructure Networks, Inc., and Prairie Broadcasting, Inc.

Licensee	Call Sign	Path	Status	Transmitter	Receiver	Frequency (MHz) [1]
Basin Electric Power Cooperative	WQQW846	2	Licensed	NESET	WHEELOCK	6256.54
	WQRB986	1	Licensed	WHEELOCK	NESET	6004.50
Continental Resources, Inc.	WQRU770	1	Licensed	CORINTH	SPRINGBROOK	10735.00
		2	Licensed	CORINTH	NEMONT	10775.00
	WQRU773	3	Licensed	NEMONT	CORINTH	11265.00
	WQRU779	1	Licensed	SPRINGBROOK	CORINTH	11225.00
Infrastructure Networks, Inc.	WQTP889	2	Licensed	ALAMO	McGREGOR	6330.67
	WQTP891	1	Licensed	McGREGOR	ALAMO	6078.63
PRAIRIE PUBLIC BROADCASTING, INC.	WPJB257	1	Licensed	Location 1	Location 2	944.25

Table 1: Microwave paths with Fresnel zones overlying the study area

Conclusion

The results of this analysis indicate that nine Fresnel zones (green, ***Figure 4***) associated with five unique microwave paths overlie the Aurora wind project. Wind turbines should be sited outside of the lateral boundaries of the Fresnel zones associated with these paths in order to avoid the likelihood of signal blockage. Due to the relatively narrow size of most microwave path Fresnel zones, it is likely that impact on these paths can be avoided through micrositing. However, wind turbines (including the rotor-swept area) could be sited within the lateral boundaries of Fresnel zones provided they do not penetrate the three dimensional Fresnel zones

If you have any questions regarding the findings of this study, please contact ***Rick Coles*** or ***Tim Connolly*** at (703) 256-2485.

[1] Microwave paths may be licensed to operate using more than one frequency. For the purposes of calculating Fresnel zone radii, the lowest frequency was used to create the largest Fresnel zone.

Aurora Wind Project

Figure 4 - Microwave Path Fresnel Zones

Plot Date: 18 April 2018

Coordinate System: NAD 1983 UTM Zone 13N

N

0 1 2 4 6 8 10 Kilometers

0 0.5 1 2 3 4 5 6 Miles

PRAIRIE PUBLIC BROADCASTING, INC.
(30.6 km @ 0.94 GHz)

Location 1

CORINTH

ALAMO

Infrastructure Networks, Inc.
(41.08 km @ 6.08 - 6.33 GHz)

McGREGOR

Continental Resources, Inc.
(36.93 km @ 10.73 - 11.22 GHz)

Continental Resources, Inc.
(36.58 km @ 10.78 - 11.27 GHz)

NESET

Basin Electric Power Cooperative
(33.82 km @ 6.00 - 6.26 GHz)

NEMONT

WHEELOCK

Legend

- Antenna Location
- Fresnel Zone (2D)
- Study Area

Capitol Airspace Group

Wind Power GeoPlanner™

Land Mobile & Emergency Services Report

Aurora Wind Project

Prepared on Behalf of
Aurora Wind Project,
LLC

May 3, 2018

COMSEARCH®
A CommScope Company

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1. Introduction

An assessment of the emergency services in the Aurora Wind Project area was performed by Comsearch to identify potential impact from the planned turbines. We evaluated the registered frequencies for the following types of first responder entities: police, fire, emergency medical services, emergency management, hospitals, public works, transportation and other state, county, and municipal agencies. We also identified all industrial and business land mobile radio (LMR) systems and commercial E911 operators within the proposed wind energy facility boundaries. This information is useful in the planning stages of the wind energy facility because the data can be used in support of facility communications needs and to evaluate any potential impact on the emergency services provided in that region. An overview of the project area, which is located in Williams and Mountrail Counties, North Dakota, appears in Figure 1.

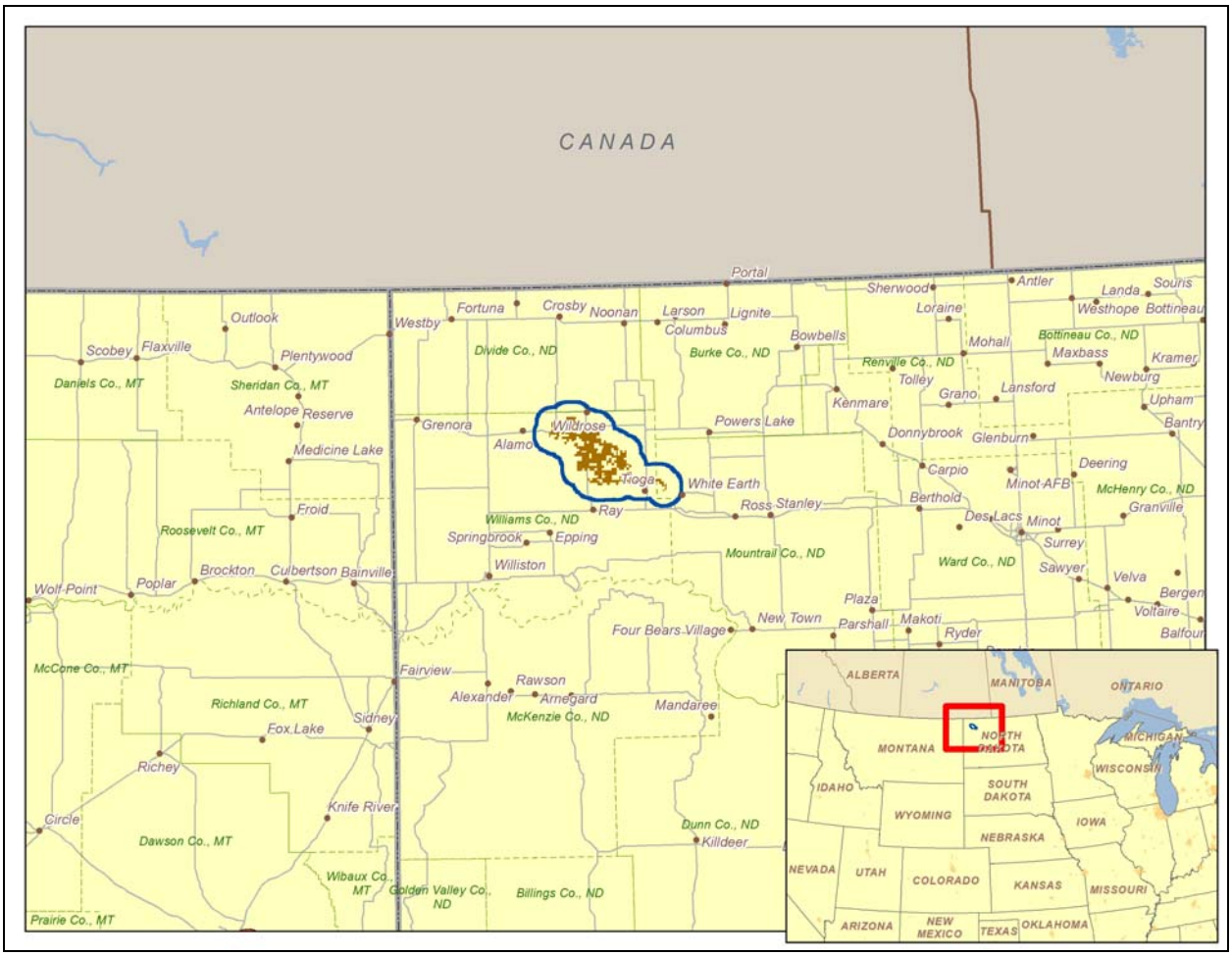

Figure 1: Area of Interest (AOI)

2. Summary of Results

Our land mobile and emergency services incumbent data[1] was derived from the FCC's Universal Licensing System (ULS) and the FCC's Public Safety & Homeland Security bureau. We identified both site-based licenses as well as regional area-wide licenses designated for public safety use.

Site-Based Licenses

The site-based licenses were imported into GIS software and geographically mapped relative to the wind energy project area of interest as defined by the customer. Each site on the map was given an ID number and associated with site information in a data table. A depiction of the fixed-site licenses in and around the project area appears in Figure 2.

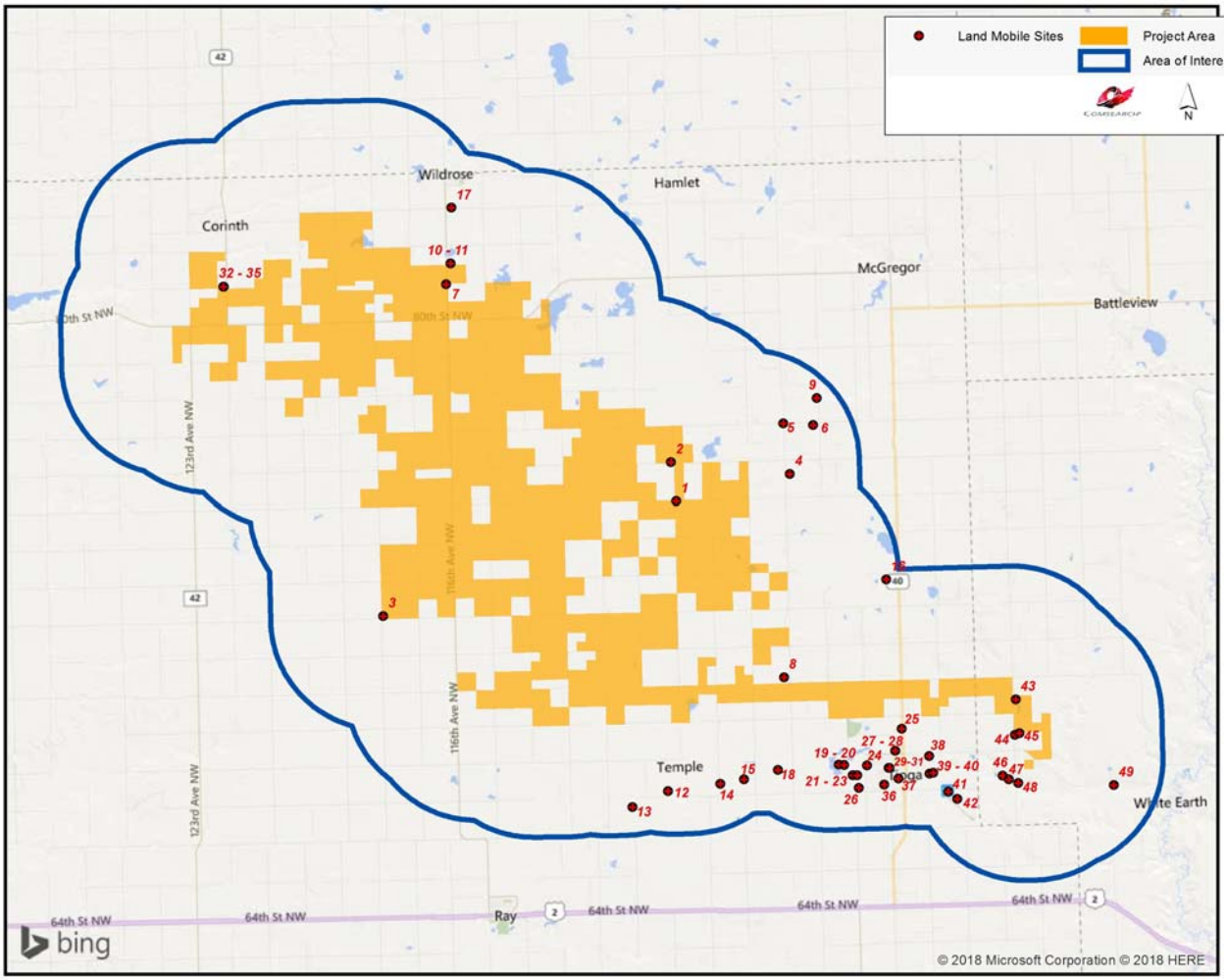

Figure 2: Land Mobile & Emergency Service Sites in Area of Interest

Figure 2 identifies forty-nine site-based licenses in and around the Aurora Wind Project area of interest. Specific information about these sites is provided in Table 1.

ID	Call Sign	Frequency Band (MHz)	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)	Distance to Center of AOI (km)
1	WPCQ417	150-174	Sundhagen, Scott	18.0	48.502528	-103.058806	4.58
2	WPCQ417	150-174	Sundhagen, Scott	18.0	48.517806	-103.061306	4.83
3	WQOK920	450-470	Static Oilfield Service	18.0	48.460528	-103.232417	9.33
4	WNQN724	450-470	Hess Corporation	12.0	48.511972	-102.991583	9.64
5	WQPT498	450-470	Vestas American Wind Technology, Inc.	13.0	48.531889	-102.994750	9.97
6	WPXP604	150-174	Gohrick Farms	20.0	48.530861	-102.977139	11.16
7	WQCV562	450-470	Sevre, Lyle	24.0	48.589444	-103.190833	11.26
8	WRAQ862	150-174	Sagaser Farms	25.0	48.432750	-102.998111	11.72
9	WQMA573	150-174	Kutter, Rick	14.0	48.541333	-102.974667	11.74
10	WQPD309	150-174	Ross Eriksmoen, Inc.	75.0	48.597667	-103.187972	11.99
11	WQVC403	150-174	Divide, County of	68.6	48.597667	-103.187972	11.99
12	WQUA277	150-174	BNSF Railway Co.	3.7	48.389333	-103.067750	12.87
13	WPJX639	150-174	BNSF Railway Co.	8.5	48.383444	-103.089056	13.12
14	WPJX639	150-174	BNSF Railway Co.	5.5	48.391694	-103.037167	13.49
15	WQTU978	150-174	BNSF Railway Co.	10.1	48.393194	-103.023028	13.86
16	WQAP805	450-470	Hamm & Phillips Service Company	51.8	48.470000	-102.936667	13.99
17	WQJP467	150-174	Cvancara, Doug	37.0	48.619389	-103.186778	14.19
18	WQOM219	150-174	BNSF Railway Co.	15.2	48.396556	-103.003083	14.38
19	WQOL659	150-174	BNSF Railway Co.	15.2	48.398083	-102.967278	16.00
20	WQSC370	150-174	BNSF Railway Co.	13.1	48.397833	-102.964139	16.19
21	WQQP811	450-470	Hess North Dakota Export Logistics, LLC	15.0	48.393639	-102.959250	16.78
22	WQQP811	450-470	Hess North Dakota Export Logistics, LLC	15.0	48.393639	-102.959111	16.78

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the land mobile station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf

ID	Call Sign	Frequency Band (MHz)	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)	Distance to Center of AOI (km)
23	WQQP811	450-470	Hess North Dakota Export Logistics, LLC	18.0	48.393639	-102.956667	16.91
24	WQUA277	150-174	BNSF Railway Co.	3.7	48.397333	-102.950722	16.95
25	WQVA418	150-174	Tioga Police Dept.	31.0	48.411417	-102.929889	17.18
26	WQQP811	450-470	Hess North Dakota Export Logistics, LLC	10.0	48.388778	-102.955833	17.34
27	KDV691	150-174	Tioga Medical Center	37.0	48.402806	-102.934083	17.50
28	WNRB580	150-174	Tioga Medical Center	18.0	48.402806	-102.934083	17.50
29	WQPK452	150-174	Tioga, City of	11.0	48.396139	-102.938250	17.73
30	WQVA418	150-174	Tioga Police Dept.	7.9	48.396222	-102.937778	17.75
31	WPBM404	450-470	Tioga, City of	15.0	48.396139	-102.937694	17.76
32	WQTV298	150-174	M & C Sales, Inc.	45.7	48.590528	-103.321889	17.97
33	KNEK337	150-174	Williams, County of	57.0	48.590611	-103.322111	17.99
34	WQBR535	150-174	Williams, County of	62.8	48.590611	-103.322111	17.99
35	WQWP378	150-174	Williams, County of	37.0	48.590611	-103.322111	17.99
36	WQLE363	150-174	Rehak, Dennis	6.0	48.389667	-102.941111	18.05
37	WQMF627	450-470	Continental Resources, Inc.	9.0	48.391917	-102.932667	18.35
38	WQUE654	450-470	Hess North Dakota Export Logistics, LLC	30.0	48.400361	-102.914167	18.84
39	WQTB945	150-174	BNSF Railway Co.	10.2	48.393611	-102.914167	19.29
40	WQOL659	150-174	BNSF Railway Co.	15.2	48.393778	-102.912028	19.41
41	WQIU457	450-470	Tioga Municipal Airport	4.4	48.386333	-102.903528	20.41
42	WQIU457	450-470	Tioga Municipal Airport	10.7	48.383389	-102.898472	20.91
43	WQNZ498	150-174	Knife River, Inc.	26.2	48.421667	-102.862500	20.97
44	KAD948	25-50	Montana-Dakota Utilities Co.	40.5	48.407806	-102.863528	21.59
45	WQSB262	451.075	Basin Electric Power Cooperative	73.5	48.408389	-102.860917	21.73
46	WQTB945	150-174	BNSF Railway Co.	10.2	48.391944	-102.871389	21.99
47	WPJV691	150-174	BNSF Railway Co.	10.1	48.390528	-102.867889	22.29

ID	Call Sign	Frequency Band (MHz)	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)	Distance to Center of AOI (km)
48	WQOL659	150-174	BNSF Railway Co.	15.2	48.388972	-102.862444	22.72
49	WPJX639	150-174	BNSF Railway Co.	10.7	48.387028	-102.806306	26.41

Table 1: Land Mobile & Emergency Service Sites in Area of Interest

Area-Wide Licenses

The regional area-wide licenses were compiled from FCC data sources and identified for each county in the wind energy project area. The Aurora Wind Project is located in Williams and Mountrail Counties, North Dakota, part of Public Safety Region #32, which contains all of the counties in North Dakota. Regional public safety operations are overseen by the entity listed below.

Michael Lynk
Chairperson, Public Safety Region #32
Director, North Dakota State Radio
Fraine Barracks Lane, Bldg. 35
Bismarck, North Dakota 58503
phone: 701-328-8150
email: mlynk@nd.gov

The chairperson for Region #32 serves as the representative for all public safety entities in the area and is responsible for coordinating current and future public safety use in the wireless spectrum. In the bands licensed by the FCC for area-wide first responders, which include 220 MHz, 700 MHz, 800 MHz and 4.9 GHz, as well as the traditional Part 90 public safety pool of frequencies, nine licenses were found for the State of North Dakota, one for the County of Mountrail, and two for the County of Williams (see Table 2). These area-wide licenses are designated for mobile use only.

ID	Licensee	Area of Operation	Frequency Band (MHz)
1	American National Red Cross	Statewide: North Dakota	25-50
2	Metro Area Ambulance Service, Inc.	Statewide: North Dakota	150-174
3	Minot Police Department	Statewide: North Dakota	450-470, 2450-2500
4	Mountrail County Dept. of Roads & Bridges	Countywide: Mountrail	150-174
5	National Ski Patrol System, Inc.	Statewide: North Dakota	150-174
6	North Dakota, State of	Statewide: North Dakota	0-10, 150-174, 450-470

ID	Licensee	Area of Operation	Frequency Band (MHz)
7	North Dakota Department of Health	Statewide: North Dakota	150-174
8	North Dakota Department of Transportation	Statewide: North Dakota	150-174, 4940-4990
9	North Dakota Division of State Radio Communications	Statewide: North Dakota	150-174, 450-470
10	North Dakota EMS Association	Statewide: North Dakota	450-470
11	Williams, County of	Countywide: Williams	150-174
12	Williston Fire Department, Station 1	Countywide: Williams	150-174

Table 2: Regional Licenses

E911 Operators

Wireless operators are granted area-wide licenses from the FCC to deploy their cellular networks, which often include handsets with E911 capabilities. Since mobile phone market boundaries differ from service to service, we disaggregated the carriers' licensed areas down to the county level. We have identified the type of service for each carrier in Mountrail and Williams Counties, North Dakota in Table 3.

Mobile Phone Carrier	Service[2]	
	Mountrail County, North Dakota	Williams County, North Dakota
AT&T	AWS, Cellular, PCS, WCS, 700 MHz	AWS, Cellular, PCS, WCS, 700 MHz
Commnet Wireless	PCS	-
DISH Network	AWS, 700 MHz	AWS, 700 MHz
Infrastructure Networks	700 MHz	700 MHz
Kurian, Beaulah T.	AWS	AWS
Nemont Telephone (Sagebrush Cellular)	700 MHz	PCS, 700 MHz
Sprint	PCS	PCS

[2] AWS: Advanced Wireless Service at 1.7/2.1 GHz
CELL: Cellular Service at 800 MHz
PCS: Personal Communication Service at 1.9 GHz
WCS: Wireless Communications Service at 2.3 GHz
700 MHz: Lower 700 MHz Service

Mobile Phone Carrier	Service[2]	
	Mountrail County, North Dakota	Williams County, North Dakota
Standing Rock Telecommunications	PCS	PCS
T-Mobile	AWS, PCS	AWS, PCS
Verizon	AWS, Cellular, PCS, 700 MHz	AWS, Cellular, PCS, 700 MHz

Table 3: Mobile Phone Carriers in Area of Interest with E911 Service

3. Impact Assessment

The first responder, industrial/business land mobile sites, area-wide public safety, and commercial E-911 communications as described in this report are typically unaffected by the presence of wind turbines, and we do not anticipate any significant harmful effect to these services in the Aurora Wind Project area. Although each of these services operates in different frequency ranges and provides different types of service including voice, video and data applications, there is commonality among these different networks in regards to the impact of wind turbines on their service. Each of these networks is designed to operate reliably in a non-line-of-sight (NLOS) environment. Many land mobile systems are designed with multiple base transmitter stations covering a large geographic area with overlap between adjacent transmitter sites in order to provide handoff between cells. Therefore, any signal blockage caused by the wind turbines does not materially degrade the reception because the end user is likely receiving signals from multiple transmitter locations. Additionally, the frequencies of operation for these services have characteristics that allow the signal to propagate through wind turbines. As a result, very little, if any, change in their coverage should occur when the wind turbines are installed.

When planning the wind energy turbine locations in the area of interest, a conservative approach would dictate not locating any turbines within 77.5 meters of land mobile fixed-base stations to avoid any possible impact to the communications services provided by these stations. This distance is based on FCC interference emissions from electrical devices in the land mobile frequency bands. As long as the turbines are located more than 77.5 meters from the land mobile stations, they will meet the setback distance criteria for FCC interference emissions in the land mobile bands.

4. Recommendations

In the event that a public safety entity believes its coverage has been compromised by the presence of the wind energy facility, it has many options to improve its signal coverage to the area through optimization of a nearby base station or even adding a repeater site. Utility

towers, meteorological towers or even the turbine towers within the wind project area can serve as the platform for a base station or repeater site.

5. Contact

For questions or information regarding the Land Mobile & Emergency Services Report, please contact:

Contact person:	David Meyer
Title:	Senior Manager
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
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Wind Power GeoPlanner™

Off-Air TV Analysis

Aurora Wind Project

Prepared on Behalf of
Aurora Wind Project,
LLC

May 3, 2018

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1. Introduction

Off-air television stations broadcast signals from terrestrially-based facilities directly to television receivers. Comsearch identified those off-air stations whose service could potentially be affected by the proposed Aurora Wind Project in Williams and Mountrail Counties, North Dakota. Comsearch then examined the coverage of the stations and the communities in the area that could potentially have degraded television reception due to the location of the proposed wind turbines.

2. Summary of Results

The proposed wind energy project area and local communities are depicted in Figure 1, below.

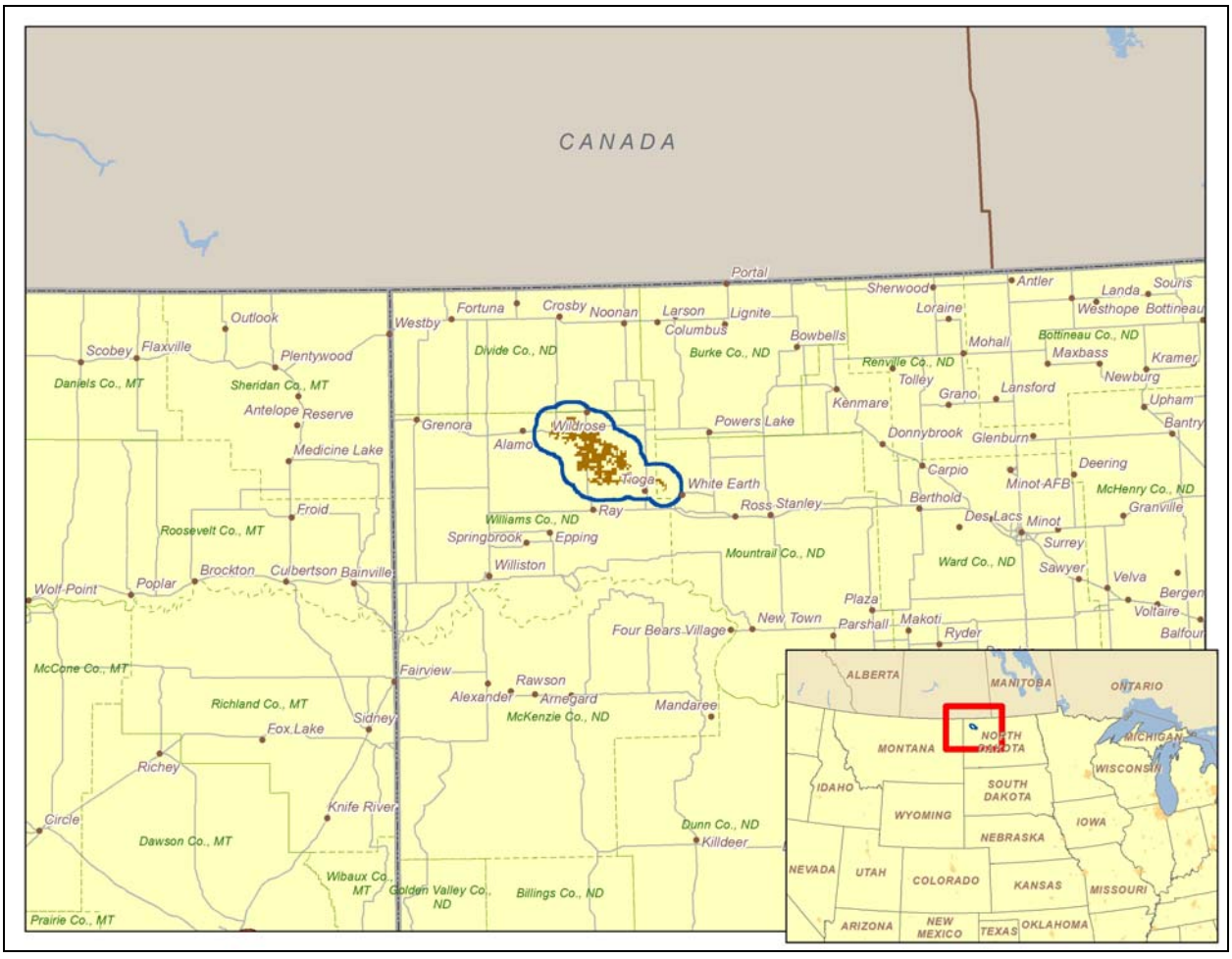

Figure 1: Wind Farm Project Area and Local Communities

To begin the analysis, Comsearch compiled all off-air television stations[1] within 150 kilometers of the project area of interest (AOI). Appendix A contains a tabular summary of these stations. A plot depicting their locations appears in Figure 2, below.

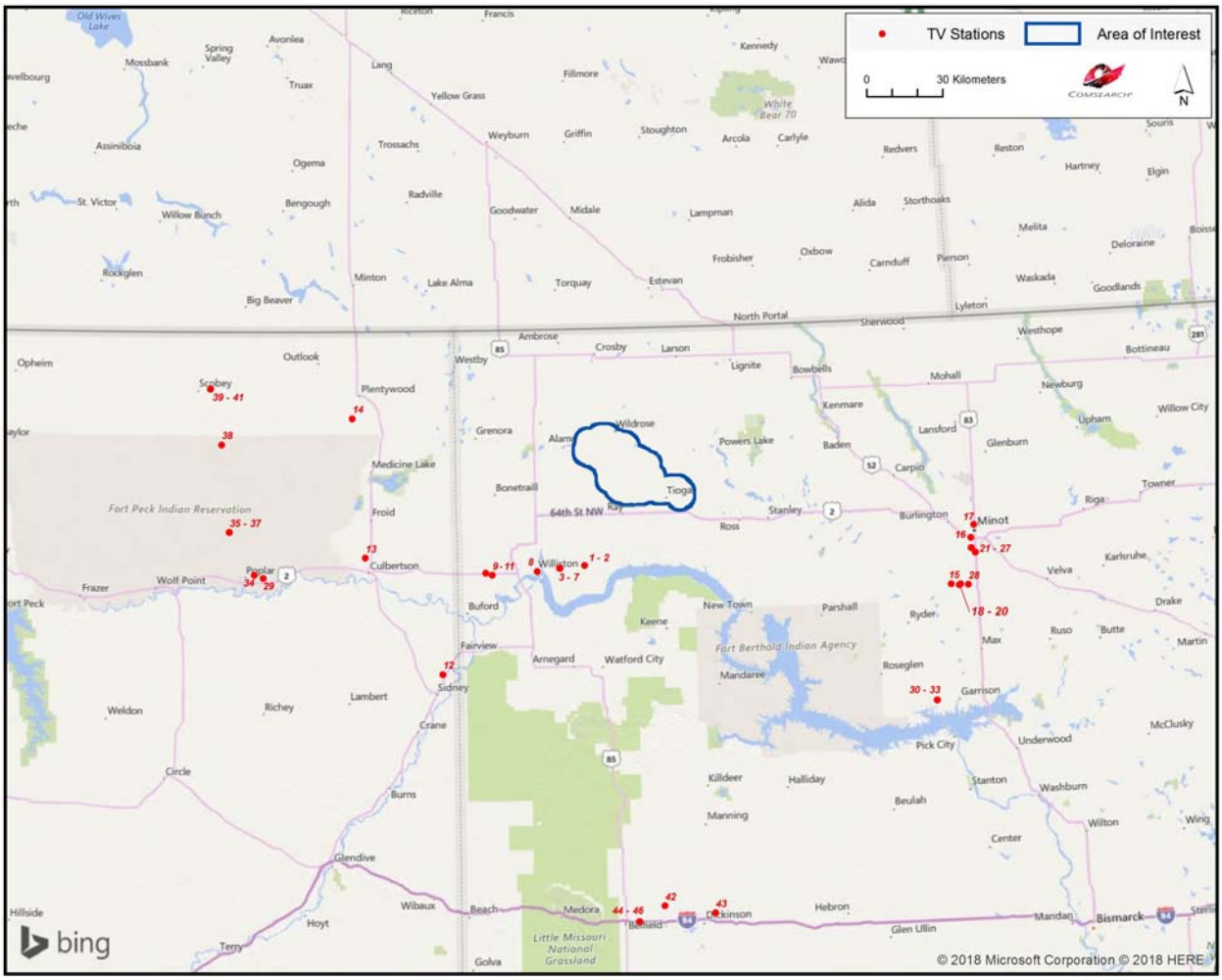

Figure 2: Plot of Off-Air TV Stations within 150 Kilometers of Project Area

TV stations at a distance of 100 kilometers or less are the most likely to provide off-air coverage to the project area and neighboring communities. These stations are listed in Table 1, below, and a plot depicting their locations is provided in Figure 3. There are a total of fourteen database records for stations within approximately 100 kilometers of the limits of the project

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the TV station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

AOI. Of these stations, only nine are currently licensed and operating, six of which are low-power stations or translators. Translator stations are low-power stations that receive signals from distant broadcasters and retransmit the signal to a local audience. These stations serve local audiences and have limited range, which is a function of their transmit power and the height of their transmit antenna.

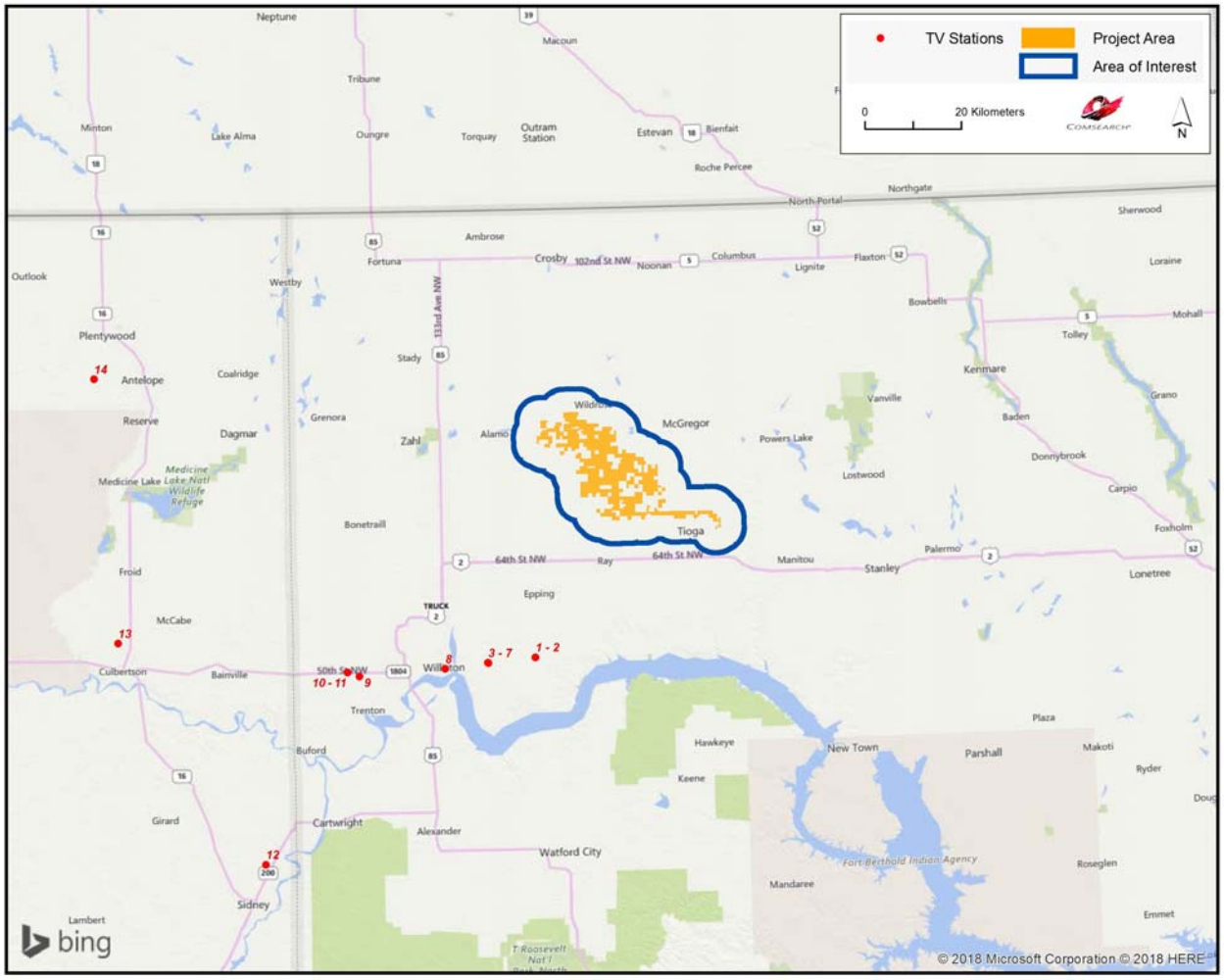

Figure 3: Plot of Off-Air TV Stations within 100 Kilometers of Project Area

ID	Call Sign	Status	Service[2]	Channel	Transmit ERP[3] (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Center of Project (km)
1	KXND-LD	CP MOD	LD	38	15.0	48.163611	-103.368889	41.65
2	KXND-LD	LIC	LD	38	15.0	48.163611	-103.368889	41.65
3	K16KS-D	CP	LD	16	2.75	48.155389	-103.501222	47.55
4	K33MY-D	CP	LD	33	2.75	48.155389	-103.501222	47.55
5	K36MQ-D	CP	LD	36	2.75	48.155389	-103.501222	47.55
6	K46ME-D	CP	LD	46	2.75	48.155389	-103.501222	47.55
7	KXND-LD	LIC	TX	38	20.5	48.154944	-103.500611	47.56
8	K40DE	LIC	TX	40	0.851	48.145278	-103.621583	54.15
9	KUMV-TV	LIC	DT	8	6.0	48.133889	-103.860556	68.30
10	KWSE	LIC	DT	11	84.9	48.141667	-103.893333	69.77
11	KXMD-TV	LIC	DT	14	100.0	48.141667	-103.893333	69.77
12	K13IG-D	LIC	LD	13	0.014	47.784167	-104.126861	109.25
13	K34GY-D	LIC	LD	34	0.354	48.200000	-104.532167	109.80
14	K46GS-D	LIC	LD	46	0.3	48.693056	-104.596056	110.94

Table 1: Off-Air TV Stations within 100 Kilometers of Project Area

[2] Definitions of service and status codes:
DT – Digital television broadcast station
LD – Low power digital television broadcast station
TX – Translator station
LIC – Licensed and operational station
CP – Construction permit granted
CP MOD – Modification of construction permit
APP – Application for construction permit, not yet operational

[3] ERP = Transmit Effective Radiated Power

3. Impact Assessment

Based on a contour analysis of the licensed stations within 100 kilometers of the Aurora Wind Project, it was determined that the three full-power digital stations, identified below in Table 2, may have their reception disrupted in and around the project. The areas primarily affected would include TV service locations within 10 kilometers of the wind energy project that have clear line-of-sight (LOS) to a proposed wind turbine but not to the respective station. After the wind turbines are installed, communities and homes in these locations may have degraded reception of these stations. This is due to multipath interference caused by signal scattering as TV signals are reflected by the rotating wind turbine blades and mast.

However, based on the low number of full-power TV channels available in the immediate vicinity of the project area, it is unlikely that off-air television stations are the primary mode of television service for the local communities. TV cable service, where available, and direct broadcast satellite service (DBS) are more likely the dominant modes of service delivery.

ID	Call Sign	Status	Service[4]	Channel	Transmit ERP[5] (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Center of Project (km)
9	KUMV-TV	LIC	DT	8	6.0	48.133889	-103.860556	68.30
10	KWSE	LIC	DT	11	84.9	48.141667	-103.893333	69.77
11	KXMD-TV	LIC	DT	14	100.0	48.141667	-103.893333	69.77

Table 2: Licensed Off-Air TV Stations Subject to Degradation

[4] Definitions of service and status codes:
DT – Digital television broadcast station
LIC – Licensed and operational station

[5] ERP = Transmit Effective Radiated Power

4. Recommendations

While TV signals are reflected by wind turbines, which can cause multipath interference to the TV receiver, modern digital TV receivers have undergone significant improvements to mitigate the effects of signal scattering. When used in combination with a directional antenna, it becomes even less likely that signal scattering from wind farms will cause interference to digital TV reception.

Nevertheless, signal scattering could still impact certain areas currently served by the TV station mentioned above, especially those that would have line-of-sight to at least one wind turbine but not to the station antenna. In the unlikely event that interference is observed in any of the TV service areas, it is recommended that a high-gain directional antenna be used, preferably outdoors, and oriented towards the signal origin in order to mitigate the interference.

Both cable service and direct broadcast satellite service will be unaffected by the presence of the wind turbine facility and may be offered to those residents who can show that their off-air TV reception has been disrupted by the presence of the wind turbines after they are installed.

5. Contact

For questions or information regarding the Off-Air TV Analysis, please contact:

Contact person:	David Meyer
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Email:	dmeyer@comsearch.com
Web site:	www.comsearch.com

Appendix A

ID	Call Sign	Status	Service[6]	Channel	Transmit ERP[7] (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Center of Project (km)
1	KXND-LD	CP MOD	LD	38	15.0	48.163611	-103.368889	41.65
2	KXND-LD	LIC	LD	38	15.0	48.163611	-103.368889	41.65
3	K16KS-D	CP	LD	16	2.75	48.155389	-103.501222	47.55
4	K33MY-D	CP	LD	33	2.75	48.155389	-103.501222	47.55
5	K36MQ-D	CP	LD	36	2.75	48.155389	-103.501222	47.55
6	K46ME-D	CP	LD	46	2.75	48.155389	-103.501222	47.55
7	KXND-LD	LIC	TX	38	20.5	48.154944	-103.500611	47.56
8	K40DE	LIC	TX	40	0.851	48.145278	-103.621583	54.15
9	KUMV-TV	LIC	DT	8	6.0	48.133889	-103.860556	68.30
10	KWSE	LIC	DT	11	84.9	48.141667	-103.893333	69.77
11	KXMD-TV	LIC	DT	14	100.0	48.141667	-103.893333	69.77
12	K13IG-D	LIC	LD	13	0.014	47.784167	-104.126861	109.25
13	K34GY-D	LIC	LD	34	0.354	48.200000	-104.532167	109.80
14	K46GS-D	LIC	LD	46	0.3	48.693056	-104.596056	110.94
15	KNDM	LIC	DT	24	50.0	48.053889	-101.434722	134.60
16	KMOT	LIC	DT	10	7.69	48.215556	-101.318611	137.24
17	K42IM-D	LIC	LD	42	1.0	48.260833	-101.299861	137.47
18	K23MB-D	CP	LD	23	15.0	48.050556	-101.390833	137.77
19	KSRE	LIC	DT	40	146.0	48.050556	-101.390833	137.77
20	KMCY	LIC	DT	14	40.0	48.053056	-101.385278	138.05
21	K30NA-D	CP	LD	30	5.0	48.179361	-101.318722	138.25
22	K32KW-D	CP	LD	32	5.0	48.179361	-101.318722	138.25
23	K33MQ-D	CP	LD	33	5.0	48.179361	-101.318722	138.25
24	K38OK-D	CP	LD	38	5.0	48.179361	-101.318722	138.25
25	K21GQ	LIC	TX	21	10.0	48.163333	-101.299167	140.14
26	K21GQ	CP	LD	21	2.5	48.163333	-101.299167	140.14
27	K27LX-D	CP	LD	27	15.0	48.163333	-101.299167	140.14
28	KXMC-TV	LIC	DT	13	16.1	48.050000	-101.342778	141.13

[6] Definitions of service and status codes :
TV – Analog television broadcast station
DT – Digital television broadcast station
DS – Digital special temporary authority (STA)
LP – Low power analog television broadcast station
LD – Low power digital television broadcast station
CA – Class A analog television broadcast station
DC – Class A digital television broadcast station
TX – Translator station
LIC – Licensed and operational station
CP – Construction permit granted
CP MOD – Modification of construction permit
APP – Application for construction permit, not yet operational
STA – Special transmit authorization, usually granted by FCC for temporary operation

[7] ERP = Transmit Effective Radiated Power

ID	Call Sign	Status	Service[6]	Channel	Transmit ERP[7] (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Center of Project (km)
29	K05KK-D	LIC	LD	5	0.037	48.127778	-105.073028	150.60
30	K21MK-D	CP	LD	21	5.0	47.644806	-101.534417	151.68
31	K27MH-D	CP	LD	27	5.0	47.644806	-101.534417	151.68
32	K43OI-D	CP	LD	43	5.0	47.644806	-101.534417	151.68
33	K48OE-D	CP	LD	48	5.0	47.644806	-101.534417	151.68
34	K13PZ-D	LIC	LD	13	0.054	48.140278	-105.121361	153.67
35	K22KY-D	LIC	LD	22	0.245	48.291111	-105.253028	159.61
36	K48IA-D	LIC	LD	48	0.245	48.291111	-105.253028	159.61
37	K50GU-D	LIC	LD	50	0.245	48.291111	-105.253028	159.61
38	K31MJ-D	LIC	LD	31	1.052	48.600556	-105.296083	161.00
39	K03DP-D	LIC	LD	3	0.03	48.797500	-105.357306	168.11
40	K13MA-D	LIC	LD	13	0.038	48.797500	-105.357306	168.11
41	NEW	APP	LD	26	0.239	48.797500	-105.357306	168.11
42	KQCD-TV	LIC	DT	7	11.3	46.948056	-102.990833	172.78
43	KNDX-LD	LIC	LD	38	3.3	46.918889	-102.730167	178.17
44	K22KG-D	CP	LD	22	1.5	46.894361	-103.124111	178.48
45	K31LR-D	CP	LD	31	1.5	46.894361	-103.124111	178.48
46	K46MQ-D	CP	LD	46	1.5	46.894361	-103.124111	178.48

Table A: Off-Air TV Stations within 150 Kilometers of Project Area

Wind Power GeoPlanner™

Communication Tower Study

Aurora Wind Project

Prepared on Behalf of
Aurora Wind Project, LLC

May 7, 2018

COMSEARCH®
A CommScope Company

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1. Introduction

This Communication Tower Study was performed for the Aurora Wind Project in Williams County, North Dakota to identify the tower structures as well as FCC-licensed communication antennas that exist in the project area of interest. This information is useful in the planning stages of the wind energy facilities to identify turbine setbacks and to prevent disruption to the services provided by the tenants on the towers. This data can be used in support of the wind energy facilities communications needs in addition to avoiding any potential impact to the current communications services provided in the region.

2. Summary of Results

The communication towers and antennas in the study area were derived from a variety of sources including the FCC's Antenna Structure Registration (ASR) database, Universal Licensing System (ULS), national and regional tower owner databases, and the local planning and zoning boards. The data[1] was imported into GIS software and the structures mapped in the wind energy area of interest. Each tower location is identified with a unique ID number associated with detailed structure and contact information provided in a spreadsheet attachment.

A total of 15 tower structures and 59 communication antennas were identified within the Aurora Wind Project area of interest using the data sources described in our methodology above. The tower structures identified contain 13 of the 59 communication antennas. The remaining antennas may be located on a variety of structure types such as guyed towers, monopoles, silos, rooftops or portable structures. The specific type of structure would normally need to be determined by an on-site visit.

Detailed information about the tower structures and communication antennas is provided in Table 1 and Table 2 including location coordinates, structure height above ground level, and owner-operator name[2].

A discussion of turbine setback distances is provided in section three.

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data provided in this report is governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

[2] Please note that this report analyzes all known operators on the towers from data sources available to Comsearch. Unidentified operators may exist on the towers due to unlicensed or federal government systems, mobile phone operators with proprietary locations, erroneous data on the FCC license, and other factors beyond our control.

Tower ID	ASR Number	Owner	Structure Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)
Tower001	1262776	Tioga Municipal Airport Authority	9.10	48.38338889	-102.89847222
Tower002	1294452	Northwest Dakota Cellular of North Dakota Limited Partnership	24.40	48.38747222	-102.93172222
Tower003	1281361	Tioga Broadcasting Corp	59.10	48.39122222	-102.93491667
Tower004	1207772	TIOGA BROADCASTING CORP	62.60	48.39130556	-102.93650000
Tower005	1265315	Northwest Communications Cooperative	36.60	48.39205556	-102.94022222
Tower006	1206464	The Burlington Northern and Santa Fe Railway Co	30.00	48.39475000	-102.93852778
Tower007	N/A	KGI	6.1	48.39554800	-102.93024700
Tower008	1202434	Hess Bakken Investments II, LLC	18.20	48.39916667	-102.91822222
Tower009	1278466	Northwest Dakota Cellular of North Dakota Limited Partnership	33.50	48.40172222	-102.95386111
Tower010	1208967	Montana-Dakota Utilities Co.	39.60	48.40780556	-102.86352778
Tower011	1286018	BASIN ELECTRIC POWER COOPERATIVE	88.40	48.40838889	-102.86091667
Tower012	1287589	Skyway Towers, LLC	64.00	48.44547222	-102.90827778
Tower013	1051850	PORTAL PIPE LINE COMPANY	76.00	48.45277778	-102.92972222
Tower014	1038858	VB-S1 Assets, LLC	57.00	48.59061111	-103.32211111
Tower015	1267208	Northwest Communications Cooperative	103.60	48.59766667	-103.18797222

Table 1: Summary of Tower Structures

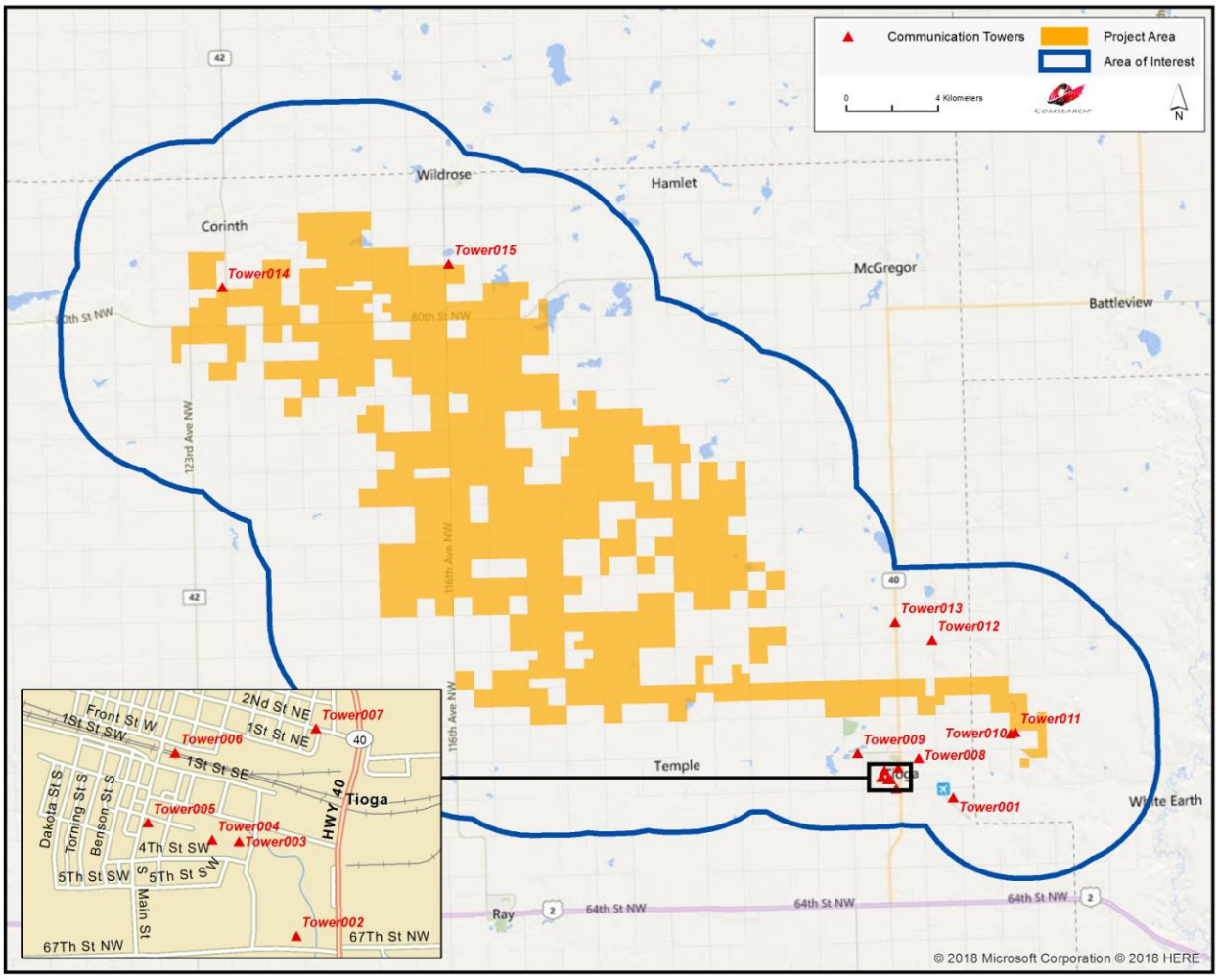

Figure 1: Towers within the Area of Interest

ID	Tower ID	Callsign	Service Type	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)
1	Tower001	WQIU457	Land Mobile	tioga municipal airport	10.7	48.38338889	-102.89847222
2		WPJX639	Land Mobile	BNSF Railway Co.	8.5	48.38344444	-103.08905556
3		WQJD208	Aviation	tioga municipal airport	4.4	48.38633333	-102.90352778
4		WQIU457	Land Mobile	tioga municipal airport	4.4	48.38633333	-102.90352778
5		WPJX639	Land Mobile	BNSF Railway Co.	10.7	48.38702778	-102.80630556
6		WQRU774	Microwave	Continental Resources, Inc.	7.62	48.38741667	-102.93683333
7		WQQP811	Land Mobile	Hess North Dakota Export Logistics LLC	10.0	48.38877778	-102.95583333
8		WQOL659	Land Mobile	BNSF Railway Co.	15.2	48.38897222	-102.86244444
9		WQUA277	Land Mobile	BNSF RAILWAY CO.	3.7	48.38933333	-103.06775000
10		WQLE363	Land Mobile	REHAK, DENNIS	6.0	48.38966667	-102.94111111
11		WPJV691	Land Mobile	BNSF Railway Co.	10.1	48.39052778	-102.86788889
12	Tower003	KTGO	AM	BAKKEN BEACON MEDIA LLC	Unknown	48.39113306	-102.93490465
13	Tower003	K224FJ	FM	BAKKEN BEACON MEDIA LLC	57.0	48.39113306	-102.93490465
14		WPJX639	Land Mobile	BNSF Railway Co.	5.5	48.39169444	-103.03716667
15		WQMF627	Land Mobile	Continental Resources, Inc.	9.0	48.39191667	-102.93266667
16		WQTB945	Land Mobile	BNSF RAILWAY CO.	10.2	48.39194444	-102.87138889
17		WQTU978	Land Mobile	BNSF RAILWAY CO.	10.1	48.39319444	-103.02302778
18		WQTB945	Land Mobile	BNSF RAILWAY CO.	10.2	48.39361111	-102.91416667
19		WQQP811	Land Mobile	Hess North Dakota Export Logistics LLC	15.0	48.39363889	-102.95925000
20		WQQP811	Land Mobile	Hess North Dakota Export Logistics LLC	15.0	48.39363889	-102.95911111
21		WQQP811	Land Mobile	Hess North Dakota Export Logistics LLC	18.0	48.39363889	-102.95666667
22		WQOL659	Land Mobile	BNSF Railway Co.	15.2	48.39377778	-102.91202778
23		WQPK452	Land Mobile	TIOGA, CITY OF	11.0	48.39613889	-102.93825000
24		WPBM404	Land Mobile	TIOGA, CITY OF	15.0	48.39613889	-102.93769444
25		WQVA418	Land Mobile	Tioga Police Dept	7.9	48.39622222	-102.93777778
26		WQOM219	Land Mobile	BNSF Railway Co.	15.2	48.39655556	-103.00308333
27		WQUA277	Land Mobile	BNSF RAILWAY CO.	3.7	48.39733333	-102.95072222
28		WQSC370	Land Mobile	BNSF RAILWAY CO.	13.1	48.39783333	-102.96413889
29		WQOL659	Land Mobile	BNSF Railway Co.	15.2	48.39808333	-102.96727778
30		WQUE654	Land Mobile	HESS NORTH DAKOTA EXPORT LOGISTICS LLC	30.0	48.40036111	-102.91416667
31		K220FH	FM	PRAIRIE PUBLIC BROADCASTING, INC.	42.0	48.40141106	-102.93768242
32		KDV691	Land Mobile	TIOGA MEDICAL CENTER	37.0	48.40280556	-102.93408333
33		WNRB580	Land Mobile	TIOGA MEDICAL CENTER	18.0	48.40280556	-102.93408333

ID	Tower ID	Callsign	Service Type	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)
34	Tower010	KAD948	Land Mobile	Montana-Dakota Utilities Co., A Division of MDU Resources Group, Inc.	40.5	48.40780556	-102.86352778
35		WHJ624	Microwave	Basin Electric Power Cooperative	27.432	48.40780556	-102.86352778
36	Tower011	WQSB262	Land Mobile	BASIN ELECTRIC POWER COOPERATIVE	73.5	48.40838889	-102.86091667
37	Tower011	WQQW846	Microwave	Basin Electric Power Cooperative	59.44 - 86.87	48.40838889	-102.86094444
38		WQVA418	Land Mobile	Tioga Police Dept	31.0	48.41141667	-102.92988889
39		WQNZ498	Land Mobile	Knife River Inc.	26.2	48.42166667	-102.86250000
40		WRAQ862	Land Mobile	SAGASER FARMS	25.0	48.43275000	-102.99811111
41	Tower012	KNKN285	Cellular	AT&T Mobility Spectrum LLC		48.44547222	-102.90827778
42		WQOK920	Land Mobile	STATIC OILFIELD SERVICE	18.0	48.46052778	-103.23241667
43		WQAP805	Land Mobile	Hamm & Phillips Service Company	51.8	48.47000000	-102.93666667
44		WPCQ417	Land Mobile	SUNDHAGEN, SCOTT	18.0	48.50252778	-103.05880556
45		WNQN724	Land Mobile	Hess Corporation	12.0	48.51197222	-102.99158333
46		WPCQ417	Land Mobile	SUNDHAGEN, SCOTT	18.0	48.51780556	-103.06130556
47		WPXP604	Land Mobile	GOHRICK FARMS	20.0	48.53086111	-102.97713889
48		WQPT498	Land Mobile	Vestas American Wind Technology Inc	13.0	48.53188889	-102.99475000
49		WQMA573	Land Mobile	KUTTER, RICK	14.0	48.54133333	-102.97466667
50		WQCV562	Land Mobile	SEVRE, LYLE	24.0	48.58944444	-103.19083333
51		WQTV298	Land Mobile	M & C SALES, INC.	45.7	48.59052778	-103.32188889
52	Tower014	WQRU770	Microwave	Continental Resources, Inc.	36.58/51.82	48.59061111	-103.32211111
53	Tower014	KNEK337	Land Mobile	WILLIAMS, COUNTY OF	57.0	48.59061111	-103.32211111
54	Tower014	WQBR535	Land Mobile	WILLIAMS, COUNTY OF	62.8	48.59061111	-103.32211111
55	Tower014	WQWP378	Land Mobile	WILLIAMS, COUNTY OF	37.0	48.59061111	-103.32211111
56	Tower015	WQPD309	Land Mobile	ROSS ERIKSMOEN INC	75.0	48.59766667	-103.18797222
57	Tower015	WQVC403	Land Mobile	DIVIDE, COUNTY OF	68.6	48.59766667	-103.18797222
58		WQJP467	Land Mobile	CVANCARA, DOUG	37.0	48.61938889	-103.18677778
59		WPJB257	Microwave	Prairie Public Broadcasting, Inc.	52.12	48.63752778	-103.32269444

Table 2: Summary of Communication Antennas

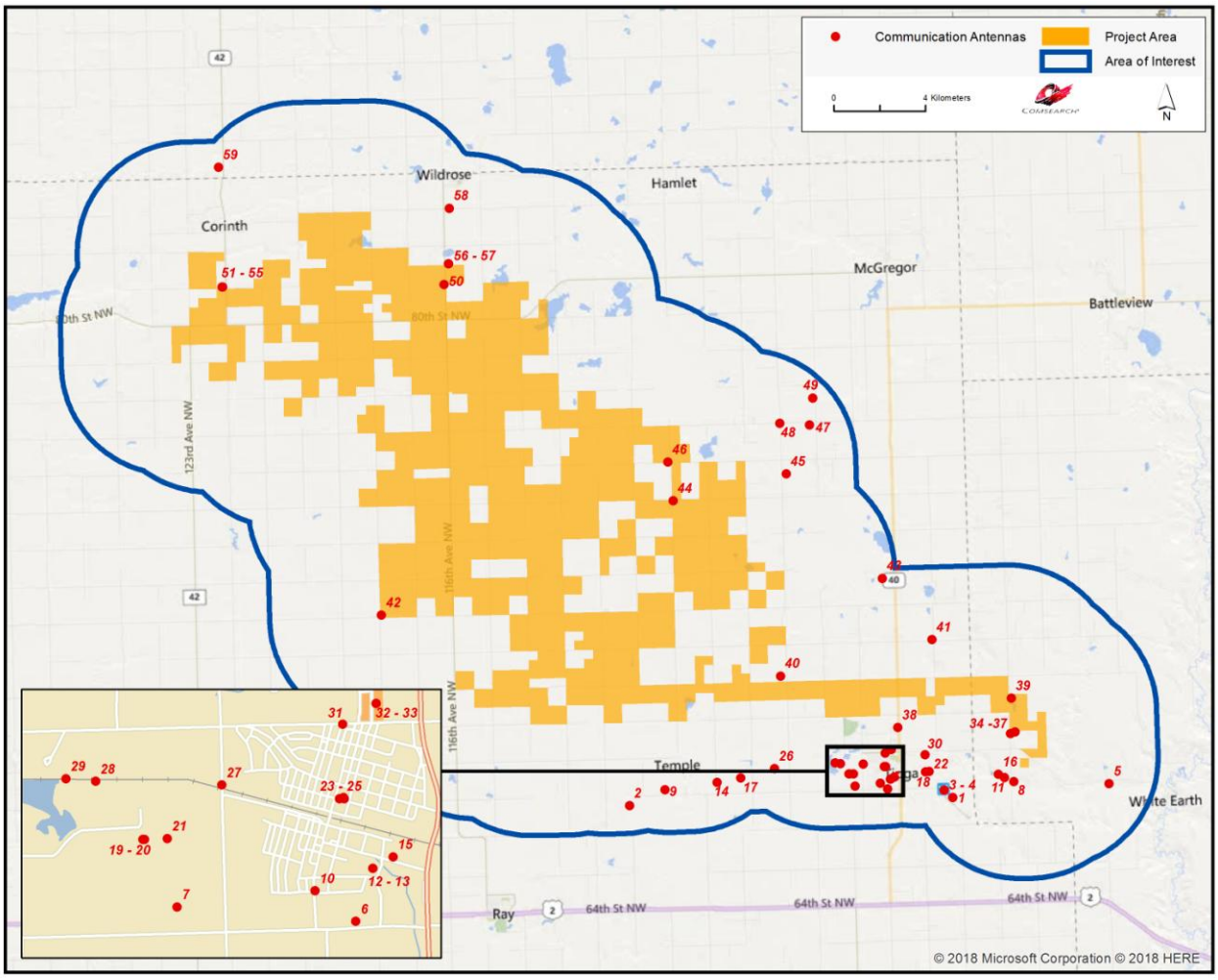

Figure 2: Communication Antennas within the Area of Interest

3. Discussion of Separation Distances

In planning the wind energy turbine locations, a conservative approach would dictate not locating any turbines in close proximity to existing tower structures to avoid any possible impact to the communications services provided by the structures. Reasonable distance between communication towers and wind turbine towers is a function of two things: (1) the physical turning radius of the wind turbine blades and (2) the characteristics of the communication systems on the communication tower.

Since wind turbine blades can rotate 360º, the first consideration of separation distance to other structures is clearance of the blades. If the blade radius is 50 meters, then a separation distance greater than 50 meters is necessary. From a practical standpoint, a setback distance greater than the maximum height of the turbine is necessary to insure a "fall" safety zone in the unlikely event of a turbine tower failure. Setback requirements for "fall" safety are typically specified by the local zoning ordinances.

The required separation distance based on the characteristics of the communication systems will vary depending on the type of communication antennas that are installed on the tower. For example, AM broadcast antennas should be separated by distances that allow for normal coverage which can extend up to 3 kilometers. For land mobile and mobile phone systems, setback distances are based on FCC interference emission limits from electrical devices in the land mobile and mobile phone frequency bands.

Finally, the tower structures identified could be a potential benefit in support of communications network needs for the wind energy facility. An example would be the implementation of a Supervisory Control and Data Acquisition (SCADA) system that monitors and provides communications access to the wind energy facility.

4. Conclusions

Our study identified 15 communication tower structures and 59 communication antennas within the Aurora project area of interest. They are used for microwave, cellular, AM, FM, Aviation and land mobile services in the area.

5. Contact Us

For questions or information regarding the Communication Tower Study, please contact:

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Wind Power GeoPlanner™

AM and FM Radio Report

Aurora Wind Project

Prepared on Behalf of
Aurora Wind Project,
LLC

May 3, 2018

COMSEARCH®
A CommScope Company

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1. Introduction

Comsearch analyzed AM and FM radio broadcast stations whose service could potentially be affected by the proposed Aurora Wind Project in Williams and Mountrail Counties, North Dakota.

2. Summary of Results

AM Radio Analysis
Comsearch found four database records[1] for AM stations within approximately 30 kilometers of the project area, as shown in Table 1 and Figure 1. These records represent station KTGO, which broadcasts out of Tioga, North Dakota, to the south of the project, and station KEYZ, out of Williston, North Dakota, to the southwest. Both stations are licensed separately for daytime and nighttime operations.

ID	Call Sign	Status[2]	Frequency (kHz)	Transmit ERP[3] (kW)	Operation Time	Latitude (NAD 27)	Longitude (NAD 27)	Required Separation Distance[4] (km)	Distance to Project (km)
1	KTGO	LIC	1090	1.1	Daytime	48.391111	-102.934444	0.28	2.79
2	KTGO	LIC	1090	0.006	Nighttime	48.391111	-102.934444	0.28	2.79
3	KEYZ	LIC	660	5.0	Daytime	48.238889	-103.650278	3.00	39.47
4	KEYZ	LIC	660	5.0	Nighttime	48.238889	-103.650278	3.00	39.47

Table 1: AM Radio Stations within 30 Kilometers of Project Area

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the AM/FM station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf. The coordinates provided for AM station KVWC were adjusted slightly based on aerial imagery.

[2] LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

[3] ERP = Transmit Effective Radiated Power.

[4] The required separation distance is based on the lesser of 10 wavelengths or 3 kilometers for directional antennas and 1 wavelength for non-directional antennas.

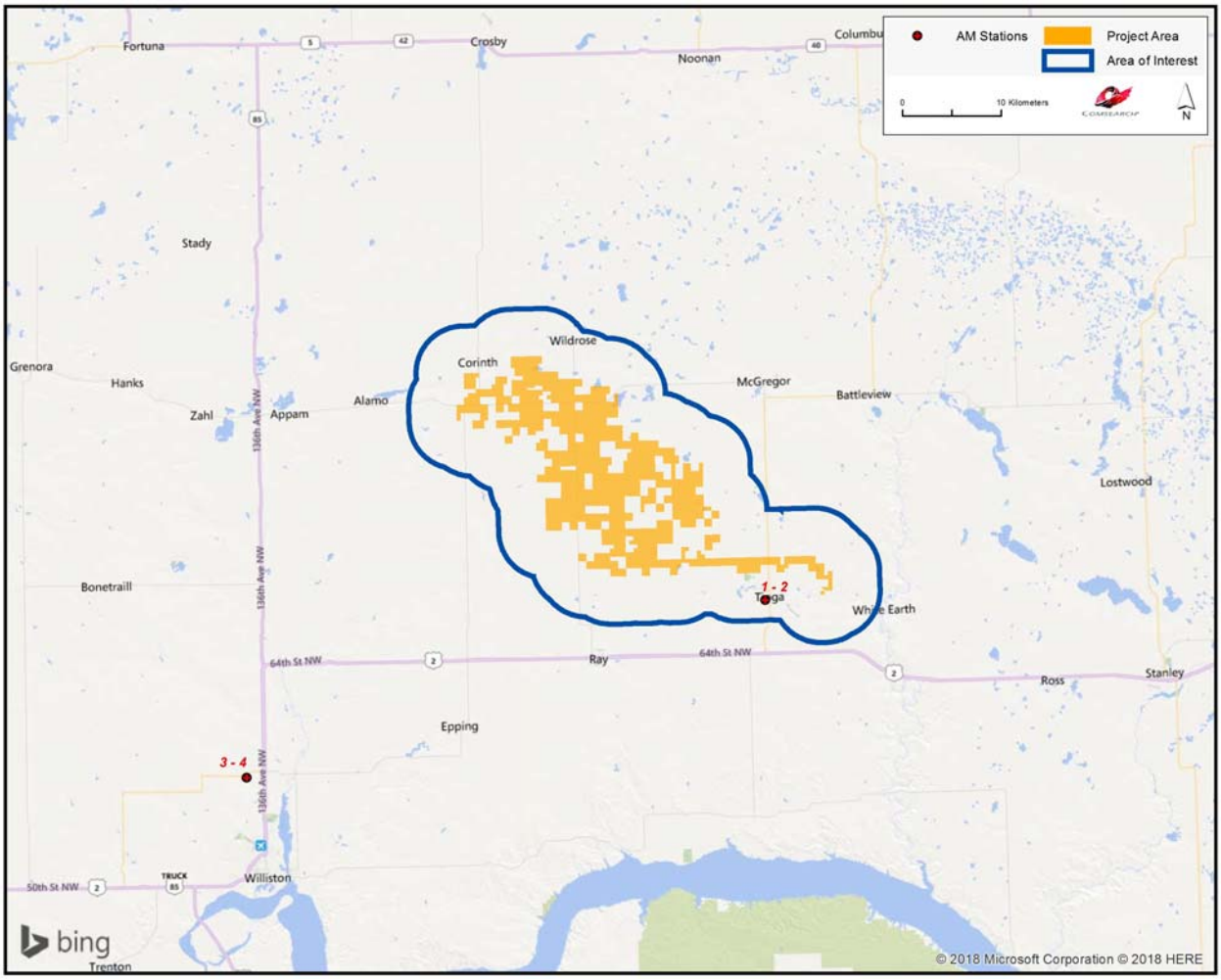

Figure 1: AM Radio Stations within 30 Kilometers of Project Area

FM Radio Analysis

Comsearch determined that there were nine database records for FM stations within approximately 30 kilometers of the Aurora Wind Project area, as shown in Table 2 and Figure 2. Only six of these stations are currently licensed and operating, four of which are translator stations that broadcast with limited range.

ID	Call Sign	Status[5]	Service[6]	Frequency (MHz)	Transmit ERP[7] (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Project (km)
1	K220FH	LIC	FX	91.9	0.008	48.401389	-102.937222	1.63
2	K224FJ	CP	FX	92.7	0.25	48.391111	-102.934444	2.79
3	KZTW	LIC	FM	104.1	100.0	48.321667	-103.247778	12.40
4	KZTW	APP	FM	104.1	0.8	48.321667	-103.247778	12.40
5	K211FS	LIC	FX	90.1	0.05	48.155278	-103.500833	38.20
6	KNDW	LIC	FM	91.7	1.3	48.155278	-103.500833	38.20
7	K220FF	LIC	FX	91.9	0.008	48.911667	-103.295556	32.60
8	K201FJ	LIC	FX	88.1	0.062	48.110556	-103.443611	39.95
9	NEW	APP	FX	103.3	0.25	48.150000	-103.615000	44.38

Table 2: FM Radio Stations within 30 Kilometers of Project Area

[5] LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

[6] FM = FM broadcast station; FX = FM translator station; FL = Low-power FM station; FS = FM auxiliary (backup) station; FB = FM booster station.

[7] ERP = Transmit Effective Radiated Power.

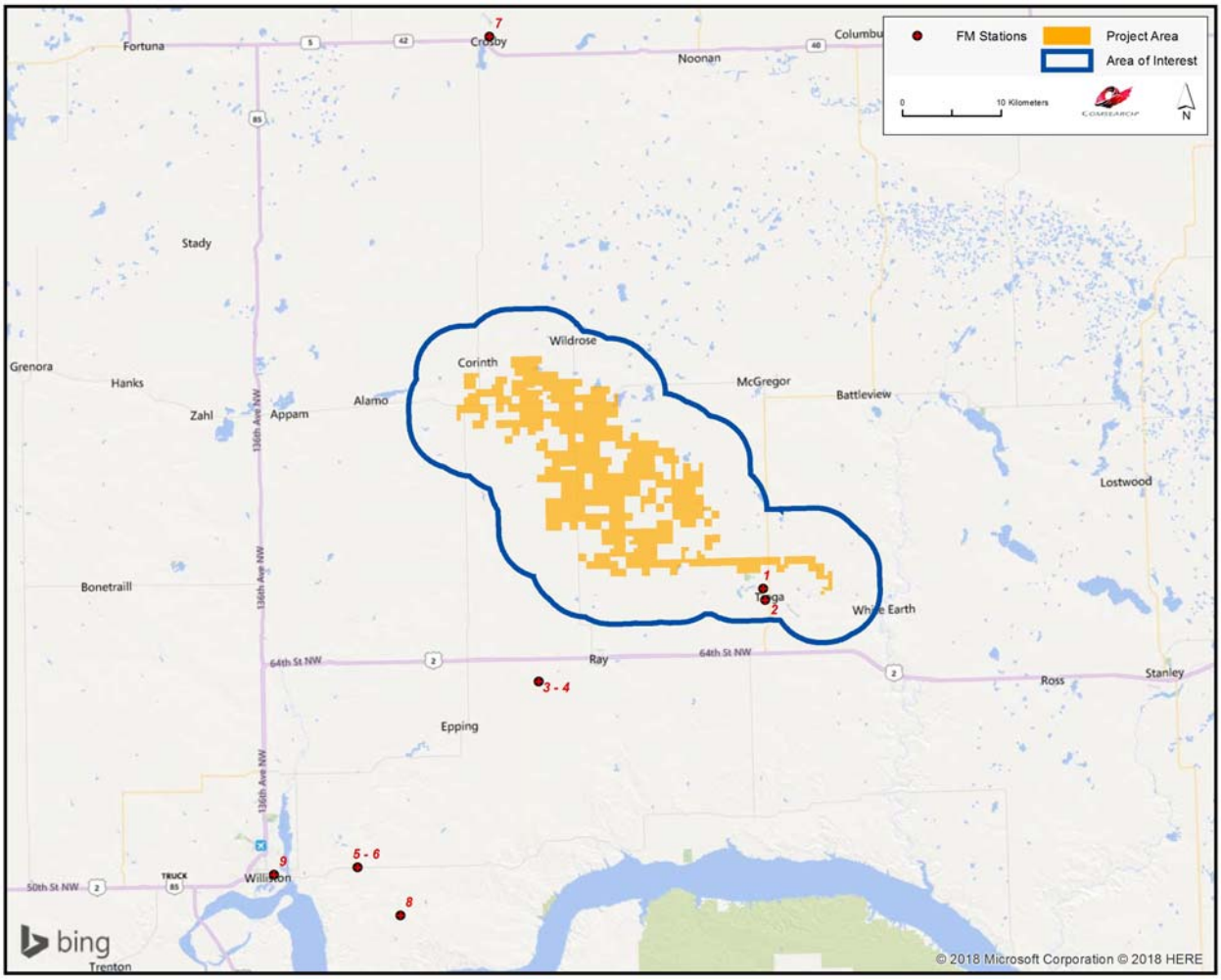

Figure 2: FM Radio Stations within 30 Kilometers of Project Area

3. Impact Assessment

The exclusion distance for AM broadcast stations varies as a function of the antenna type and broadcast frequency. For directional antennas, the exclusion distance is calculated by taking the lesser of 10 wavelengths or 3 kilometers. For non-directional antennas, the exclusion distance is simply equal to 1 wavelength. Potential problems with AM broadcast coverage are only anticipated when AM broadcast stations are located within their respective exclusion distance limit from wind turbine towers. The closest AM station to the Aurora Wind Project, KTGO, is more than 2.7 kilometers from the project limit, well beyond the station's exclusion distance of 275 meters. As there were no other stations found within 3 kilometers of the project, which is the maximum possible exclusion distance based on a directional AM antenna broadcasting at 1000 KHz or less, the project should not impact the coverage of local AM stations.

The coverage of FM stations is generally not susceptible to interference caused by wind turbines, especially when large objects, such as wind turbines, are sited in the *far field* region of the radiating FM antenna in order to avoid the risk of distorting the antenna's radiation pattern. The closest FM station to the Aurora Wind Project, K220FH, is more than 1.6 kilometers from the project limit. At this distance, there should be adequate separation to avoid radiation pattern distortion.

4. Recommendations

Since no impact on the licensed and operational AM or FM broadcast stations' broadcast, retransmission, or reception was identified in our analysis, no recommendations or mitigation techniques are required for this project.

5. Contact

For questions or information regarding the AM and FM Radio Report, please contact:

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Aurora Wind Project Sound and Shadow Flicker Summary

September 17th, 2018

On behalf of Aurora Wind Project, LLC (Aurora), Tradewind Energy, Inc. (Tradewind Energy) conducted a sound and shadow flicker analysis for the proposed Aurora Wind Project (Project) located in Williams County, North Dakota. The analysis was conducted for array A031 and assumed a variety of potential wind turbine models. The wind turbine models analyzed and presented in this report include: GE 2.5-127 on 89 meter (m) hub height (HH); Gamesa G132-3.465 on 84 m and 114 m HH; Acciona AW125-3150 on 87.5 m HH; Vestas V136-3.45/3.6 on 82 and 105 m HH; and Vestas V136-4.0/4.2 on 82 and 105 m HH. To present worst case scenarios, the sound modeling results presented utilize the shortest hub height listed for that turbine model, while the shadow flicker results are based on the highest hub height of that specific turbine model. In conjunction with the Project wind turbines being modeled, wind turbines from the nearby Lindahl Wind Project located northeast of the Project were modeled to provide a comprehensive analysis.

Tradewind Energy staff has expertise and experience in conducting such analyses for regulatory bodies. In particular, Dr. Brandon Storm, who conducted the sound and shadow flicker studies for this report, has his PhD in Wind Science and Engineering from Texas Tech University. Dr. Storm has taught advanced training courses for windPRO, the software package used in these analyses. WindPRO is used throughout the world and is a recognized leader in sound and shadow flicker studies. In addition, Dr. Storm has provided sound and shadow flicker reports and verbal testimony to the North Dakota Public Service Commission (Commission).

Shadow Flicker Analysis

Shadow flicker, the effect seen when turbine blades pass between an observer and the sun, is not regulated by Williams County nor the State of North Dakota. While there is no existing permitting threshold with regards to shadow flicker, thirty hours per year of shadow flicker is the standard that has been utilized by the Commission in the past and the goal of the Project.

A shadow flicker analysis was completed for all known occupied residences within 1.5 miles of any proposed wind turbine locations in array A031 (a total of 61 receptors) using the windPRO software. All 130 wind turbine locations within A031 were modeled, even though most of the wind turbine models presented would not utilize all locations. The Lindahl Wind Project wind turbines were also incorporated in the modeling. Each residence was modeled in greenhouse mode, which assumes flicker from any direction is visible up to a distance of 2,000 m (6,562 ft) from a wind turbine, and sunshine probability data was incorporated, along with wind speed and direction information. The statistical reduction on the shadow flicker hours from the worst case scenario (i.e., the wind turbine always facing the sun, always operating, and no cloudy days), referred to as realistic shadow flicker or anticipated shadow flicker, assumes reductions

based on probability of the sun shining and the wind turbine operating in a direction to cause flicker at the house.

Table 1 shows results for the nine locations with realistic shadow flicker hours above 20 hours per year for the G132-3.465 on 114m HH, which is the model with the highest shadow flicker potential. Results for the other 52 modeled receptors fell below this arbitrary threshold.

Table 1: Modeled shadow flicker parameters for homes within 1.5 miles of proposed turbines and have realistic shadow flicker hours above 20 hours in a year. Location projections are in UTM NAD83 zone 13.

Receptor - Property Status	Easting	Northing	AW125-3.15 87.5m HH (hours/year)	GE 2.5-127 89m HH (hours/year)	V136-3.45/3.6/4.0/4.2 105m HH (hours/year)	G132-3.465 114m HH (hours/year)
57 - Participating	633,480	5,378,691	16:28	16:54	20:25	20:27
6 - Non-Participating	637,411	5,365,868	14:46	15:23	20:45	21:21
64 - Participating	639,268	5,377,996	12:01	13:02	21:30	23:09
8 - Non-Participating	638,435	5,378,666	19:45	20:20	24:47	25:00
42 - Participating	628,500	5,384,644	20:48	21:30	26:44	26:09
44 - Participating	629,997	5,384,325	22:25	23:23	29:40	26:27
47 - Participating	634,615	5,381,825	19:35	20:16	26:18	26:44
10 - Non-Participating^	643,279	5,372,615	26:57	27:47	34:26	35:21
45 – Participating^	633,554	5,377,057	27:24	28:55	42:39	45:10

^Surrounding obstacles (e.g., trees, outbuildings) would likely reduce shadow flicker below 30 hr/yr.

Since a conservative greenhouse, bare earth modeling analysis was conducted, four of the eight receptors modeled as potentially having annual shadow flicker above 30 hours per year are not likely to experience shadow flicker levels as high as the modeled results. In particular, there are substantial trees and buildings surrounding the four residences that were not taken into account in the modeling. When blockage due to foliage and other obstacles are taken into account, it is anticipated those four locations will be below 30 hours a year.

If the two occupied residences that were modeled above 30 hours per year continue to exceed the 30 hour threshold when the final Project layout is modeled, Aurora will obtain shadow flicker acknowledgments from the homeowners, or will employ measures to ensure that the occupied residences experience no more than 30 hours per year of shadow flicker. Compliance could be demonstrated through detailed modeling of trees and outbuildings, or by curtailment (i.e., turning select turbines off during specific times), if necessary. Shadow detection mitigation systems utilize shadow flicker results from windPRO in conjunction with light sensors to determine if a turbine should be temporarily turned off to avoid flicker on a home. The turbine controller can also be hard-coded to shut down the wind turbine during a specific time to avoid shadow flicker if a shadow detection mitigation system is not feasible for the final turbine model.

Maps and windPRO reports are provided for the five turbine models presented within this report, noting that the V136-3.45/3.6 and V136-4.0/4.2 are not presented twice since both models have the same shadow flicker results.

Sound Analysis

The Commission has a wind turbine sound level limit of 50 dBA within 100 feet of an inhabited residence or community building, unless a written waiver is obtained from the owner of the occupied residence or community building. A sound analysis was completed for all known occupied residences and community buildings within 1.5 miles of any proposed wind turbine locations in array A031 (a total of 61 receptors) using the windPRO software. Each residence was modeled assuming the ISO 9613-2 General sound model with a 0.5 general ground attenuation factor, commonly used and accepted model and settings for wind turbine sound analyses. These model settings simulate typical atmospheric and ground attenuation for sound propagation. All proposed 130 Aurora wind turbine locations were modeled for five different wind turbine models with a sound emission ranging from 106.1 dBA to 110.0 dBA plus a 2 dBA uncertainty factor. The Lindahl Wind Project wind turbines were also modeled to ensure residences between the two projects would be properly represented.

Table 2 shows results for those receptors modeled as potentially having sound levels above 40 dBA using the loudest potential turbine model (i.e., GE 2.5-127 on 89m HH). All other receptors were modeled at levels below the arbitrary 40 dBA threshold.

Table 2: Modeled sound results for homes within 1.5 miles of proposed wind turbines above 40.0 dBA. Location projections are in UTM NAD83 zone 13

Receptor - Property Status	Easting	Northing	G132-3.465 84 m HH Sound (dBA)	V136-4.0/4.2 82 m HH Sound (dBA)	V136-3.45/3.6 82 m HH Sound (dBA)	AW125-3.15 87.5 m HH Sound (dBA)	GE 2.5-127 89m HH Sound (dBA)	GE 2.5-127 89m HH Distance to 50 dBA from Receptor (m/ft)
54 – Participating	643,167	5,375,685	35.7	36.7	37.4	38.4	40.0	1363 /4472
68 – Participating	635,378	5,369,828	35.6	36.8	37.7	38.8	40.6	1373 /4505
17 - Non-Participating	631,989	5,373,670	36.0	37.2	38.1	39.2	40.9	1139 /3737
4 - Non-Participating	632,031	5,373,676	36.2	37.3	38.3	39.3	41.1	1100 /3609
24 - Non-Participating	632,030	5,373,428	36.3	37.4	38.4	39.4	41.2	1068 /3504
3 - Non-Participating	630,488	5,379,437	36.9	38.1	39.0	40.0	41.7	804 /2638
2 - Non-Participating	647,930	5,371,801	40.7	40.9	41.1	41.3	41.8	884 /2900
31 - Non-Participating	633,553	5,383,375	37.2	38.3	39.3	40.3	42	883 /2897
46 – Participating	633,395	5,383,413	37.5	38.7	39.7	40.6	42.3	885 /2904
39 – Participating	643,400	5,373,972	38.2	39.2	40.2	41.0	42.6	817 /2680
59 – Participating	643,400	5,373,968	38.2	39.2	40.2	41.0	42.6	814 /2671
18 - Non-Participating	637,954	5,365,740	38.1	39.3	40.4	41.2	42.8	751 /2464
7 - Non-Participating	638,615	5,371,717	38.5	39.7	40.7	41.6	43.3	871 /2858
12 - Non-Participating	630,584	5,371,240	38.7	39.9	41.1	41.7	43.4	416 /1365
53 – Participating	642,413	5,373,644	39.6	40.7	41.8	42.5	44.1	445 /1460
6 - Non-Participating	637,411	5,365,868	39.5	40.7	41.9	42.5	44.2	451 /1480
10 - Non-Participating	643,279	5,372,615	39.8	41.0	42.1	42.7	44.3	436 /1430
16 - Non-Participating	630,734	5,381,835	39.8	41.0	42.1	42.9	44.5	646 /2119
11 - Non-Participating	643,282	5,373,088	40.1	41.3	42.4	43.0	44.6	362 /1188

Table 2: Continue

Receptor - Property Status	Easting	Northing	G132-3.465 84 m HH Sound (dBA)	V136-4.0/4.2 82 m HH Sound (dBA)	V136-3.45/3.6 82 m HH Sound (dBA)	AW125-3.15 87.5 m HH Sound (dBA)	GE 2.5-127 89m HH Sound (dBA)	GE 2.5-127 89m HH Distance to 50 dBA from Receptor (m/ft)
51 – Participating	637,621	5,371,070	40.1	41.2	42.3	43.1	44.8	553 /1814
13 - Non-Participating	630,347	5,380,996	40.1	41.3	42.4	43.1	44.8	348 /1142
40 – Participating	643,453	5,372,099	40.6	41.7	42.8	43.5	45.1	410 /1345
62 – Participating	643,453	5,372,097	40.6	41.7	42.8	43.5	45.1	409 /1342
27 - Non-Participating	646,754	5,372,213	42.1	42.7	43.5	43.9	45.1	368 /1207
52 – Participating	640,276	5,365,862	40.9	42.1	43.4	43.8	45.5	254 /833
47 – Participating	634,615	5,381,825	41.2	42.4	43.5	44.3	45.9	415 /1362
5 - Non-Participating	636,328	5,376,974	41.5	42.6	43.7	44.5	46.1	498 /1634
61 – Participating	633,645	5,373,895	41.5	42.7	43.9	44.5	46.2	297 /974
50 – Participating	636,416	5,382,006	41.7	43.0	44.1	44.7	46.4	323 /1060
64 – Participating	639,268	5,377,996	41.9	43.1	44.3	44.8	46.5	210 /689
63 – Participating	641,300	5,368,154	42.2	43.4	44.5	45.1	46.7	435 /1427
9 - Non-Participating	640,413	5,369,191	42.2	43.4	44.6	45.1	46.8	246 /807
66 – Participating	638,244	5,370,747	42.2	43.4	44.6	45.1	46.8	203 /666
8 - Non-Participating	638,435	5,378,666	42.5	43.7	44.9	45.4	47.1	251 /823
55 – Participating	635,760	5,381,775	42.5	43.7	44.9	45.5	47.1	333 /1093
42 – Participating	628,500	5,384,644	42.6	43.8	45.0	45.6	47.2	274 /899
44 - Participating	629,997	5,384,325	42.7	43.9	45.1	45.6	47.3	212 /696
67 - Participating	637,448	5,370,698	42.8	44.0	45.2	45.7	47.4	160 /525
48 - Participating	634,891	5,378,584	44.1	45.3	46.4	47.1	48.7	155 /509
49 - Participating	636,455	5,380,259	44.1	45.4	46.6	47.1	48.8	152 /499
45 - Participating	633,554	5,377,057	44.4	45.6	46.8	47.4	49.0	190 /623
57 - Participating	633,480	5,378,691	44.6	45.8	47.1	47.6	49.2	77 /253

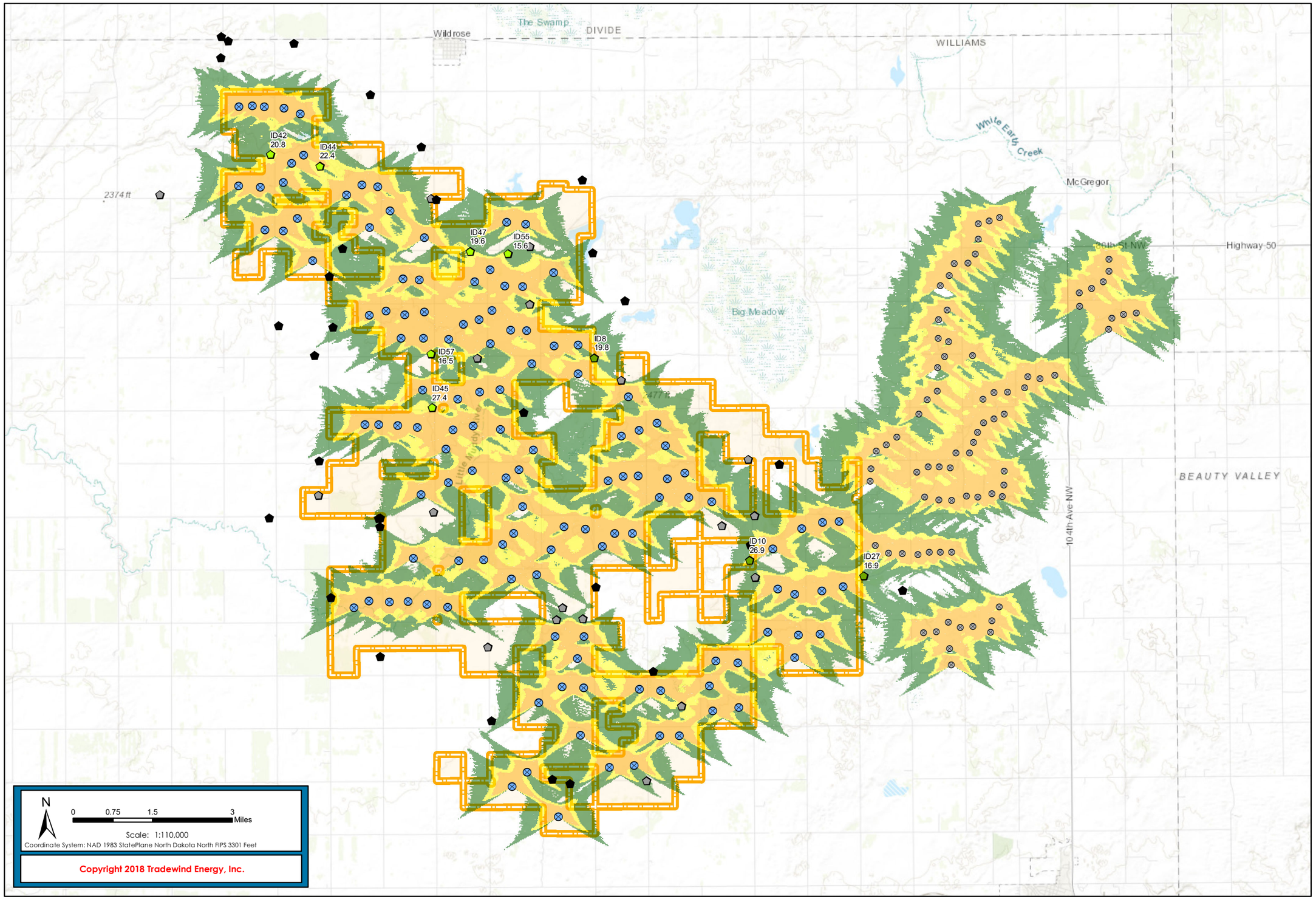
All receptors were modeled at sound levels below the 50 dBA limit, even with the 2 dBA uncertainty factor added to the wind turbine emission. If the final Project layout results in a modeled sound level above the 50 dBA limit at any receptor, Aurora will either obtain a written waiver of the sound avoidance requirement from the homeowner, or will take appropriate measures to ensure compliance (e.g., install Low Noise Trailing Edges (LNTE)).

Detailed maps and windPRO sound reports are included for reference.

Shadow Flicker Maps

Aurora Wind Project - Anticipated Realistic Shadow Flicker (Hours/Year)
AW125 3.15 87.5m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

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Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Shadow Receptors (Non-Participating)

Hours/Year

- 0.01-15.0
- 15.01 - 30.00
- 30.01+

Shadow Receptors (Participating)

Hours/Year

- 0.01 - 15.00
- 15.01 - 30.00
- 30.01+

Realistic Shadow Flicker

Hours/Year

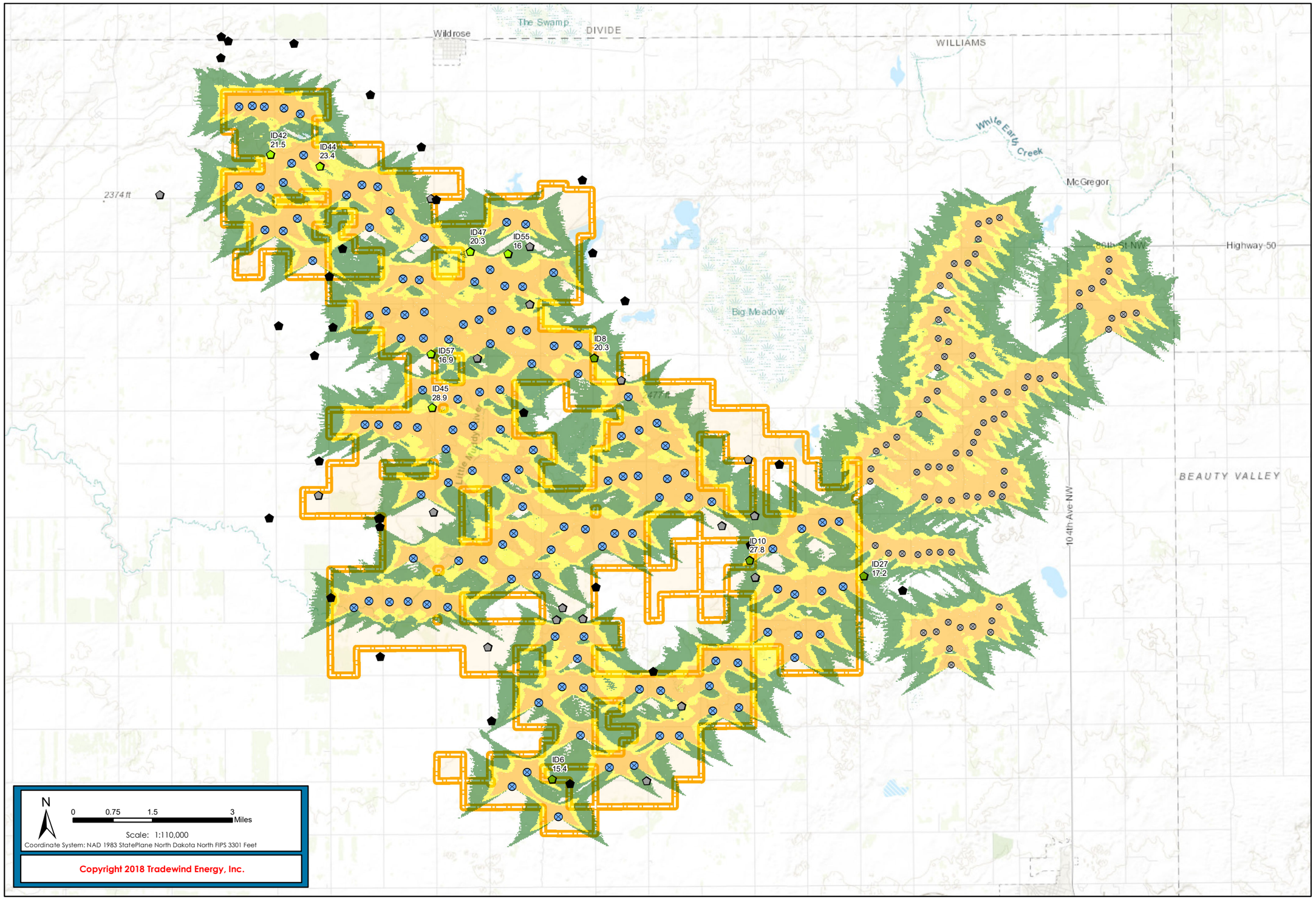
- 0.01 - 15.00
- 15.01 - 30.00
- 30.01+

The following companies and organizations provided data that contributed to the production of this map.

U.S. Geological Survey (USGS)
Environmental Systems Research Institute (ESRI)
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

Aurora Wind Project - Anticipated Realistic Shadow Flicker (Hours/Year)
GE 2.5 127 89m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Copyright 2018 Tradewind Energy, Inc.

Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Shadow Receptors (Non-Participating)

Hours/Year

- 0.01-15.0
- 15.01 - 30.00
- 30.01+

Shadow Receptors (Participating)

Hours/Year

- 0.01 - 15.00
- 15.01 - 30.00
- 30.01+

Realistic Shadow Flicker

Hours/Year

- 0.01 - 15.00
- 15.01 - 30.00
- 30.01+

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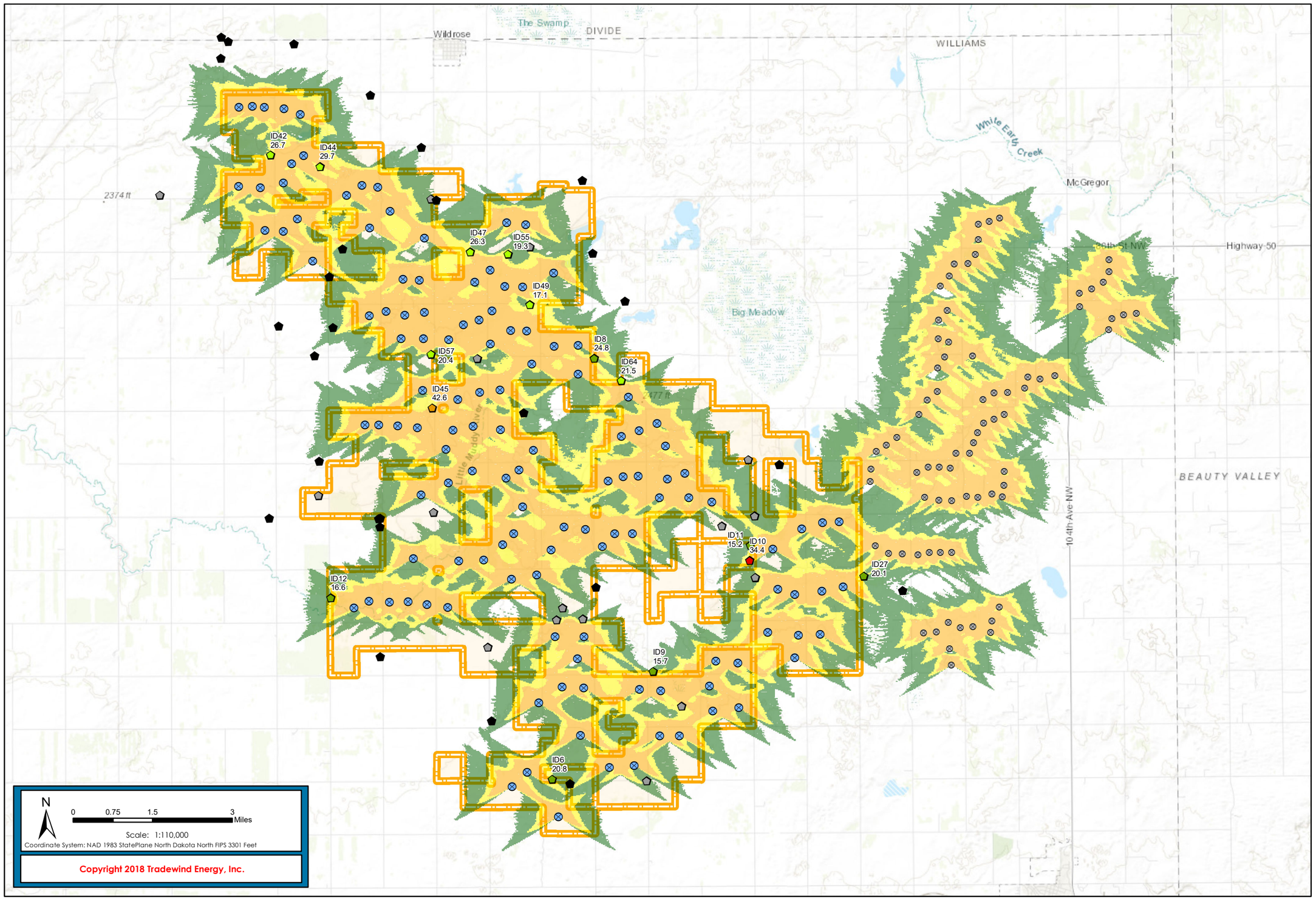
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

Aurora Wind Project - Anticipated Realistic Shadow Flicker (Hours/Year)
V136 3.45/3.6/4.0/4.2 105m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

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Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Shadow Receptors (Non-Participating)

Hours/Year

- 0.01-15.0
- 15.01 - 30.00
- 30.01+

Shadow Receptors (Participating)

Hours/Year

- 0.01 - 15.00
- 15.01 - 30.00
- 30.01+

Realistic Shadow Flicker

Hours/Year

- 0.01 - 15.00
- 15.01 - 30.00
- 30.01+

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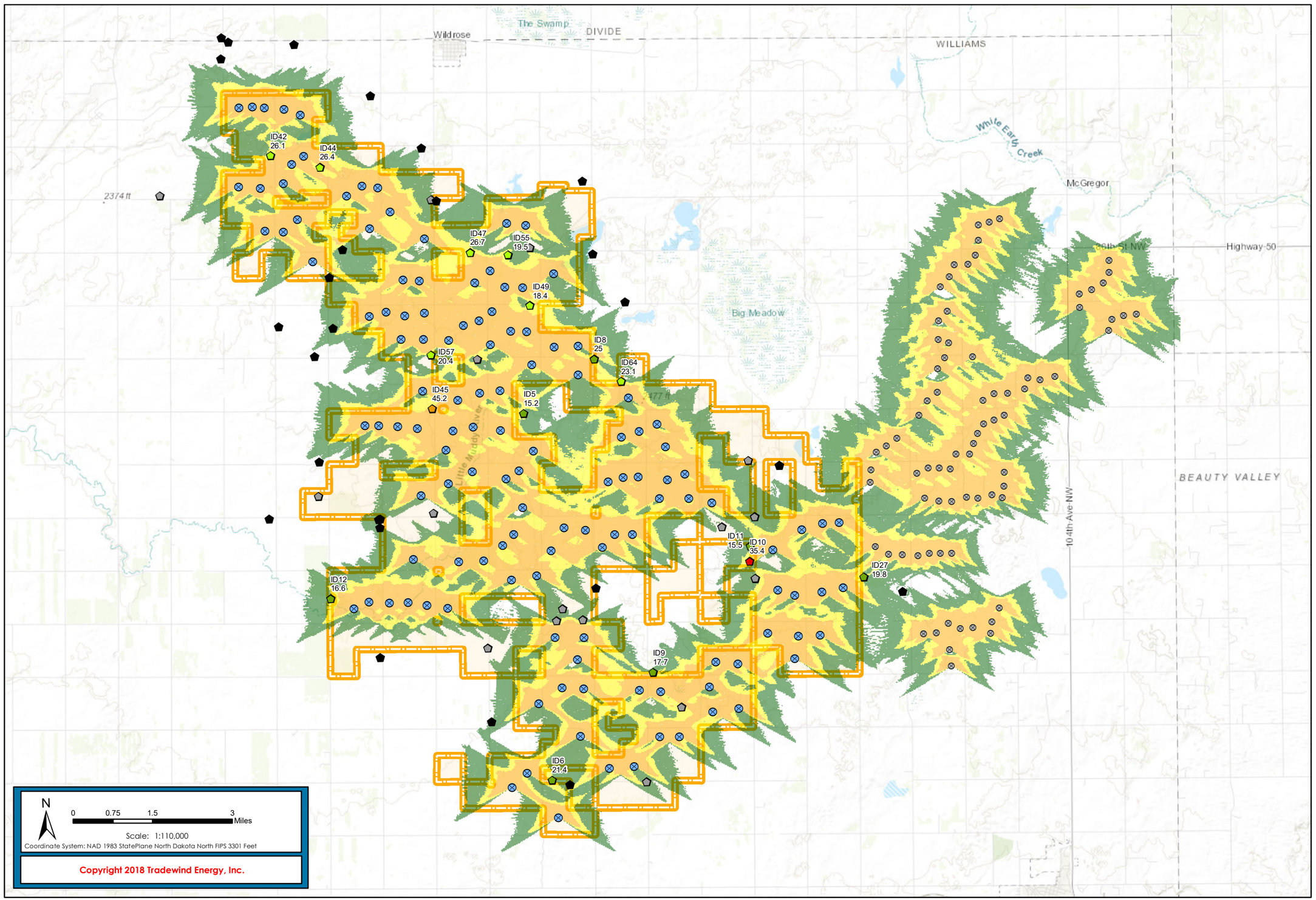
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

Aurora Wind Project - Anticipated Realistic Shadow Flicker (Hours/Year)
G132 3.465 114m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

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Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Shadow Receptors (Non-Participating)

Hours/Year

- 0.01-15.0
- 15.01 - 30.00
- 30.01+

Shadow Receptors (Participating)

Hours/Year

- 0.01 - 15.00
- 15.01 - 30.00
- 30.01+

Realistic Shadow Flicker

Hours/Year

- 0.01 - 15.00
- 15.01 - 30.00
- 30.01+

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Environmental Systems Research Institute (ESRI)
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

windPRO Shadow Flicker Reports

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Kevin Walter / kwalter@tradewindenergy.com
Calculated:
9/15/2018 3:20 AM/3.0.654

SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

Assumptions for shadow calculations

Maximum distance for influence	2,000	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational hours are calculated from WTGs in calculation and wind distribution:
0162 3/18 SDO

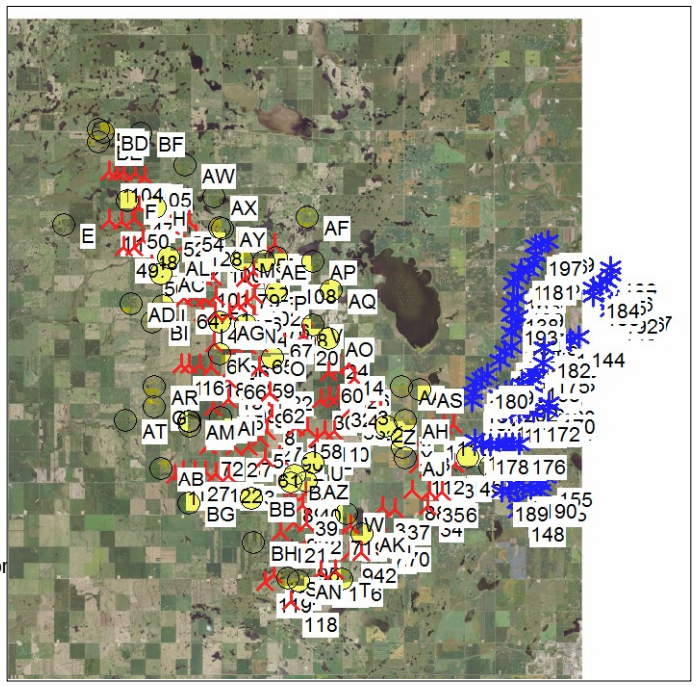
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
722	458	307	339	522	949	723	581	733	1,007	1,126	1,175	8,642

Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: 150921_TWE_LindahlWest_10ftHCLsfro
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m

All coordinates are in
UTM WGS84 Zone: 13



WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
1	637,619	5,373,512	727.5	T-43	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
2	642,085	5,374,363	728.5	T-41	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
3	641,252	5,375,220	737.7	T-63	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
4	640,729	5,375,038	740.7	T-62	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
5	635,764	5,372,945	724.6	T-45	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
6	636,817	5,372,047	728.5	T-35	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
7	635,193	5,372,473	710.2	T-47	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
8	636,346	5,374,109	734.6	T-56	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
9	635,830	5,374,972	728.5	T-55	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
10	639,692	5,373,363	740.7	T-39	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
11	639,157	5,373,344	739.4	T-38	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
12	638,790	5,372,951	734.6	T-37	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
13	633,988	5,375,810	737.6	T-70	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
14	640,372	5,376,713	738.1	T-77	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
15	634,074	5,374,798	721.2	T-53	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
16	631,934	5,376,511	729.8	T-67	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
17	631,510	5,376,507	731.5	T-66	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
18	633,108	5,376,447	723.9	T-69	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
19	632,563	5,379,145	737.6	T-93	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
20	637,951	5,378,169	715.2	T-80	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
21	641,389	5,374,486	743.7	T-58	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
22	636,640	5,375,835	734.6	T-73	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
23	643,972	5,372,967	712.3	T-28	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
24	639,495	5,377,499	738.7	T-78	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
25	639,840	5,376,489	737.6	T-76	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
26	640,649	5,376,031	731.5	T-79	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7

To be continued on next page...

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+1 913 424 5308
Kevin Walter / kwalter@tradewindenergy.com
Calculated:
9/15/2018 3:20 AM/3.0.654

SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
27	636,095	5,373,292	733.9	T-46	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
28	634,438	5,372,432	701.0	T-57	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
29	634,798	5,376,526	725.4	T-71	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
30	638,928	5,374,941	737.6	T-59	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
31	639,384	5,375,074	737.6	T-60	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
32	639,838	5,375,100	737.6	T-61	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
33	640,492	5,374,466	743.6	T-40	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
34	644,695	5,369,685	736.0	T-15	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
35	644,792	5,370,371	743.7	T-16	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
36	645,456	5,370,405	735.1	T-17	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
37	642,975	5,369,494	737.6	T-12	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
38	642,303	5,369,536	734.9	T-13	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
39	638,102	5,369,527	710.5	T-26	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
40	638,282	5,370,192	712.5	T-25	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
41	642,122	5,368,780	734.6	T-10	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
42	641,239	5,367,252	719.1	T-8	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
43	633,243	5,379,162	737.6	T-94	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
44	634,001	5,379,136	737.6	T-95	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
45	634,443	5,379,605	731.5	T-96	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
46	634,918	5,379,749	728.5	T-121	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
47	629,136	5,384,387	713.2	T-142	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
48	629,347	5,382,713	710.2	T-131	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
49	628,366	5,382,343	707.1	T-129	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
50	628,893	5,383,804	717.2	T-141	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
51	633,253	5,379,950	729.4	T-123	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
52	630,815	5,383,459	711.9	T-144	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
53	631,275	5,383,767	710.7	T-145	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
54	631,767	5,383,732	713.2	T-146	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
55	635,699	5,382,724	710.2	T-122	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
56	629,834	5,381,441	713.0	T-117	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
57	628,926	5,382,328	703.0	T-130	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
58	638,268	5,373,457	731.5	T-44	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
59	635,628	5,376,434	728.5	T-72	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
60	639,307	5,376,310	731.5	T-75	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
61	636,056	5,371,908	719.3	T-34	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
62	636,215	5,375,218	731.5	T-74	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
63	633,243	5,377,581	731.5	T-81	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
64	631,582	5,379,814	726.8	T-98	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
65	635,586	5,377,640	725.5	T-85	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
66	634,183	5,376,389	733.5	T-86	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
67	636,542	5,378,452	715.1	T-87	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
68	633,261	5,374,418	716.3	T-51	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
69	640,641	5,368,602	728.5	T-23	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
70	643,024	5,368,138	728.5	T-11	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
71	639,998	5,368,634	725.4	T-22	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
72	633,064	5,372,478	698.0	T-5	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
73	642,243	5,368,015	730.6	T-9	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
74	635,270	5,379,029	725.4	T-90	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
75	635,883	5,379,448	720.6	T-91	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
76	636,364	5,379,455	716.0	T-92	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
77	633,072	5,380,925	729.9	T-106	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
78	632,659	5,379,855	737.2	T-100	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
79	634,758	5,380,905	718.9	T-107	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
80	632,089	5,379,958	731.5	T-99	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
81	629,494	5,384,648	709.6	T-143	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
82	635,222	5,381,271	716.3	T-108	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
83	635,678	5,380,785	716.0	T-109	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
84	636,220	5,380,785	716.3	T-110	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7

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9/15/2018 3:20 AM/3.0.654

SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
85	636,276	5,382,673	710.2	T-124	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
86	637,208	5,379,005	710.9	T-88	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
87	637,941	5,379,046	713.2	T-89	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
88	643,859	5,370,443	732.3	T-14	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
89	637,408	5,370,185	701.0	T-24	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
90	637,234	5,372,817	719.9	T-42	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
91	632,509	5,376,501	722.8	T-68	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
92	638,306	5,368,644	716.3	T-21	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
93	637,648	5,368,666	713.2	T-20	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
94	640,643	5,367,238	719.3	T-19	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
95	638,242	5,367,207	710.2	T-18	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
96	634,318	5,377,326	731.6	T-83	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
97	634,979	5,377,549	725.3	T-84	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
98	634,798	5,375,163	713.2	T-54	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
99	631,532	5,382,484	707.7	T-118	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
100	633,206	5,382,201	722.4	T-120	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
101	632,585	5,380,949	731.5	T-105	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
102	635,298	5,380,049	728.5	T-97	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
103	627,504	5,386,079	711.3	T-147	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
104	627,911	5,386,105	710.2	T-148	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
105	629,368	5,385,888	704.0	T-149	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
106	628,867	5,386,049	710.2	T-150	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
107	628,269	5,386,086	711.9	T-151	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
108	637,149	5,381,224	704.1	T-152	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
109	644,833	5,373,605	713.9	T-153	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
110	645,462	5,373,811	728.5	T-154	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
111	645,966	5,373,838	730.1	T-155	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
112	644,144	5,371,765	710.2	T-156	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
113	644,660	5,371,616	715.4	T-157	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
114	645,479	5,371,724	719.3	T-158	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
115	646,127	5,371,875	717.1	T-159	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
116	639,890	5,366,309	710.2	T-160	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
117	639,135	5,366,239	709.0	T-161	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
118	637,617	5,364,719	707.6	T-162	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
119	636,191	5,365,609	711.4	T-163	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
120	636,640	5,366,042	710.2	T-164	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
121	636,954	5,368,164	711.3	T-165	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
122	633,495	5,371,087	689.0	T-166	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
123	634,130	5,371,006	696.6	T-167	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
124	632,359	5,371,139	688.8	T-168	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
125	632,926	5,371,158	686.0	T-169	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
126	631,283	5,370,947	682.8	T-170	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
127	631,732	5,371,159	684.7	T-171	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
128	632,154	5,382,999	713.2	T-172	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
129	628,195	5,383,647	711.6	T-173	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
130	627,535	5,383,666	710.2	T-174	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	18.7
131	646,913	5,375,455	745.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
132	646,888	5,375,080	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
133	648,328	5,377,151	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
134	648,570	5,377,592	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
135	648,872	5,377,853	752.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
136	648,872	5,378,572	753.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
137	649,189	5,379,368	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
138	648,868	5,380,034	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
139	649,124	5,380,328	729.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
140	651,007	5,377,868	748.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
141	651,525	5,378,000	750.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
142	651,616	5,378,348	758.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

To be continued on next page...

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SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
143	651,987	5,378,290	755.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
144	652,436	5,378,405	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
145	654,047	5,379,834	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
146	654,478	5,380,290	740.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
147	654,876	5,380,346	731.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
148	649,468	5,369,552	735.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
149	649,403	5,370,046	745.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
150	648,989	5,370,563	740.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
151	649,348	5,370,846	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
152	649,714	5,370,690	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
153	650,635	5,370,574	746.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
154	650,667	5,370,918	744.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
155	650,882	5,371,340	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
156	649,309	5,375,532	733.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
157	649,484	5,375,990	732.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
158	649,889	5,375,994	741.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
159	650,008	5,376,322	740.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
160	650,956	5,375,465	750.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
161	648,982	5,374,557	737.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
162	648,553	5,374,643	733.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
163	648,903	5,381,054	722.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
164	649,170	5,381,363	721.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
165	649,950	5,382,038	713.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
166	650,030	5,382,496	712.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
167	650,267	5,377,632	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
168	650,119	5,376,640	740.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
169	650,663	5,383,159	707.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
170	650,947	5,375,049	753.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
171	650,911	5,374,694	758.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
172	650,163	5,374,664	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
173	649,378	5,374,555	741.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
174	649,818	5,374,694	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
175	650,613	5,377,049	737.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
176	649,406	5,372,982	725.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
177	647,909	5,372,903	716.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
178	647,487	5,372,910	715.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
179	647,672	5,376,428	744.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
180	647,365	5,376,192	740.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
181	649,728	5,381,758	721.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
182	650,599	5,377,842	746.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
183	653,143	5,380,511	713.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
184	653,130	5,380,927	710.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
185	653,497	5,381,062	704.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
186	653,850	5,381,276	700.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
187	654,022	5,381,604	696.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
188	654,011	5,381,966	694.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
189	648,594	5,370,523	731.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
190	650,092	5,370,737	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
191	647,056	5,376,002	741.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
192	654,134	5,380,179	733.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
193	648,870	5,379,452	759.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
194	649,079	5,378,913	759.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
195	649,308	5,381,738	716.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
196	650,346	5,383,045	709.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
197	650,021	5,382,956	710.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
198	647,090	5,373,129	713.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
199	649,061	5,372,960	722.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
200	648,724	5,372,961	720.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

To be continued on next page...

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9/15/2018 3:20 AM/3.0.654

SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
201	648,383	5,372,886	719.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
202	648,975	5,375,560	735.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
203	648,641	5,375,554	726.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
204	648,297	5,375,376	728.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
205	649,928	5,378,956	741.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
206	650,591	5,374,779	748.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
207	650,301	5,376,922	735.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
208	650,917	5,377,197	740.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

Shadow receptor-Input

No.	Name	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	1 - Non-Participating	644,116	5,375,554	701.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
B	39 - Participating	643,400	5,373,971	711.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
C	2 - Non-Participating	647,930	5,371,801	718.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
D	40 - Participating	643,453	5,372,099	716.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
E	41 - Participating	625,162	5,383,364	711.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
F	42 - Participating	628,500	5,384,644	704.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
G	43 - Participating	630,148	5,374,326	691.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
H	44 - Participating	629,997	5,384,325	711.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
I	3 - Non-Participating	630,488	5,379,437	722.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
J	4 - Non-Participating	632,031	5,373,676	696.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
K	45 - Participating	633,554	5,377,057	735.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
L	46 - Participating	633,395	5,383,413	715.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
M	47 - Participating	634,615	5,381,825	716.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
N	48 - Participating	634,891	5,378,584	728.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
O	5 - Non-Participating	636,328	5,376,974	731.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
P	49 - Participating	636,455	5,380,259	709.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Q	50 - Participating	636,416	5,382,006	707.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
R	51 - Participating	637,621	5,371,070	716.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
S	6 - Non-Participating	637,411	5,365,868	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
T	52 - Participating	640,276	5,365,862	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
U	7 - Non-Participating	638,615	5,371,717	720.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
V	8 - Non-Participating	638,435	5,378,666	709.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
W	9 - Non-Participating	640,413	5,369,191	728.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
X	10 - Non-Participating	643,279	5,372,615	722.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Z	53 - Participating	642,413	5,373,644	734.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AA	54 - Participating	643,167	5,375,685	714.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AE	55 - Participating	635,760	5,381,775	711.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AG	57 - Participating	633,480	5,378,691	739.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AH	59 - Participating	643,400	5,373,968	711.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AI	61 - Participating	633,645	5,373,895	713.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AJ	62 - Participating	643,453	5,372,097	716.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AK	63 - Participating	641,300	5,368,154	725.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AO	64 - Participating	639,268	5,377,996	720.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"

To be continued on next page...

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9/15/2018 3:20 AM/3.0.654

SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

No.	Name	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AZ	66 - Participating	638,244	5,370,747	710.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BA	67 - Participating	637,448	5,370,698	712.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BB	68 - Participating	635,378	5,369,828	692.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Shadow, worst case: Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
A	1 - Non-Participating	0:00	0	0:00	0:00
B	39 - Participating	12:05	56	0:22	5:14
C	2 - Non-Participating	5:48	44	0:14	2:09
D	40 - Participating	26:54	58	0:46	9:26
E	41 - Participating	0:00	0	0:00	0:00
F	42 - Participating	59:04	144	0:44	20:47
G	43 - Participating	0:00	0	0:00	0:00
H	44 - Participating	55:25	158	0:40	22:25
I	3 - Non-Participating	11:23	41	0:26	4:39
J	4 - Non-Participating	17:30	63	0:22	7:14
K	45 - Participating	79:44	169	1:02	27:23
L	46 - Participating	7:59	47	0:20	2:54
M	47 - Participating	56:35	150	0:40	19:35
N	48 - Participating	20:22	121	0:19	9:08
O	5 - Non-Participating	33:42	126	0:36	10:35
P	49 - Participating	27:54	143	0:26	10:00
Q	50 - Participating	16:39	68	0:22	4:58
R	51 - Participating	7:02	52	0:13	3:31
S	6 - Non-Participating	33:53	93	0:39	14:46
T	52 - Participating	9:59	40	0:23	4:44
U	7 - Non-Participating	2:10	18	0:11	0:57
V	8 - Non-Participating	70:26	139	0:47	19:45
W	9 - Non-Participating	37:01	91	0:42	10:13
X	10 - Non-Participating	66:28	159	0:46	26:56
Y	11 - Non-Participating	26:21	74	0:42	10:59
Z	53 - Participating	1:28	15	0:08	0:31
AA	54 - Participating	1:56	15	0:12	0:40
AB	12 - Non-Participating	33:20	87	0:40	12:41
AC	13 - Non-Participating	2:28	18	0:10	0:44
AD	14 - Non-Participating	0:00	0	0:00	0:00
AE	55 - Participating	58:17	117	0:47	15:36
AF	15 - Non-Participating	0:00	0	0:00	0:00

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SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
AG	57 - Participating	34:05	124	0:30	16:27
AH	59 - Participating	12:10	58	0:22	5:17
AI	61 - Participating	0:00	0	0:00	0:00
AJ	62 - Participating	26:47	58	0:46	9:24
AK	63 - Participating	24:50	106	0:32	11:05
AL	16 - Non-Participating	17:02	85	0:31	5:48
AM	17 - Non-Participating	17:41	66	0:21	7:21
AN	18 - Non-Participating	16:55	84	0:22	7:14
AO	64 - Participating	36:14	78	0:46	12:01
AP	19 - Non-Participating	6:18	29	0:20	1:51
AQ	20 - Non-Participating	4:17	26	0:12	1:01
AR	21 - Non-Participating	0:00	0	0:00	0:00
AS	22 - Non-Participating	0:00	0	0:00	0:00
AT	23 - Non-Participating	0:00	0	0:00	0:00
AU	24 - Non-Participating	12:04	42	0:22	3:52
AV	27 - Non-Participating	50:40	143	0:54	16:56
AW	29 - Non-Participating	0:00	0	0:00	0:00
AX	30 - Non-Participating	7:37	40	0:14	1:55
AY	31 - Non-Participating	5:35	38	0:16	2:05
AZ	66 - Participating	14:08	48	0:29	3:54
BA	67 - Participating	17:26	52	0:32	5:55
BB	68 - Participating	0:00	0	0:00	0:00
BC	32 - Non-Participating	0:00	0	0:00	0:00
BD	33 - Non-Participating	0:00	0	0:00	0:00
BE	34 - Non-Participating	0:00	0	0:00	0:00
BF	35 - Non-Participating	0:00	0	0:00	0:00
BG	36 - Non-Participating	0:00	0	0:00	0:00
BH	37 - Non-Participating	5:58	31	0:18	2:28
BI	38 - Non-Participating	0:00	0	0:00	0:00

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	T-43	0:00	0:00
2	T-41	8:22	3:53
3	T-63	1:56	0:40
4	T-62	0:00	0:00
5	T-45	0:00	0:00
6	T-35	2:10	0:57
7	T-47	0:00	0:00
8	T-56	0:00	0:00
9	T-55	0:00	0:00
10	T-39	0:00	0:00
11	T-38	0:00	0:00
12	T-37	0:00	0:00
13	T-70	0:00	0:00
14	T-77	0:00	0:00
15	T-53	0:00	0:00
16	T-67	1:56	0:36
17	T-66	0:00	0:00
18	T-69	15:38	4:31
19	T-93	30:24	15:06
20	T-80	66:15	18:01
21	T-58	0:00	0:00
22	T-73	0:00	0:00
23	T-28	73:54	30:51
24	T-78	31:04	9:45

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SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
25	T-76	0:00	0:00
26	T-79	0:00	0:00
27	T-46	0:00	0:00
28	T-57	0:00	0:00
29	T-71	7:26	2:28
30	T-59	0:00	0:00
31	T-60	0:00	0:00
32	T-61	0:00	0:00
33	T-40	0:00	0:00
34	T-15	0:00	0:00
35	T-16	0:00	0:00
36	T-17	0:00	0:00
37	T-12	0:00	0:00
38	T-13	1:46	0:42
39	T-26	0:00	0:00
40	T-25	17:26	5:55
41	T-10	2:21	0:53
42	T-8	0:00	0:00
43	T-94	3:28	1:39
44	T-95	8:22	4:04
45	T-96	0:00	0:00
46	T-121	3:44	1:13
47	T-142	50:49	19:54
48	T-131	2:06	1:02
49	T-129	0:00	0:00
50	T-141	8:06	2:38
51	T-123	0:00	0:00
52	T-144	5:33	1:42
53	T-145	5:13	1:43
54	T-146	11:58	3:38
55	T-122	0:00	0:00
56	T-117	13:30	4:10
57	T-130	1:26	0:37
58	T-44	0:00	0:00
59	T-72	25:09	6:55
60	T-75	0:00	0:00
61	T-34	7:02	3:31
62	T-74	0:00	0:00
63	T-81	1:49	0:29
64	T-98	13:50	5:24
65	T-85	0:00	0:00
66	T-86	21:35	6:27
67	T-87	3:18	1:25
68	T-51	19:13	7:58
69	T-23	1:53	0:55
70	T-11	2:16	0:59
71	T-22	39:57	12:03
72	T-5	12:04	3:52
73	T-9	13:38	5:46
74	T-90	6:12	1:48
75	T-91	0:00	0:00
76	T-92	4:54	2:08
77	T-106	3:01	0:49
78	T-100	0:00	0:00
79	T-107	20:22	6:06
80	T-99	3:34	1:25
81	T-143	27:51	12:59
82	T-108	104:08	30:30
83	T-109	4:18	1:32
84	T-110	2:15	0:46

To be continued on next page...

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Calculated:
9/15/2018 3:20 AM/3.0.654

SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
85	T-124	2:24	1:00
86	T-88	7:52	3:34
87	T-89	10:08	2:51
88	T-14	0:00	0:00
89	T-24	14:08	3:54
90	T-42	0:00	0:00
91	T-68	7:15	2:15
92	T-21	0:00	0:00
93	T-20	0:00	0:00
94	T-19	0:00	0:00
95	T-18	0:00	0:00
96	T-83	28:25	11:47
97	T-84	12:16	5:20
98	T-54	0:00	0:00
99	T-118	0:00	0:00
100	T-120	5:19	2:22
101	T-105	0:00	0:00
102	T-97	8:57	3:33
103	T-147	0:00	0:00
104	T-148	0:00	0:00
105	T-149	0:00	0:00
106	T-150	0:00	0:00
107	T-151	0:00	0:00
108	T-152	19:22	6:06
109	T-153	13:03	5:13
110	T-154	0:00	0:00
111	T-155	0:00	0:00
112	T-156	32:52	11:12
113	T-157	10:33	3:44
114	T-158	5:30	1:41
115	T-159	32:31	9:59
116	T-160	0:00	0:00
117	T-161	21:04	9:23
118	T-162	0:00	0:00
119	T-163	7:51	3:01
120	T-164	25:52	11:42
121	T-165	5:58	2:28
122	T-166	0:00	0:00
123	T-167	0:00	0:00
124	T-168	2:12	0:57
125	T-169	0:00	0:00
126	T-170	25:13	9:06
127	T-171	8:07	3:33
128	T-172	8:00	2:40
129	T-173	1:23	0:26
130	T-174	13:49	3:26
131	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (1)	0:00	0:00
132	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (2)	0:00	0:00
133	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (3)	0:00	0:00
134	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (4)	0:00	0:00
135	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (5)	0:00	0:00
136	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (6)	0:00	0:00
137	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (7)	0:00	0:00
138	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (8)	0:00	0:00
139	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (9)	0:00	0:00
140	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (10)	0:00	0:00
141	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (11)	0:00	0:00
142	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (12)	0:00	0:00
143	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (13)	0:00	0:00
144	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (14)	0:00	0:00

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SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
145	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (15)	0:00	0:00
146	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (16)	0:00	0:00
147	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (17)	0:00	0:00
148	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (18)	0:00	0:00
149	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (19)	0:00	0:00
150	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (20)	0:00	0:00
151	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (21)	4:06	1:25
152	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (22)	0:00	0:00
153	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (23)	0:00	0:00
154	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (24)	0:00	0:00
155	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (25)	0:00	0:00
156	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (26)	0:00	0:00
157	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (27)	0:00	0:00
158	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (28)	0:00	0:00
159	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (29)	0:00	0:00
160	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (30)	0:00	0:00
161	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (31)	0:00	0:00
162	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (32)	0:00	0:00
163	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (33)	0:00	0:00
164	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (34)	0:00	0:00
165	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (35)	0:00	0:00
166	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (36)	0:00	0:00
167	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (37)	0:00	0:00
168	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (38)	0:00	0:00
169	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (39)	0:00	0:00
170	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (40)	0:00	0:00
171	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (41)	0:00	0:00
172	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (42)	0:00	0:00
173	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (43)	0:00	0:00
174	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (44)	0:00	0:00
175	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (45)	0:00	0:00
176	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (46)	0:00	0:00
177	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (47)	12:37	5:14
178	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (48)	0:00	0:00
179	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (49)	0:00	0:00
180	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (50)	0:00	0:00
181	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (51)	0:00	0:00
182	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (52)	0:00	0:00
183	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (53)	0:00	0:00
184	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (54)	0:00	0:00
185	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (55)	0:00	0:00
186	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (56)	0:00	0:00
187	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (57)	0:00	0:00
188	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (58)	0:00	0:00
189	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (59)	0:00	0:00
190	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (60)	0:00	0:00
191	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (61)	0:00	0:00
192	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (62)	0:00	0:00
193	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (63)	0:00	0:00
194	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (64)	0:00	0:00
195	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (65)	0:00	0:00
196	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (66)	0:00	0:00
197	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (67)	0:00	0:00
198	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (68)	0:00	0:00
199	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (69)	0:00	0:00
200	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (70)	0:00	0:00
201	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (71)	1:44	0:43
202	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (72)	0:00	0:00
203	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (73)	0:00	0:00
204	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (74)	0:00	0:00

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SHADOW - Main Result

Calculation: AW125-3.15 87.5m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
205	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (75)	0:00	0:00
206	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (76)	0:00	0:00
207	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (77)	0:00	0:00
208	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (78)	0:00	0:00

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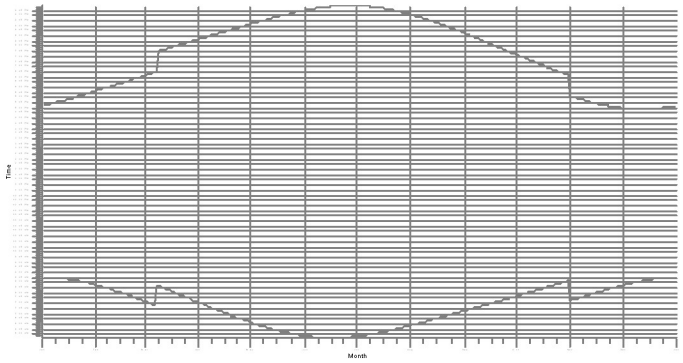
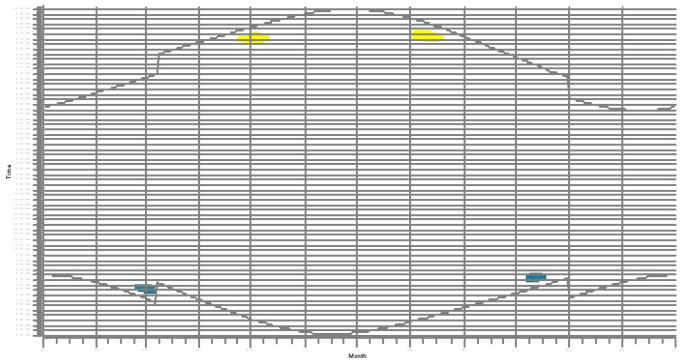
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

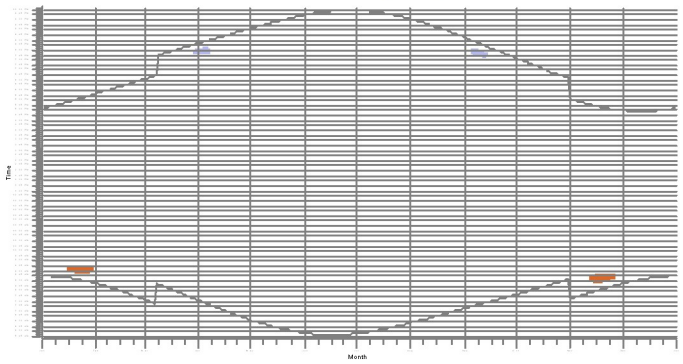
A: 1 - Non-Participating



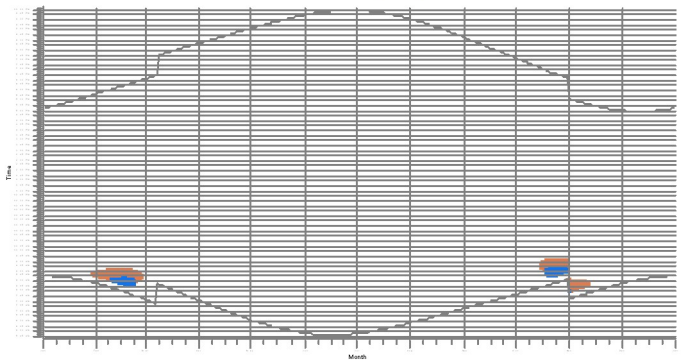
B: 39 - Participating



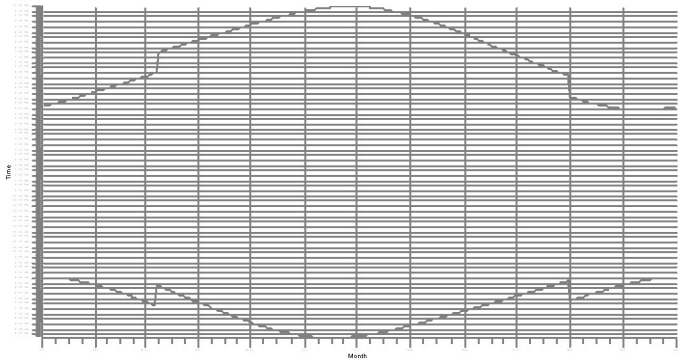
C: 2 - Non-Participating



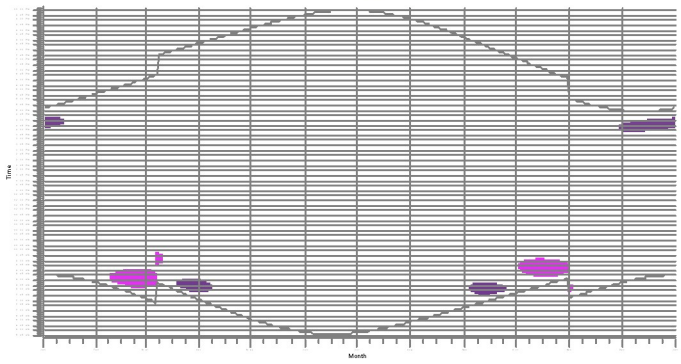
D: 40 - Participating



E: 41 - Participating



F: 42 - Participating



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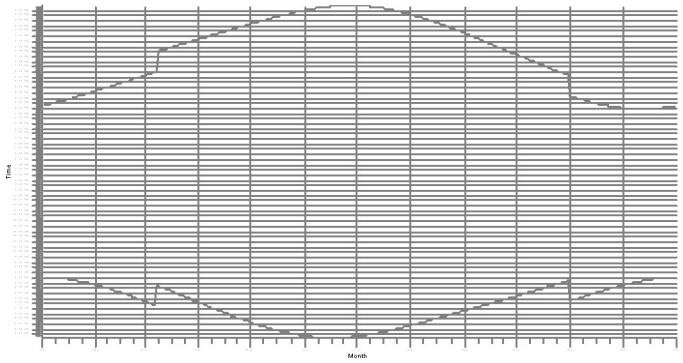
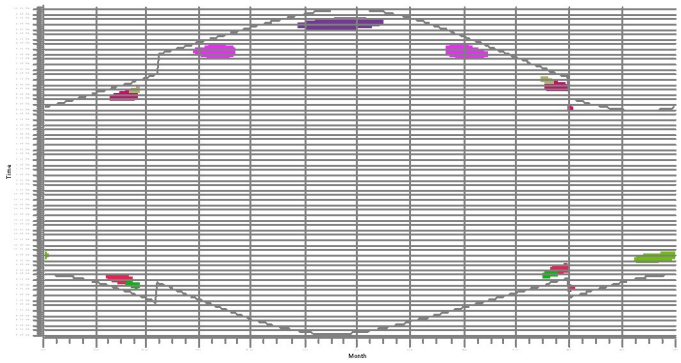
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

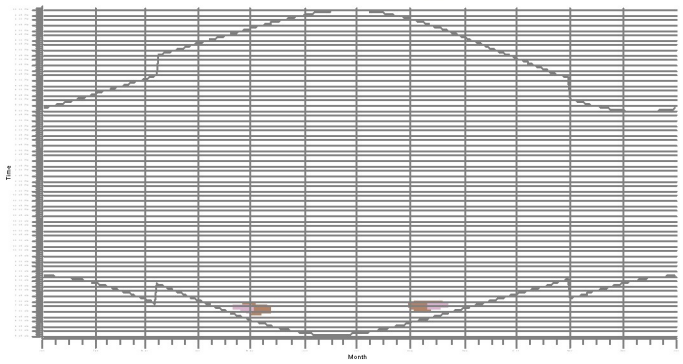
G: 43 - Participating



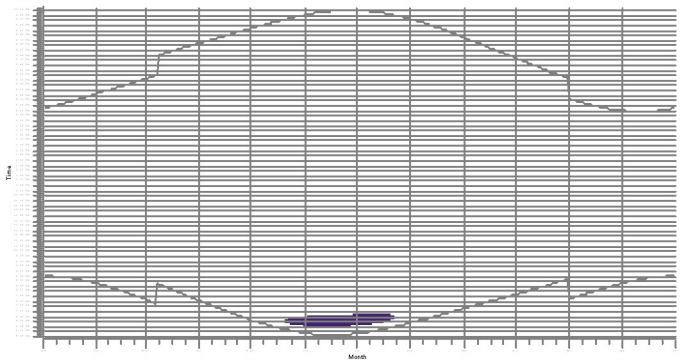
H: 44 - Participating



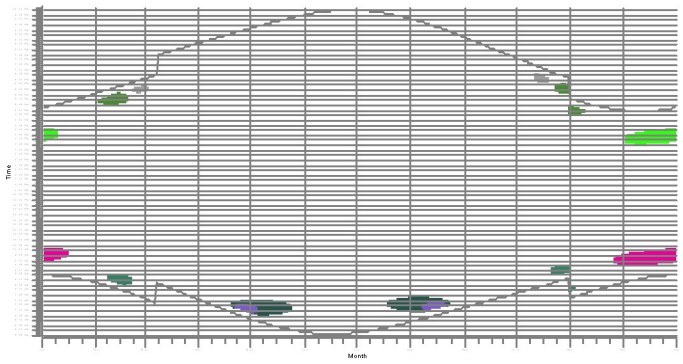
I: 3 - Non-Participating



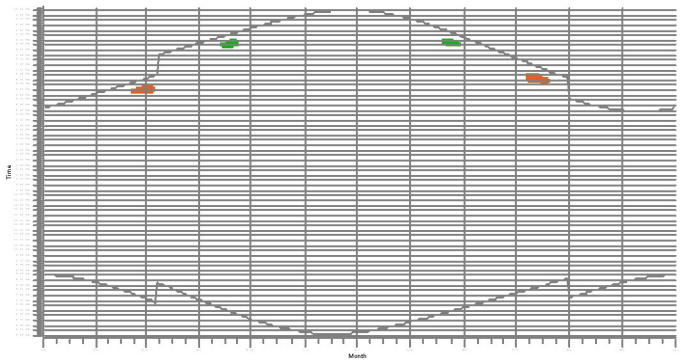
J: 4 - Non-Participating



K: 45 - Participating



L: 46 - Participating



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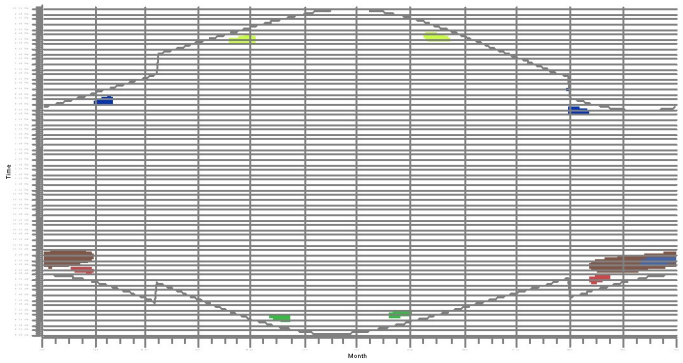
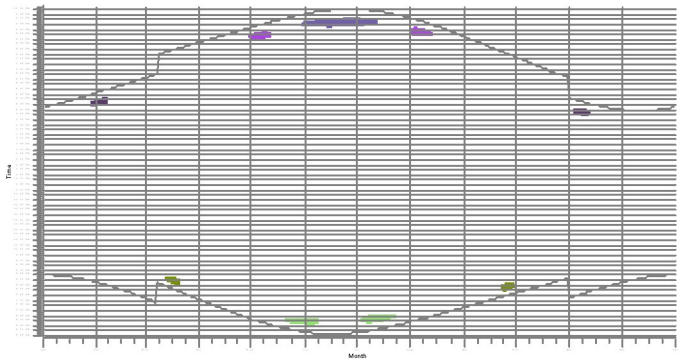
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

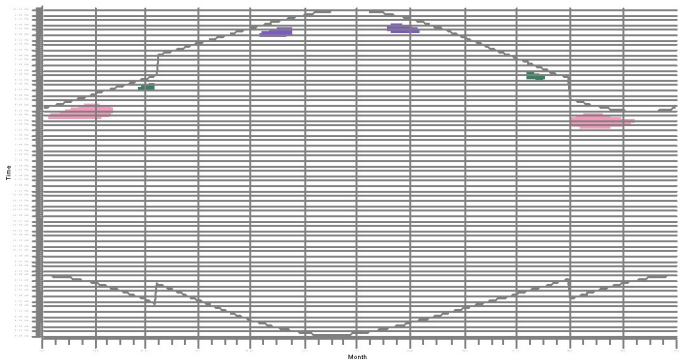
M: 47 - Participating



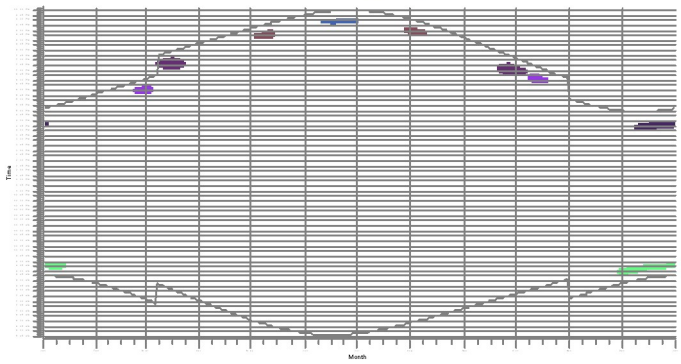
N: 48 - Participating



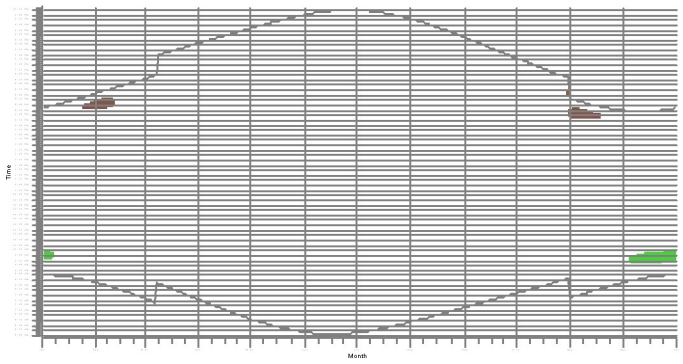
O: 5 - Non-Participating



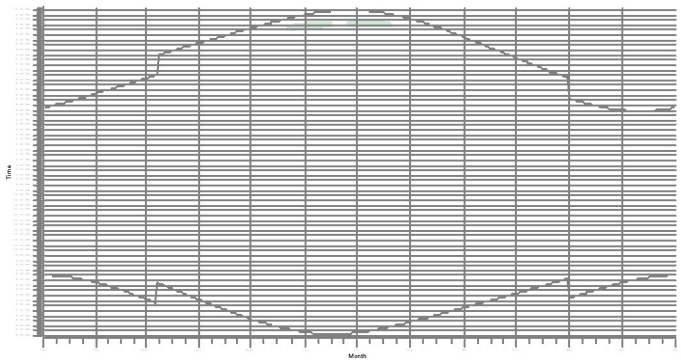
P: 49 - Participating

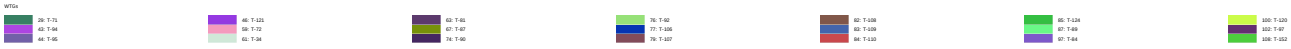


Q: 50 - Participating



R: 51 - Participating





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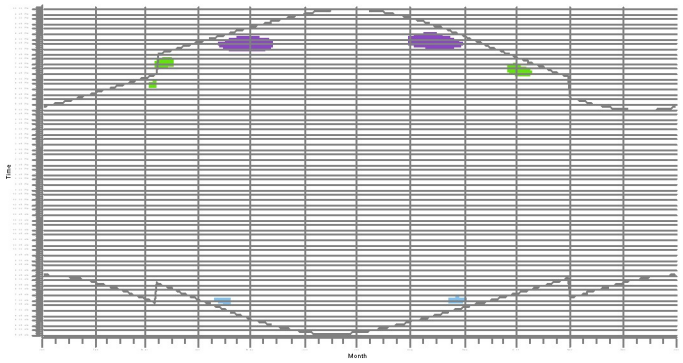
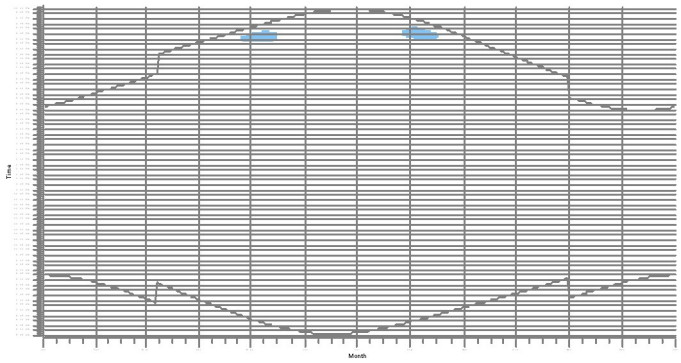
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

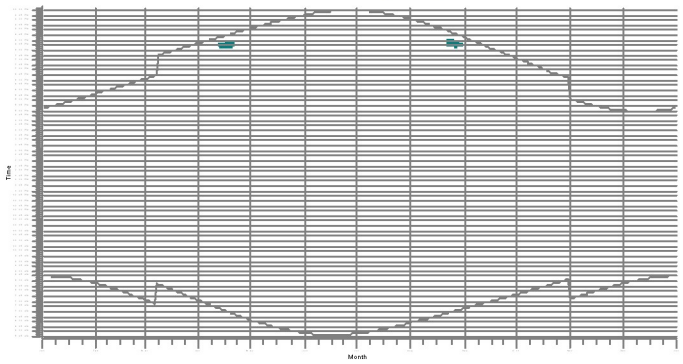
S: 6 - Non-Participating



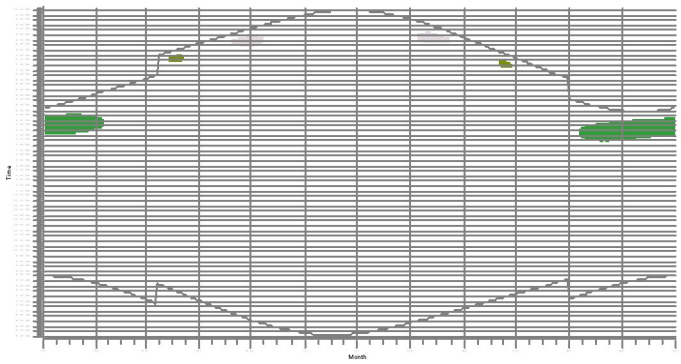
T: 52 - Participating



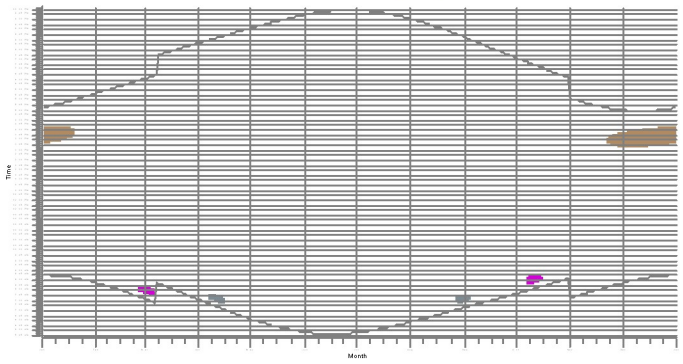
U: 7 - Non-Participating



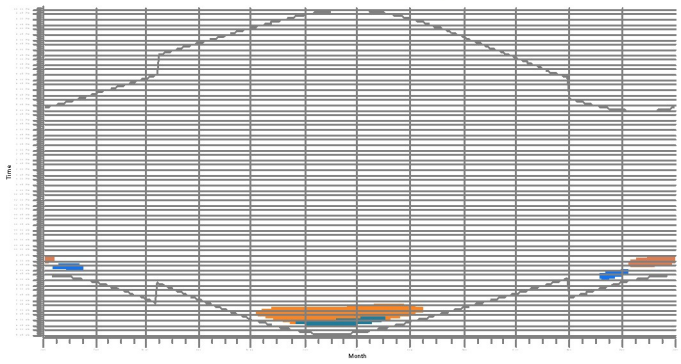
V: 8 - Non-Participating



W: 9 - Non-Participating



X: 10 - Non-Participating



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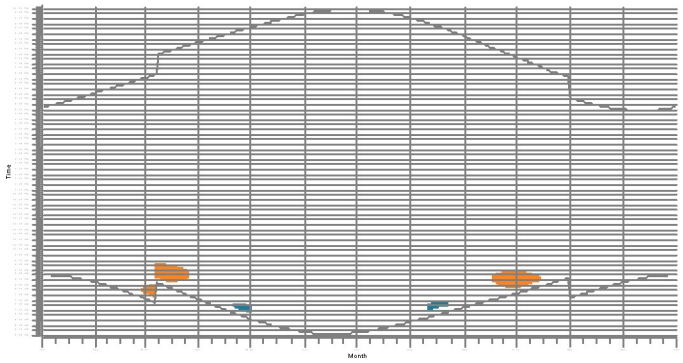
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

Y: 11 - Non-Participating



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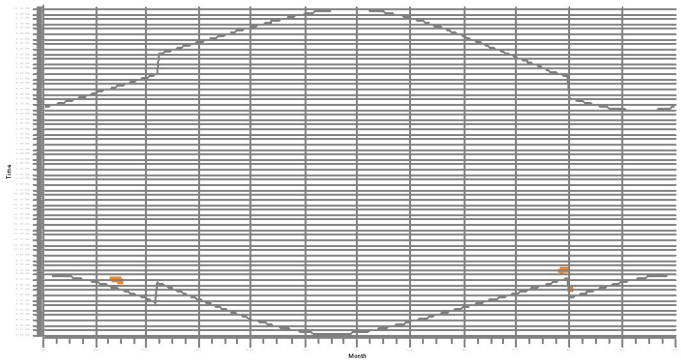

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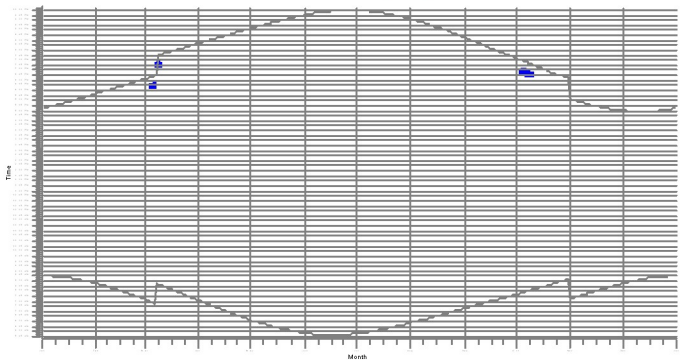

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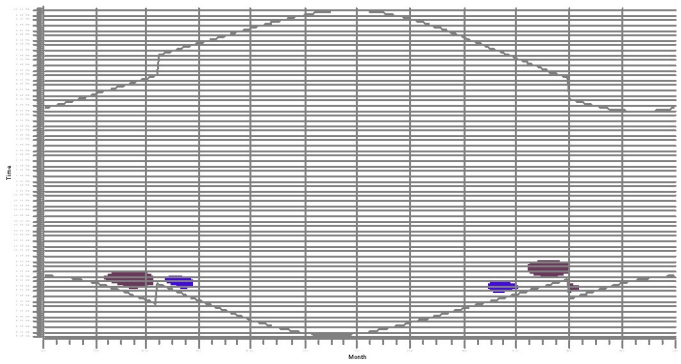
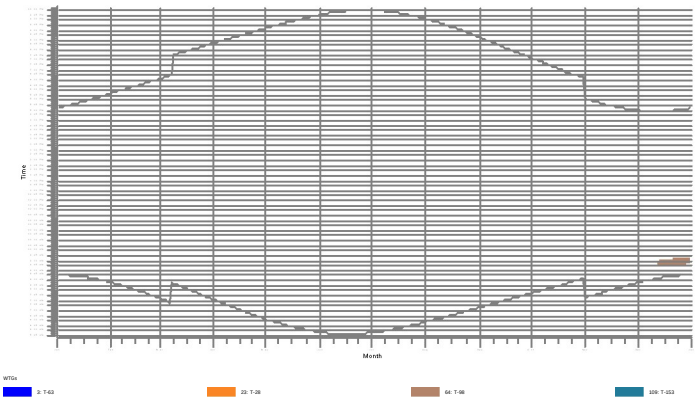
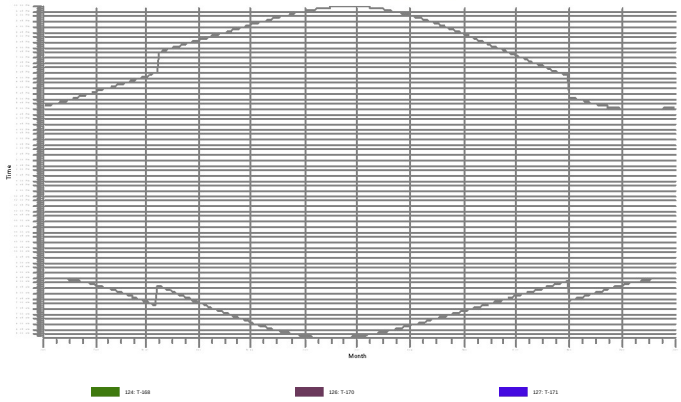


AC: 13 - Non-Participating



AD: 14 - Non-Participating



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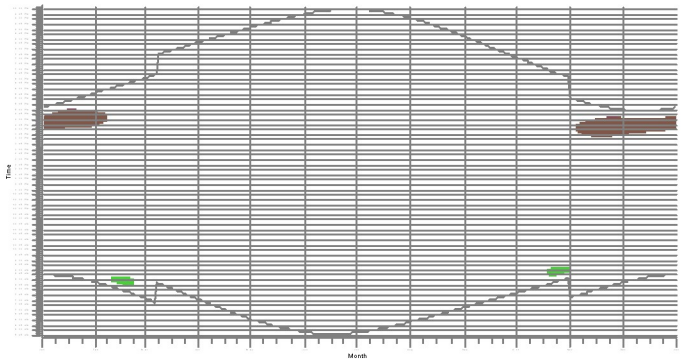
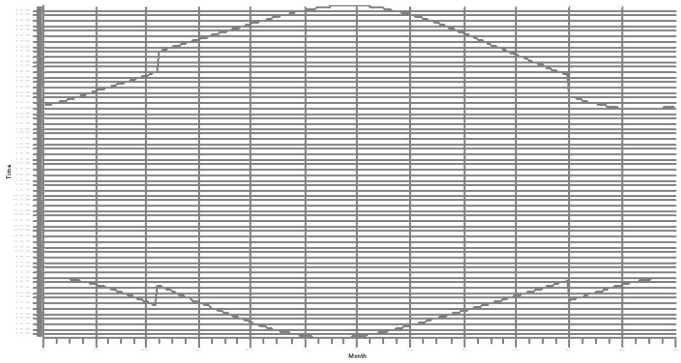
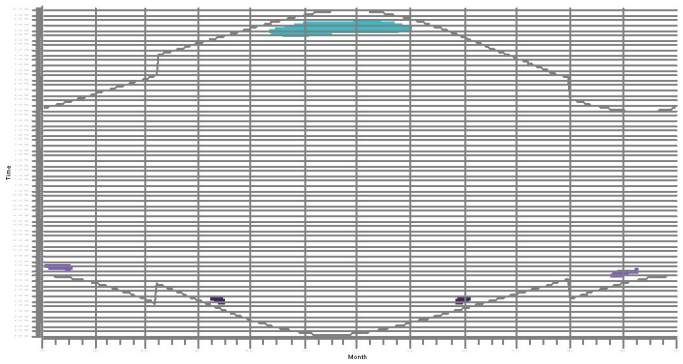
AE: 55 - Participating



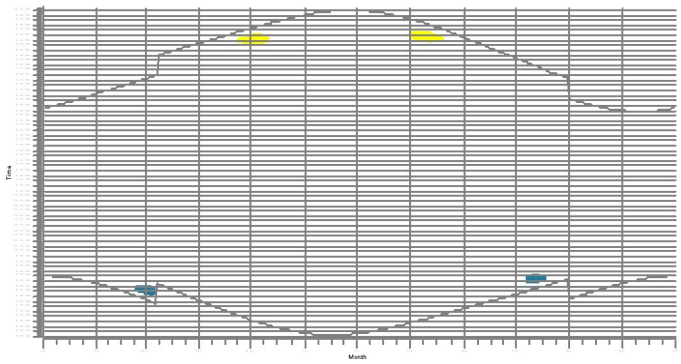
AF: 15 - Non-Participating



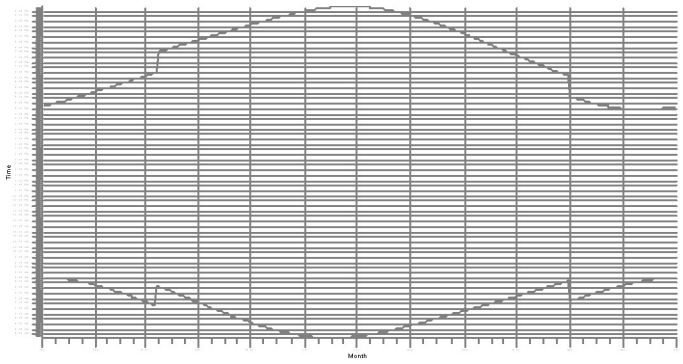
AG: 57 - Participating



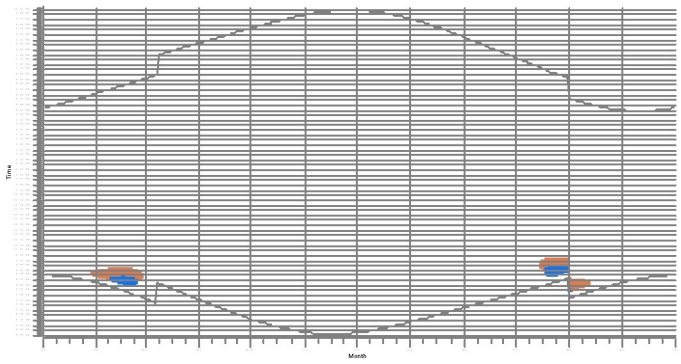
AH: 59 - Participating



AI: 61 - Participating



AJ: 62 - Participating



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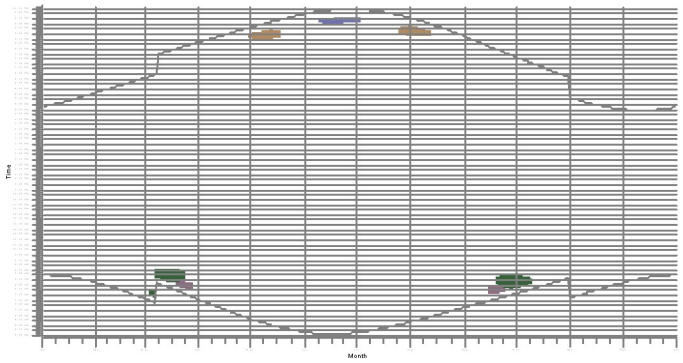
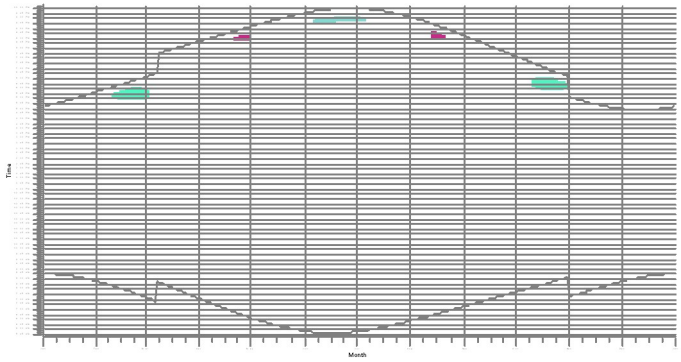
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

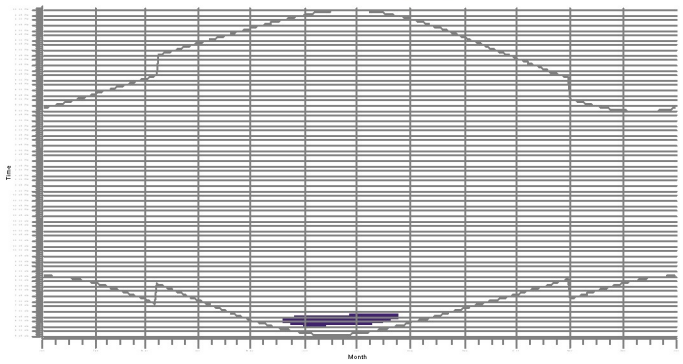
AK: 63 - Participating



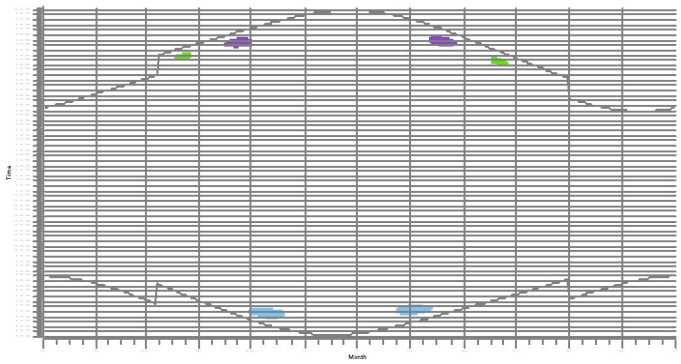
AL: 16 - Non-Participating



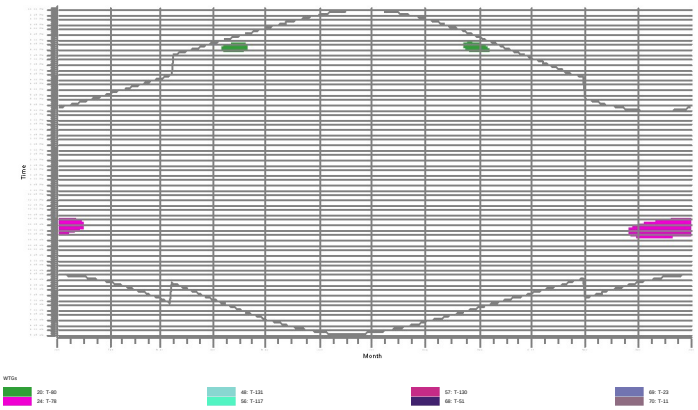
AM: 17 - Non-Participating



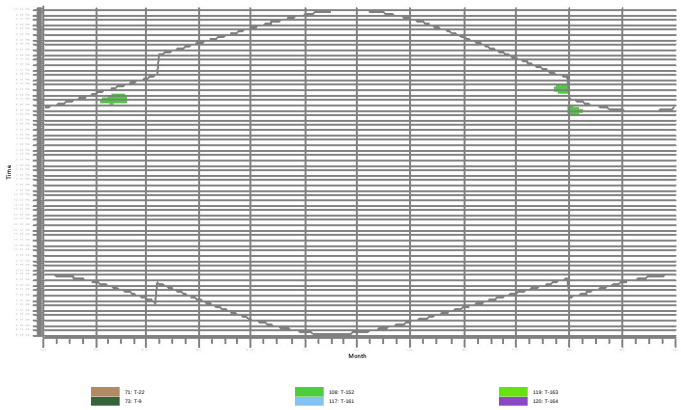
AN: 18 - Non-Participating



AO: 64 - Participating



AP: 19 - Non-Participating



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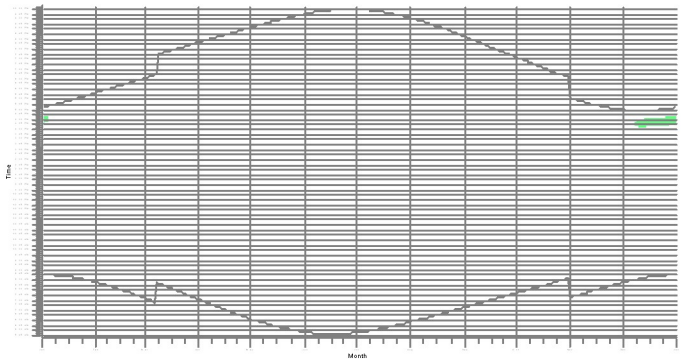
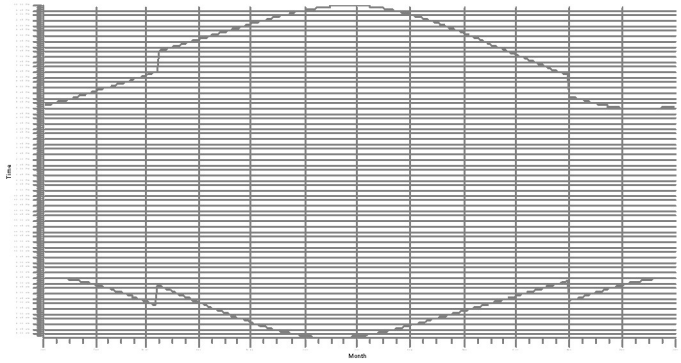
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

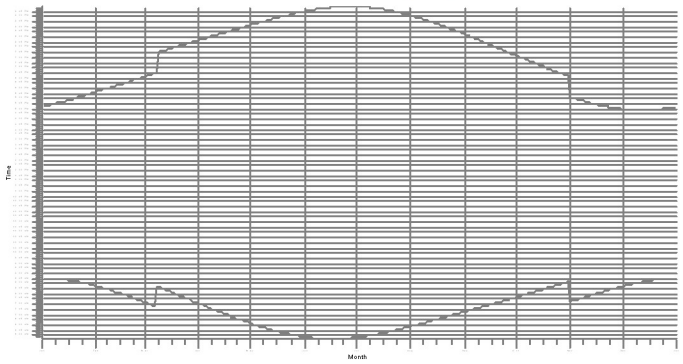
AQ: 20 - Non-Participating



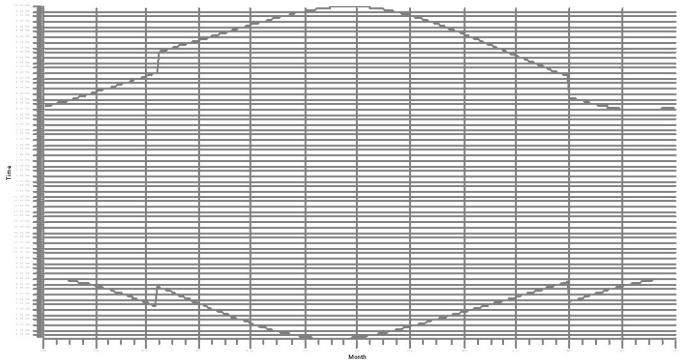
AR: 21 - Non-Participating



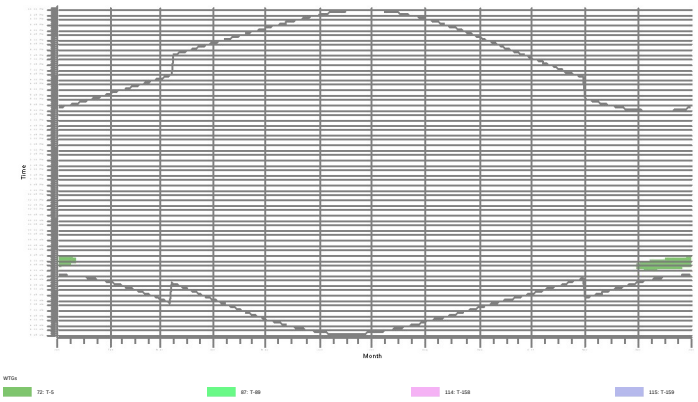
AS: 22 - Non-Participating



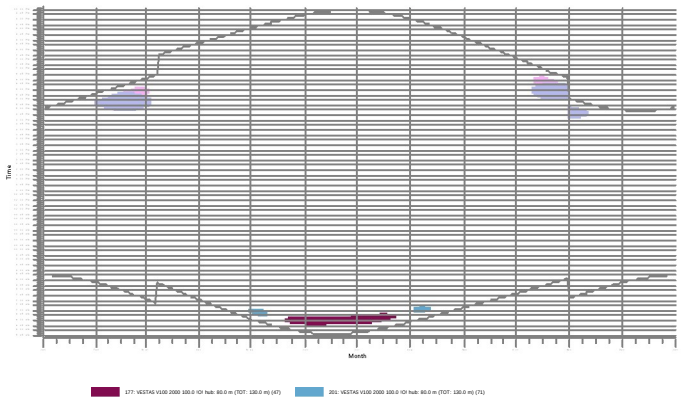
AT: 23 - Non-Participating



AU: 24 - Non-Participating



AV: 27 - Non-Participating



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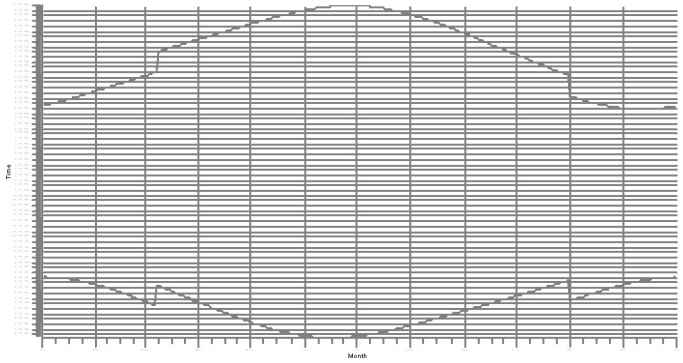
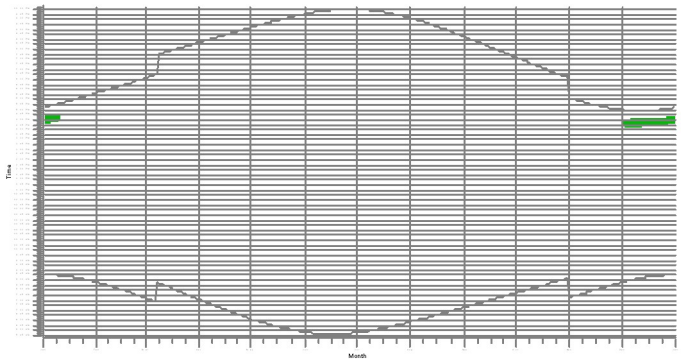
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

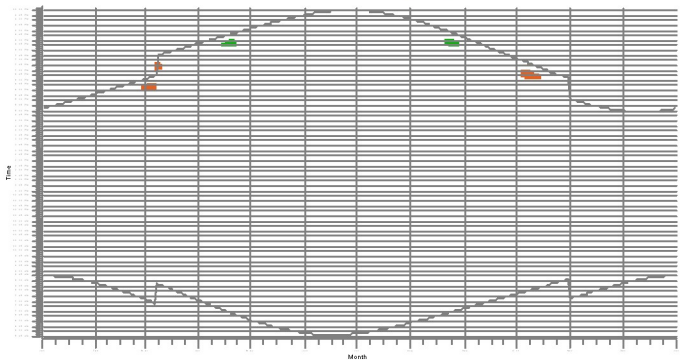
AW: 29 - Non-Participating



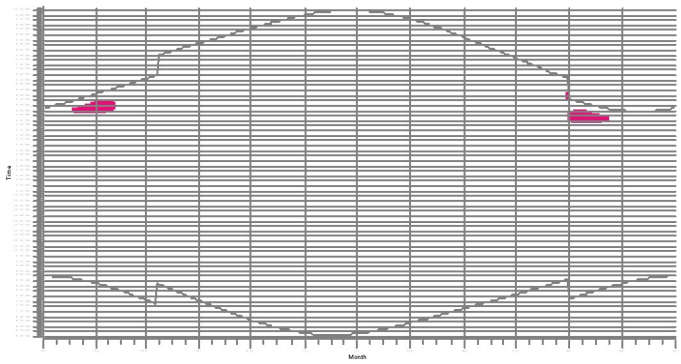
AX: 30 - Non-Participating



AY: 31 - Non-Participating



AZ: 66 - Participating



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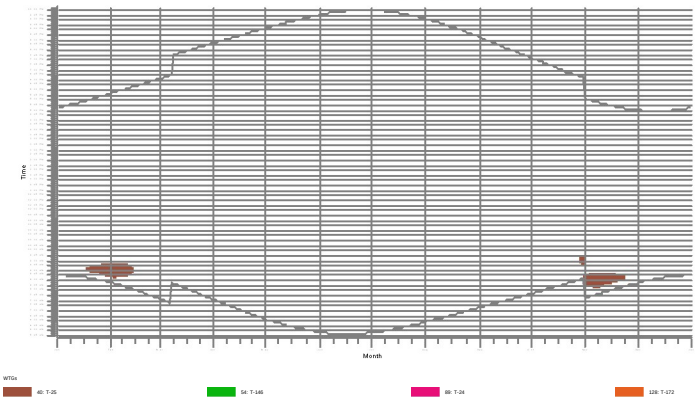

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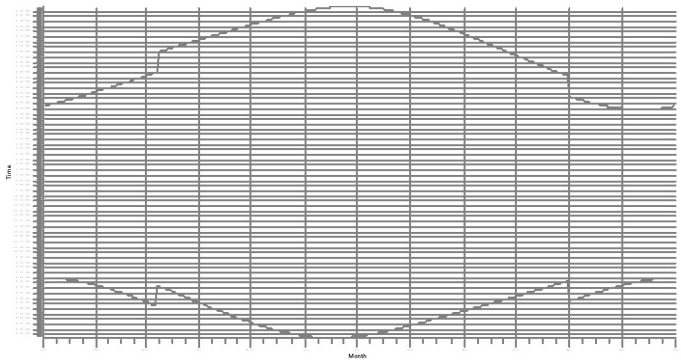

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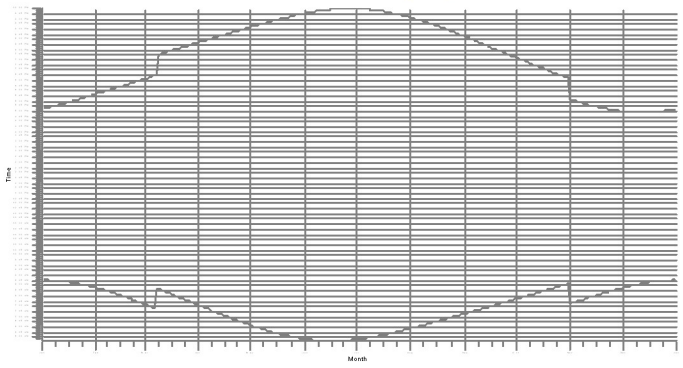
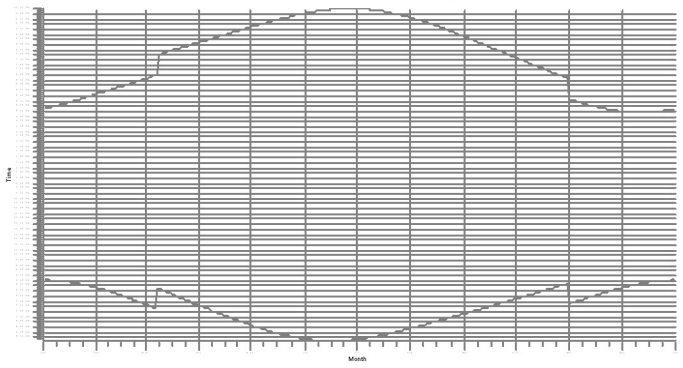
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

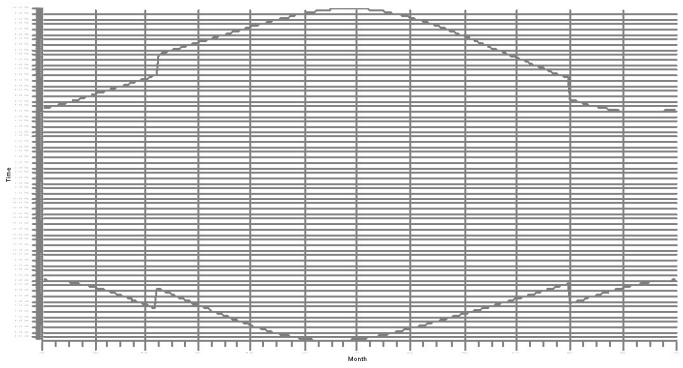
BC: 32 - Non-Participating



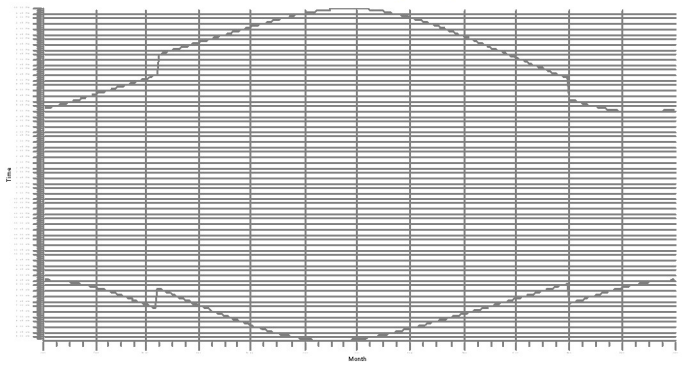
BD: 33 - Non-Participating



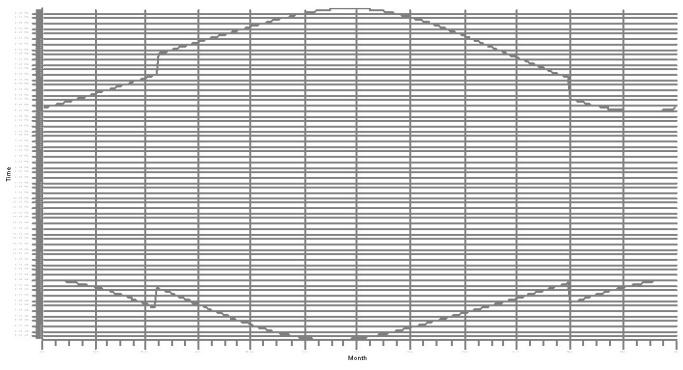
BE: 34 - Non-Participating



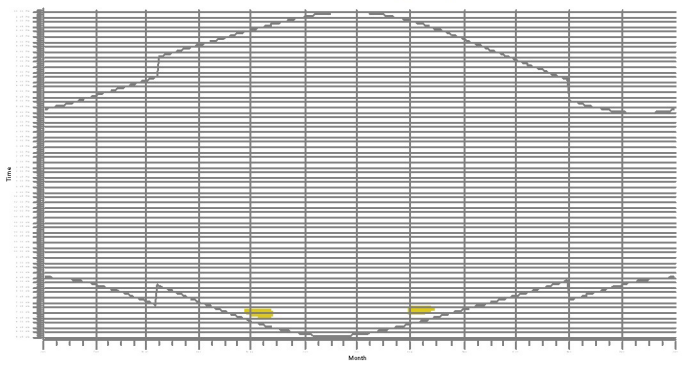
BF: 35 - Non-Participating



BG: 36 - Non-Participating



BH: 37 - Non-Participating



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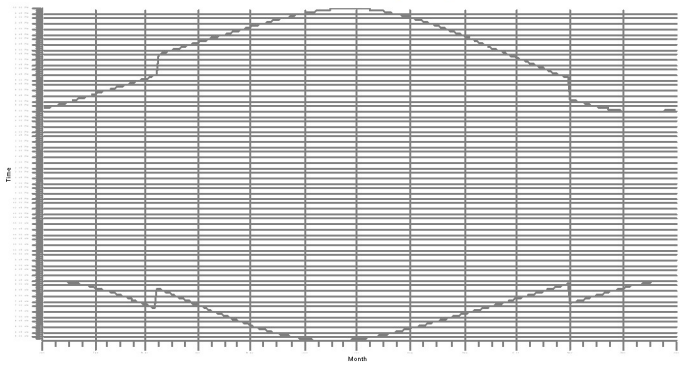
SHADOW - Calendar, graphical

Calculation: AW125-3.15 87.5m HH Shadow Flicker

BI: 38 - Non-Participating



WTGs

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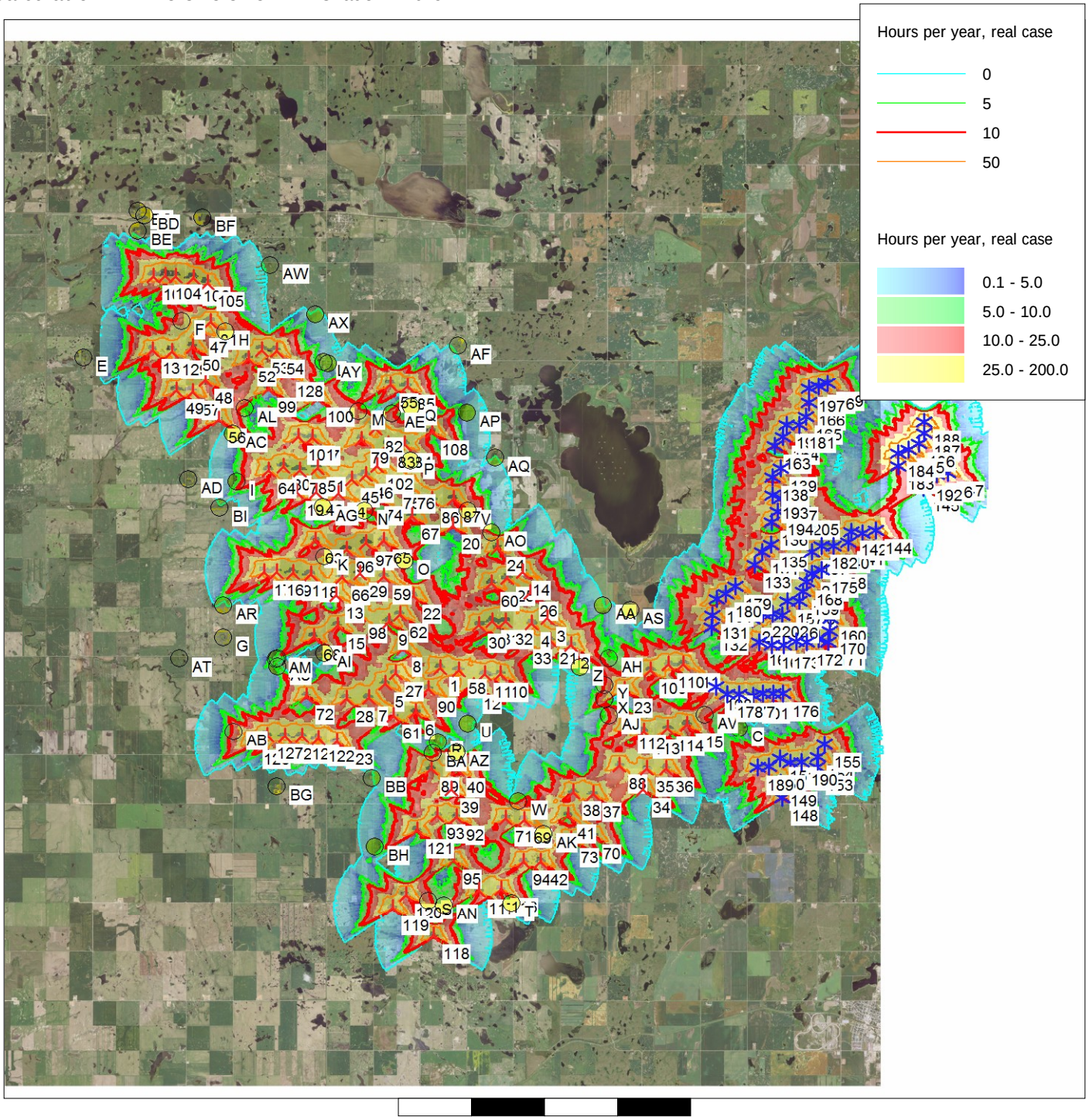
SHADOW - Map

Calculation: AW125-3.15 87.5m HH Shadow Flicker



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 640,676 North: 5,375,910

New WTG Existing WTG Shadow receptor

Flicker map level: Height Contours: 150921_TWE_LindahlWest_10ftHCLsfrom10mNED.wpo (3)

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

Assumptions for shadow calculations

Maximum distance for influence	2,000	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational hours are calculated from WTGs in calculation and wind distribution:
0162 3/18 SDO

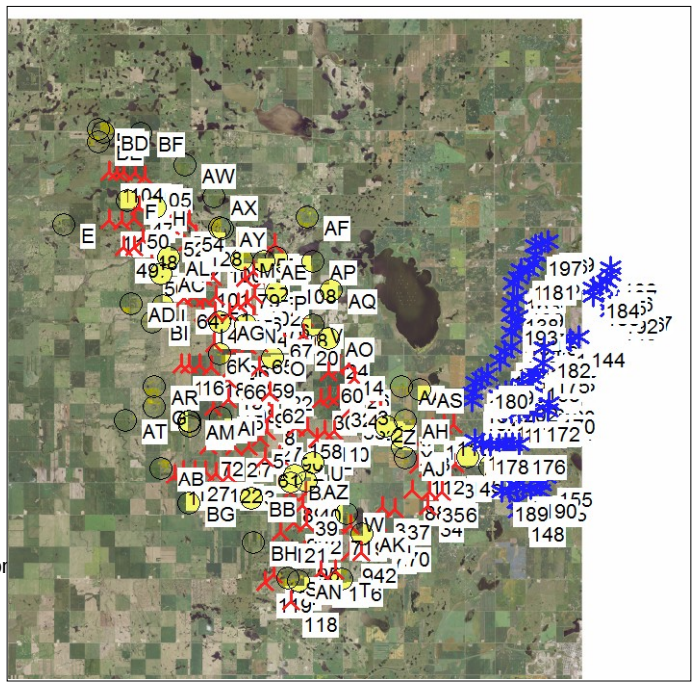
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
717	455	305	337	519	943	718	577	729	1,000	1,119	1,167	8,587

Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: 150921_TWE_LindahlWest_10ftHCLsfror
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m

All coordinates are in
UTM WGS84 Zone: 13



WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
1	637,619	5,373,512	727.5	T-43	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
2	642,085	5,374,363	728.5	T-41	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
3	641,252	5,375,220	737.7	T-63	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
4	640,729	5,375,038	740.7	T-62	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
5	635,764	5,372,945	724.6	T-45	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
6	636,817	5,372,047	728.5	T-35	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
7	635,193	5,372,473	710.2	T-47	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
8	636,346	5,374,109	734.6	T-56	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
9	635,830	5,374,972	728.5	T-55	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
10	639,692	5,373,363	740.7	T-39	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
11	639,157	5,373,344	739.4	T-38	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
12	638,790	5,372,951	734.6	T-37	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
13	633,988	5,375,810	737.6	T-70	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
14	640,372	5,376,713	738.1	T-77	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
15	634,074	5,374,798	721.2	T-53	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
16	631,934	5,376,511	729.8	T-67	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
17	631,510	5,376,507	731.5	T-66	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
18	633,108	5,376,447	723.9	T-69	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
19	632,563	5,379,145	737.6	T-93	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
20	637,951	5,378,169	715.2	T-80	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
21	641,389	5,374,486	743.7	T-58	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
22	636,640	5,375,835	734.6	T-73	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
23	643,972	5,372,967	712.3	T-28	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
24	639,495	5,377,499	738.7	T-78	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
25	639,840	5,376,489	737.6	T-76	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
26	640,649	5,376,031	731.5	T-79	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7

To be continued on next page...

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
27	636,095	5,373,292	733.9	T-46	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
28	634,438	5,372,432	701.0	T-57	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
29	634,798	5,376,526	725.4	T-71	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
30	638,928	5,374,941	737.6	T-59	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
31	639,384	5,375,074	737.6	T-60	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
32	639,838	5,375,100	737.6	T-61	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
33	640,492	5,374,466	743.6	T-40	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
34	644,695	5,369,685	736.0	T-15	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
35	644,792	5,370,371	743.7	T-16	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
36	645,456	5,370,405	735.1	T-17	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
37	642,975	5,369,494	737.6	T-12	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
38	642,303	5,369,536	734.9	T-13	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
39	638,102	5,369,527	710.5	T-26	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
40	638,282	5,370,192	712.5	T-25	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
41	642,122	5,368,780	734.6	T-10	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
42	641,239	5,367,252	719.1	T-8	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
43	633,243	5,379,162	737.6	T-94	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
44	634,001	5,379,136	737.6	T-95	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
45	634,443	5,379,605	731.5	T-96	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
46	634,918	5,379,749	728.5	T-121	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
47	629,136	5,384,387	713.2	T-142	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
48	629,347	5,382,713	710.2	T-131	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
49	628,366	5,382,343	707.1	T-129	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
50	628,893	5,383,804	717.2	T-141	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
51	633,253	5,379,950	729.4	T-123	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
52	630,815	5,383,459	711.9	T-144	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
53	631,275	5,383,767	710.7	T-145	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
54	631,767	5,383,732	713.2	T-146	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
55	635,699	5,382,724	710.2	T-122	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
56	629,834	5,381,441	713.0	T-117	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
57	628,926	5,382,328	703.0	T-130	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
58	638,268	5,373,457	731.5	T-44	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
59	635,628	5,376,434	728.5	T-72	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
60	639,307	5,376,310	731.5	T-75	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
61	636,056	5,371,908	719.3	T-34	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
62	636,215	5,375,218	731.5	T-74	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
63	633,243	5,377,581	731.5	T-81	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
64	631,582	5,379,814	726.8	T-98	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
65	635,586	5,377,640	725.5	T-85	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
66	634,183	5,376,389	733.5	T-86	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
67	636,542	5,378,452	715.1	T-87	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
68	633,261	5,374,418	716.3	T-51	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
69	640,641	5,368,602	728.5	T-23	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
70	643,024	5,368,138	728.5	T-11	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
71	639,998	5,368,634	725.4	T-22	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
72	633,064	5,372,478	698.0	T-5	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
73	642,243	5,368,015	730.6	T-9	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
74	635,270	5,379,029	725.4	T-90	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
75	635,883	5,379,448	720.6	T-91	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
76	636,364	5,379,455	716.0	T-92	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
77	633,072	5,380,925	729.9	T-106	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
78	632,659	5,379,855	737.2	T-100	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
79	634,758	5,380,905	718.9	T-107	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
80	632,089	5,379,958	731.5	T-99	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
81	629,494	5,384,648	709.6	T-143	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
82	635,222	5,381,271	716.3	T-108	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
83	635,678	5,380,785	716.0	T-109	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
84	636,220	5,380,785	716.3	T-110	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7

To be continued on next page...

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
85	636,276	5,382,673	710.2	T-124	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
86	637,208	5,379,005	710.9	T-88	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
87	637,941	5,379,046	713.2	T-89	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
88	643,859	5,370,443	732.3	T-14	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
89	637,408	5,370,185	701.0	T-24	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
90	637,234	5,372,817	719.9	T-42	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
91	632,509	5,376,501	722.8	T-68	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
92	638,306	5,368,644	716.3	T-21	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
93	637,648	5,368,666	713.2	T-20	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
94	640,643	5,367,238	719.3	T-19	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
95	638,242	5,367,207	710.2	T-18	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
96	634,318	5,377,326	731.6	T-83	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
97	634,979	5,377,549	725.3	T-84	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
98	634,798	5,375,163	713.2	T-54	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
99	631,532	5,382,484	707.7	T-118	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
100	633,206	5,382,201	722.4	T-120	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
101	632,585	5,380,949	731.5	T-105	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
102	635,298	5,380,049	728.5	T-97	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
103	627,504	5,386,079	711.3	T-147	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
104	627,911	5,386,105	710.2	T-148	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
105	629,368	5,385,888	704.0	T-149	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
106	628,867	5,386,049	710.2	T-150	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
107	628,269	5,386,086	711.9	T-151	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
108	637,149	5,381,224	704.1	T-152	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
109	644,833	5,373,605	713.9	T-153	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
110	645,462	5,373,811	728.5	T-154	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
111	645,966	5,373,838	730.1	T-155	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
112	644,144	5,371,765	710.2	T-156	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
113	644,660	5,371,616	715.4	T-157	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
114	645,479	5,371,724	719.3	T-158	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
115	646,127	5,371,875	717.1	T-159	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
116	639,890	5,366,309	710.2	T-160	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
117	639,135	5,366,239	709.0	T-161	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
118	637,617	5,364,719	707.6	T-162	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
119	636,191	5,365,609	711.4	T-163	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
120	636,640	5,366,042	710.2	T-164	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
121	636,954	5,368,164	711.3	T-165	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
122	633,495	5,371,087	689.0	T-166	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
123	634,130	5,371,006	696.6	T-167	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
124	632,359	5,371,139	688.8	T-168	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
125	632,926	5,371,158	686.0	T-169	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
126	631,283	5,370,947	682.8	T-170	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
127	631,732	5,371,159	684.7	T-171	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
128	632,154	5,382,999	713.2	T-172	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
129	628,195	5,383,647	711.6	T-173	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
130	627,535	5,383,666	710.2	T-174	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	15.7
131	646,913	5,375,455	745.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
132	646,888	5,375,080	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
133	648,328	5,377,151	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
134	648,570	5,377,592	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
135	648,872	5,377,853	752.9	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
136	648,872	5,378,572	753.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
137	649,189	5,379,368	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
138	648,868	5,380,034	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
139	649,124	5,380,328	729.4	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
140	651,007	5,377,868	748.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
141	651,525	5,378,000	750.5	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
142	651,616	5,378,348	758.5	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

To be continued on next page...

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
143	651,987	5,378,290	755.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
144	652,436	5,378,405	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
145	654,047	5,379,834	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
146	654,478	5,380,290	740.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
147	654,876	5,380,346	731.4	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
148	649,468	5,369,552	735.9	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
149	649,403	5,370,046	745.1	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
150	648,989	5,370,563	740.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
151	649,348	5,370,846	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
152	649,714	5,370,690	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
153	650,635	5,370,574	746.1	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
154	650,667	5,370,918	744.2	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
155	650,882	5,371,340	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
156	649,309	5,375,532	733.1	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
157	649,484	5,375,990	732.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
158	649,889	5,375,994	741.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
159	650,008	5,376,322	740.0	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
160	650,956	5,375,465	750.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
161	648,982	5,374,557	737.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
162	648,553	5,374,643	733.0	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
163	648,903	5,381,054	722.4	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
164	649,170	5,381,363	721.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
165	649,950	5,382,038	713.3	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
166	650,030	5,382,496	712.9	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
167	650,267	5,377,632	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
168	650,119	5,376,640	740.5	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
169	650,663	5,383,159	707.1	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
170	650,947	5,375,049	753.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
171	650,911	5,374,694	758.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
172	650,163	5,374,664	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
173	649,378	5,374,555	741.2	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
174	649,818	5,374,694	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
175	650,613	5,377,049	737.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
176	649,406	5,372,982	725.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
177	647,909	5,372,903	716.3	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
178	647,487	5,372,910	715.5	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
179	647,672	5,376,428	744.3	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
180	647,365	5,376,192	740.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
181	649,728	5,381,758	721.2	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
182	650,599	5,377,842	746.4	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
183	653,143	5,380,511	713.2	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
184	653,130	5,380,927	710.2	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
185	653,497	5,381,062	704.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
186	653,850	5,381,276	700.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
187	654,022	5,381,604	696.2	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
188	654,011	5,381,966	694.9	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
189	648,594	5,370,523	731.5	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
190	650,092	5,370,737	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
191	647,056	5,376,002	741.1	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
192	654,134	5,380,179	733.9	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
193	648,870	5,379,452	759.0	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
194	649,079	5,378,913	759.0	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
195	649,308	5,381,738	716.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
196	650,346	5,383,045	709.6	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
197	650,021	5,382,956	710.0	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
198	647,090	5,373,129	713.2	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
199	649,061	5,372,960	722.4	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
200	648,724	5,372,961	720.7	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

To be continued on next page...

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
201	648,383	5,372,886	719.3	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
202	648,975	5,375,560	735.2	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
203	648,641	5,375,554	726.1	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
204	648,297	5,375,376	728.5	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
205	649,928	5,378,956	741.8	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
206	650,591	5,374,779	748.5	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
207	650,301	5,376,922	735.1	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
208	650,917	5,377,197	740.0	VESTAS V100 2000 100.0 !O! hub: 80.0 ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

Shadow receptor-Input

No.	Name	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	1 - Non-Participating	644,116	5,375,554	701.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
B	39 - Participating	643,400	5,373,971	711.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
C	2 - Non-Participating	647,930	5,371,801	718.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
D	40 - Participating	643,453	5,372,099	716.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
E	41 - Participating	625,162	5,383,364	711.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
F	42 - Participating	628,500	5,384,644	704.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
G	43 - Participating	630,148	5,374,326	691.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
H	44 - Participating	629,997	5,384,325	711.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
I	3 - Non-Participating	630,488	5,379,437	722.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
J	4 - Non-Participating	632,031	5,373,676	696.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
K	45 - Participating	633,554	5,377,057	735.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
L	46 - Participating	633,395	5,383,413	715.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
M	47 - Participating	634,615	5,381,825	716.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
N	48 - Participating	634,891	5,378,584	728.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
O	5 - Non-Participating	636,328	5,376,974	731.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
P	49 - Participating	636,455	5,380,259	709.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Q	50 - Participating	636,416	5,382,006	707.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
R	51 - Participating	637,621	5,371,070	716.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
S	6 - Non-Participating	637,411	5,365,868	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
T	52 - Participating	640,276	5,365,862	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
U	7 - Non-Participating	638,615	5,371,717	720.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
V	8 - Non-Participating	638,435	5,378,666	709.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
W	9 - Non-Participating	640,413	5,369,191	728.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
X	10 - Non-Participating	643,279	5,372,615	722.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Z	53 - Participating	642,413	5,373,644	734.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AA	54 - Participating	643,167	5,375,685	714.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AE	55 - Participating	635,760	5,381,775	711.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AG	57 - Participating	633,480	5,378,691	739.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AH	59 - Participating	643,400	5,373,968	711.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AI	61 - Participating	633,645	5,373,895	713.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AJ	62 - Participating	643,453	5,372,097	716.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AK	63 - Participating	641,300	5,368,154	725.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AO	64 - Participating	639,268	5,377,996	720.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"

To be continued on next page...

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9/15/2018 4:32 AM/3.0.654

SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

No.	Name	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AZ	66 - Participating	638,244	5,370,747	710.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BA	67 - Participating	637,448	5,370,698	712.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BB	68 - Participating	635,378	5,369,828	692.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Shadow, worst case: Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
A	1 - Non-Participating	0:00	0	0:00	0:00
B	39 - Participating	12:38	59	0:22	5:26
C	2 - Non-Participating	5:55	44	0:14	2:11
D	40 - Participating	27:47	58	0:47	9:41
E	41 - Participating	0:00	0	0:00	0:00
F	42 - Participating	61:26	147	0:45	21:29
G	43 - Participating	0:00	0	0:00	0:00
H	44 - Participating	58:22	163	0:42	23:23
I	3 - Non-Participating	11:58	42	0:26	4:52
J	4 - Non-Participating	17:45	63	0:23	7:18
K	45 - Participating	84:54	173	1:05	28:54
L	46 - Participating	8:29	47	0:20	3:04
M	47 - Participating	58:49	155	0:40	20:15
N	48 - Participating	21:36	123	0:20	9:36
O	5 - Non-Participating	35:14	127	0:36	11:02
P	49 - Participating	29:52	146	0:26	10:36
Q	50 - Participating	18:02	73	0:22	5:22
R	51 - Participating	8:04	60	0:13	4:01
S	6 - Non-Participating	35:30	94	0:40	15:22
T	52 - Participating	10:35	42	0:24	4:59
U	7 - Non-Participating	2:22	18	0:12	1:02
V	8 - Non-Participating	72:48	141	0:47	20:19
W	9 - Non-Participating	39:06	94	0:43	10:43
X	10 - Non-Participating	69:06	160	0:47	27:46
Y	11 - Non-Participating	27:27	75	0:43	11:22
Z	53 - Participating	1:39	17	0:09	0:34
AA	54 - Participating	2:03	16	0:12	0:42
AB	12 - Non-Participating	34:26	88	0:41	13:02
AC	13 - Non-Participating	3:02	20	0:11	0:54
AD	14 - Non-Participating	0:00	0	0:00	0:00
AE	55 - Participating	60:07	120	0:48	16:00
AF	15 - Non-Participating	0:00	0	0:00	0:00

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
AG	57 - Participating	35:16	124	0:31	16:53
AH	59 - Participating	12:38	59	0:22	5:28
AI	61 - Participating	0:00	0	0:00	0:00
AJ	62 - Participating	27:50	59	0:47	9:43
AK	63 - Participating	26:22	108	0:32	11:42
AL	16 - Non-Participating	17:58	87	0:31	6:06
AM	17 - Non-Participating	18:11	67	0:22	7:30
AN	18 - Non-Participating	17:54	86	0:22	7:37
AO	64 - Participating	39:28	80	0:48	13:01
AP	19 - Non-Participating	6:40	30	0:21	1:57
AQ	20 - Non-Participating	4:39	28	0:12	1:06
AR	21 - Non-Participating	0:00	0	0:00	0:00
AS	22 - Non-Participating	0:00	0	0:00	0:00
AT	23 - Non-Participating	0:00	0	0:00	0:00
AU	24 - Non-Participating	12:42	42	0:22	4:03
AV	27 - Non-Participating	51:59	144	0:56	17:14
AW	29 - Non-Participating	0:00	0	0:00	0:00
AX	30 - Non-Participating	8:12	42	0:15	2:04
AY	31 - Non-Participating	5:57	39	0:17	2:12
AZ	66 - Participating	14:44	49	0:30	4:03
BA	67 - Participating	18:05	53	0:32	6:06
BB	68 - Participating	0:00	0	0:00	0:00
BC	32 - Non-Participating	0:00	0	0:00	0:00
BD	33 - Non-Participating	0:00	0	0:00	0:00
BE	34 - Non-Participating	0:00	0	0:00	0:00
BF	35 - Non-Participating	0:00	0	0:00	0:00
BG	36 - Non-Participating	0:00	0	0:00	0:00
BH	37 - Non-Participating	6:15	31	0:19	2:34
BI	38 - Non-Participating	0:00	0	0:00	0:00

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	T-43	0:00	0:00
2	T-41	8:41	4:00
3	T-63	2:03	0:42
4	T-62	0:00	0:00
5	T-45	0:00	0:00
6	T-35	2:22	1:02
7	T-47	0:00	0:00
8	T-56	0:00	0:00
9	T-55	0:00	0:00
10	T-39	0:00	0:00
11	T-38	0:00	0:00
12	T-37	0:00	0:00
13	T-70	0:00	0:00
14	T-77	0:00	0:00
15	T-53	0:00	0:00
16	T-67	2:07	0:40
17	T-66	0:00	0:00
18	T-69	17:29	5:02
19	T-93	31:14	15:25
20	T-80	68:26	18:31
21	T-58	0:00	0:00
22	T-73	0:00	0:00
23	T-28	76:14	31:38
24	T-78	33:54	10:36

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
25	T-76	0:00	0:00
26	T-79	0:00	0:00
27	T-46	0:00	0:00
28	T-57	0:00	0:00
29	T-71	7:52	2:36
30	T-59	0:00	0:00
31	T-60	0:00	0:00
32	T-61	0:00	0:00
33	T-40	0:00	0:00
34	T-15	0:00	0:00
35	T-16	0:00	0:00
36	T-17	0:00	0:00
37	T-12	0:00	0:00
38	T-13	1:51	0:44
39	T-26	0:00	0:00
40	T-25	18:05	6:06
41	T-10	2:27	0:55
42	T-8	0:00	0:00
43	T-94	3:40	1:44
44	T-95	8:44	4:12
45	T-96	0:00	0:00
46	T-121	3:56	1:16
47	T-142	52:49	20:35
48	T-131	2:16	1:06
49	T-129	0:00	0:00
50	T-141	8:27	2:44
51	T-123	0:00	0:00
52	T-144	6:32	2:00
53	T-145	5:30	1:48
54	T-146	12:52	3:53
55	T-122	0:00	0:00
56	T-117	14:06	4:21
57	T-130	1:36	0:42
58	T-44	0:00	0:00
59	T-72	26:04	7:07
60	T-75	0:00	0:00
61	T-34	8:04	4:01
62	T-74	0:00	0:00
63	T-81	1:59	0:32
64	T-98	14:59	5:46
65	T-85	0:00	0:00
66	T-86	22:49	6:46
67	T-87	3:35	1:31
68	T-51	19:39	8:05
69	T-23	2:06	1:01
70	T-11	2:28	1:04
71	T-22	42:20	12:42
72	T-5	12:42	4:03
73	T-9	14:16	6:00
74	T-90	6:52	2:00
75	T-91	0:16	0:04
76	T-92	5:17	2:18
77	T-106	3:14	0:53
78	T-100	0:00	0:00
79	T-107	21:15	6:21
80	T-99	3:44	1:28
81	T-143	28:40	13:16
82	T-108	107:16	31:13
83	T-109	5:04	1:47
84	T-110	2:28	0:50

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
85	T-124	2:38	1:05
86	T-88	8:17	3:44
87	T-89	10:44	3:00
88	T-14	0:00	0:00
89	T-24	14:44	4:03
90	T-42	0:00	0:00
91	T-68	7:35	2:21
92	T-21	0:00	0:00
93	T-20	0:00	0:00
94	T-19	0:00	0:00
95	T-18	0:00	0:00
96	T-83	29:41	12:14
97	T-84	13:16	5:44
98	T-54	0:00	0:00
99	T-118	0:00	0:00
100	T-120	5:40	2:31
101	T-105	0:00	0:00
102	T-97	9:22	3:42
103	T-147	0:00	0:00
104	T-148	0:00	0:00
105	T-149	0:00	0:00
106	T-150	0:00	0:00
107	T-151	0:00	0:00
108	T-152	20:51	6:32
109	T-153	13:45	5:28
110	T-154	0:00	0:00
111	T-155	0:00	0:00
112	T-156	34:44	11:46
113	T-157	11:07	3:54
114	T-158	5:48	1:46
115	T-159	33:41	10:17
116	T-160	0:00	0:00
117	T-161	22:23	9:54
118	T-162	0:00	0:00
119	T-163	8:23	3:13
120	T-164	26:57	12:07
121	T-165	6:15	2:34
122	T-166	0:00	0:00
123	T-167	0:00	0:00
124	T-168	2:17	0:59
125	T-169	0:00	0:00
126	T-170	26:00	9:20
127	T-171	8:26	3:40
128	T-172	8:24	2:47
129	T-173	1:26	0:27
130	T-174	14:31	3:36
131	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (1)	0:00	0:00
132	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (2)	0:00	0:00
133	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (3)	0:00	0:00
134	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (4)	0:00	0:00
135	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (5)	0:00	0:00
136	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (6)	0:00	0:00
137	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (7)	0:00	0:00
138	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (8)	0:00	0:00
139	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (9)	0:00	0:00
140	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (10)	0:00	0:00
141	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (11)	0:00	0:00
142	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (12)	0:00	0:00
143	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (13)	0:00	0:00
144	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (14)	0:00	0:00

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Calculated:
9/15/2018 4:32 AM/3.0.654

SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
145	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (15)	0:00	0:00
146	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (16)	0:00	0:00
147	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (17)	0:00	0:00
148	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (18)	0:00	0:00
149	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (19)	0:00	0:00
150	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (20)	0:00	0:00
151	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (21)	4:06	1:25
152	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (22)	0:00	0:00
153	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (23)	0:00	0:00
154	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (24)	0:00	0:00
155	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (25)	0:00	0:00
156	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (26)	0:00	0:00
157	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (27)	0:00	0:00
158	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (28)	0:00	0:00
159	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (29)	0:00	0:00
160	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (30)	0:00	0:00
161	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (31)	0:00	0:00
162	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (32)	0:00	0:00
163	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (33)	0:00	0:00
164	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (34)	0:00	0:00
165	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (35)	0:00	0:00
166	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (36)	0:00	0:00
167	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (37)	0:00	0:00
168	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (38)	0:00	0:00
169	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (39)	0:00	0:00
170	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (40)	0:00	0:00
171	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (41)	0:00	0:00
172	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (42)	0:00	0:00
173	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (43)	0:00	0:00
174	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (44)	0:00	0:00
175	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (45)	0:00	0:00
176	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (46)	0:00	0:00
177	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (47)	12:37	5:12
178	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (48)	0:00	0:00
179	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (49)	0:00	0:00
180	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (50)	0:00	0:00
181	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (51)	0:00	0:00
182	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (52)	0:00	0:00
183	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (53)	0:00	0:00
184	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (54)	0:00	0:00
185	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (55)	0:00	0:00
186	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (56)	0:00	0:00
187	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (57)	0:00	0:00
188	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (58)	0:00	0:00
189	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (59)	0:00	0:00
190	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (60)	0:00	0:00
191	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (61)	0:00	0:00
192	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (62)	0:00	0:00
193	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (63)	0:00	0:00
194	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (64)	0:00	0:00
195	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (65)	0:00	0:00
196	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (66)	0:00	0:00
197	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (67)	0:00	0:00
198	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (68)	0:00	0:00
199	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (69)	0:00	0:00
200	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (70)	0:00	0:00
201	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (71)	1:44	0:42
202	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (72)	0:00	0:00
203	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (73)	0:00	0:00
204	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (74)	0:00	0:00

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SHADOW - Main Result

Calculation: GE 2.5-127 89m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
205	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (75)	0:00	0:00
206	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (76)	0:00	0:00
207	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (77)	0:00	0:00
208	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (78)	0:00	0:00

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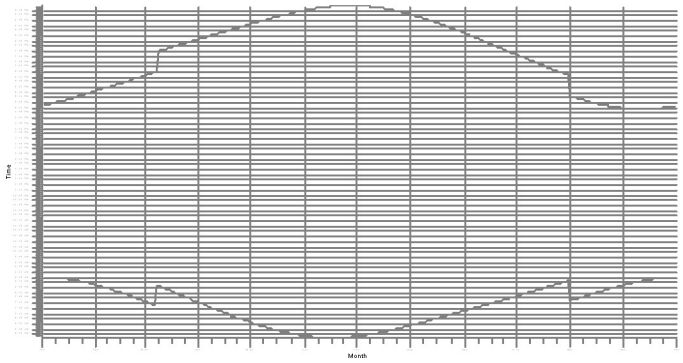
Calculated:
9/15/2018 4:32 AM/3.0.654

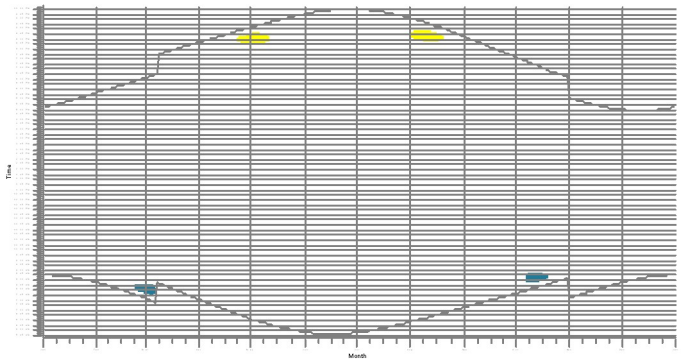
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

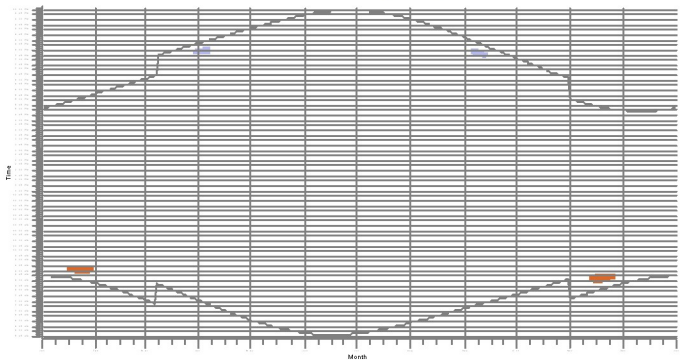
A: 1 - Non-Participating



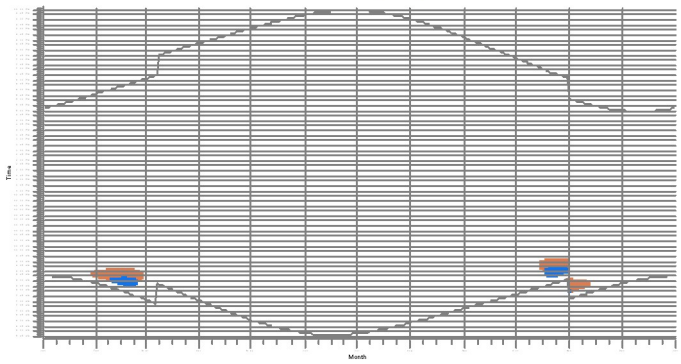
B: 39 - Participating



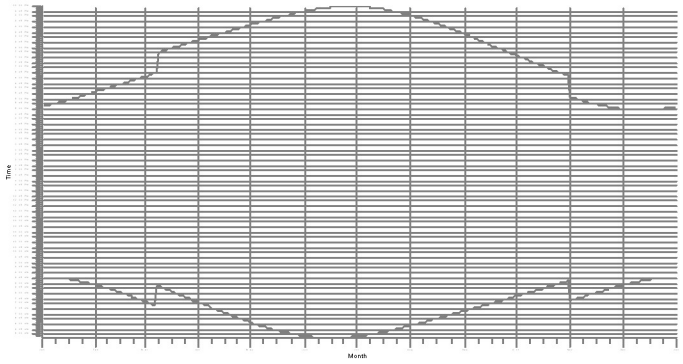
C: 2 - Non-Participating



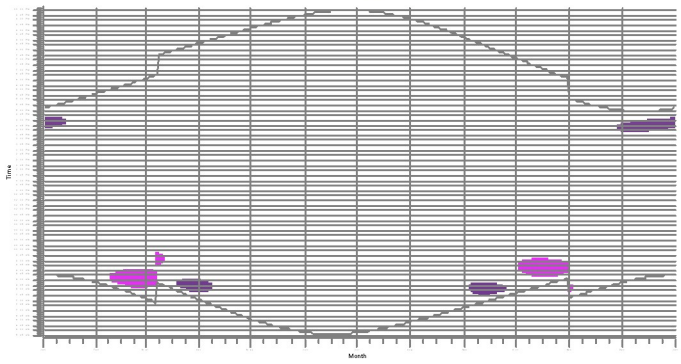
D: 40 - Participating



E: 41 - Participating



F: 42 - Participating



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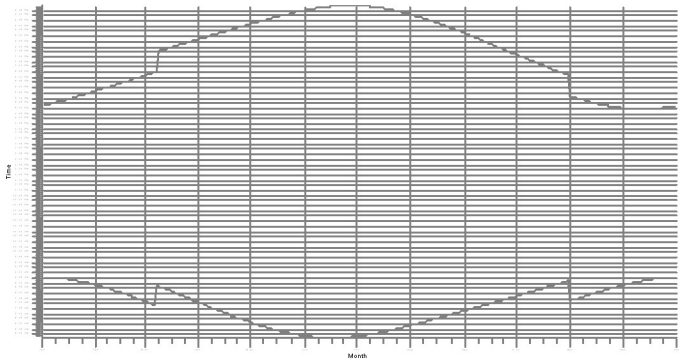
9/15/2018 4:32 AM/3.0.654

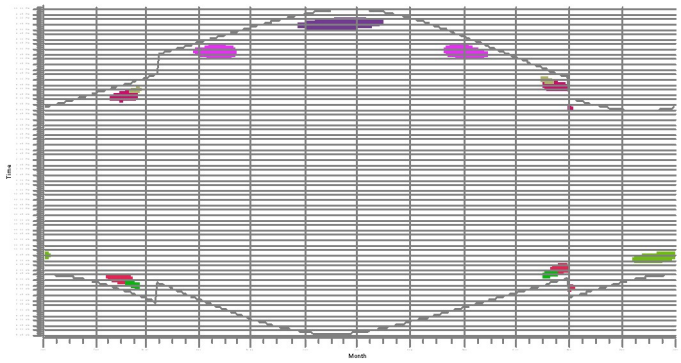
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

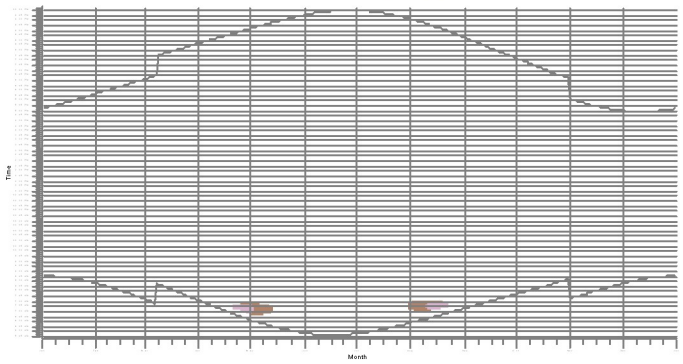
G: 43 - Participating



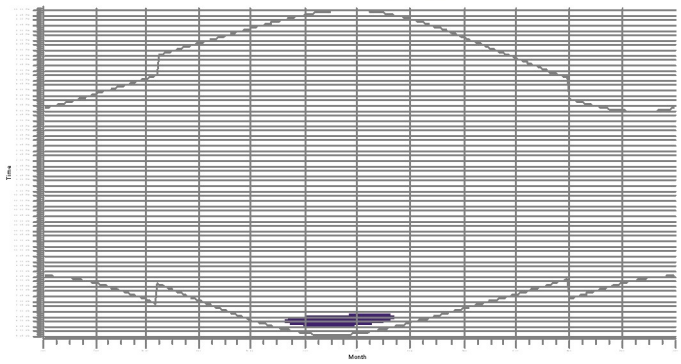
H: 44 - Participating



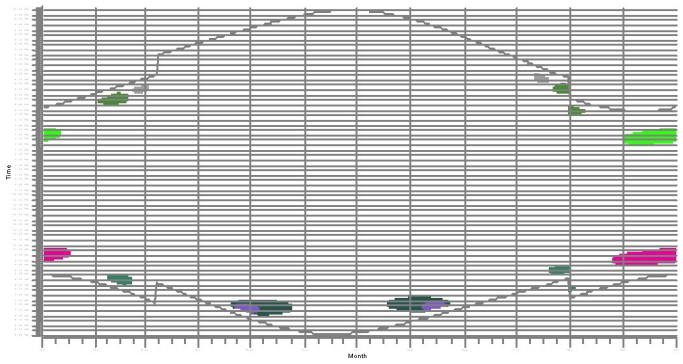
I: 3 - Non-Participating



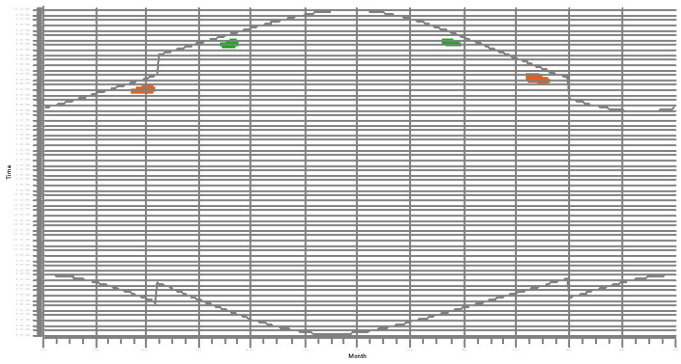
J: 4 - Non-Participating



K: 45 - Participating



L: 46 - Participating



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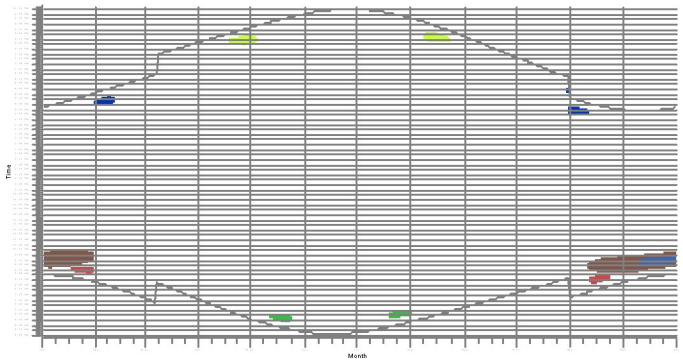
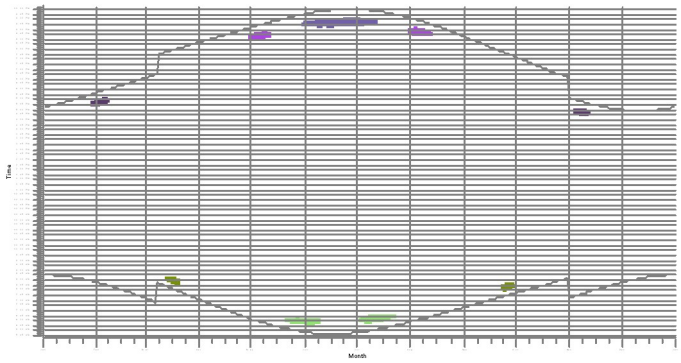
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

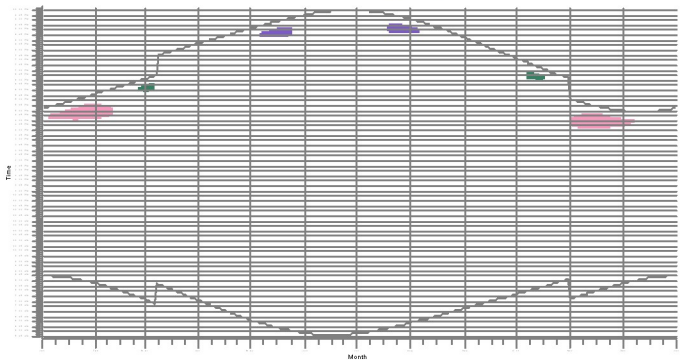
M: 47 - Participating



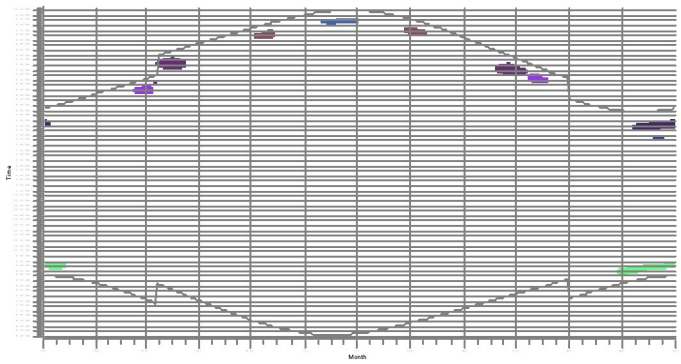
N: 48 - Participating



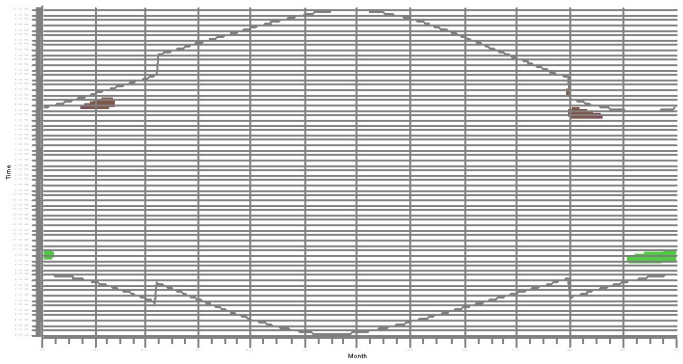
O: 5 - Non-Participating



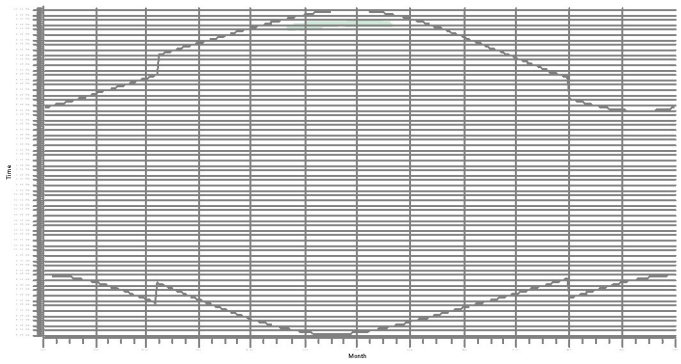
P: 49 - Participating



Q: 50 - Participating



R: 51 - Participating



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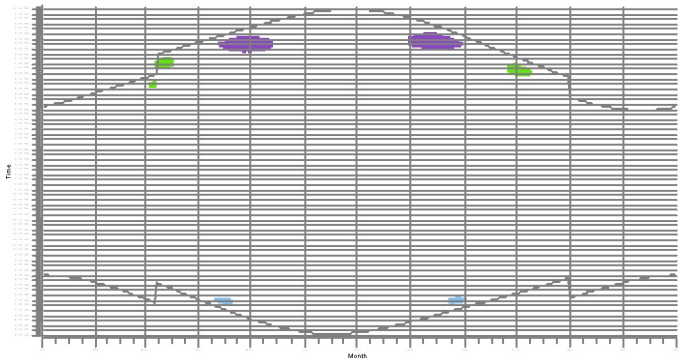
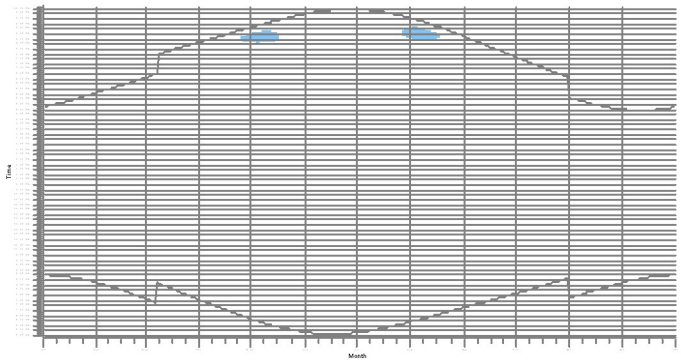
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

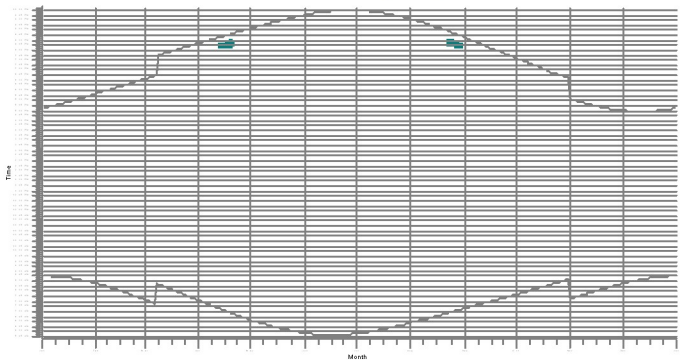
S: 6 - Non-Participating



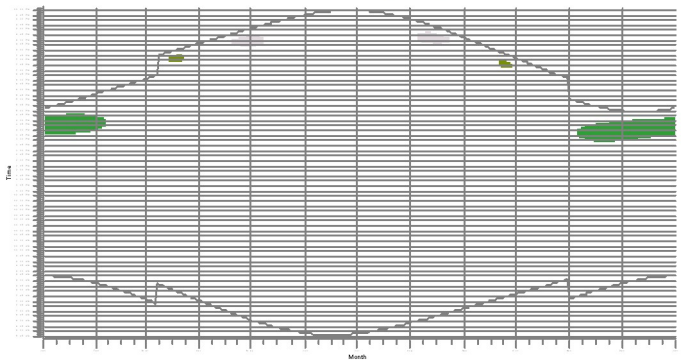
T: 52 - Participating



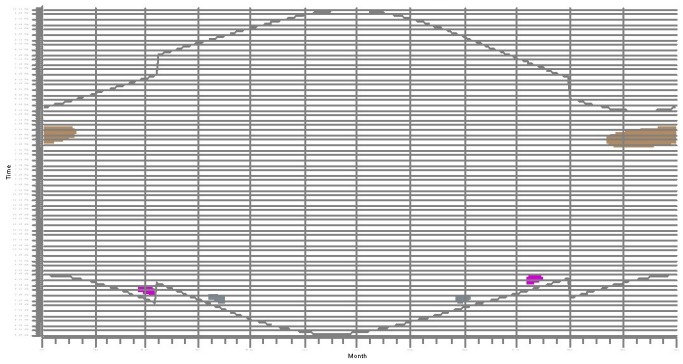
U: 7 - Non-Participating



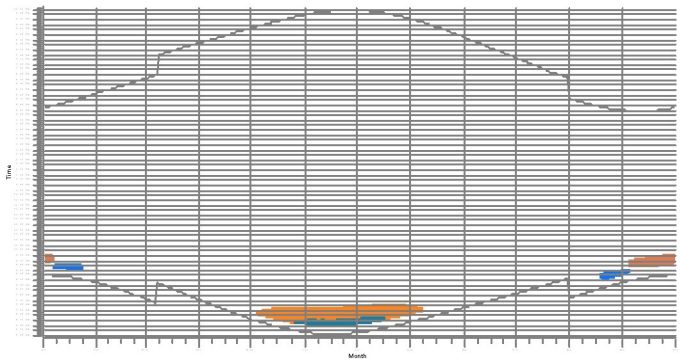
V: 8 - Non-Participating



W: 9 - Non-Participating



X: 10 - Non-Participating



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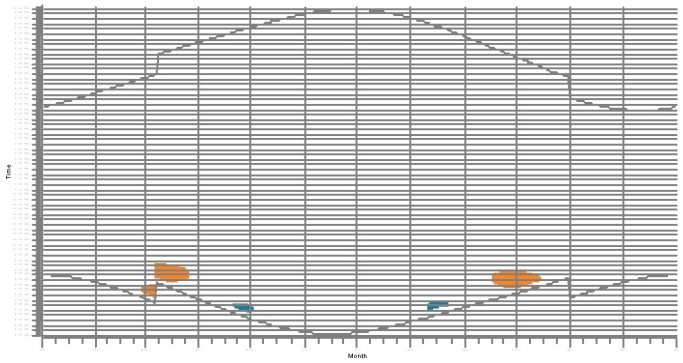
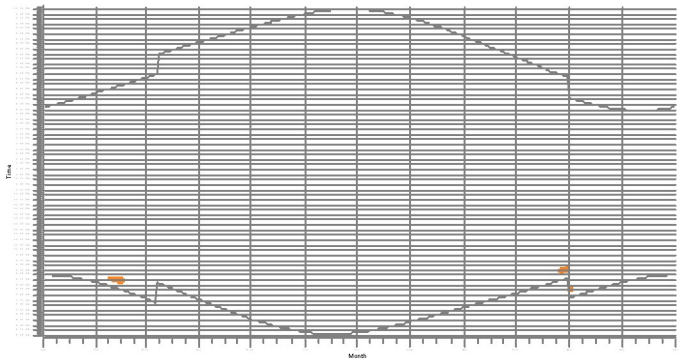
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

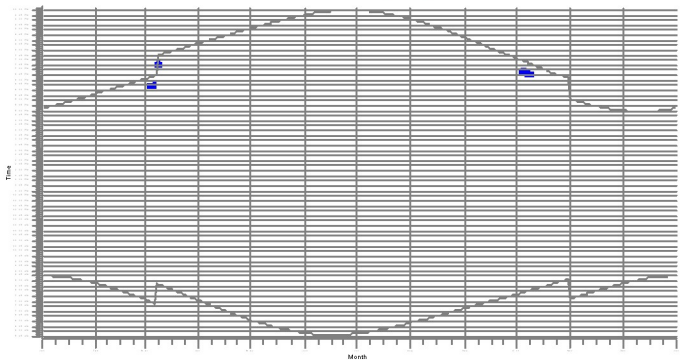
Y: 11 - Non-Participating



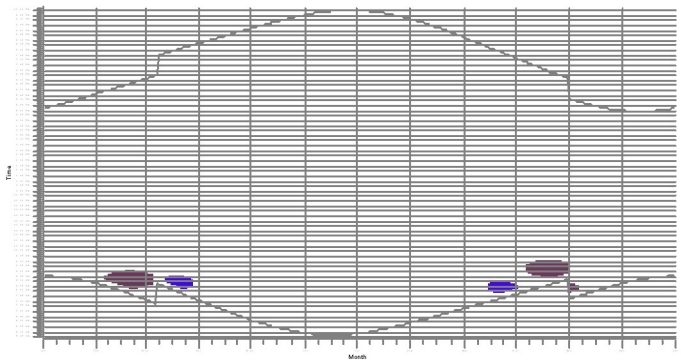
Z: 53 - Participating



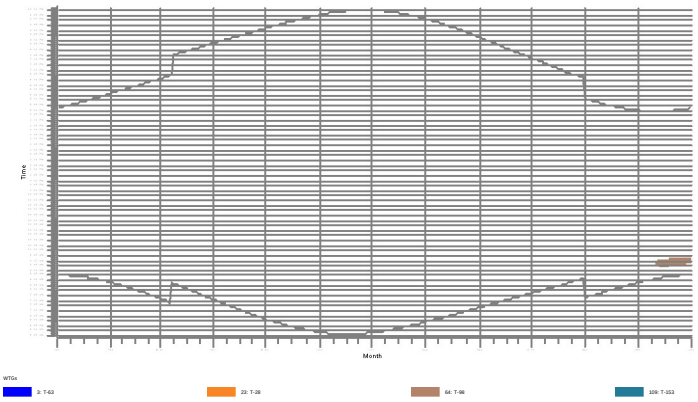
AA: 54 - Participating



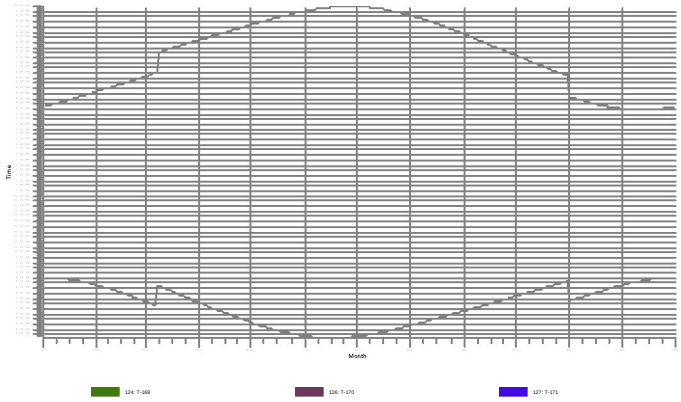
AB: 12 - Non-Participating



AC: 13 - Non-Participating



AD: 14 - Non-Participating



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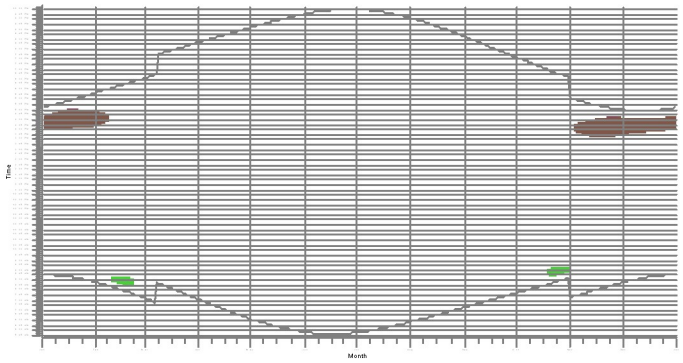
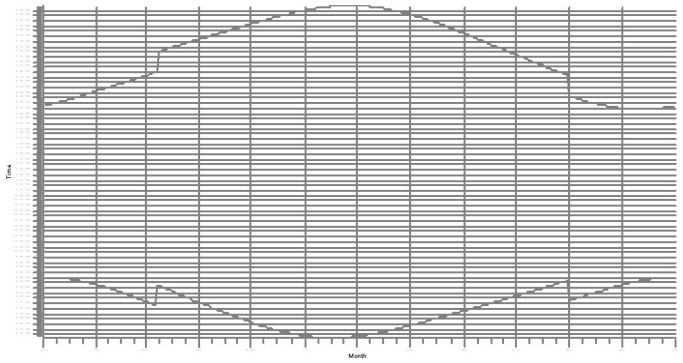
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

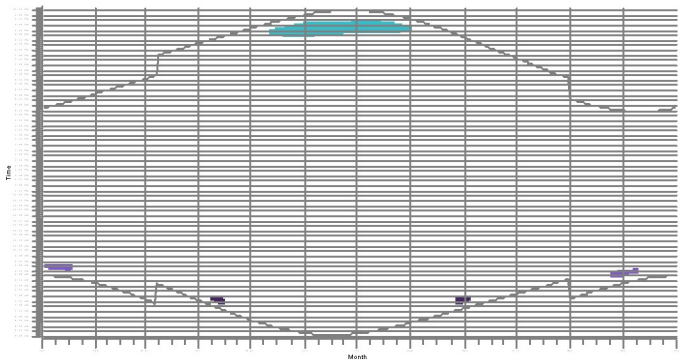
AE: 55 - Participating



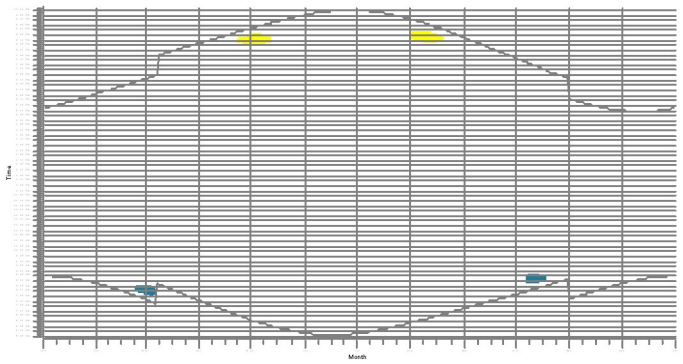
AF: 15 - Non-Participating



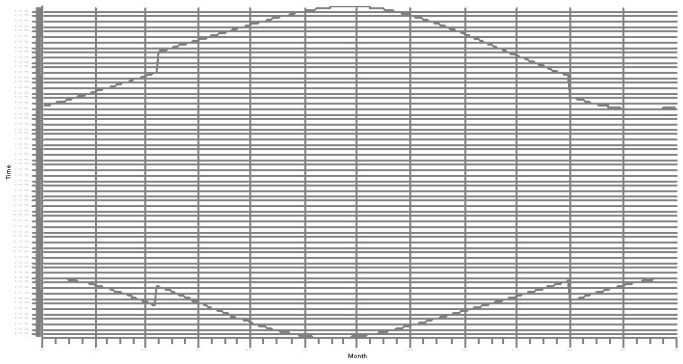
AG: 57 - Participating



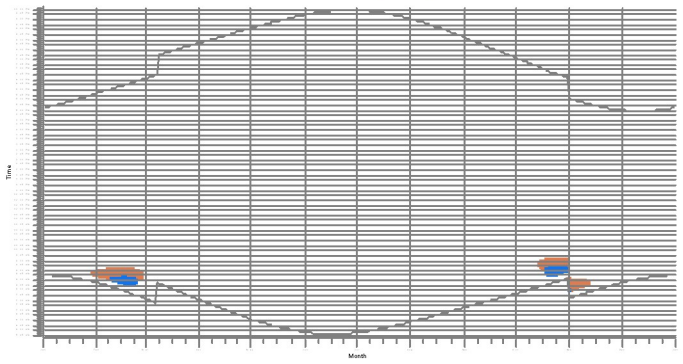
AH: 59 - Participating



AI: 61 - Participating



AJ: 62 - Participating



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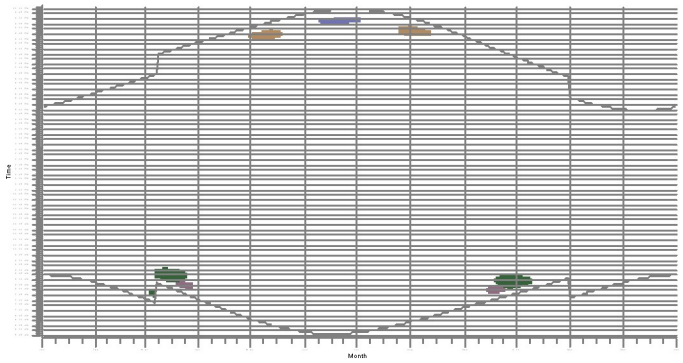
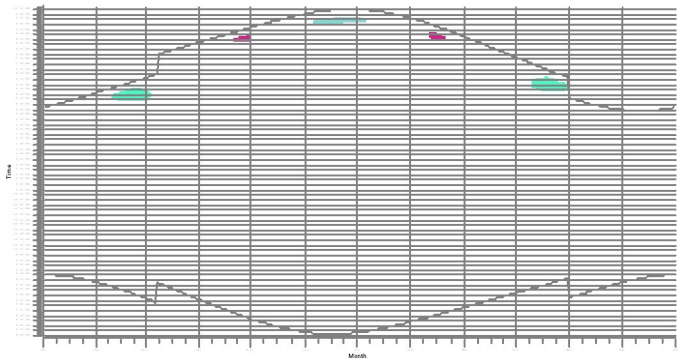
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

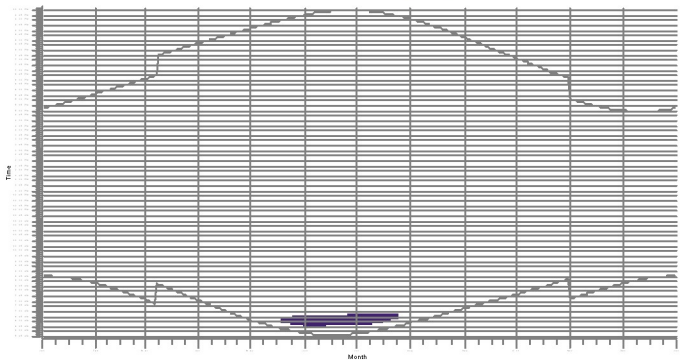
AK: 63 - Participating



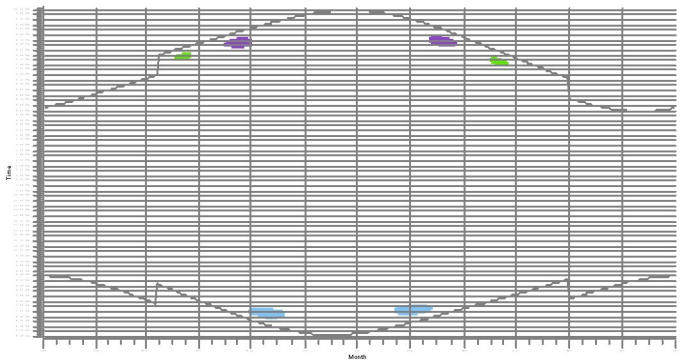
AL: 16 - Non-Participating



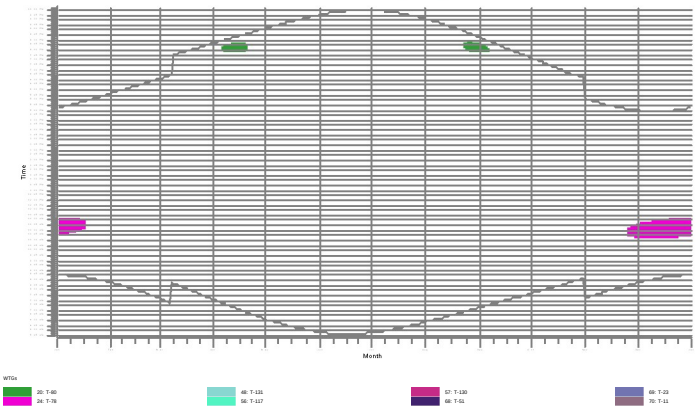
AM: 17 - Non-Participating



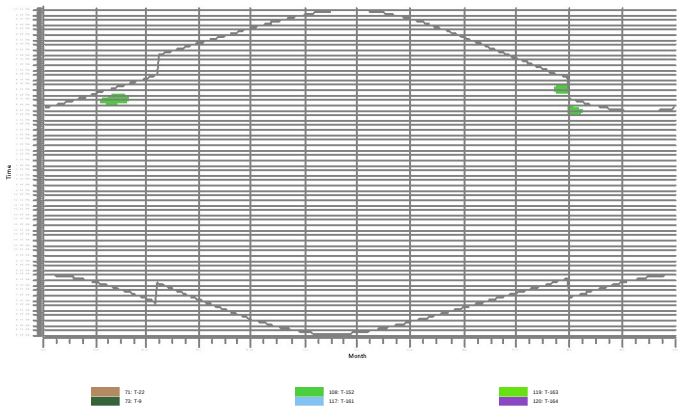
AN: 18 - Non-Participating



AO: 64 - Participating



AP: 19 - Non-Participating



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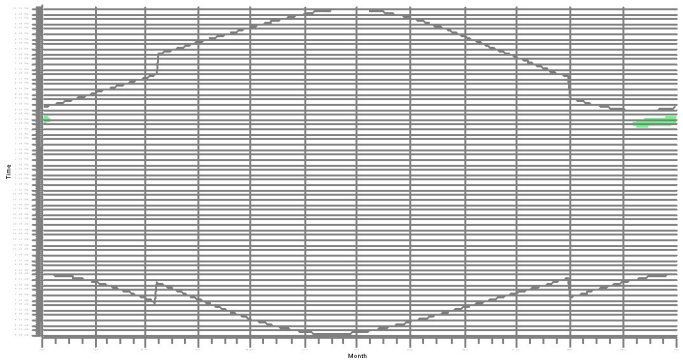
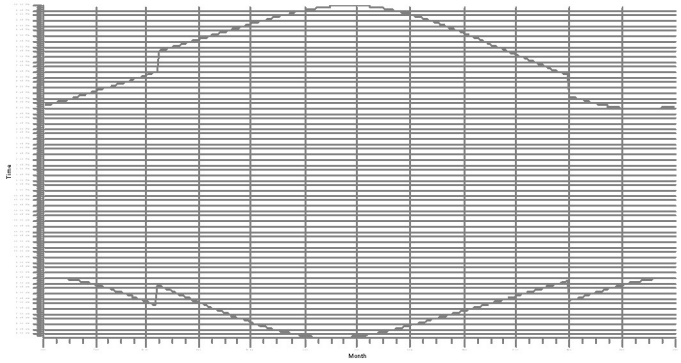
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

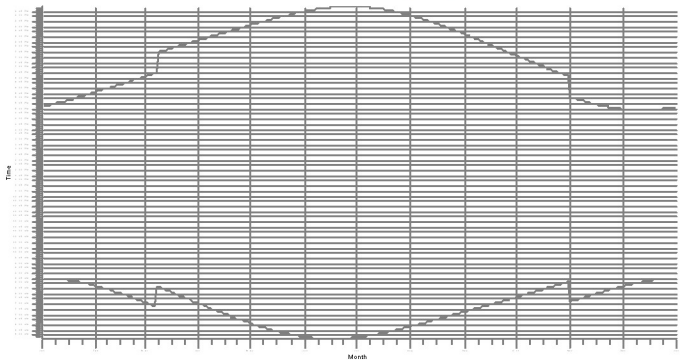
AQ: 20 - Non-Participating



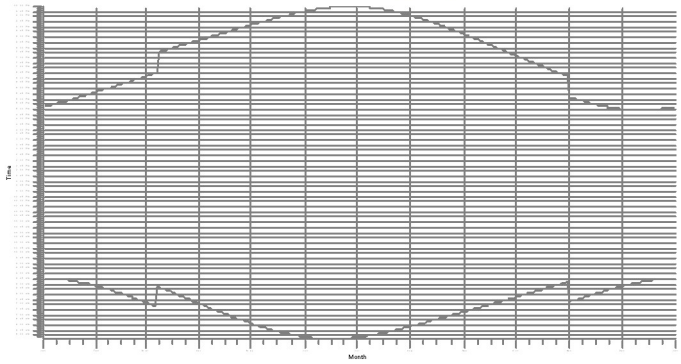
AR: 21 - Non-Participating



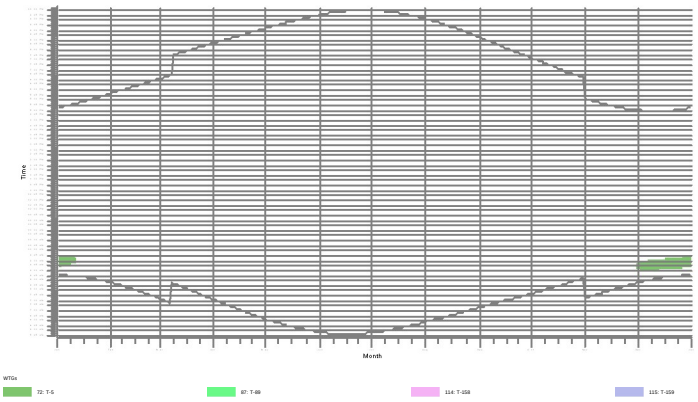
AS: 22 - Non-Participating



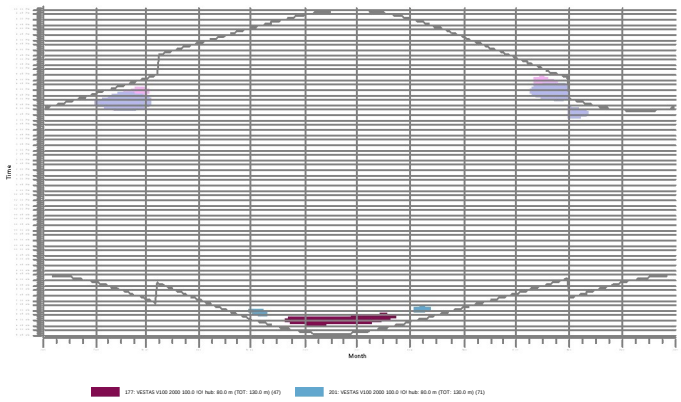
AT: 23 - Non-Participating



AU: 24 - Non-Participating



AV: 27 - Non-Participating



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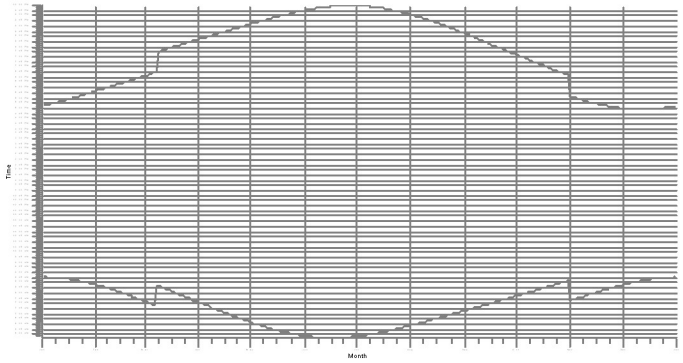
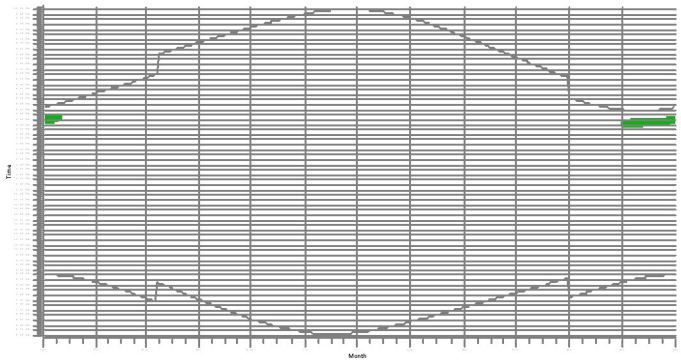
Calculation: GE 2.5-127 89m HH Shadow Flicker

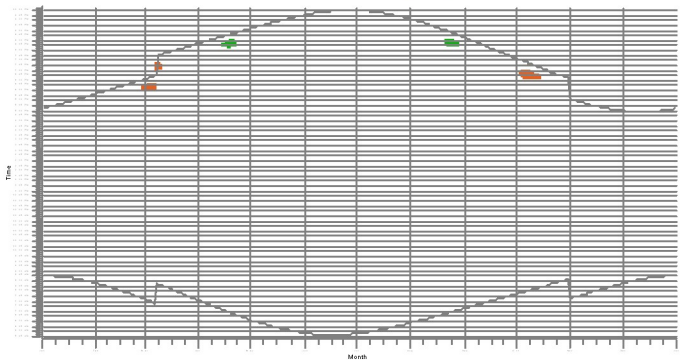
AW: 29 - Non-Participating



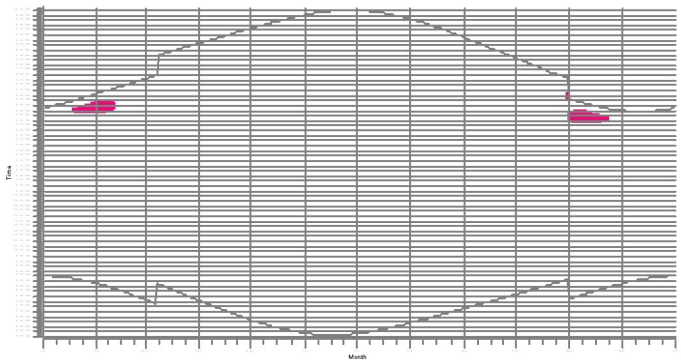
AX: 30 - Non-Participating



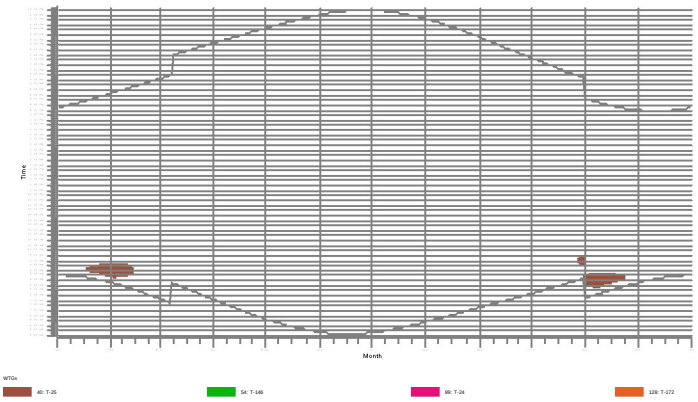
AY: 31 - Non-Participating



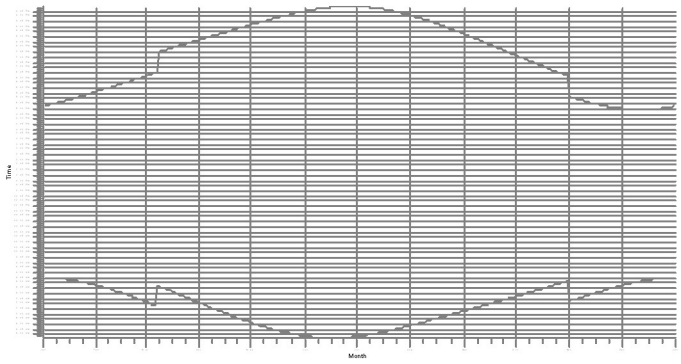
AZ: 66 - Participating



BA: 67 - Participating



BB: 68 - Participating



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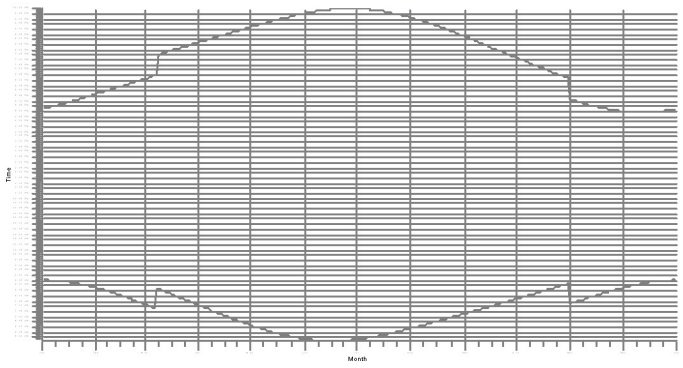
9/15/2018 4:32 AM/3.0.654

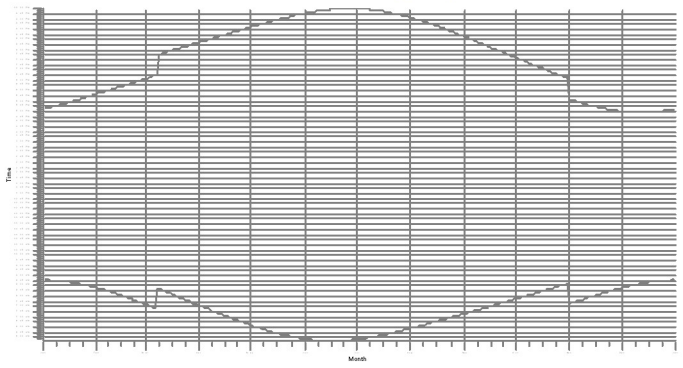
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

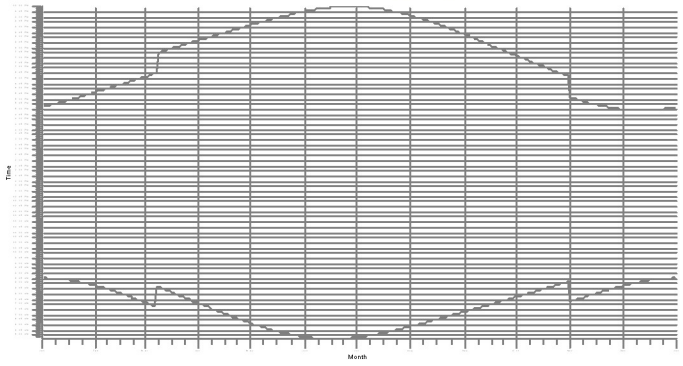
BC: 32 - Non-Participating



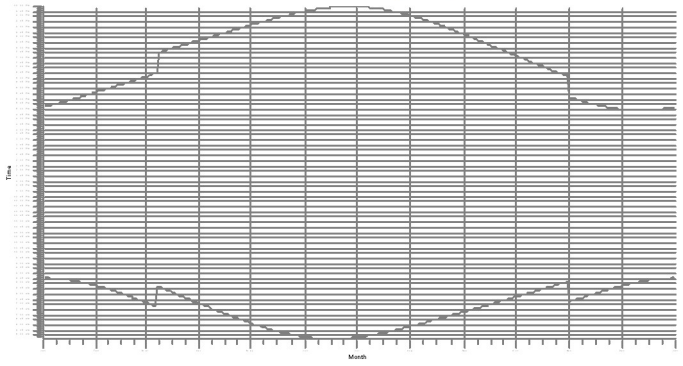
BD: 33 - Non-Participating



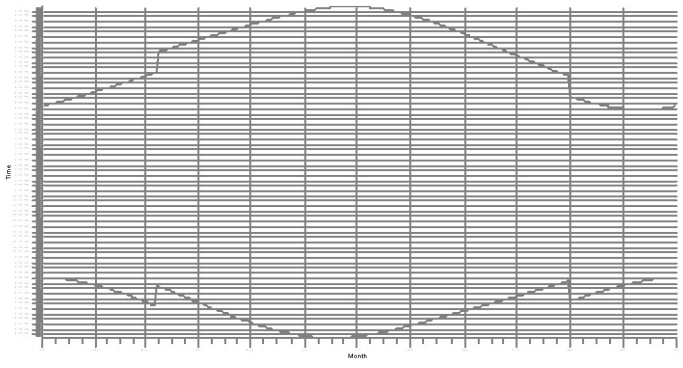
BE: 34 - Non-Participating



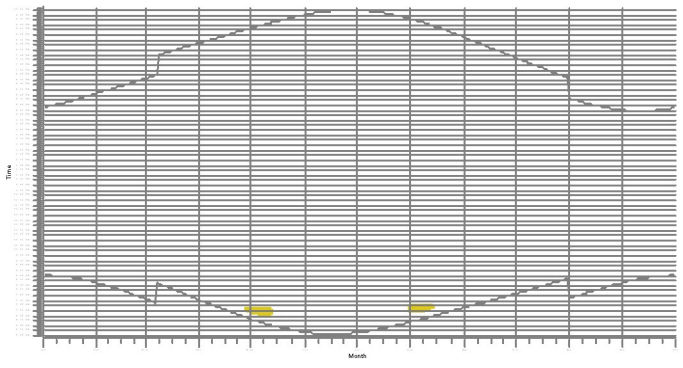
BF: 35 - Non-Participating



BG: 36 - Non-Participating



BH: 37 - Non-Participating



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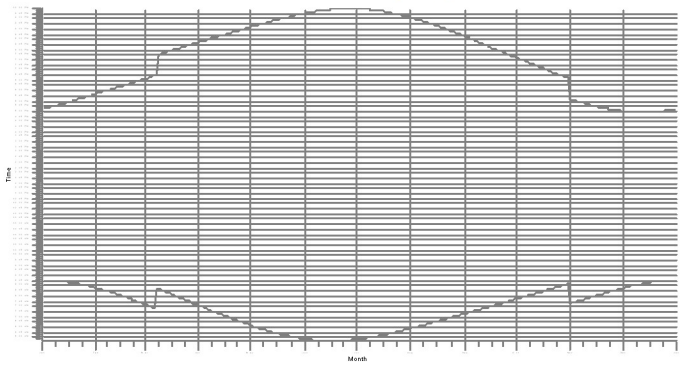
SHADOW - Calendar, graphical

Calculation: GE 2.5-127 89m HH Shadow Flicker

BI: 38 - Non-Participating



WTGs

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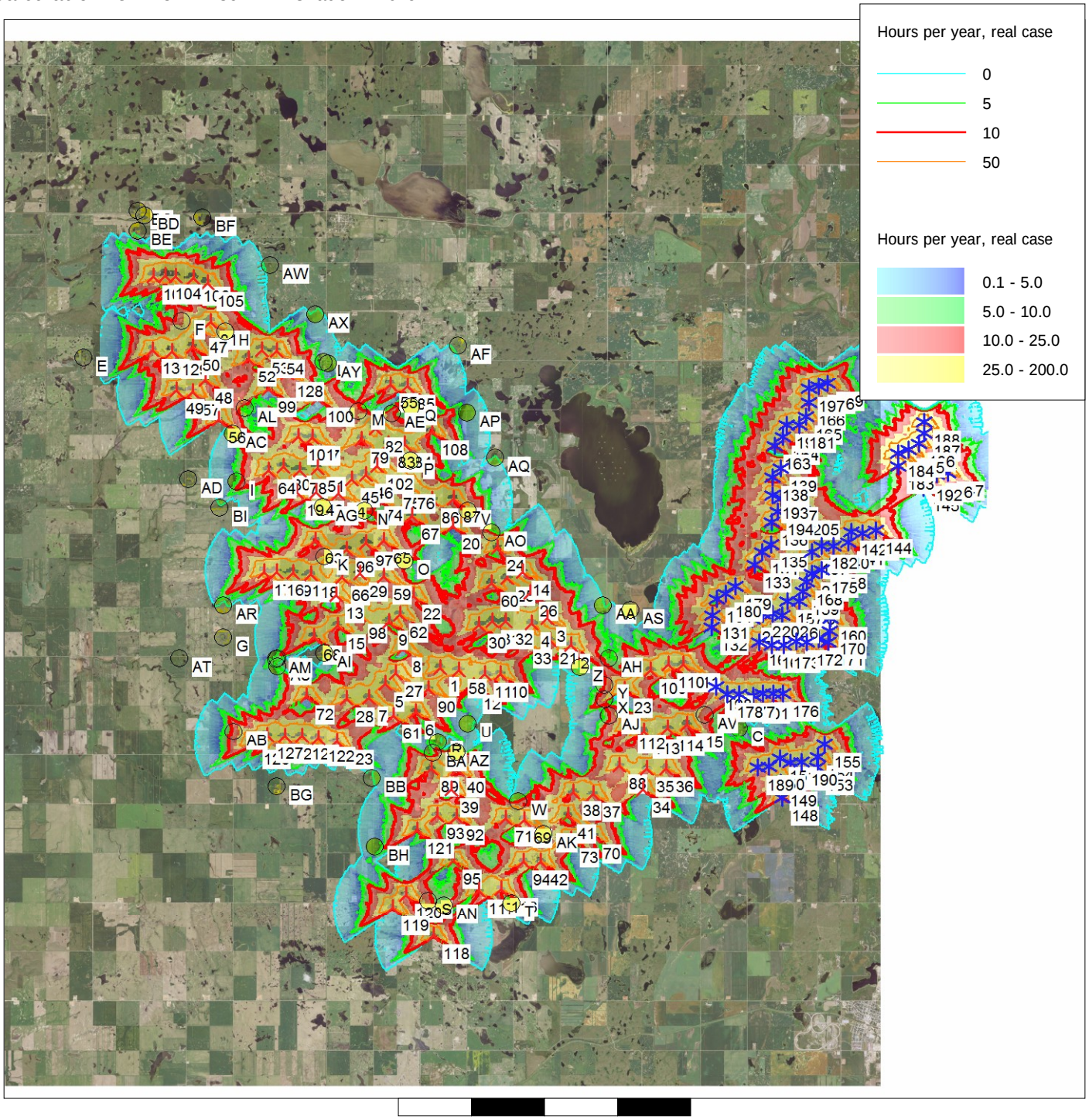
SHADOW - Map

Calculation: GE 2.5-127 89m HH Shadow Flicker



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 640,676 North: 5,375,910

New WTG Existing WTG Shadow receptor

Flicker map level: Height Contours: 150921_TWE_LindahlWest_10ftHCLsfrom10mNED.wpo (3)

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SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

Assumptions for shadow calculations

Maximum distance for influence	2,000	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational hours are calculated from WTGs in calculation and wind distribution:
0162 3/18 SDO

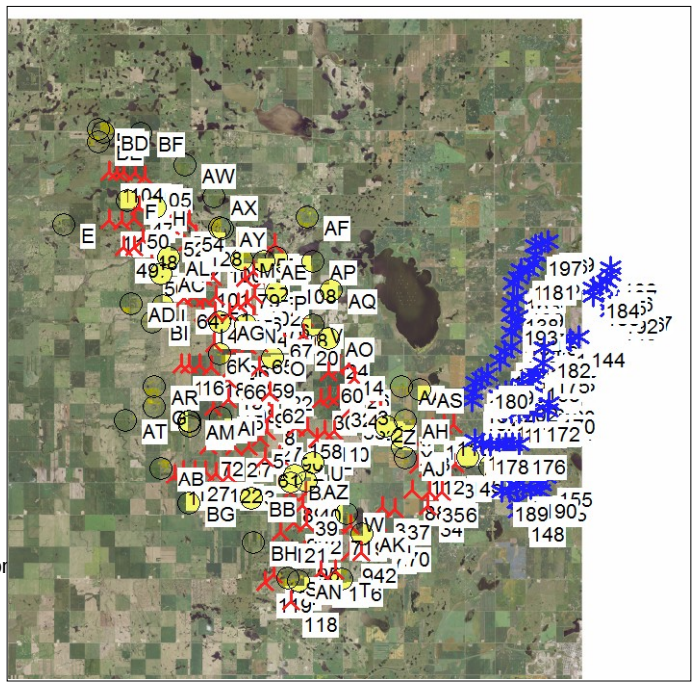
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
722	459	308	340	523	950	724	582	734	1,008	1,127	1,176	8,652

Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: 150921_TWE_LindahlWest_10ftHCLsfron
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m

All coordinates are in
UTM WGS84 Zone: 13



Scale 1:400,000

New WTG
Existing WTG
Shadow receptor

WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
1	637,619	5,373,512	727.5	T-43	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
2	642,085	5,374,363	728.5	T-41	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
3	641,252	5,375,220	737.7	T-63	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
4	640,729	5,375,038	740.7	T-62	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
5	635,764	5,372,945	724.6	T-45	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
6	636,817	5,372,047	728.5	T-35	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
7	635,193	5,372,473	710.2	T-47	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
8	636,346	5,374,109	734.6	T-56	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
9	635,830	5,374,972	728.5	T-55	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
10	639,692	5,373,363	740.7	T-39	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
11	639,157	5,373,344	739.4	T-38	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
12	638,790	5,372,951	734.6	T-37	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
13	633,988	5,375,810	737.6	T-70	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
14	640,372	5,376,713	738.1	T-77	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
15	634,074	5,374,798	721.2	T-53	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
16	631,934	5,376,511	729.8	T-67	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
17	631,510	5,376,507	731.5	T-66	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
18	633,108	5,376,447	723.9	T-69	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
19	632,563	5,379,145	737.6	T-93	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
20	637,951	5,378,169	715.2	T-80	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
21	641,389	5,374,486	743.7	T-58	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
22	636,640	5,375,835	734.6	T-73	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
23	643,972	5,372,967	712.3	T-28	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
24	639,495	5,377,499	738.7	T-78	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
25	639,840	5,376,489	737.6	T-76	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
26	640,649	5,376,031	731.5	T-79	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
27	636,095	5,373,292	733.9	T-46	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0

To be continued on next page...

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Calculated:
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SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
28	634,438	5,372,432	701.0	T-57	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
29	634,798	5,376,526	725.4	T-71	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
30	638,928	5,374,941	737.6	T-59	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
31	639,384	5,375,074	737.6	T-60	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
32	639,838	5,375,100	737.6	T-61	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
33	640,492	5,374,466	743.6	T-40	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
34	644,695	5,369,685	736.0	T-15	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
35	644,792	5,370,371	743.7	T-16	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
36	645,456	5,370,405	735.1	T-17	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
37	642,975	5,369,494	737.6	T-12	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
38	642,303	5,369,536	734.9	T-13	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
39	638,102	5,369,527	710.5	T-26	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
40	638,282	5,370,192	712.5	T-25	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
41	642,122	5,368,780	734.6	T-10	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
42	641,239	5,367,252	719.1	T-8	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
43	633,243	5,379,162	737.6	T-94	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
44	634,001	5,379,136	737.6	T-95	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
45	634,443	5,379,605	731.5	T-96	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
46	634,918	5,379,749	728.5	T-121	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
47	629,136	5,384,387	713.2	T-142	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
48	629,347	5,382,713	710.2	T-131	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
49	628,366	5,382,343	707.1	T-129	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
50	628,893	5,383,804	717.2	T-141	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
51	633,253	5,379,950	729.4	T-123	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
52	630,815	5,383,459	711.9	T-144	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
53	631,275	5,383,767	710.7	T-145	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
54	631,767	5,383,732	713.2	T-146	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
55	635,699	5,382,724	710.2	T-122	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
56	629,834	5,381,441	713.0	T-117	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
57	628,926	5,382,328	703.0	T-130	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
58	638,268	5,373,457	731.5	T-44	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
59	635,628	5,376,434	728.5	T-72	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
60	639,307	5,376,310	731.5	T-75	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
61	636,056	5,371,908	719.3	T-34	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
62	636,215	5,375,218	731.5	T-74	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
63	633,243	5,377,581	731.5	T-81	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
64	631,582	5,379,814	726.8	T-98	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
65	635,586	5,377,640	725.5	T-85	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
66	634,183	5,376,389	733.5	T-86	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
67	636,542	5,378,452	715.1	T-87	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
68	633,261	5,374,418	716.3	T-51	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
69	640,641	5,368,602	728.5	T-23	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
70	643,024	5,368,138	728.5	T-11	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
71	639,998	5,368,634	725.4	T-22	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
72	633,064	5,372,478	698.0	T-5	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
73	642,243	5,368,015	730.6	T-9	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
74	635,270	5,379,029	725.4	T-90	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
75	635,883	5,379,448	720.6	T-91	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
76	636,364	5,379,455	716.0	T-92	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
77	633,072	5,380,925	729.9	T-106	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
78	632,659	5,379,855	737.2	T-100	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
79	634,758	5,380,905	718.9	T-107	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
80	632,089	5,379,958	731.5	T-99	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
81	629,494	5,384,648	709.6	T-143	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
82	635,222	5,381,271	716.3	T-108	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
83	635,678	5,380,785	716.0	T-109	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
84	636,220	5,380,785	716.3	T-110	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
85	636,276	5,382,673	710.2	T-124	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
86	637,208	5,379,005	710.9	T-88	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0

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Kevin Walter / kwalter@tradewindenergy.com

SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
87	637,941	5,379,046	713.2	T-89	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
88	643,859	5,370,443	732.3	T-14	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
89	637,408	5,370,185	701.0	T-24	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
90	637,234	5,372,817	719.9	T-42	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
91	632,509	5,376,501	722.8	T-68	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
92	638,306	5,368,644	716.3	T-21	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
93	637,648	5,368,666	713.2	T-20	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
94	640,643	5,367,238	719.3	T-19	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
95	638,242	5,367,207	710.2	T-18	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
96	634,318	5,377,326	731.6	T-83	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
97	634,979	5,377,549	725.3	T-84	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
98	634,798	5,375,163	713.2	T-54	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
99	631,532	5,382,484	707.7	T-118	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
100	633,206	5,382,201	722.4	T-120	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
101	632,585	5,380,949	731.5	T-105	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
102	635,298	5,380,049	728.5	T-97	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
103	627,504	5,386,079	711.3	T-147	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
104	627,911	5,386,105	710.2	T-148	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
105	629,368	5,385,888	704.0	T-149	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
106	628,867	5,386,049	710.2	T-150	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
107	628,269	5,386,086	711.9	T-151	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
108	637,149	5,381,224	704.1	T-152	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
109	644,833	5,373,605	713.9	T-153	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
110	645,462	5,373,811	728.5	T-154	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
111	645,966	5,373,838	730.1	T-155	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
112	644,144	5,371,765	710.2	T-156	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
113	644,660	5,371,616	715.4	T-157	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
114	645,479	5,371,724	719.3	T-158	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
115	646,127	5,371,875	717.1	T-159	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
116	639,890	5,366,309	710.2	T-160	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
117	639,135	5,366,239	709.0	T-161	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
118	637,617	5,364,719	707.6	T-162	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
119	636,191	5,365,609	711.4	T-163	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
120	636,640	5,366,042	710.2	T-164	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
121	636,954	5,368,164	711.3	T-165	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
122	633,495	5,371,087	689.0	T-166	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
123	634,130	5,371,006	696.6	T-167	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
124	632,359	5,371,139	688.8	T-168	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
125	632,926	5,371,158	686.0	T-169	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
126	631,283	5,370,947	682.8	T-170	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
127	631,732	5,371,159	684.7	T-171	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
128	632,154	5,382,999	713.2	T-172	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
129	628,195	5,383,647	711.6	T-173	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
130	627,535	5,383,666	710.2	T-174	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	105.0	0.0
131	646,913	5,375,455	745.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
132	646,888	5,375,080	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
133	648,328	5,377,151	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
134	648,570	5,377,592	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
135	648,872	5,377,853	752.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
136	648,872	5,378,572	753.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
137	649,189	5,379,368	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
138	648,868	5,380,034	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
139	649,124	5,380,328	729.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
140	651,007	5,377,868	748.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
141	651,525	5,378,000	750.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
142	651,616	5,378,348	758.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
143	651,987	5,378,290	755.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
144	652,436	5,378,405	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
145	654,047	5,379,834	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

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Calculated:
9/15/2018 2:06 AM/3.0.654

SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

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	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
146	654,478	5,380,290	740.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
147	654,876	5,380,346	731.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
148	649,468	5,369,552	735.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
149	649,403	5,370,046	745.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
150	648,989	5,370,563	740.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
151	649,348	5,370,846	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
152	649,714	5,370,690	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
153	650,635	5,370,574	746.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
154	650,667	5,370,918	744.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
155	650,882	5,371,340	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
156	649,309	5,375,532	733.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
157	649,484	5,375,990	732.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
158	649,889	5,375,994	741.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
159	650,008	5,376,322	740.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
160	650,956	5,375,465	750.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
161	648,982	5,374,557	737.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
162	648,553	5,374,643	733.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
163	648,903	5,381,054	722.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
164	649,170	5,381,363	721.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
165	649,950	5,382,038	713.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
166	650,030	5,382,496	712.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
167	650,267	5,377,632	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
168	650,119	5,376,640	740.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
169	650,663	5,383,159	707.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
170	650,947	5,375,049	753.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
171	650,911	5,374,694	758.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
172	650,163	5,374,664	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
173	649,378	5,374,555	741.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
174	649,818	5,374,694	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
175	650,613	5,377,049	737.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
176	649,406	5,372,982	725.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
177	647,909	5,372,903	716.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
178	647,487	5,372,910	715.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
179	647,672	5,376,428	744.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
180	647,365	5,376,192	740.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
181	649,728	5,381,758	721.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
182	650,599	5,377,842	746.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
183	653,143	5,380,511	713.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
184	653,130	5,380,927	710.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
185	653,497	5,381,062	704.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
186	653,850	5,381,276	700.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
187	654,022	5,381,604	696.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
188	654,011	5,381,966	694.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
189	648,594	5,370,523	731.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
190	650,092	5,370,737	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
191	647,056	5,376,002	741.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
192	654,134	5,380,179	733.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
193	648,870	5,379,452	759.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
194	649,079	5,378,913	759.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
195	649,308	5,381,738	716.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
196	650,346	5,383,045	709.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
197	650,021	5,382,956	710.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
198	647,090	5,373,129	713.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
199	649,061	5,372,960	722.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
200	648,724	5,372,961	720.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
201	648,383	5,372,886	719.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
202	648,975	5,375,560	735.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
203	648,641	5,375,554	726.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
204	648,297	5,375,376	728.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

To be continued on next page...

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Calculated:
9/15/2018 2:06 AM/3.0.654

SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

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	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
205	649,928	5,378,956	741.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
206	650,591	5,374,779	748.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
207	650,301	5,376,922	735.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
208	650,917	5,377,197	740.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

Shadow receptor-Input

No.	Name	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	1 - Non-Participating	644,116	5,375,554	701.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
B	39 - Participating	643,400	5,373,971	711.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
C	2 - Non-Participating	647,930	5,371,801	718.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
D	40 - Participating	643,453	5,372,099	716.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
E	41 - Participating	625,162	5,383,364	711.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
F	42 - Participating	628,500	5,384,644	704.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
G	43 - Participating	630,148	5,374,326	691.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
H	44 - Participating	629,997	5,384,325	711.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
I	3 - Non-Participating	630,488	5,379,437	722.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
J	4 - Non-Participating	632,031	5,373,676	696.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
K	45 - Participating	633,554	5,377,057	735.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
L	46 - Participating	633,395	5,383,413	715.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
M	47 - Participating	634,615	5,381,825	716.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
N	48 - Participating	634,891	5,378,584	728.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
O	5 - Non-Participating	636,328	5,376,974	731.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
P	49 - Participating	636,455	5,380,259	709.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Q	50 - Participating	636,416	5,382,006	707.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
R	51 - Participating	637,621	5,371,070	716.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
S	6 - Non-Participating	637,411	5,365,868	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
T	52 - Participating	640,276	5,365,862	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
U	7 - Non-Participating	638,615	5,371,717	720.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
V	8 - Non-Participating	638,435	5,378,666	709.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
W	9 - Non-Participating	640,413	5,369,191	728.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
X	10 - Non-Participating	643,279	5,372,615	722.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Z	53 - Participating	642,413	5,373,644	734.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AA	54 - Participating	643,167	5,375,685	714.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AE	55 - Participating	635,760	5,381,775	711.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AG	57 - Participating	633,480	5,378,691	739.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AH	59 - Participating	643,400	5,373,968	711.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AI	61 - Participating	633,645	5,373,895	713.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AJ	62 - Participating	643,453	5,372,097	716.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AK	63 - Participating	641,300	5,368,154	725.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AO	64 - Participating	639,268	5,377,996	720.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"

To be continued on next page...

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Calculated:
9/15/2018 2:06 AM/3.0.654

SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

...continued from previous page

No.	Name	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AZ	66 - Participating	638,244	5,370,747	710.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BA	67 - Participating	637,448	5,370,698	712.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BB	68 - Participating	635,378	5,369,828	692.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

		Shadow, worst case			Shadow, expected values
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
A	1 - Non-Participating	0:00	0	0:00	0:00
B	39 - Participating	17:11	67	0:25	7:28
C	2 - Non-Participating	6:53	46	0:14	2:37
D	40 - Participating	34:49	63	0:53	12:19
E	41 - Participating	0:00	0	0:00	0:00
F	42 - Participating	75:40	161	0:48	26:44
G	43 - Participating	0:00	0	0:00	0:00
H	44 - Participating	75:58	174	0:54	29:39
I	3 - Non-Participating	16:02	50	0:29	6:36
J	4 - Non-Participating	19:57	62	0:25	8:16
K	45 - Participating	125:25	201	1:19	42:38
L	46 - Participating	12:05	55	0:24	4:27
M	47 - Participating	75:01	171	0:48	26:17
N	48 - Participating	32:07	139	0:27	14:03
O	5 - Non-Participating	45:50	143	0:39	14:47
P	49 - Participating	51:48	154	0:49	17:07
Q	50 - Participating	29:00	91	0:30	8:55
R	51 - Participating	12:41	62	0:17	6:20
S	6 - Non-Participating	47:15	108	0:43	20:44
T	52 - Participating	14:36	49	0:28	6:57
U	7 - Non-Participating	3:32	22	0:15	1:33
V	8 - Non-Participating	86:38	159	0:50	24:47
W	9 - Non-Participating	56:06	112	0:50	15:39
X	10 - Non-Participating	86:00	164	0:56	34:25
Y	11 - Non-Participating	36:08	87	0:47	15:12
Z	53 - Participating	2:53	20	0:13	1:01
AA	54 - Participating	2:57	19	0:15	1:02
AB	12 - Non-Participating	42:50	97	0:44	16:32
AC	13 - Non-Participating	7:16	32	0:17	2:17
AD	14 - Non-Participating	0:00	0	0:00	0:00
AE	55 - Participating	71:47	129	0:51	19:19
AF	15 - Non-Participating	0:00	0	0:00	0:00
AG	57 - Participating	42:54	138	0:35	20:24
AH	59 - Participating	17:08	67	0:25	7:29
AI	61 - Participating	0:00	0	0:00	0:00
AJ	62 - Participating	34:43	64	0:53	12:18
AK	63 - Participating	32:49	101	0:37	14:41

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SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

...continued from previous page

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
AL	16 - Non-Participating	23:26	98	0:34	8:11
AM	17 - Non-Participating	20:47	66	0:24	8:38
AN	18 - Non-Participating	25:27	96	0:26	10:57
AO	64 - Participating	64:22	102	0:59	21:30
AP	19 - Non-Participating	8:57	34	0:24	2:39
AQ	20 - Non-Participating	7:47	36	0:16	1:55
AR	21 - Non-Participating	0:00	0	0:00	0:00
AS	22 - Non-Participating	0:00	0	0:00	0:00
AT	23 - Non-Participating	0:00	0	0:00	0:00
AU	24 - Non-Participating	17:44	50	0:25	5:46
AV	27 - Non-Participating	60:07	147	1:06	20:02
AW	29 - Non-Participating	0:00	0	0:00	0:00
AX	30 - Non-Participating	11:20	48	0:18	2:54
AY	31 - Non-Participating	8:54	48	0:21	3:21
AZ	66 - Participating	19:11	55	0:34	5:21
BA	67 - Participating	22:42	57	0:35	7:46
BB	68 - Participating	0:00	0	0:00	0:00
BC	32 - Non-Participating	0:00	0	0:00	0:00
BD	33 - Non-Participating	0:00	0	0:00	0:00
BE	34 - Non-Participating	0:00	0	0:00	0:00
BF	35 - Non-Participating	0:00	0	0:00	0:00
BG	36 - Non-Participating	0:00	0	0:00	0:00
BH	37 - Non-Participating	8:43	38	0:22	3:38
BI	38 - Non-Participating	0:00	0	0:00	0:00

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	T-43	0:00	0:00
2	T-41	11:37	5:25
3	T-63	2:57	1:02
4	T-62	0:00	0:00
5	T-45	0:00	0:00
6	T-35	3:32	1:33
7	T-47	0:00	0:00
8	T-56	0:00	0:00
9	T-55	0:00	0:00
10	T-39	0:00	0:00
11	T-38	0:00	0:00
12	T-37	0:00	0:00
13	T-70	0:00	0:00
14	T-77	0:00	0:00
15	T-53	0:00	0:00
16	T-67	3:17	1:03
17	T-66	0:00	0:00
18	T-69	31:35	9:17
19	T-93	35:45	17:47
20	T-80	79:53	22:03
21	T-58	0:00	0:00
22	T-73	0:00	0:00
23	T-28	91:20	38:13
24	T-78	57:05	18:12
25	T-76	0:00	0:00
26	T-79	0:00	0:00
27	T-46	0:00	0:00
28	T-57	0:00	0:00
29	T-71	11:27	3:48

To be continued on next page...

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SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
30	T-59	0:00	0:00
31	T-60	0:00	0:00
32	T-61	0:00	0:00
33	T-40	0:00	0:00
34	T-15	0:00	0:00
35	T-16	0:00	0:00
36	T-17	0:00	0:00
37	T-12	0:00	0:00
38	T-13	2:49	1:08
39	T-26	0:00	0:00
40	T-25	22:42	7:46
41	T-10	3:39	1:23
42	T-8	0:00	0:00
43	T-94	5:28	2:36
44	T-95	9:10	4:15
45	T-96	0:00	0:00
46	T-121	5:22	1:46
47	T-142	63:40	25:20
48	T-131	2:54	1:26
49	T-129	0:00	0:00
50	T-141	11:05	3:38
51	T-123	0:00	0:00
52	T-144	13:45	4:23
53	T-145	7:37	2:31
54	T-146	18:31	5:44
55	T-122	0:00	0:00
56	T-117	17:48	5:36
57	T-130	2:44	1:12
58	T-44	0:00	0:00
59	T-72	31:54	8:46
60	T-75	0:00	0:00
61	T-34	12:41	6:20
62	T-74	0:00	0:00
63	T-81	3:10	0:52
64	T-98	23:13	8:51
65	T-85	0:00	0:00
66	T-86	32:35	9:41
67	T-87	5:45	2:28
68	T-51	22:05	9:10
69	T-23	0:28	0:13
70	T-11	3:36	1:34
71	T-22	60:21	18:22
72	T-5	17:44	5:46
73	T-9	18:02	7:41
74	T-90	11:58	3:32
75	T-91	10:38	2:48
76	T-92	11:08	4:57
77	T-106	4:41	1:19
78	T-100	0:00	0:00
79	T-107	28:18	8:41
80	T-99	5:29	2:12
81	T-143	30:44	14:08
82	T-108	127:33	37:29
83	T-109	9:26	3:04
84	T-110	3:59	1:22
85	T-124	4:36	1:55
86	T-88	11:28	5:15
87	T-89	16:34	4:35
88	T-14	0:00	0:00
89	T-24	19:11	5:21

To be continued on next page...

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SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
90	T-42	0:00	0:00
91	T-68	10:38	3:21
92	T-21	0:00	0:00
93	T-20	0:00	0:00
94	T-19	0:00	0:00
95	T-18	0:00	0:00
96	T-83	39:56	16:40
97	T-84	20:48	9:01
98	T-54	0:00	0:00
99	T-118	0:00	0:00
100	T-120	7:54	3:34
101	T-105	0:00	0:00
102	T-97	11:48	4:43
103	T-147	0:00	0:00
104	T-148	0:00	0:00
105	T-149	0:00	0:00
106	T-150	0:00	0:00
107	T-151	0:00	0:00
108	T-152	33:11	10:39
109	T-153	19:19	7:46
110	T-154	0:00	0:00
111	T-155	0:00	0:00
112	T-156	47:57	16:27
113	T-157	15:35	5:30
114	T-158	7:47	2:26
115	T-159	41:00	12:52
116	T-160	0:00	0:00
117	T-161	31:31	14:05
118	T-162	0:00	0:00
119	T-163	11:45	4:36
120	T-164	35:12	16:03
121	T-165	8:43	3:38
122	T-166	0:00	0:00
123	T-167	0:00	0:00
124	T-168	3:23	1:29
125	T-169	0:00	0:00
126	T-170	31:46	11:39
127	T-171	11:04	4:51
128	T-172	11:22	3:49
129	T-173	2:23	0:46
130	T-174	19:35	4:56
131	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (1)	0:00	0:00
132	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (2)	0:00	0:00
133	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (3)	0:00	0:00
134	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (4)	0:00	0:00
135	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (5)	0:00	0:00
136	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (6)	0:00	0:00
137	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (7)	0:00	0:00
138	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (8)	0:00	0:00
139	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (9)	0:00	0:00
140	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (10)	0:00	0:00
141	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (11)	0:00	0:00
142	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (12)	0:00	0:00
143	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (13)	0:00	0:00
144	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (14)	0:00	0:00
145	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (15)	0:00	0:00
146	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (16)	0:00	0:00
147	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (17)	0:00	0:00
148	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (18)	0:00	0:00
149	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (19)	0:00	0:00

To be continued on next page...

windPRO

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SHADOW - Main Result

Calculation: V136 105m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
150	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (20)	0:00	0:00
151	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (21)	4:06	1:25
152	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (22)	0:00	0:00
153	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (23)	0:00	0:00
154	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (24)	0:00	0:00
155	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (25)	0:00	0:00
156	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (26)	0:00	0:00
157	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (27)	0:00	0:00
158	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (28)	0:00	0:00
159	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (29)	0:00	0:00
160	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (30)	0:00	0:00
161	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (31)	0:00	0:00
162	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (32)	0:00	0:00
163	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (33)	0:00	0:00
164	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (34)	0:00	0:00
165	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (35)	0:00	0:00
166	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (36)	0:00	0:00
167	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (37)	0:00	0:00
168	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (38)	0:00	0:00
169	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (39)	0:00	0:00
170	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (40)	0:00	0:00
171	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (41)	0:00	0:00
172	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (42)	0:00	0:00
173	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (43)	0:00	0:00
174	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (44)	0:00	0:00
175	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (45)	0:00	0:00
176	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (46)	0:00	0:00
177	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (47)	12:37	5:15
178	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (48)	0:00	0:00
179	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (49)	0:00	0:00
180	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (50)	0:00	0:00
181	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (51)	0:00	0:00
182	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (52)	0:00	0:00
183	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (53)	0:00	0:00
184	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (54)	0:00	0:00
185	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (55)	0:00	0:00
186	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (56)	0:00	0:00
187	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (57)	0:00	0:00
188	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (58)	0:00	0:00
189	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (59)	0:00	0:00
190	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (60)	0:00	0:00
191	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (61)	0:00	0:00
192	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (62)	0:00	0:00
193	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (63)	0:00	0:00
194	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (64)	0:00	0:00
195	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (65)	0:00	0:00
196	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (66)	0:00	0:00
197	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (67)	0:00	0:00
198	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (68)	0:00	0:00
199	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (69)	0:00	0:00
200	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (70)	0:00	0:00
201	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (71)	1:44	0:43
202	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (72)	0:00	0:00
203	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (73)	0:00	0:00
204	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (74)	0:00	0:00
205	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (75)	0:00	0:00
206	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (76)	0:00	0:00
207	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (77)	0:00	0:00
208	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (78)	0:00	0:00

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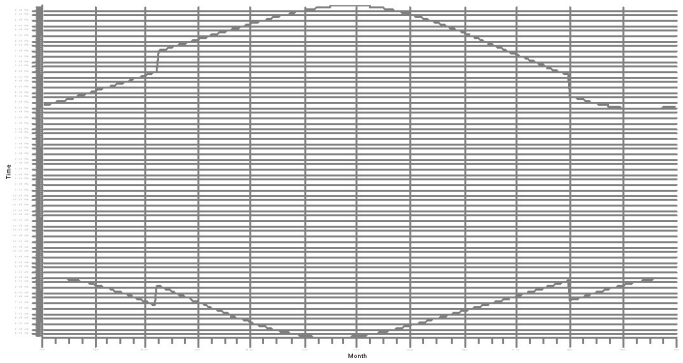
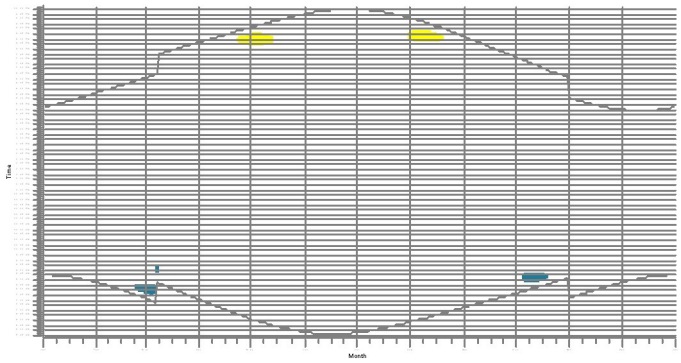
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

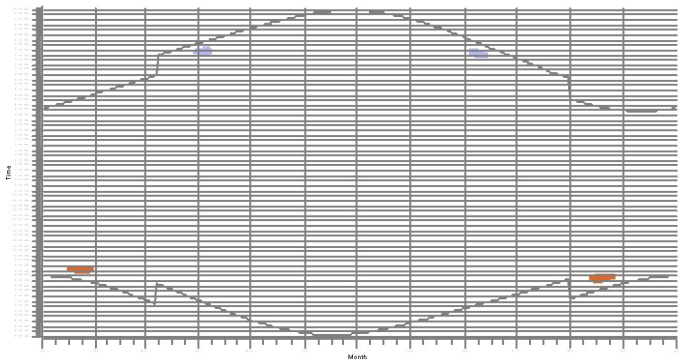
A: 1 - Non-Participating



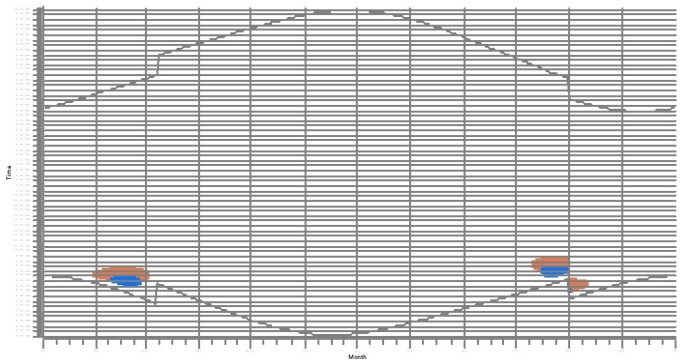
B: 39 - Participating



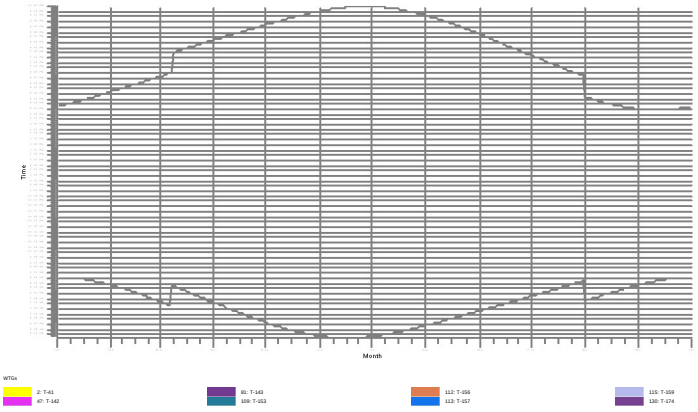
C: 2 - Non-Participating



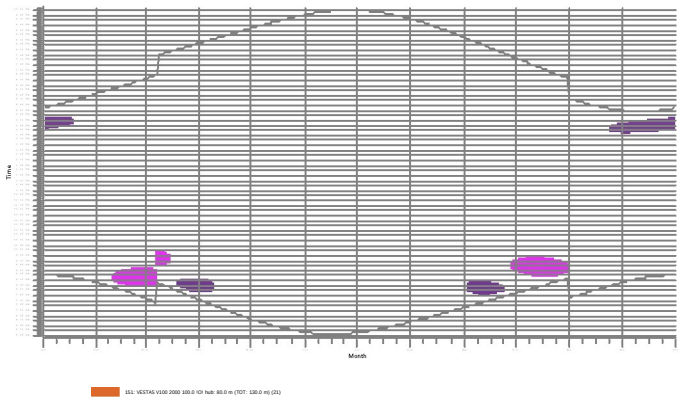
D: 40 - Participating



E: 41 - Participating



F: 42 - Participating



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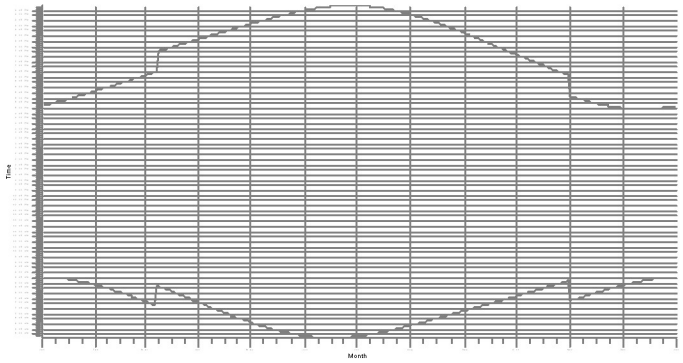
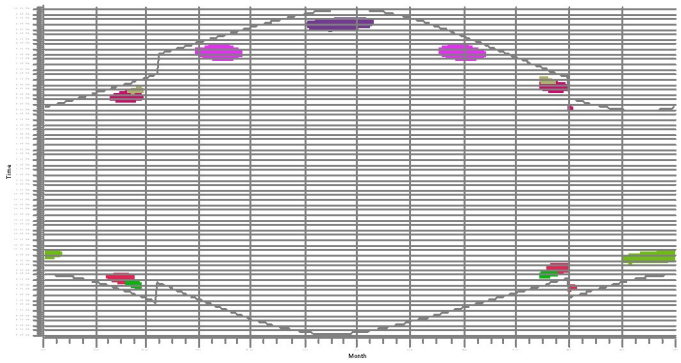
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

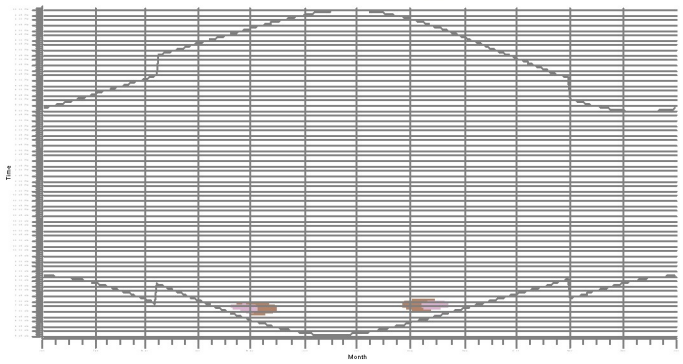
G: 43 - Participating



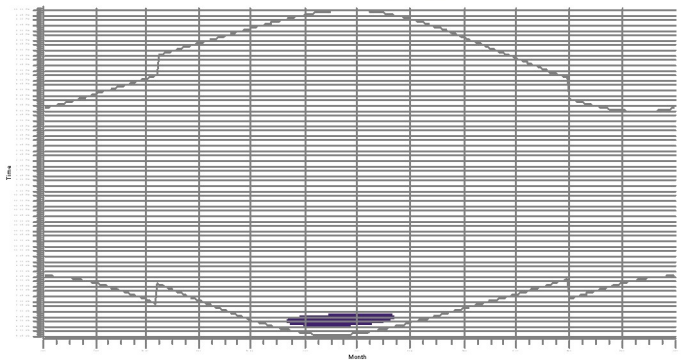
H: 44 - Participating



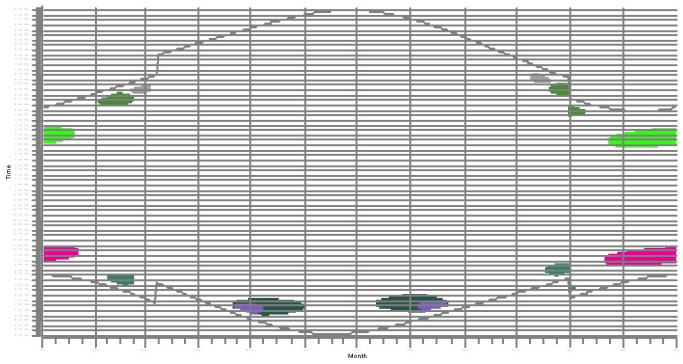
I: 3 - Non-Participating



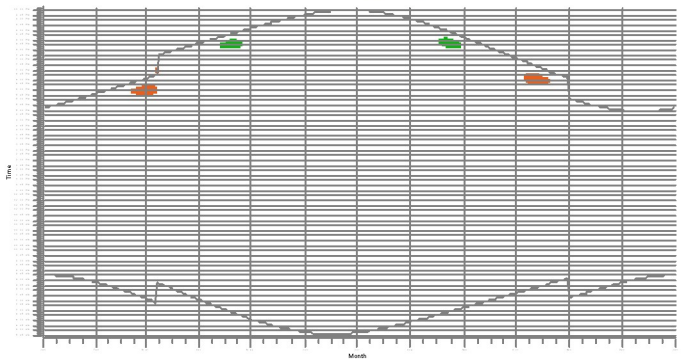
J: 4 - Non-Participating



K: 45 - Participating



L: 46 - Participating



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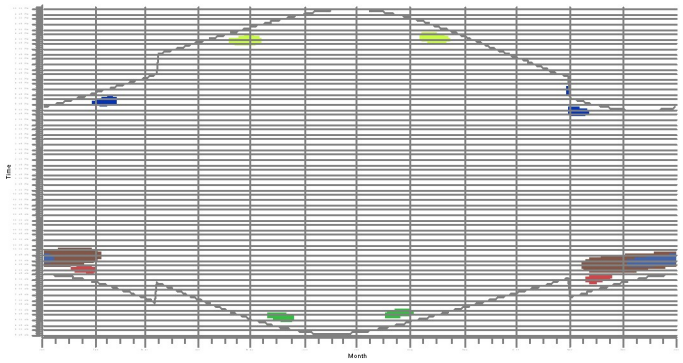
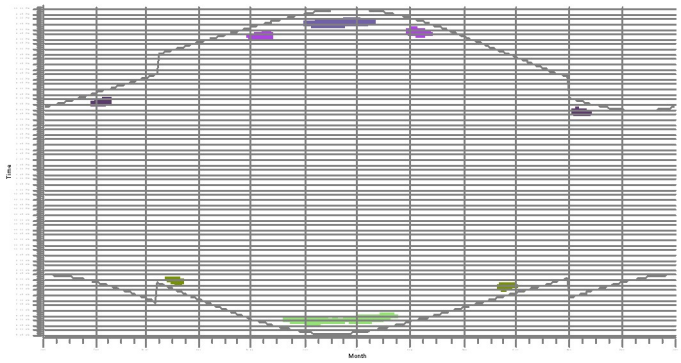
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

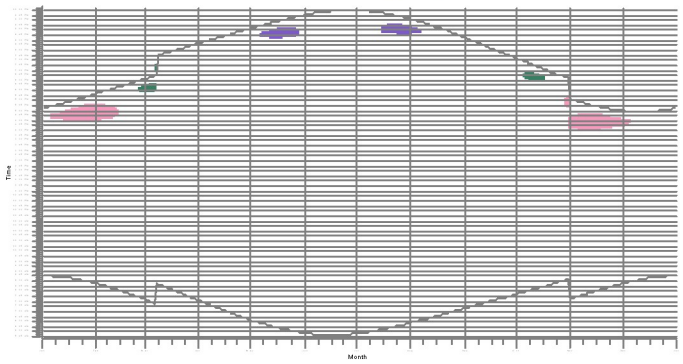
M: 47 - Participating



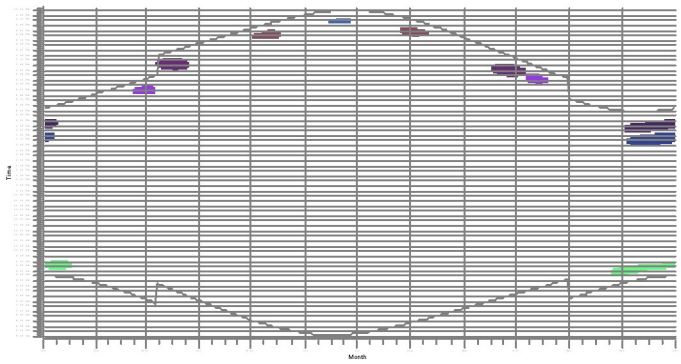
N: 48 - Participating



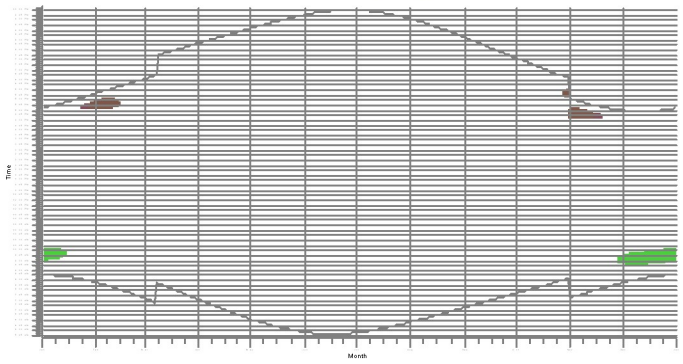
O: 5 - Non-Participating



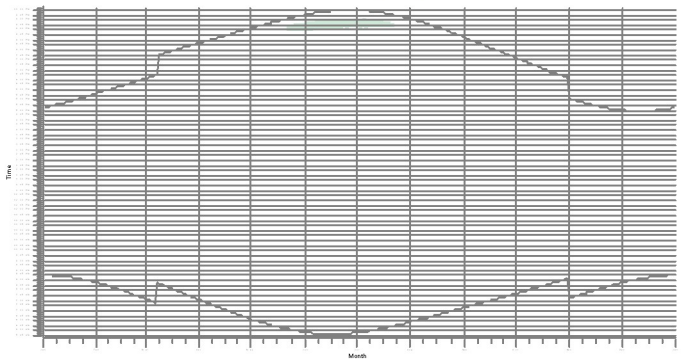
P: 49 - Participating



Q: 50 - Participating



R: 51 - Participating



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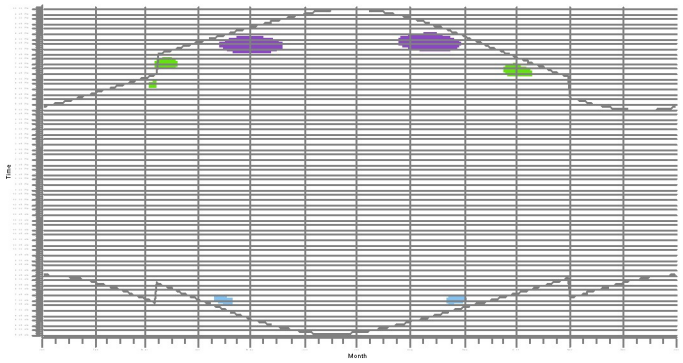
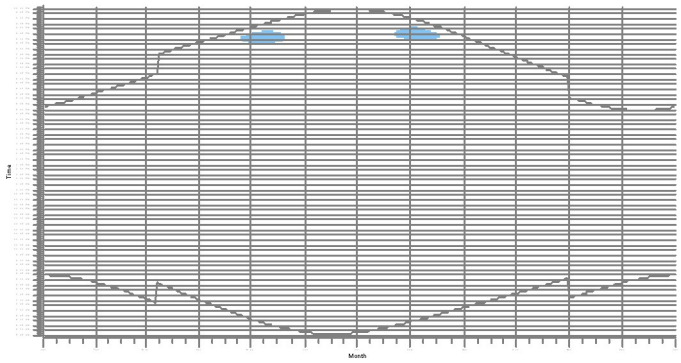
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

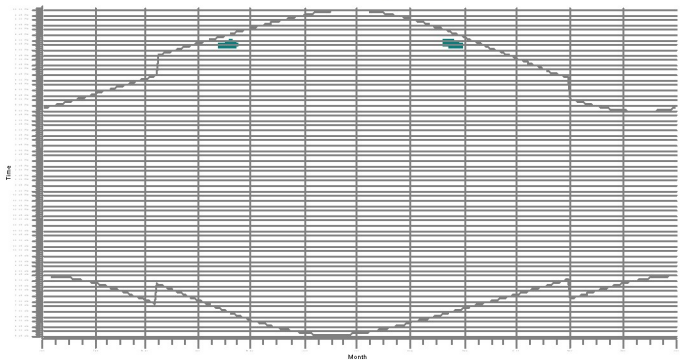
S: 6 - Non-Participating



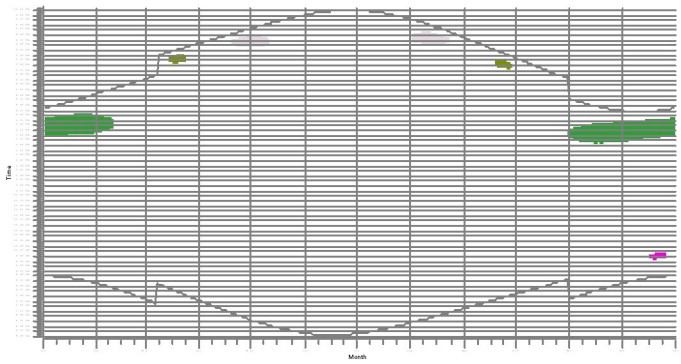
T: 52 - Participating



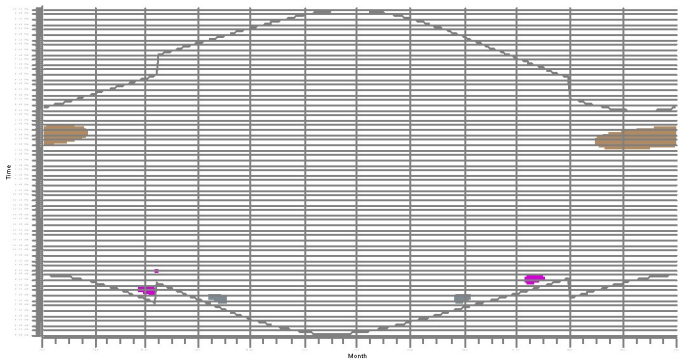
U: 7 - Non-Participating



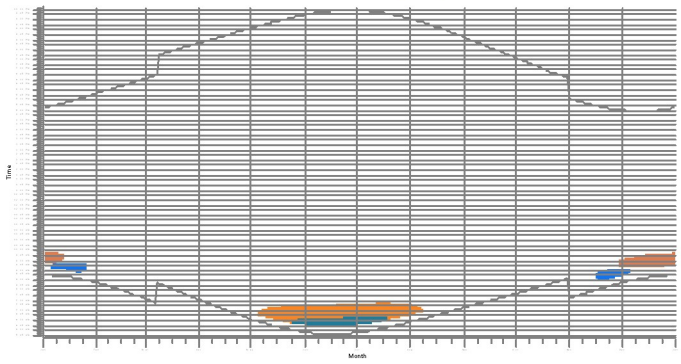
V: 8 - Non-Participating

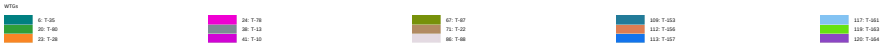


W: 9 - Non-Participating



X: 10 - Non-Participating





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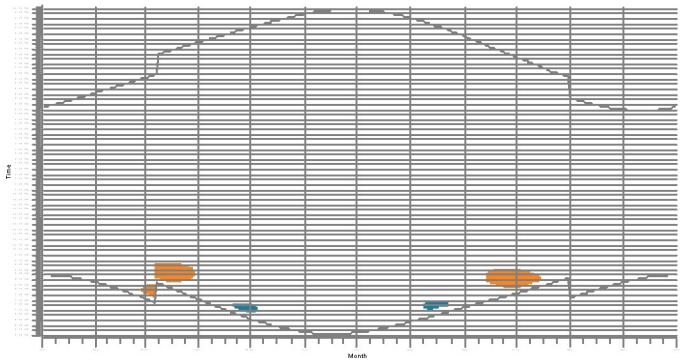
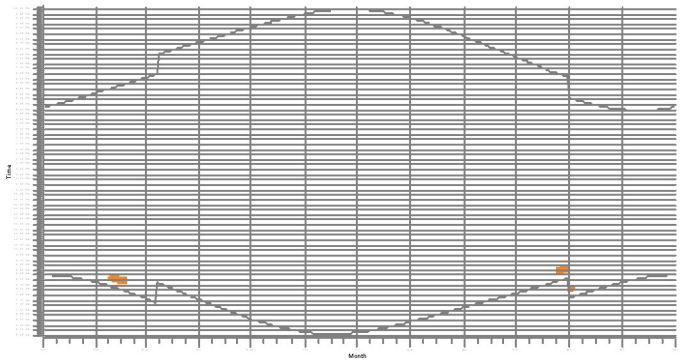
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

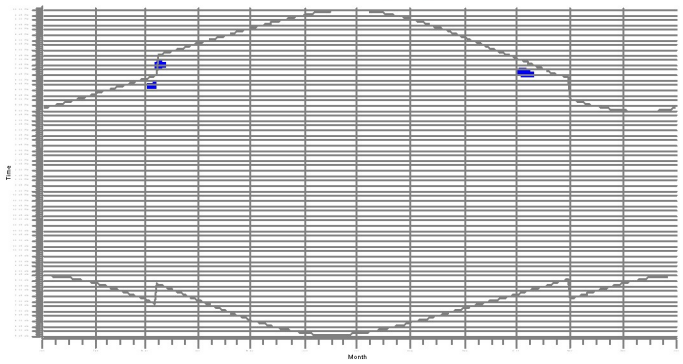
Y: 11 - Non-Participating



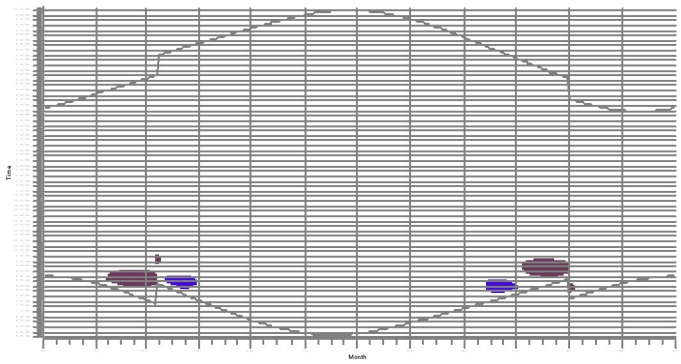
Z: 53 - Participating



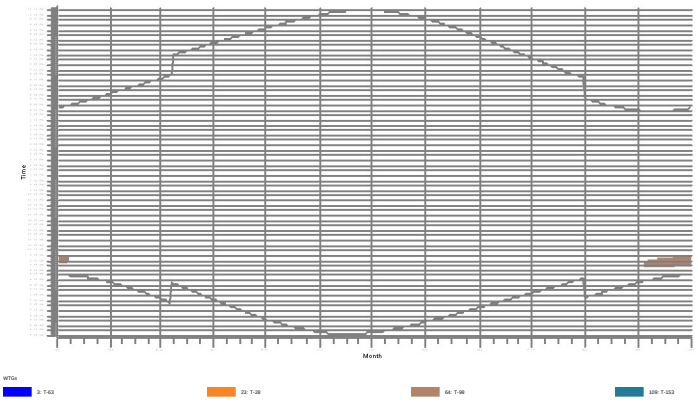
AA: 54 - Participating



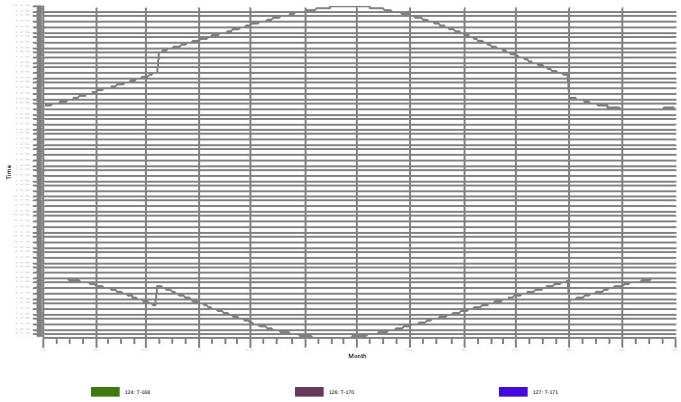
AB: 12 - Non-Participating



AC: 13 - Non-Participating



AD: 14 - Non-Participating



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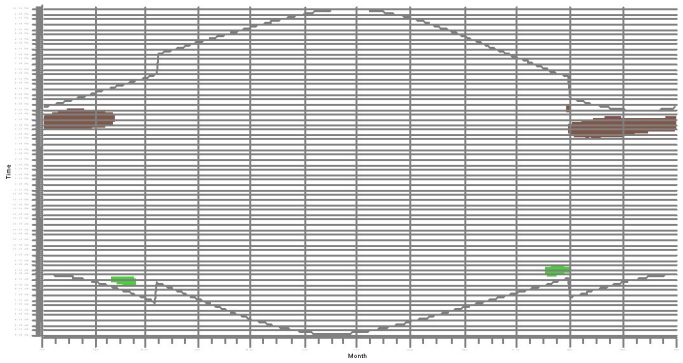
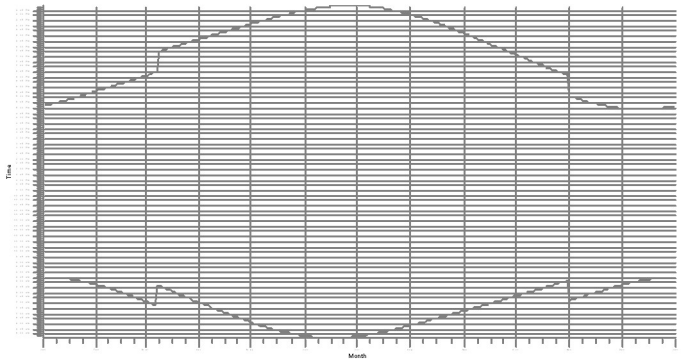
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

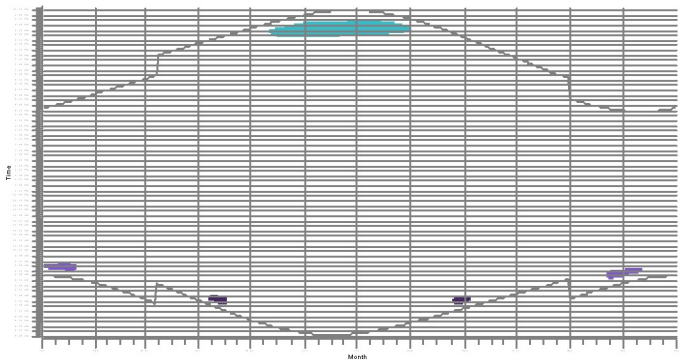
AE: 55 - Participating



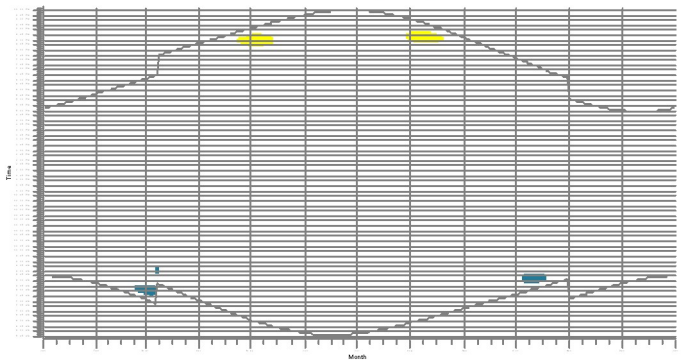
AF: 15 - Non-Participating



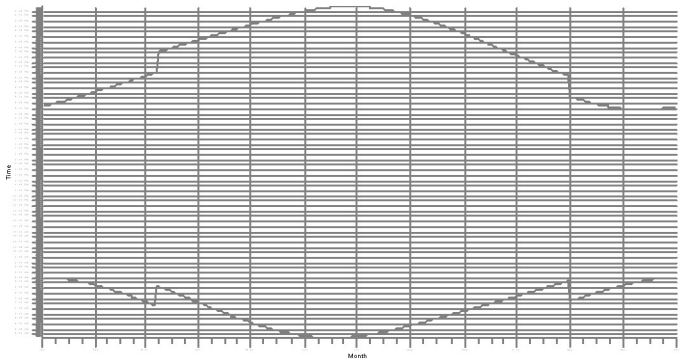
AG: 57 - Participating



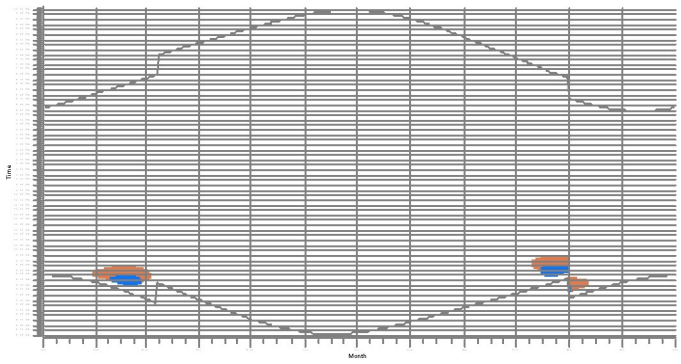
AH: 59 - Participating



AI: 61 - Participating



AJ: 62 - Participating



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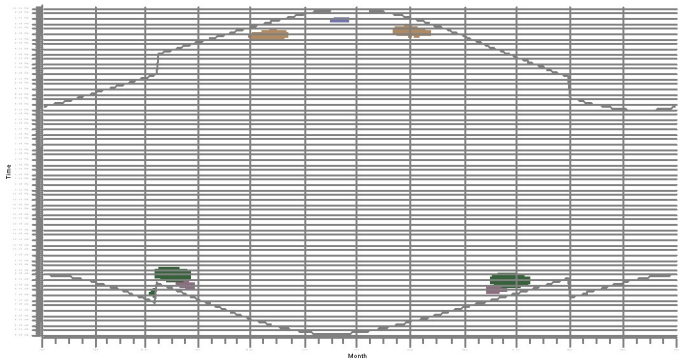
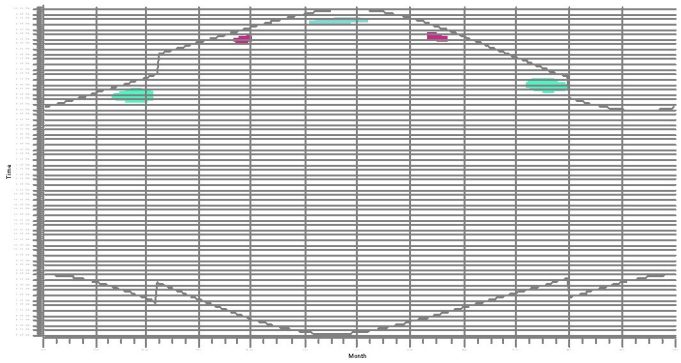
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

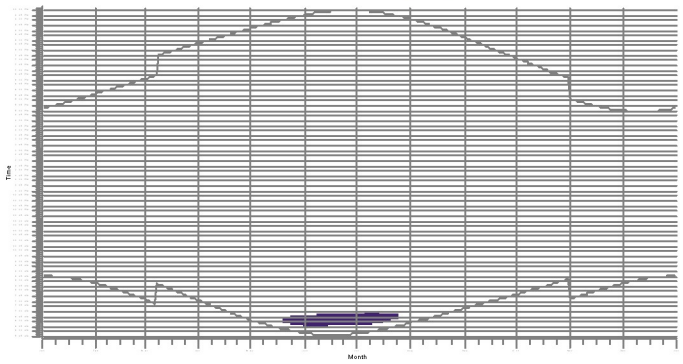
AK: 63 - Participating



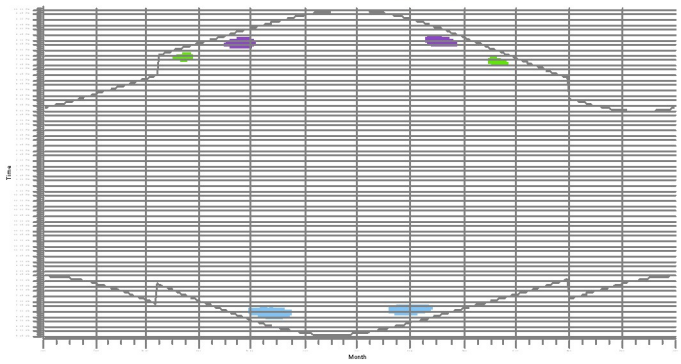
AL: 16 - Non-Participating



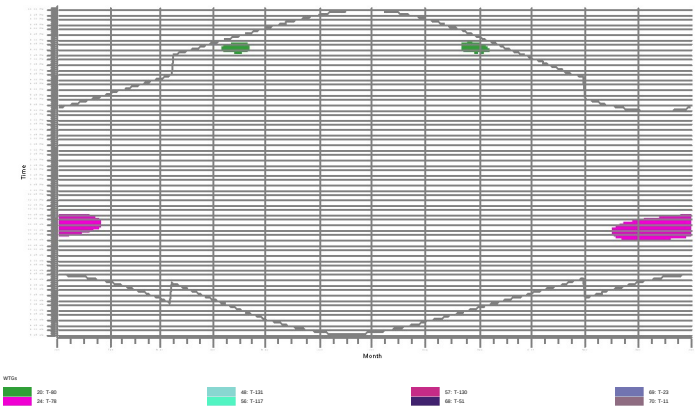
AM: 17 - Non-Participating



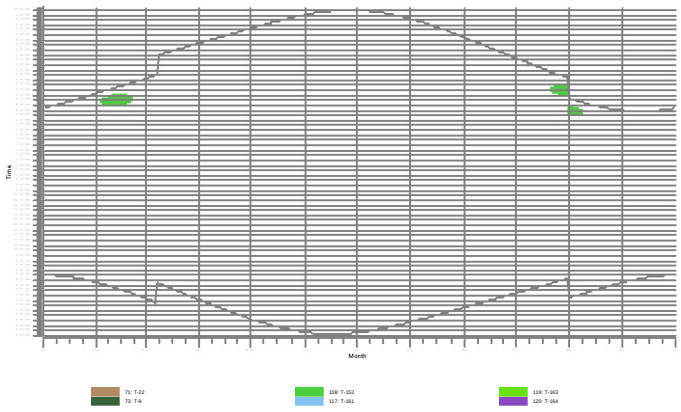
AN: 18 - Non-Participating



AO: 64 - Participating



AP: 19 - Non-Participating



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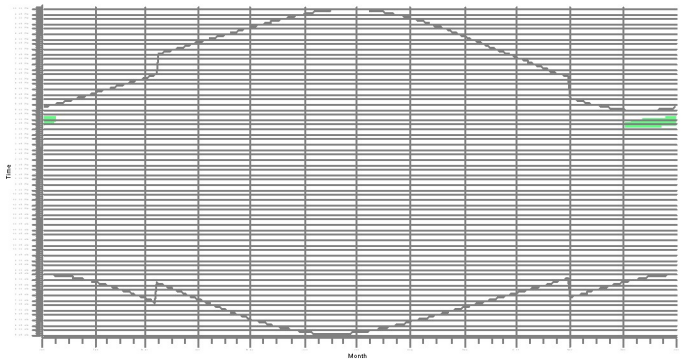
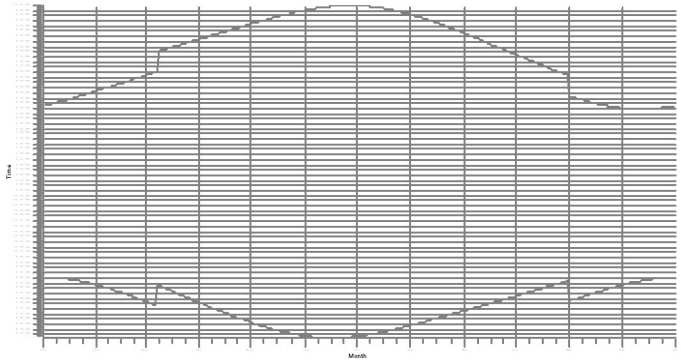
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

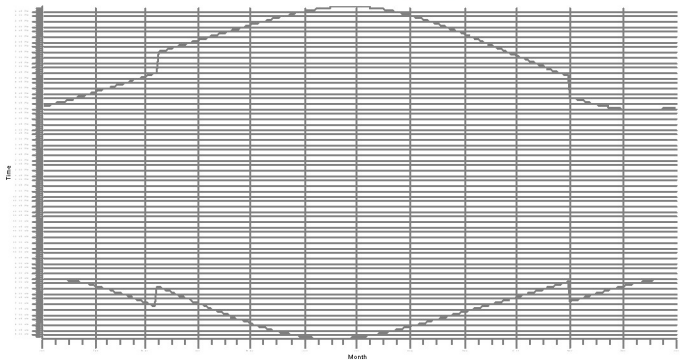
AQ: 20 - Non-Participating



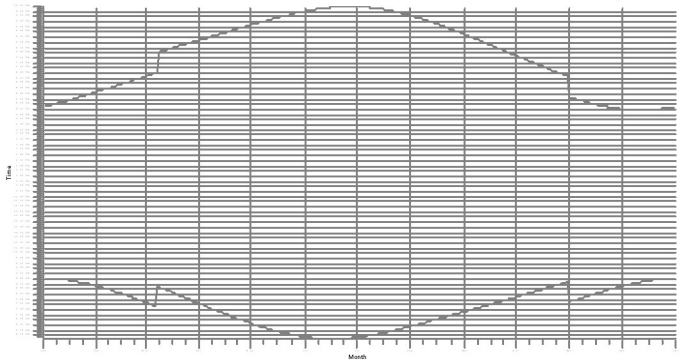
AR: 21 - Non-Participating



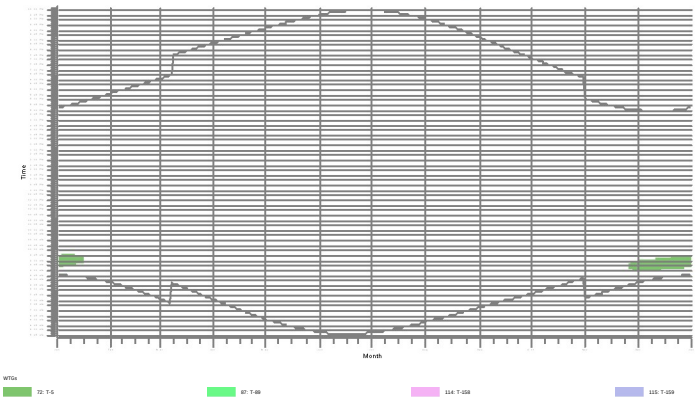
AS: 22 - Non-Participating



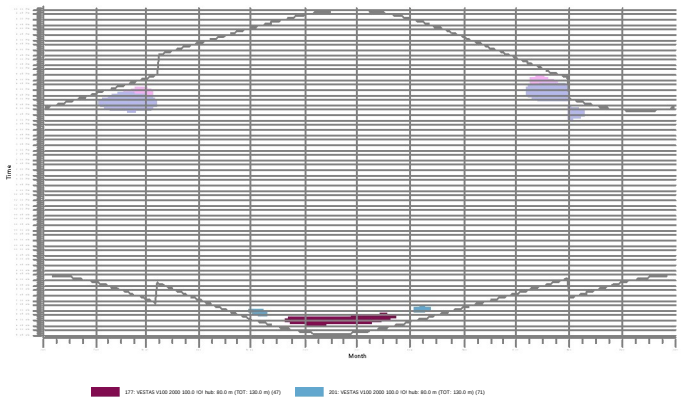
AT: 23 - Non-Participating



AU: 24 - Non-Participating



AV: 27 - Non-Participating



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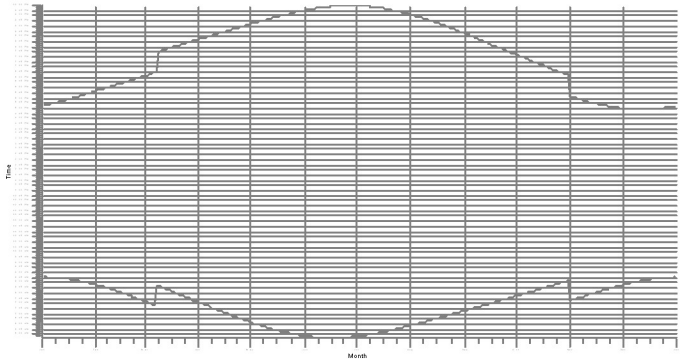
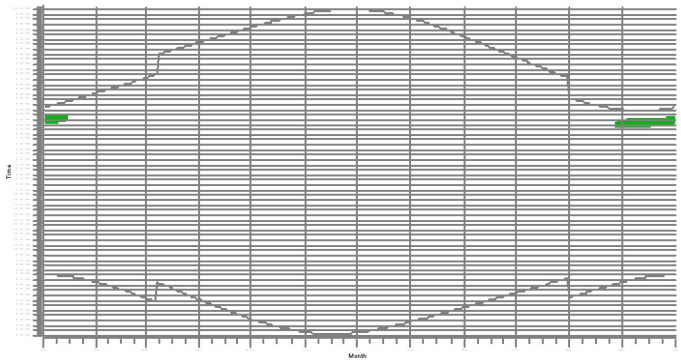
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

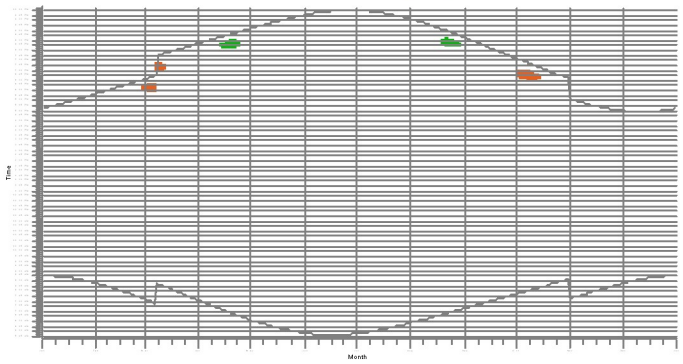
AW: 29 - Non-Participating



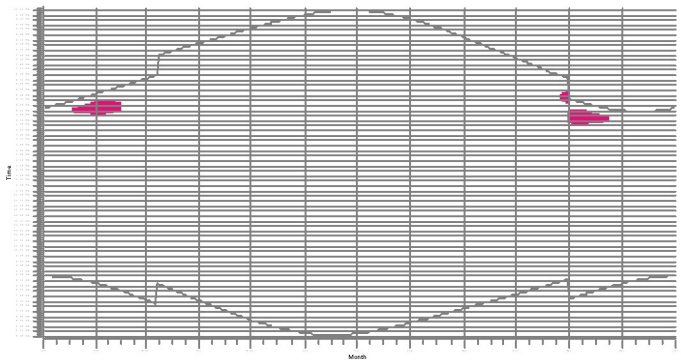
AX: 30 - Non-Participating



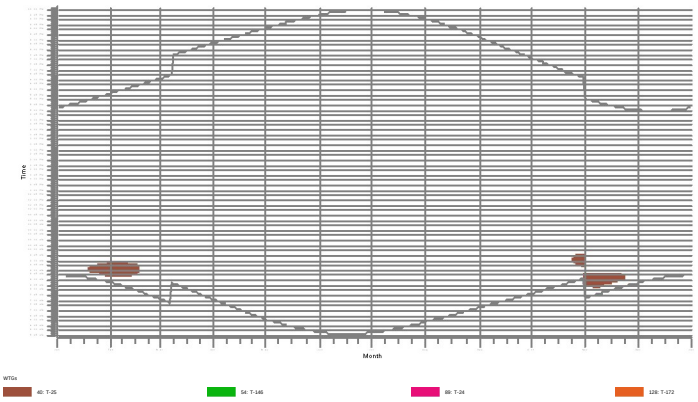
AY: 31 - Non-Participating



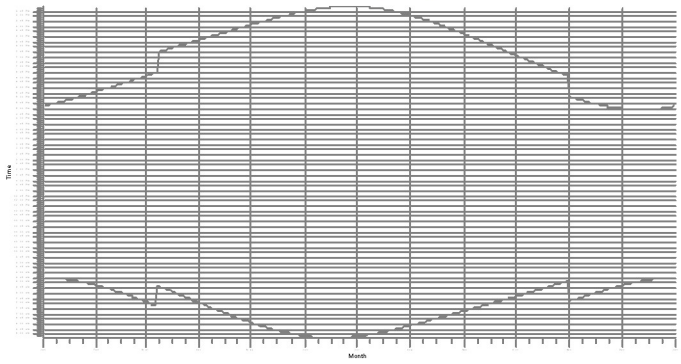
AZ: 66 - Participating



BA: 67 - Participating



BB: 68 - Participating



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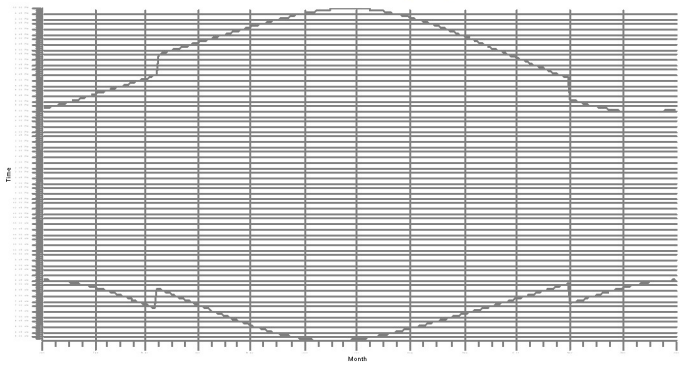
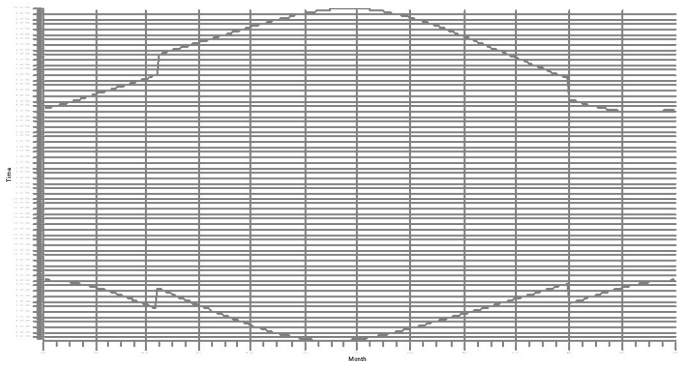
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

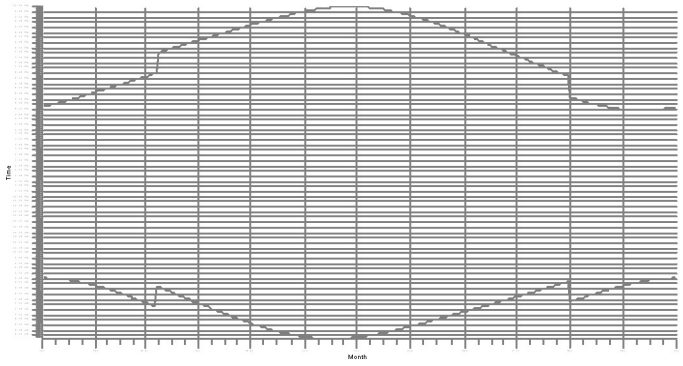
BC: 32 - Non-Participating



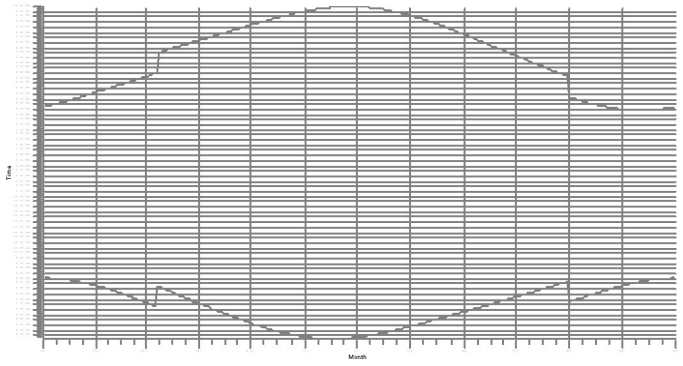
BD: 33 - Non-Participating



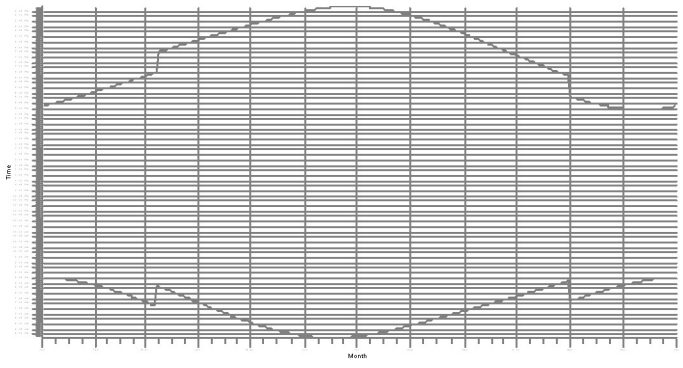
BE: 34 - Non-Participating



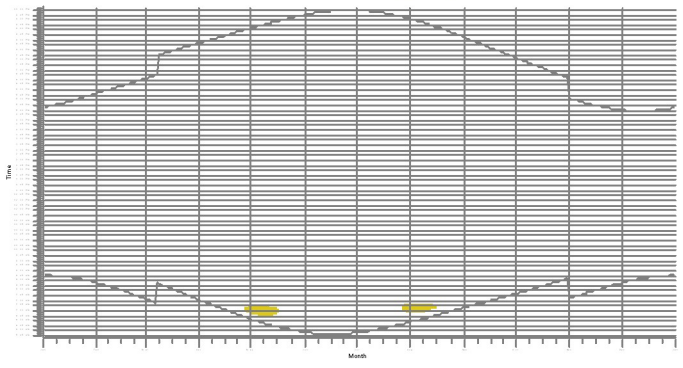
BF: 35 - Non-Participating



BG: 36 - Non-Participating



BH: 37 - Non-Participating



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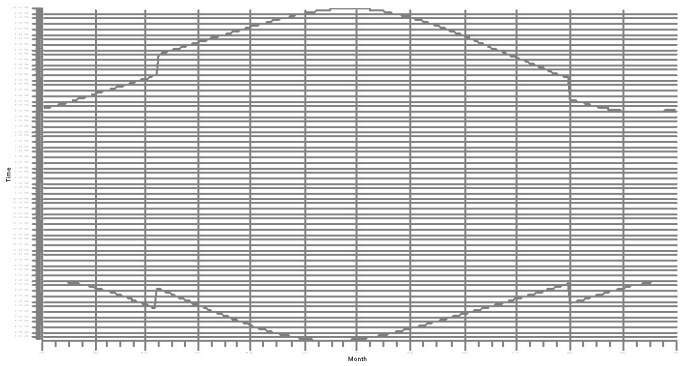
SHADOW - Calendar, graphical

Calculation: V136 105m HH Shadow Flicker

BI: 38 - Non-Participating



WTGs

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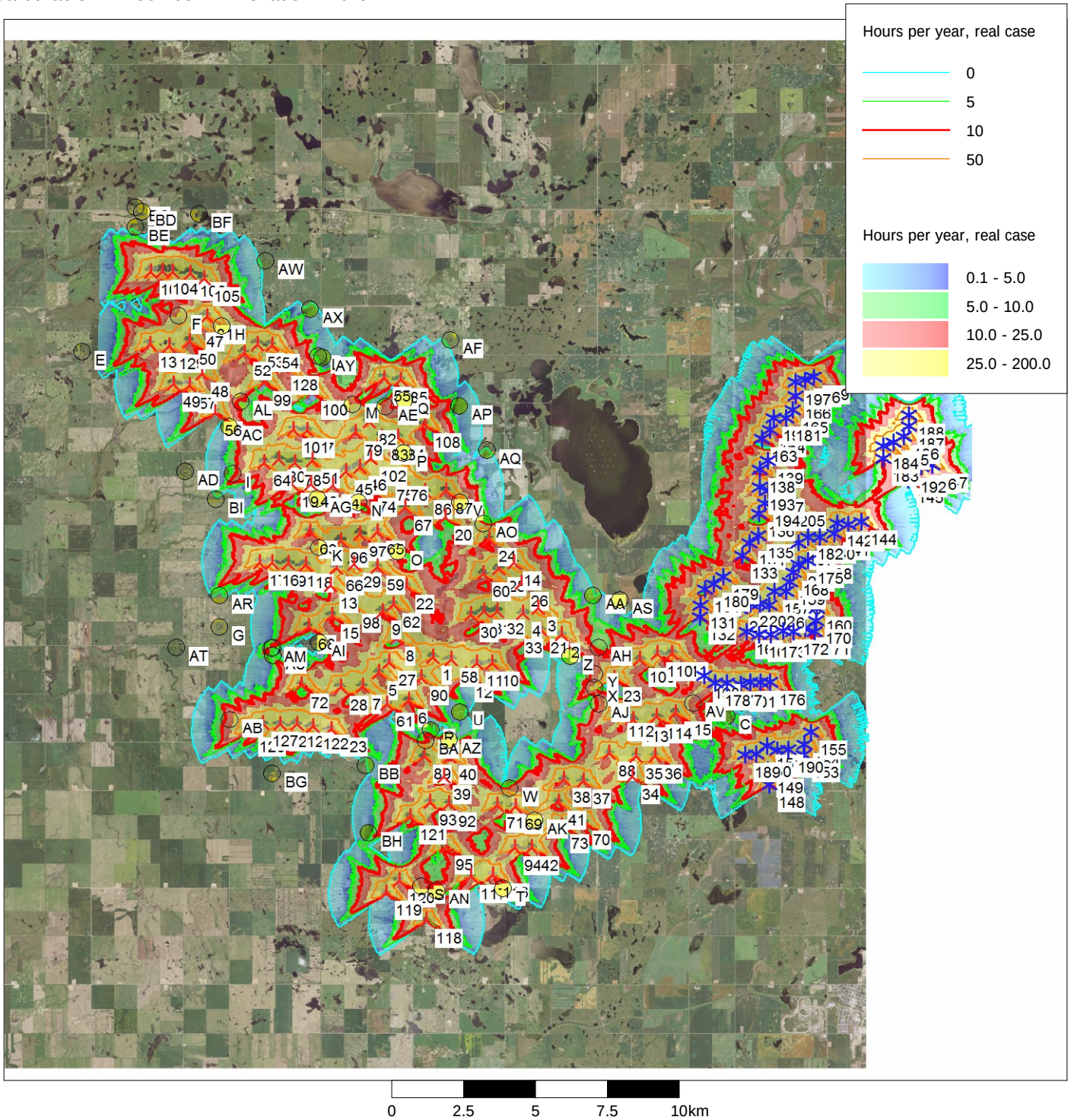
SHADOW - Map

Calculation: V136 105m HH Shadow Flicker



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 640,676 North: 5,375,910

New WTG Existing WTG Shadow receptor

Flicker map level: Height Contours: 150921_TWE_LindahlWest_10ftHCLsfrom10mNED.wpo (3)

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SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

Assumptions for shadow calculations

Maximum distance for influence	2,000	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

Sunshine probability S (Average daily sunshine hours) [BISMARCK]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.92	5.13	7.45	8.03	10.20	11.21	11.69	10.35	8.68	5.69	4.02	3.69

Operational hours are calculated from WTGs in calculation and wind distribution:
0162 3/18 SDO

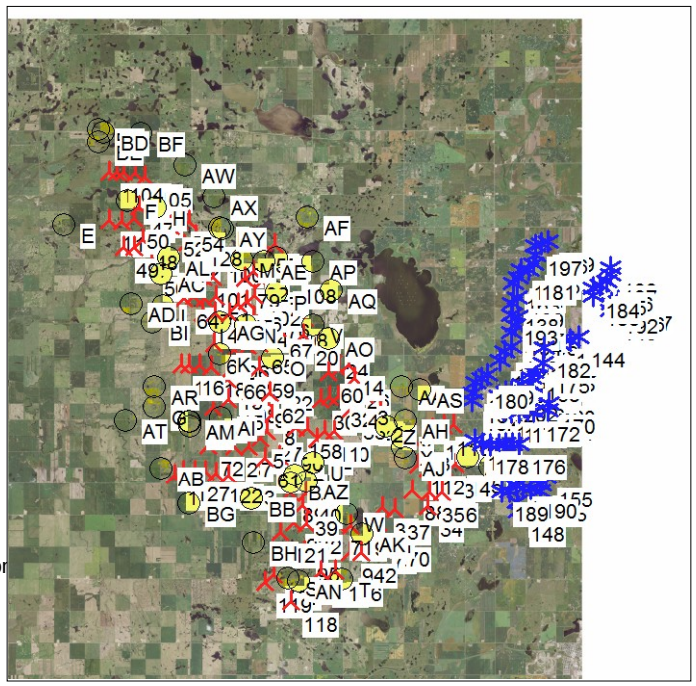
Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
722	459	308	340	523	950	724	582	735	1,009	1,128	1,176	8,655

Idle start wind speed: Cut in wind speed from power curve

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: 150921_TWE_LindahlWest_10ftHCLsfron
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m

All coordinates are in
UTM WGS84 Zone: 13



Scale 1:400,000

New WTG
Existing WTG
Shadow receptor

WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
1	637,619	5,373,512	727.5	T-43	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
2	642,085	5,374,363	728.5	T-41	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
3	641,252	5,375,220	737.7	T-63	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
4	640,729	5,375,038	740.7	T-62	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
5	635,764	5,372,945	724.6	T-45	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
6	636,817	5,372,047	728.5	T-35	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
7	635,193	5,372,473	710.2	T-47	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
8	636,346	5,374,109	734.6	T-56	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
9	635,830	5,374,972	728.5	T-55	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
10	639,692	5,373,363	740.7	T-39	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
11	639,157	5,373,344	739.4	T-38	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
12	638,790	5,372,951	734.6	T-37	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
13	633,988	5,375,810	737.6	T-70	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
14	640,372	5,376,713	738.1	T-77	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
15	634,074	5,374,798	721.2	T-53	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
16	631,934	5,376,511	729.8	T-67	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
17	631,510	5,376,507	731.5	T-66	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
18	633,108	5,376,447	723.9	T-69	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
19	632,563	5,379,145	737.6	T-93	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
20	637,951	5,378,169	715.2	T-80	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
21	641,389	5,374,486	743.7	T-58	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
22	636,640	5,375,835	734.6	T-73	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
23	643,972	5,372,967	712.3	T-28	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
24	639,495	5,377,499	738.7	T-78	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
25	639,840	5,376,489	737.6	T-76	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
26	640,649	5,376,031	731.5	T-79	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
27	636,095	5,373,292	733.9	T-46	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5

To be continued on next page...

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9/15/2018 5:45 AM/3.0.654

SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
28	634,438	5,372,432	701.0	T-57	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
29	634,798	5,376,526	725.4	T-71	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
30	638,928	5,374,941	737.6	T-59	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
31	639,384	5,375,074	737.6	T-60	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
32	639,838	5,375,100	737.6	T-61	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
33	640,492	5,374,466	743.6	T-40	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
34	644,695	5,369,685	736.0	T-15	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
35	644,792	5,370,371	743.7	T-16	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
36	645,456	5,370,405	735.1	T-17	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
37	642,975	5,369,494	737.6	T-12	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
38	642,303	5,369,536	734.9	T-13	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
39	638,102	5,369,527	710.5	T-26	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
40	638,282	5,370,192	712.5	T-25	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
41	642,122	5,368,780	734.6	T-10	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
42	641,239	5,367,252	719.1	T-8	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
43	633,243	5,379,162	737.6	T-94	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
44	634,001	5,379,136	737.6	T-95	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
45	634,443	5,379,605	731.5	T-96	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
46	634,918	5,379,749	728.5	T-121	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
47	629,136	5,384,387	713.2	T-142	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
48	629,347	5,382,713	710.2	T-131	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
49	628,366	5,382,343	707.1	T-129	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
50	628,893	5,383,804	717.2	T-141	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
51	633,253	5,379,950	729.4	T-123	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
52	630,815	5,383,459	711.9	T-144	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
53	631,275	5,383,767	710.7	T-145	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
54	631,767	5,383,732	713.2	T-146	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
55	635,699	5,382,724	710.2	T-122	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
56	629,834	5,381,441	713.0	T-117	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
57	628,926	5,382,328	703.0	T-130	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
58	638,268	5,373,457	731.5	T-44	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
59	635,628	5,376,434	728.5	T-72	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
60	639,307	5,376,310	731.5	T-75	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
61	636,056	5,371,908	719.3	T-34	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
62	636,215	5,375,218	731.5	T-74	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
63	633,243	5,377,581	731.5	T-81	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
64	631,582	5,379,814	726.8	T-98	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
65	635,586	5,377,640	725.5	T-85	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
66	634,183	5,376,389	733.5	T-86	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
67	636,542	5,378,452	715.1	T-87	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
68	633,261	5,374,418	716.3	T-51	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
69	640,641	5,368,602	728.5	T-23	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
70	643,024	5,368,138	728.5	T-11	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
71	639,998	5,368,634	725.4	T-22	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
72	633,064	5,372,478	698.0	T-5	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
73	642,243	5,368,015	730.6	T-9	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
74	635,270	5,379,029	725.4	T-90	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
75	635,883	5,379,448	720.6	T-91	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
76	636,364	5,379,455	716.0	T-92	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
77	633,072	5,380,925	729.9	T-106	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
78	632,659	5,379,855	737.2	T-100	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
79	634,758	5,380,905	718.9	T-107	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
80	632,089	5,379,958	731.5	T-99	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
81	629,494	5,384,648	709.6	T-143	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
82	635,222	5,381,271	716.3	T-108	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
83	635,678	5,380,785	716.0	T-109	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
84	636,220	5,380,785	716.3	T-110	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
85	636,276	5,382,673	710.2	T-124	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
86	637,208	5,379,005	710.9	T-88	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5

To be continued on next page...

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9/15/2018 5:45 AM/3.0.654

SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
87	637,941	5,379,046	713.2	T-89	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
88	643,859	5,370,443	732.3	T-14	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
89	637,408	5,370,185	701.0	T-24	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
90	637,234	5,372,817	719.9	T-42	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
91	632,509	5,376,501	722.8	T-68	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
92	638,306	5,368,644	716.3	T-21	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
93	637,648	5,368,666	713.2	T-20	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
94	640,643	5,367,238	719.3	T-19	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
95	638,242	5,367,207	710.2	T-18	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
96	634,318	5,377,326	731.6	T-83	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
97	634,979	5,377,549	725.3	T-84	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
98	634,798	5,375,163	713.2	T-54	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
99	631,532	5,382,484	707.7	T-118	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
100	633,206	5,382,201	722.4	T-120	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
101	632,585	5,380,949	731.5	T-105	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
102	635,298	5,380,049	728.5	T-97	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
103	627,504	5,386,079	711.3	T-147	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
104	627,911	5,386,105	710.2	T-148	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
105	629,368	5,385,888	704.0	T-149	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
106	628,867	5,386,049	710.2	T-150	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
107	628,269	5,386,086	711.9	T-151	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
108	637,149	5,381,224	704.1	T-152	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
109	644,833	5,373,605	713.9	T-153	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
110	645,462	5,373,811	728.5	T-154	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
111	645,966	5,373,838	730.1	T-155	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
112	644,144	5,371,765	710.2	T-156	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
113	644,660	5,371,616	715.4	T-157	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
114	645,479	5,371,724	719.3	T-158	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
115	646,127	5,371,875	717.1	T-159	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
116	639,890	5,366,309	710.2	T-160	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
117	639,135	5,366,239	709.0	T-161	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
118	637,617	5,364,719	707.6	T-162	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
119	636,191	5,365,609	711.4	T-163	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
120	636,640	5,366,042	710.2	T-164	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
121	636,954	5,368,164	711.3	T-165	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
122	633,495	5,371,087	689.0	T-166	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
123	634,130	5,371,006	696.6	T-167	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
124	632,359	5,371,139	688.8	T-168	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
125	632,926	5,371,158	686.0	T-169	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
126	631,283	5,370,947	682.8	T-170	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
127	631,732	5,371,159	684.7	T-171	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
128	632,154	5,382,999	713.2	T-172	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
129	628,195	5,383,647	711.6	T-173	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
130	627,535	5,383,666	710.2	T-174	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	10.5
131	646,913	5,375,455	745.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
132	646,888	5,375,080	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
133	648,328	5,377,151	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
134	648,570	5,377,592	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
135	648,872	5,377,853	752.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
136	648,872	5,378,572	753.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
137	649,189	5,379,368	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
138	648,868	5,380,034	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
139	649,124	5,380,328	729.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
140	651,007	5,377,868	748.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
141	651,525	5,378,000	750.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
142	651,616	5,378,348	758.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
143	651,987	5,378,290	755.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
144	652,436	5,378,405	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
145	654,047	5,379,834	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

To be continued on next page...

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9/15/2018 5:45 AM/3.0.654

SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
146	654,478	5,380,290	740.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
147	654,876	5,380,346	731.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
148	649,468	5,369,552	735.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
149	649,403	5,370,046	745.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
150	648,989	5,370,563	740.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
151	649,348	5,370,846	749.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
152	649,714	5,370,690	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
153	650,635	5,370,574	746.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
154	650,667	5,370,918	744.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
155	650,882	5,371,340	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
156	649,309	5,375,532	733.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
157	649,484	5,375,990	732.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
158	649,889	5,375,994	741.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
159	650,008	5,376,322	740.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
160	650,956	5,375,465	750.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
161	648,982	5,374,557	737.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
162	648,553	5,374,643	733.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
163	648,903	5,381,054	722.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
164	649,170	5,381,363	721.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
165	649,950	5,382,038	713.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
166	650,030	5,382,496	712.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
167	650,267	5,377,632	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
168	650,119	5,376,640	740.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
169	650,663	5,383,159	707.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
170	650,947	5,375,049	753.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
171	650,911	5,374,694	758.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
172	650,163	5,374,664	746.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
173	649,378	5,374,555	741.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
174	649,818	5,374,694	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
175	650,613	5,377,049	737.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
176	649,406	5,372,982	725.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
177	647,909	5,372,903	716.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
178	647,487	5,372,910	715.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
179	647,672	5,376,428	744.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
180	647,365	5,376,192	740.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
181	649,728	5,381,758	721.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
182	650,599	5,377,842	746.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
183	653,143	5,380,511	713.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
184	653,130	5,380,927	710.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
185	653,497	5,381,062	704.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
186	653,850	5,381,276	700.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
187	654,022	5,381,604	696.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
188	654,011	5,381,966	694.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
189	648,594	5,370,523	731.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
190	650,092	5,370,737	743.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
191	647,056	5,376,002	741.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
192	654,134	5,380,179	733.9	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
193	648,870	5,379,452	759.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
194	649,079	5,378,913	759.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
195	649,308	5,381,738	716.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
196	650,346	5,383,045	709.6	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
197	650,021	5,382,956	710.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
198	647,090	5,373,129	713.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
199	649,061	5,372,960	722.4	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
200	648,724	5,372,961	720.7	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
201	648,383	5,372,886	719.3	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
202	648,975	5,375,560	735.2	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
203	648,641	5,375,554	726.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
204	648,297	5,375,376	728.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

To be continued on next page...

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Calculated:
9/15/2018 5:45 AM/3.0.654

SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	RPM
			[m]					[kW]	[m]	[m]	[RPM]
205	649,928	5,378,956	741.8	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
206	650,591	5,374,779	748.5	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
207	650,301	5,376,922	735.1	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9
208	650,917	5,377,197	740.0	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 13...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	14.9

Shadow receptor-Input

No.	Name	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	1 - Non-Participating	644,116	5,375,554	701.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
B	39 - Participating	643,400	5,373,971	711.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
C	2 - Non-Participating	647,930	5,371,801	718.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
D	40 - Participating	643,453	5,372,099	716.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
E	41 - Participating	625,162	5,383,364	711.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
F	42 - Participating	628,500	5,384,644	704.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
G	43 - Participating	630,148	5,374,326	691.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
H	44 - Participating	629,997	5,384,325	711.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
I	3 - Non-Participating	630,488	5,379,437	722.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
J	4 - Non-Participating	632,031	5,373,676	696.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
K	45 - Participating	633,554	5,377,057	735.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
L	46 - Participating	633,395	5,383,413	715.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
M	47 - Participating	634,615	5,381,825	716.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
N	48 - Participating	634,891	5,378,584	728.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
O	5 - Non-Participating	636,328	5,376,974	731.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
P	49 - Participating	636,455	5,380,259	709.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Q	50 - Participating	636,416	5,382,006	707.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
R	51 - Participating	637,621	5,371,070	716.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
S	6 - Non-Participating	637,411	5,365,868	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
T	52 - Participating	640,276	5,365,862	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
U	7 - Non-Participating	638,615	5,371,717	720.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
V	8 - Non-Participating	638,435	5,378,666	709.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
W	9 - Non-Participating	640,413	5,369,191	728.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
X	10 - Non-Participating	643,279	5,372,615	722.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
Z	53 - Participating	642,413	5,373,644	734.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AA	54 - Participating	643,167	5,375,685	714.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AE	55 - Participating	635,760	5,381,775	711.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AG	57 - Participating	633,480	5,378,691	739.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AH	59 - Participating	643,400	5,373,968	711.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AI	61 - Participating	633,645	5,373,895	713.7	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AJ	62 - Participating	643,453	5,372,097	716.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AK	63 - Participating	641,300	5,368,154	725.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AO	64 - Participating	639,268	5,377,996	720.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"

To be continued on next page...

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SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

No.	Name	X(East)	Y(North)	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
AZ	66 - Participating	638,244	5,370,747	710.8	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BA	67 - Participating	637,448	5,370,698	712.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BB	68 - Participating	635,378	5,369,828	692.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.0	11.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

		Shadow, worst case			Shadow, expected values
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
A	1 - Non-Participating	0:00	0	0:00	0:00
B	39 - Participating	17:46	67	0:24	7:45
C	2 - Non-Participating	7:15	48	0:14	2:46
D	40 - Participating	35:25	61	0:53	12:36
E	41 - Participating	0:00	0	0:00	0:00
F	42 - Participating	73:56	160	0:47	26:09
G	43 - Participating	0:00	0	0:00	0:00
H	44 - Participating	70:29	158	0:57	26:26
I	3 - Non-Participating	16:43	51	0:29	6:54
J	4 - Non-Participating	19:30	60	0:25	8:05
K	45 - Participating	132:56	209	1:20	45:09
L	46 - Participating	12:46	55	0:24	4:43
M	47 - Participating	76:04	174	0:49	26:44
N	48 - Participating	32:54	139	0:27	14:14
O	5 - Non-Participating	46:28	141	0:38	15:09
P	49 - Participating	56:15	145	0:52	18:22
Q	50 - Participating	31:23	94	0:30	9:43
R	51 - Participating	13:20	62	0:18	6:40
S	6 - Non-Participating	48:30	111	0:42	21:20
T	52 - Participating	15:16	49	0:28	7:17
U	7 - Non-Participating	3:50	22	0:16	1:41
V	8 - Non-Participating	86:31	164	0:48	25:00
W	9 - Non-Participating	62:59	117	1:06	17:43
X	10 - Non-Participating	88:30	162	0:57	35:21
Y	11 - Non-Participating	36:45	85	0:46	15:31
Z	53 - Participating	3:18	22	0:15	1:10
AA	54 - Participating	3:07	20	0:15	1:05
AB	12 - Non-Participating	42:38	92	0:42	16:35
AC	13 - Non-Participating	8:15	35	0:18	2:36
AD	14 - Non-Participating	0:00	0	0:00	0:00
AE	55 - Participating	72:17	130	0:50	19:32
AF	15 - Non-Participating	0:00	0	0:00	0:00
AG	57 - Participating	43:11	135	0:34	20:27
AH	59 - Participating	17:50	68	0:24	7:48
AI	61 - Participating	0:00	0	0:00	0:00
AJ	62 - Participating	35:14	61	0:53	12:33
AK	63 - Participating	33:16	91	0:38	14:55

To be continued on next page...

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Calculated:
9/15/2018 5:45 AM/3.0.654

SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

No.	Name	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow, expected values Shadow hours per year [h/year]
AL	16 - Non-Participating	23:42	97	0:33	8:19
AM	17 - Non-Participating	20:33	64	0:24	8:33
AN	18 - Non-Participating	26:41	97	0:26	11:29
AO	64 - Participating	69:12	106	0:59	23:09
AP	19 - Non-Participating	9:18	35	0:25	2:45
AQ	20 - Non-Participating	8:35	38	0:16	2:07
AR	21 - Non-Participating	0:00	0	0:00	0:00
AS	22 - Non-Participating	0:00	0	0:00	0:00
AT	23 - Non-Participating	0:00	0	0:00	0:00
AU	24 - Non-Participating	18:30	54	0:25	6:02
AV	27 - Non-Participating	58:48	144	1:07	19:45
AW	29 - Non-Participating	0:00	0	0:00	0:00
AX	30 - Non-Participating	12:08	50	0:18	3:07
AY	31 - Non-Participating	9:38	49	0:21	3:38
AZ	66 - Participating	19:36	54	0:33	5:28
BA	67 - Participating	26:00	71	0:34	8:39
BB	68 - Participating	0:00	0	0:00	0:00
BC	32 - Non-Participating	0:00	0	0:00	0:00
BD	33 - Non-Participating	0:00	0	0:00	0:00
BE	34 - Non-Participating	0:00	0	0:00	0:00
BF	35 - Non-Participating	0:00	0	0:00	0:00
BG	36 - Non-Participating	0:00	0	0:00	0:00
BH	37 - Non-Participating	9:09	37	0:22	3:49
BI	38 - Non-Participating	0:00	0	0:00	0:00

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	T-43	0:00	0:00
2	T-41	11:58	5:35
3	T-63	3:07	1:05
4	T-62	0:00	0:00
5	T-45	0:00	0:00
6	T-35	3:50	1:41
7	T-47	0:00	0:00
8	T-56	0:00	0:00
9	T-55	0:00	0:00
10	T-39	0:00	0:00
11	T-38	0:00	0:00
12	T-37	0:00	0:00
13	T-70	0:00	0:00
14	T-77	0:00	0:00
15	T-53	0:00	0:00
16	T-67	3:40	1:11
17	T-66	0:00	0:00
18	T-69	34:46	10:14
19	T-93	35:13	17:31
20	T-80	77:48	21:41
21	T-58	0:00	0:00
22	T-73	0:00	0:00
23	T-28	90:48	38:02
24	T-78	63:12	20:06
25	T-76	0:00	0:00
26	T-79	0:00	0:00
27	T-46	0:00	0:00
28	T-57	0:00	0:00
29	T-71	12:11	4:03

To be continued on next page...

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SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
30	T-59	0:00	0:00
31	T-60	0:00	0:00
32	T-61	0:00	0:00
33	T-40	0:00	0:00
34	T-15	0:00	0:00
35	T-16	0:00	0:00
36	T-17	0:00	0:00
37	T-12	0:00	0:00
38	T-13	3:08	1:16
39	T-26	0:00	0:00
40	T-25	22:40	7:46
41	T-10	3:54	1:29
42	T-8	0:00	0:00
43	T-94	5:50	2:47
44	T-95	7:36	3:29
45	T-96	0:00	0:00
46	T-121	5:36	1:51
47	T-142	61:06	24:32
48	T-131	2:45	1:21
49	T-129	0:00	0:00
50	T-141	11:26	3:45
51	T-123	0:00	0:00
52	T-144	15:30	4:58
53	T-145	7:57	2:38
54	T-146	19:52	6:09
55	T-122	0:00	0:00
56	T-117	17:51	5:38
57	T-130	3:06	1:22
58	T-44	0:00	0:00
59	T-72	31:24	8:38
60	T-75	0:00	0:00
61	T-34	13:20	6:40
62	T-74	0:00	0:00
63	T-81	3:30	0:57
64	T-98	24:46	9:26
65	T-85	0:00	0:00
66	T-86	34:06	10:08
67	T-87	6:13	2:41
68	T-51	21:53	9:05
69	T-23	4:01	1:01
70	T-11	3:51	1:41
71	T-22	63:20	19:30
72	T-5	18:30	6:02
73	T-9	18:01	7:43
74	T-90	13:11	3:55
75	T-91	13:29	3:36
76	T-92	12:30	5:29
77	T-106	4:58	1:25
78	T-100	0:00	0:00
79	T-107	29:10	9:02
80	T-99	5:46	2:19
81	T-143	22:22	9:54
82	T-108	125:00	36:49
83	T-109	10:14	3:15
84	T-110	4:15	1:27
85	T-124	5:06	2:08
86	T-88	11:58	5:29
87	T-89	17:58	4:57
88	T-14	0:00	0:00
89	T-24	22:56	6:22

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SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
90	T-42	0:00	0:00
91	T-68	11:05	3:30
92	T-21	0:00	0:00
93	T-20	0:00	0:00
94	T-19	0:00	0:00
95	T-18	0:00	0:00
96	T-83	41:28	17:22
97	T-84	22:36	9:48
98	T-54	0:00	0:00
99	T-118	0:00	0:00
100	T-120	8:16	3:44
101	T-105	0:00	0:00
102	T-97	11:48	4:44
103	T-147	0:00	0:00
104	T-148	0:00	0:00
105	T-149	0:00	0:00
106	T-150	0:00	0:00
107	T-151	0:00	0:00
108	T-152	35:53	11:33
109	T-153	20:27	8:14
110	T-154	0:00	0:00
111	T-155	0:00	0:00
112	T-156	49:14	16:57
113	T-157	16:28	5:49
114	T-158	8:06	2:32
115	T-159	39:30	12:33
116	T-160	0:00	0:00
117	T-161	33:07	14:48
118	T-162	0:00	0:00
119	T-163	12:15	4:48
120	T-164	35:54	16:26
121	T-165	9:09	3:49
122	T-166	0:00	0:00
123	T-167	0:00	0:00
124	T-168	3:41	1:37
125	T-169	0:00	0:00
126	T-170	31:09	11:30
127	T-171	11:27	5:01
128	T-172	12:03	4:03
129	T-173	2:40	0:51
130	T-174	20:17	5:08
131	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (1)	0:00	0:00
132	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (2)	0:00	0:00
133	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (3)	0:00	0:00
134	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (4)	0:00	0:00
135	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (5)	0:00	0:00
136	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (6)	0:00	0:00
137	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (7)	0:00	0:00
138	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (8)	0:00	0:00
139	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (9)	0:00	0:00
140	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (10)	0:00	0:00
141	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (11)	0:00	0:00
142	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (12)	0:00	0:00
143	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (13)	0:00	0:00
144	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (14)	0:00	0:00
145	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (15)	0:00	0:00
146	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (16)	0:00	0:00
147	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (17)	0:00	0:00
148	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (18)	0:00	0:00
149	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (19)	0:00	0:00

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SHADOW - Main Result

Calculation: SG132-3.465 114m HH Shadow Flicker

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
150	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (20)	0:00	0:00
151	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (21)	4:06	1:25
152	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (22)	0:00	0:00
153	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (23)	0:00	0:00
154	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (24)	0:00	0:00
155	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (25)	0:00	0:00
156	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (26)	0:00	0:00
157	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (27)	0:00	0:00
158	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (28)	0:00	0:00
159	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (29)	0:00	0:00
160	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (30)	0:00	0:00
161	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (31)	0:00	0:00
162	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (32)	0:00	0:00
163	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (33)	0:00	0:00
164	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (34)	0:00	0:00
165	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (35)	0:00	0:00
166	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (36)	0:00	0:00
167	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (37)	0:00	0:00
168	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (38)	0:00	0:00
169	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (39)	0:00	0:00
170	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (40)	0:00	0:00
171	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (41)	0:00	0:00
172	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (42)	0:00	0:00
173	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (43)	0:00	0:00
174	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (44)	0:00	0:00
175	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (45)	0:00	0:00
176	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (46)	0:00	0:00
177	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (47)	12:37	5:15
178	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (48)	0:00	0:00
179	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (49)	0:00	0:00
180	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (50)	0:00	0:00
181	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (51)	0:00	0:00
182	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (52)	0:00	0:00
183	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (53)	0:00	0:00
184	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (54)	0:00	0:00
185	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (55)	0:00	0:00
186	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (56)	0:00	0:00
187	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (57)	0:00	0:00
188	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (58)	0:00	0:00
189	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (59)	0:00	0:00
190	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (60)	0:00	0:00
191	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (61)	0:00	0:00
192	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (62)	0:00	0:00
193	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (63)	0:00	0:00
194	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (64)	0:00	0:00
195	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (65)	0:00	0:00
196	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (66)	0:00	0:00
197	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (67)	0:00	0:00
198	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (68)	0:00	0:00
199	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (69)	0:00	0:00
200	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (70)	0:00	0:00
201	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (71)	1:44	0:43
202	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (72)	0:00	0:00
203	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (73)	0:00	0:00
204	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (74)	0:00	0:00
205	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (75)	0:00	0:00
206	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (76)	0:00	0:00
207	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (77)	0:00	0:00
208	VESTAS V100 2000 100.0 !O! hub: 80.0 m (TOT: 130.0 m) (78)	0:00	0:00

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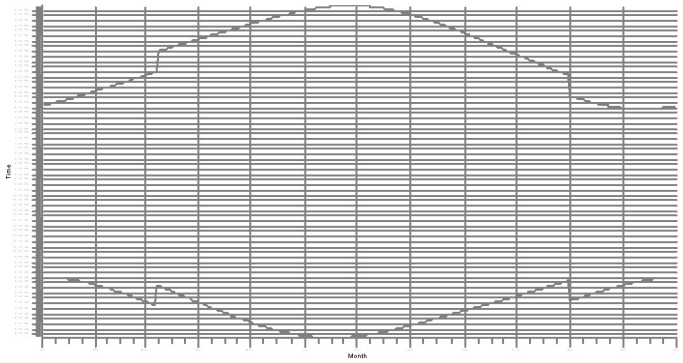
Calculated:
9/15/2018 5:45 AM/3.0.654

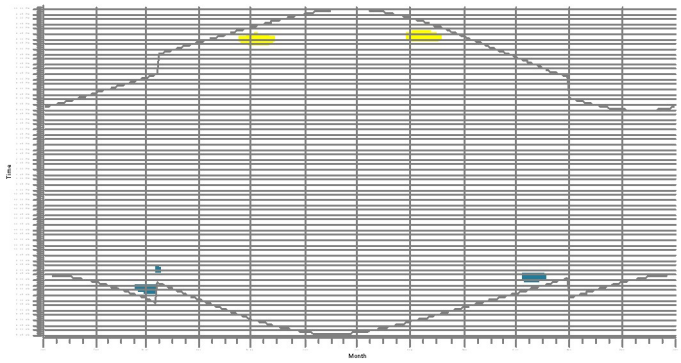
SHADOW - Calendar, graphical

Calculation: SG132-3.465 114m HH Shadow Flicker

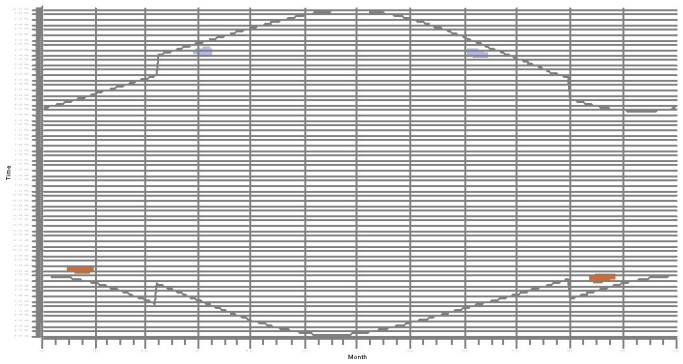
A: 1 - Non-Participating



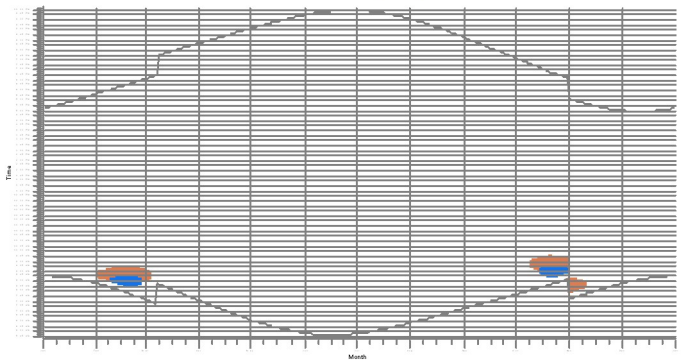
B: 39 - Participating



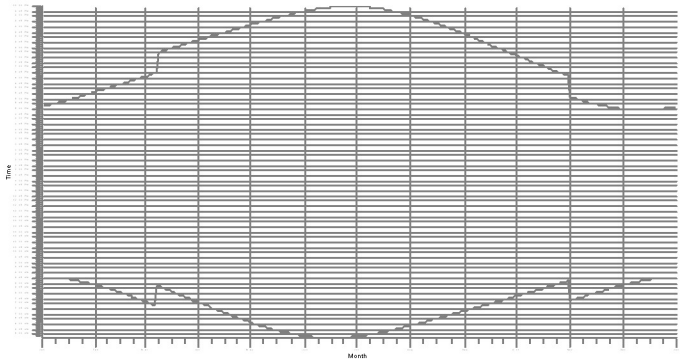
C: 2 - Non-Participating



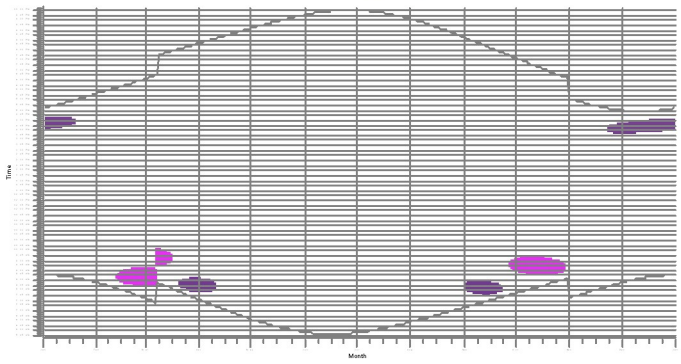
D: 40 - Participating



E: 41 - Participating



F: 42 - Participating



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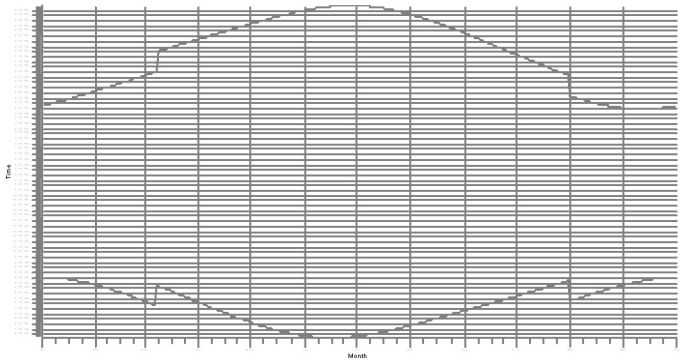
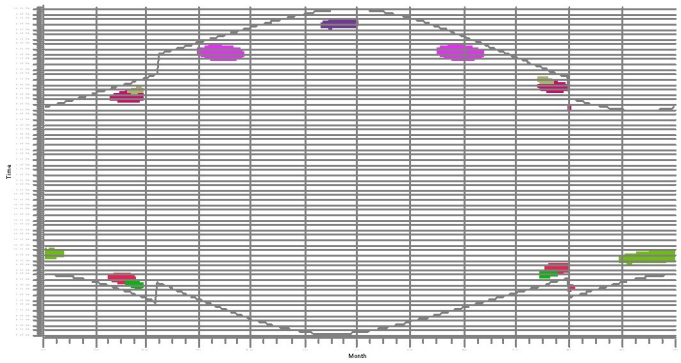
SHADOW - Calendar, graphical

Calculation: SG132-3.465 114m HH Shadow Flicker

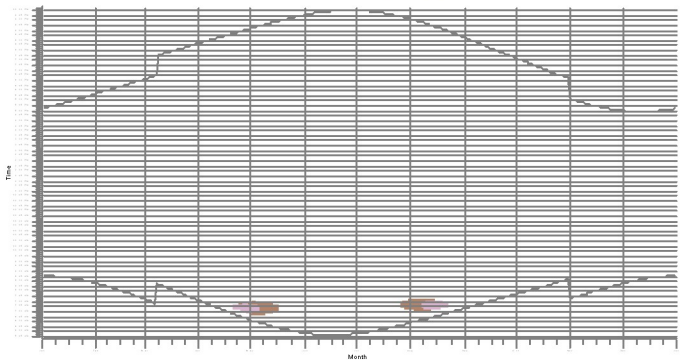
G: 43 - Participating



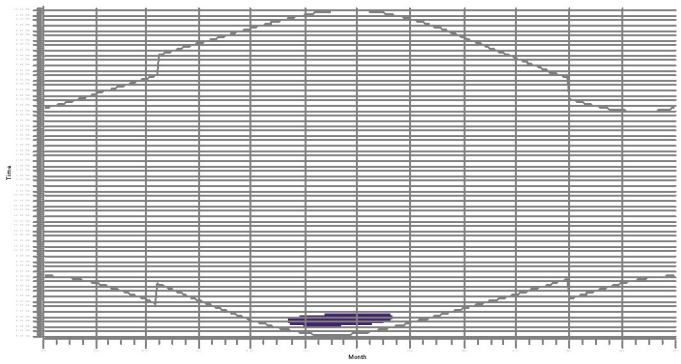
H: 44 - Participating



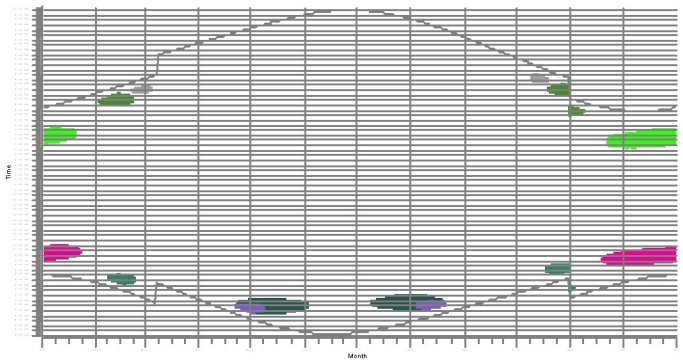
I: 3 - Non-Participating



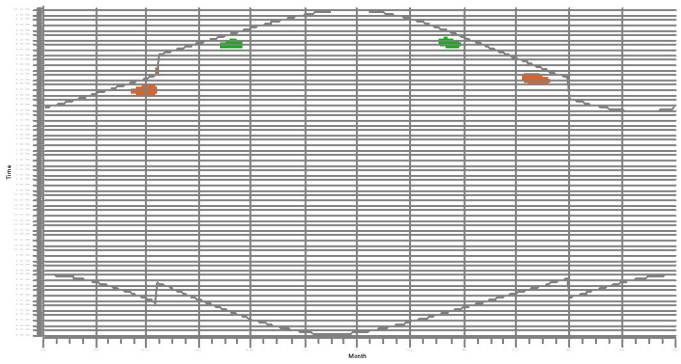
J: 4 - Non-Participating



K: 45 - Participating



L: 46 - Participating



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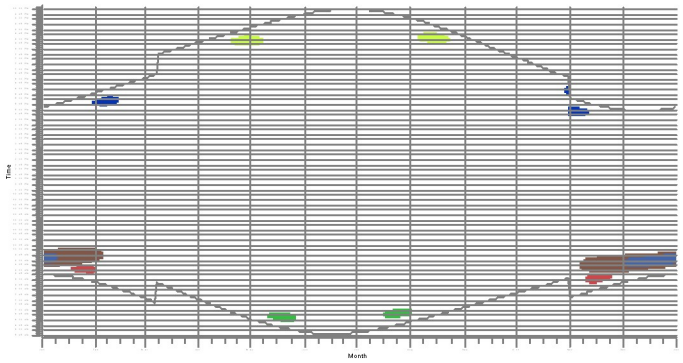
Calculated:
9/15/2018 5:45 AM/3.0.654

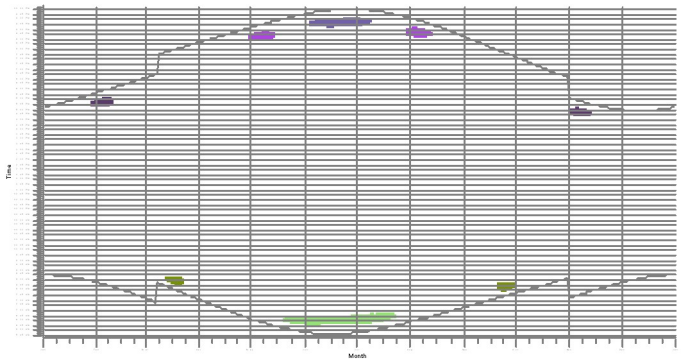
SHADOW - Calendar, graphical

Calculation: SG132-3.465 114m HH Shadow Flicker

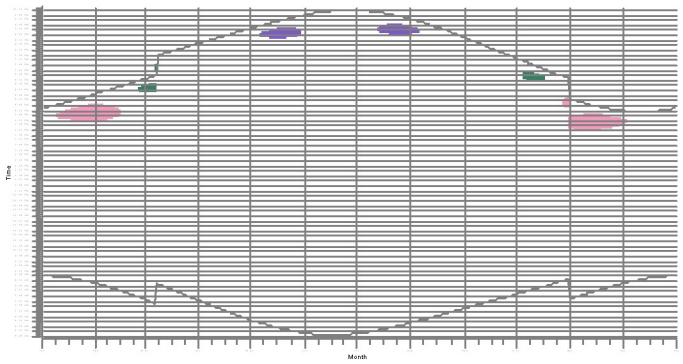
M: 47 - Participating



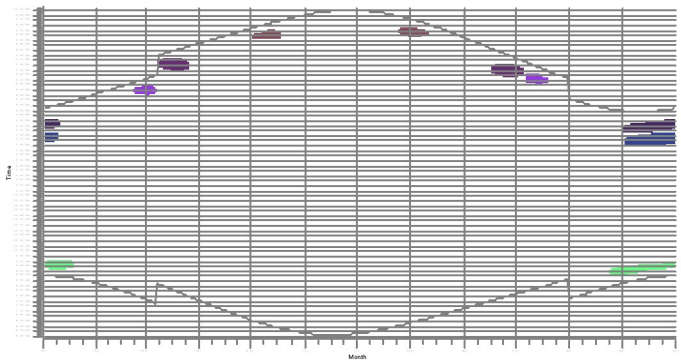
N: 48 - Participating



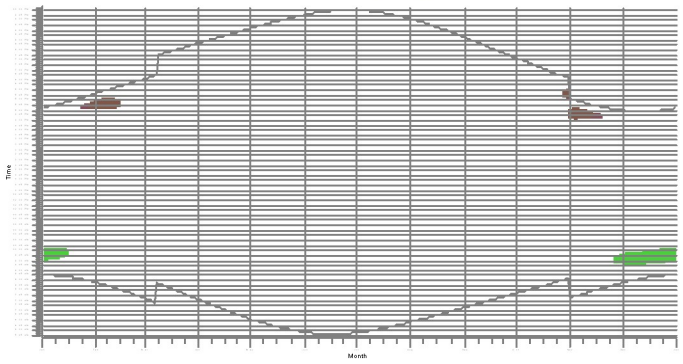
O: 5 - Non-Participating



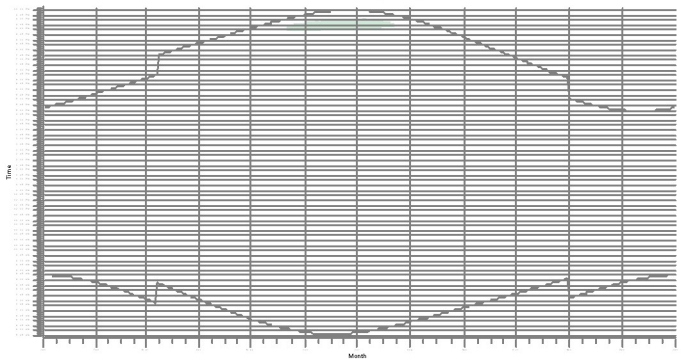
P: 49 - Participating



Q: 50 - Participating



R: 51 - Participating



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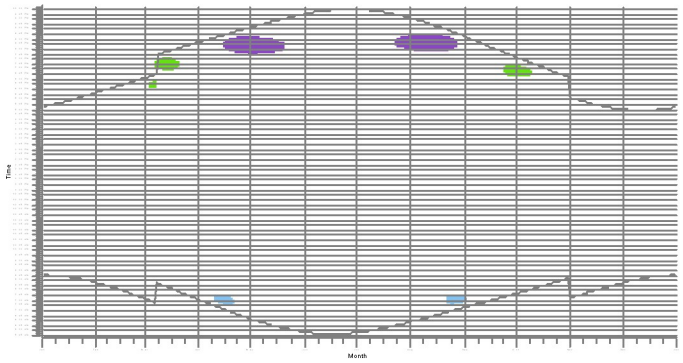
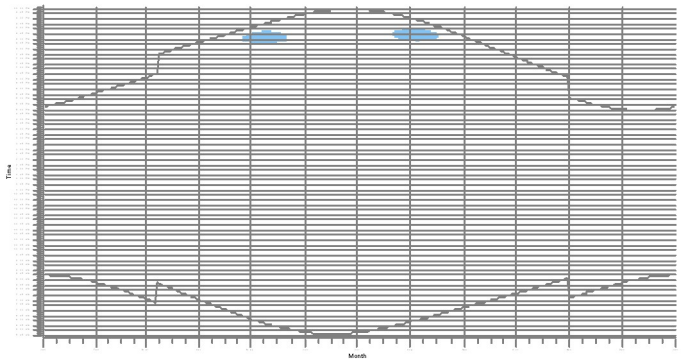
SHADOW - Calendar, graphical

Calculation: SG132-3.465 114m HH Shadow Flicker

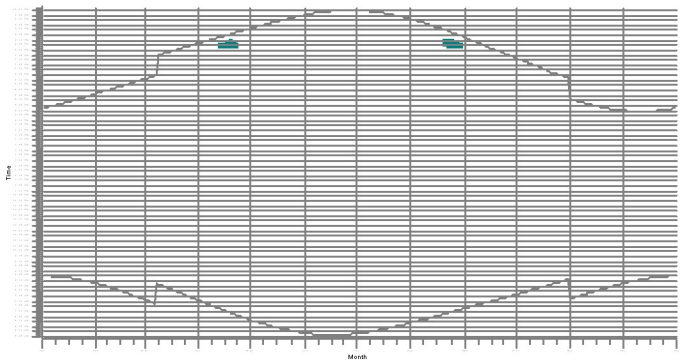
S: 6 - Non-Participating



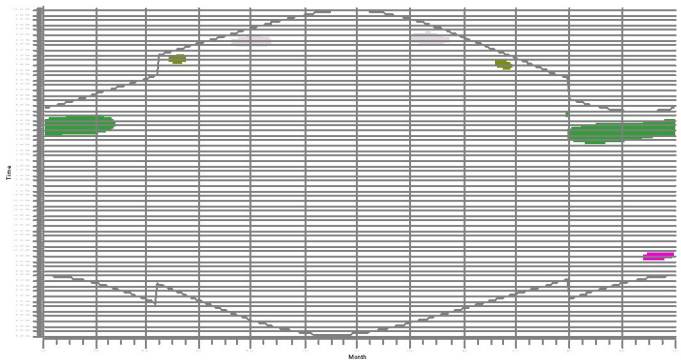
T: 52 - Participating



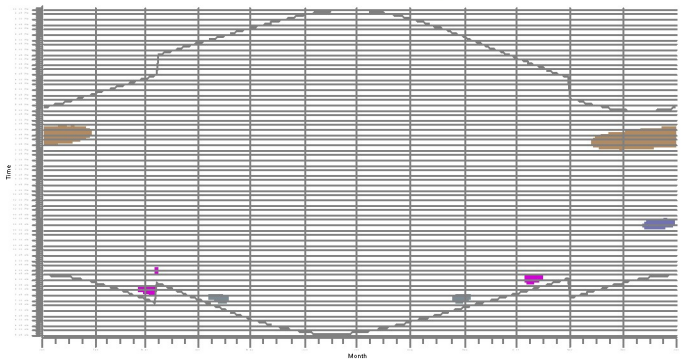
U: 7 - Non-Participating



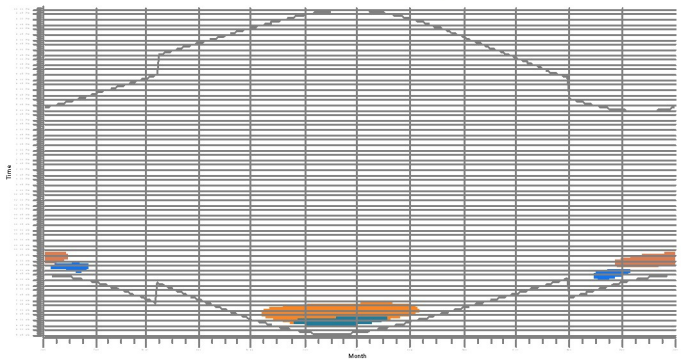
V: 8 - Non-Participating



W: 9 - Non-Participating



X: 10 - Non-Participating



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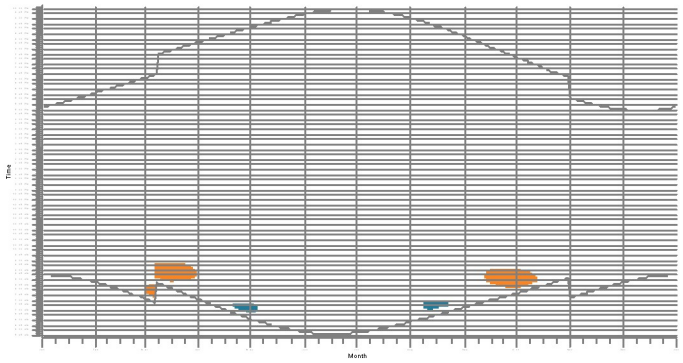
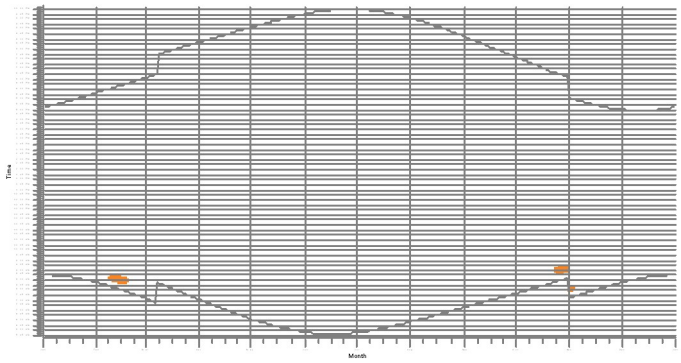
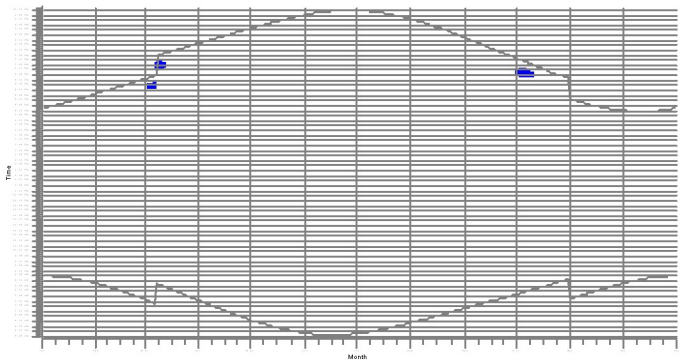
Y: 11 - Non-Participating



Z: 53 - Participating



AA: 54 - Participating



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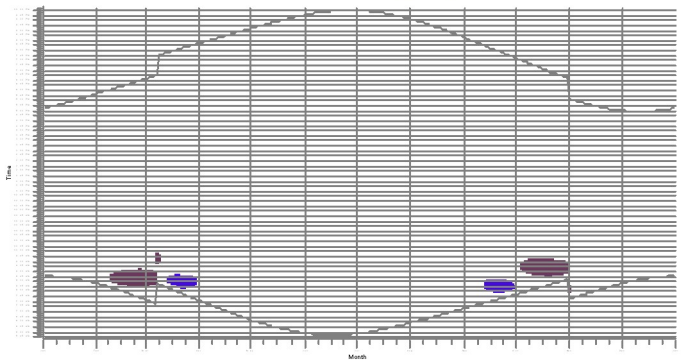
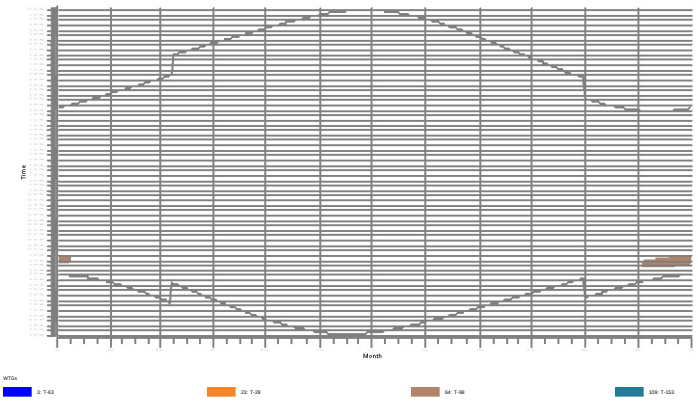
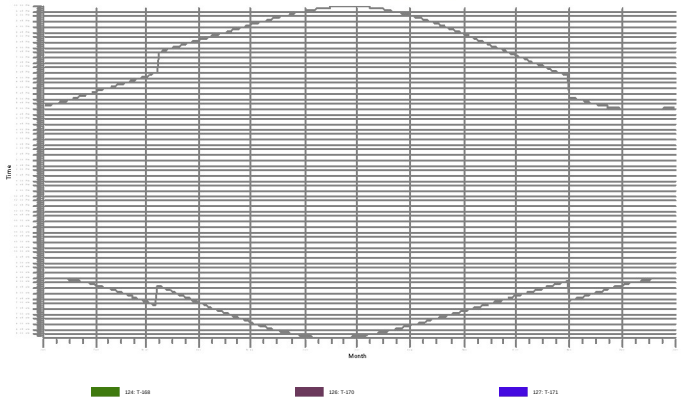


AC: 13 - Non-Participating



AD: 14 - Non-Participating



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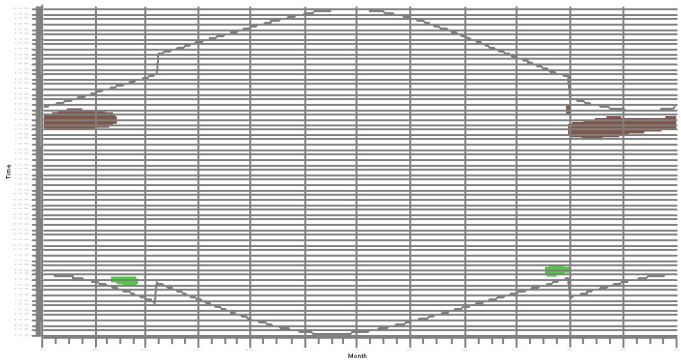
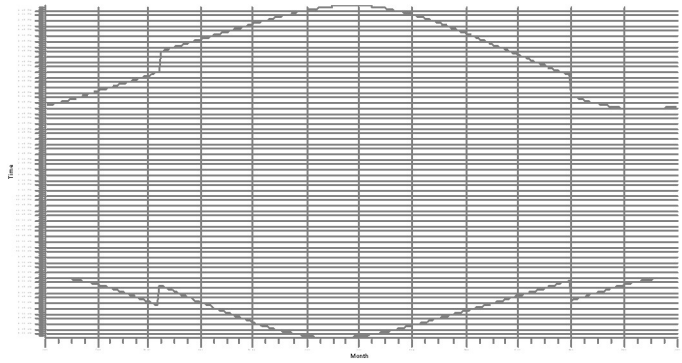
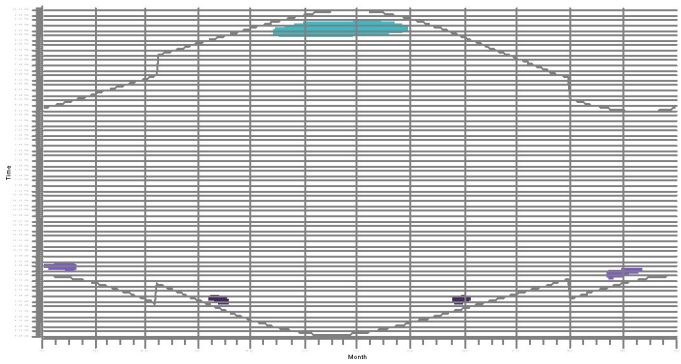
AE: 55 - Participating



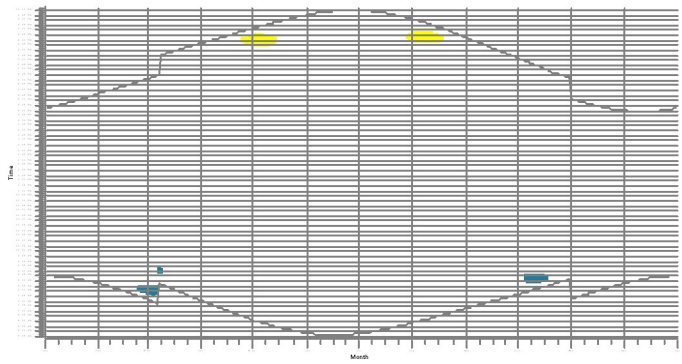
AF: 15 - Non-Participating



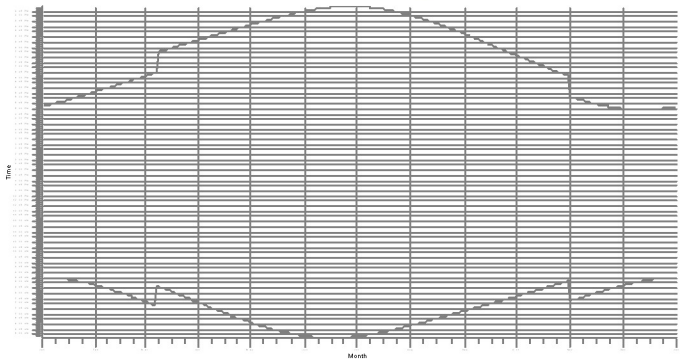
AG: 57 - Participating



AH: 59 - Participating



AI: 61 - Participating



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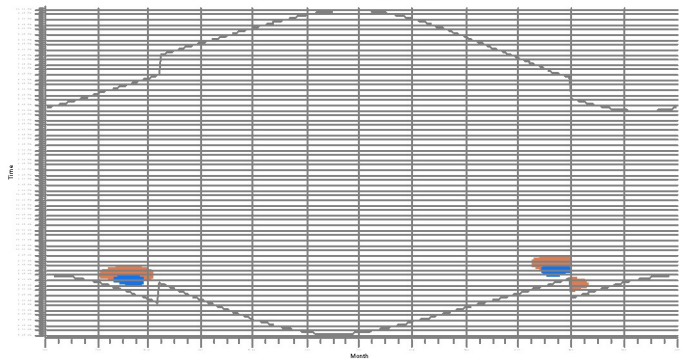

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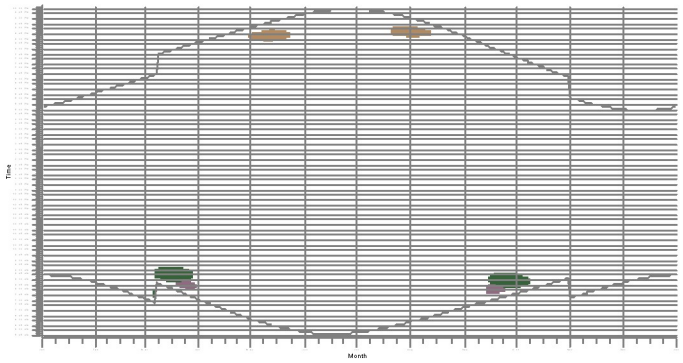
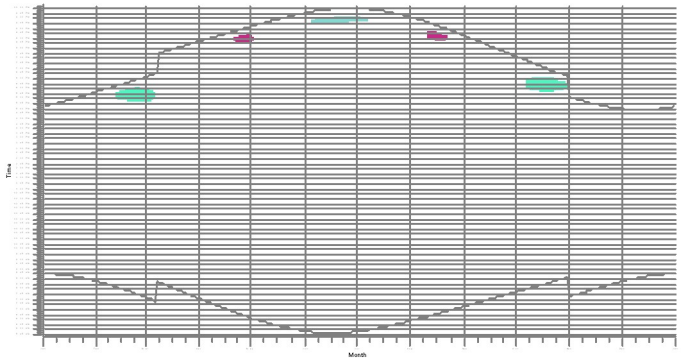
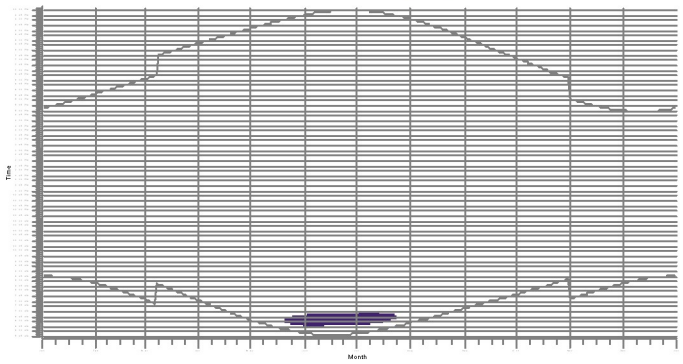
AK: 63 - Participating



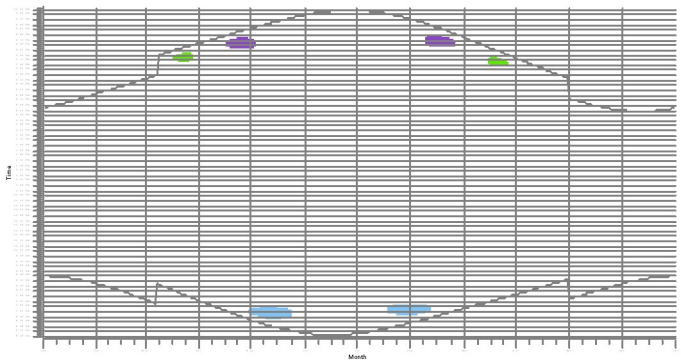
AL: 16 - Non-Participating



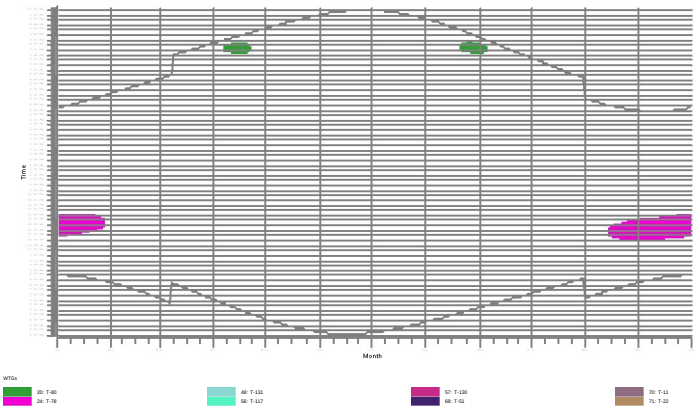
AM: 17 - Non-Participating



AN: 18 - Non-Participating



AO: 64 - Participating



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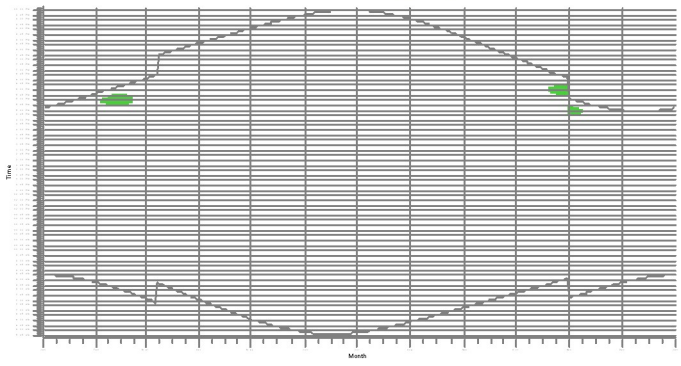

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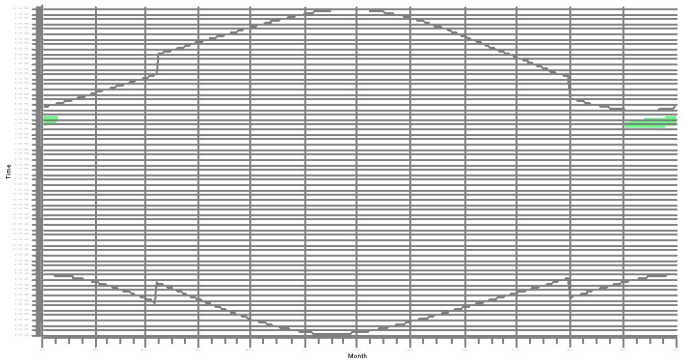
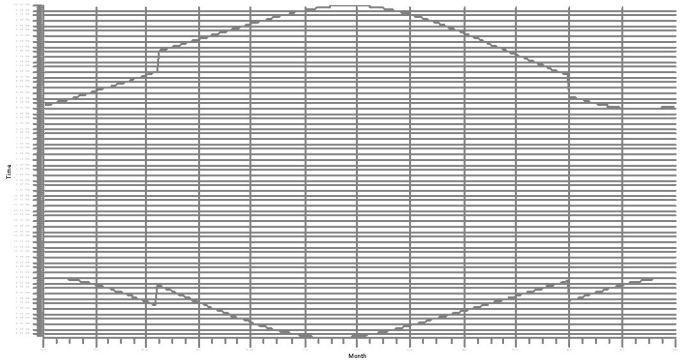
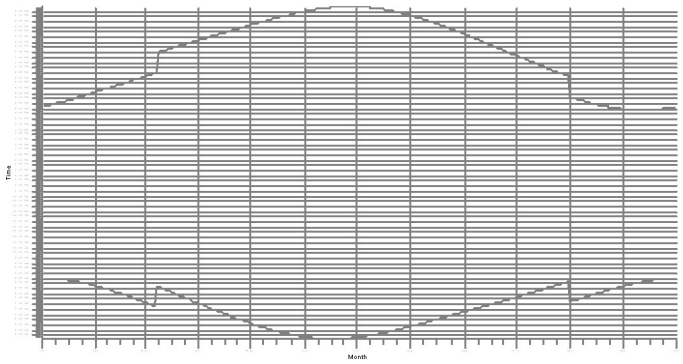
AQ: 20 - Non-Participating



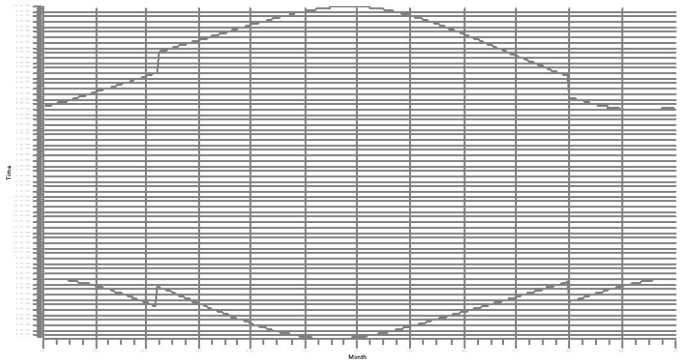
AR: 21 - Non-Participating



AS: 22 - Non-Participating



AT: 23 - Non-Participating



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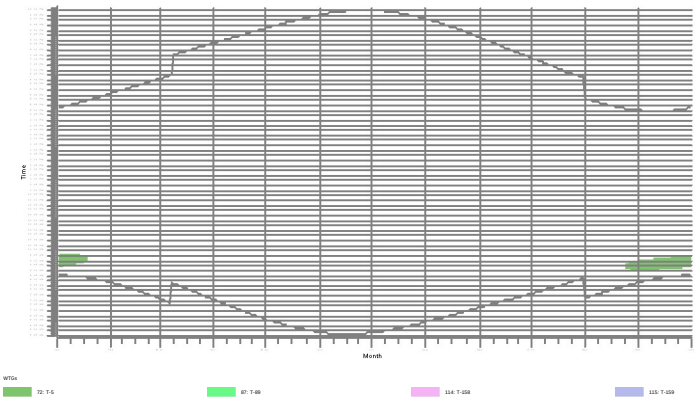
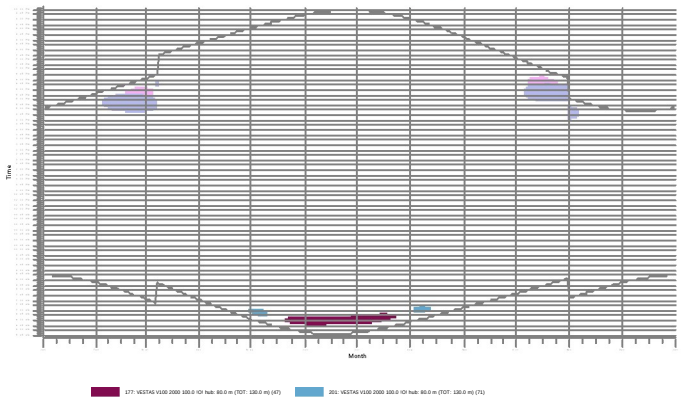


AV: 27 - Non-Participating



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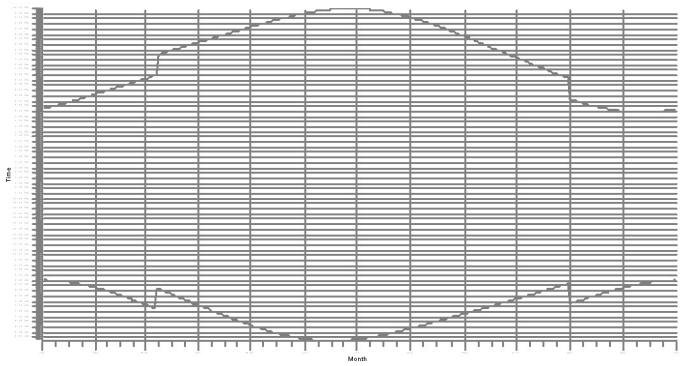
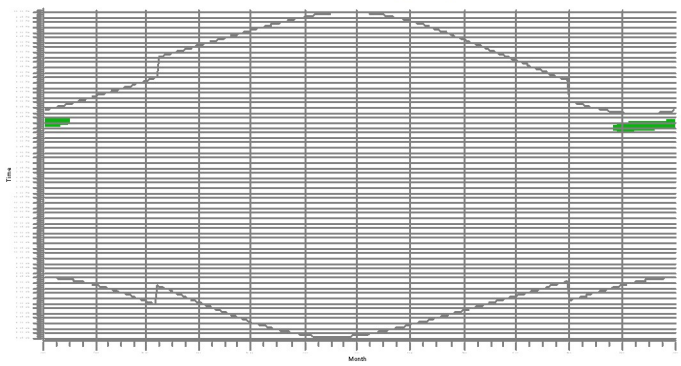
AW: 29 - Non-Participating



AX: 30 - Non-Participating



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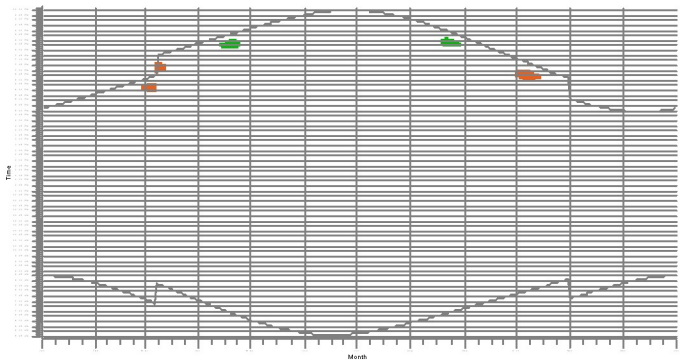
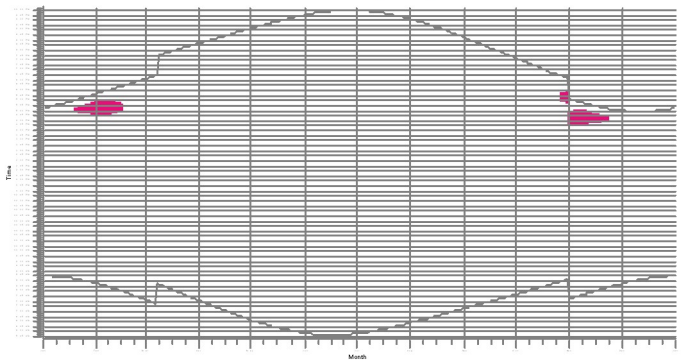
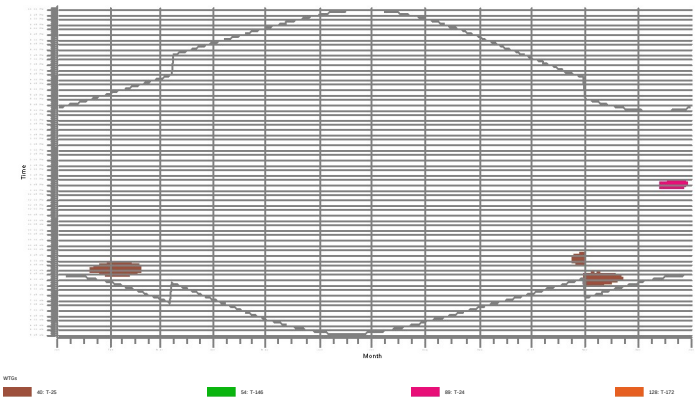


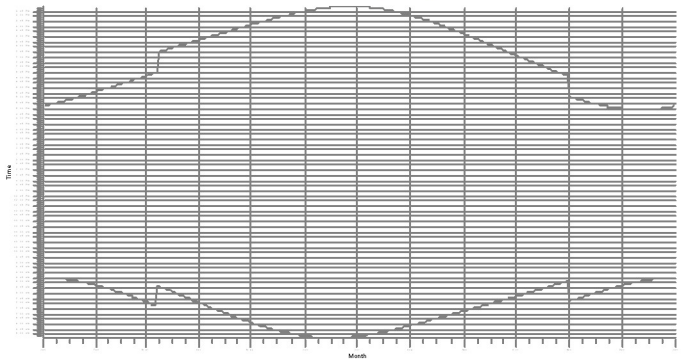
AZ: 66 - Participating



BA: 67 - Participating



BB: 68 - Participating



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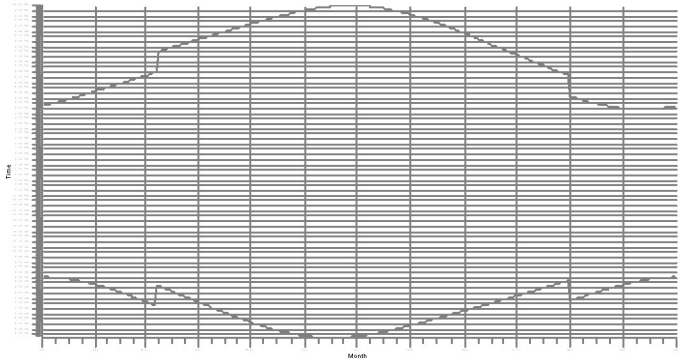
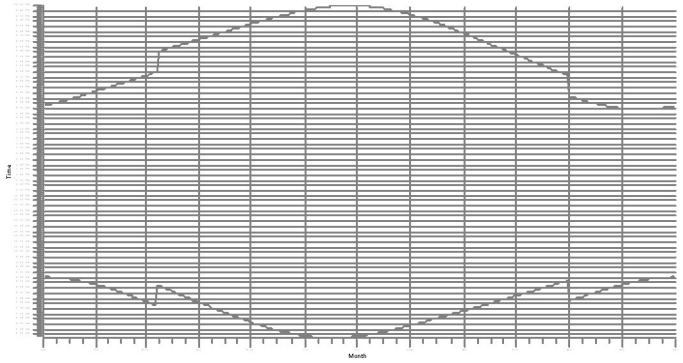
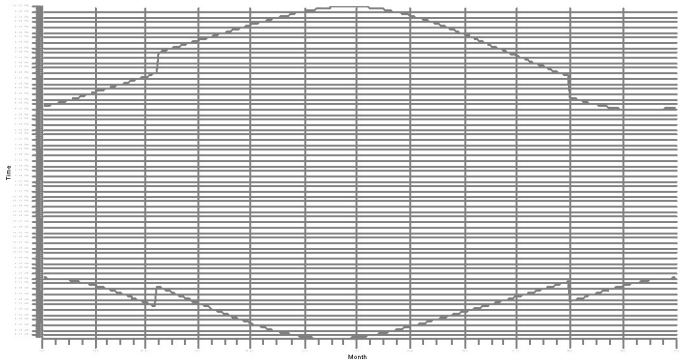
BC: 32 - Non-Participating



BD: 33 - Non-Participating



BE: 34 - Non-Participating



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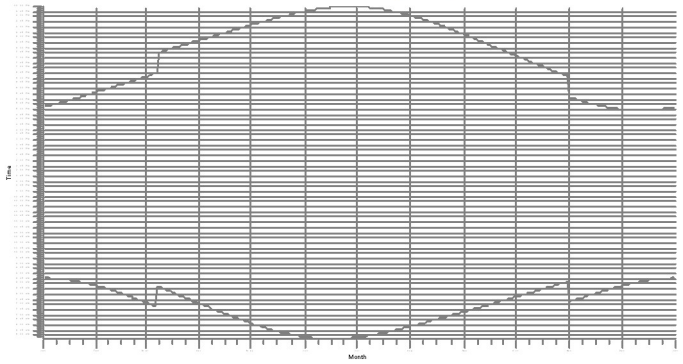
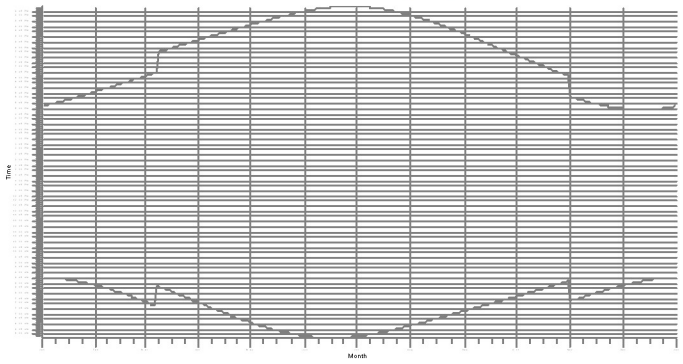
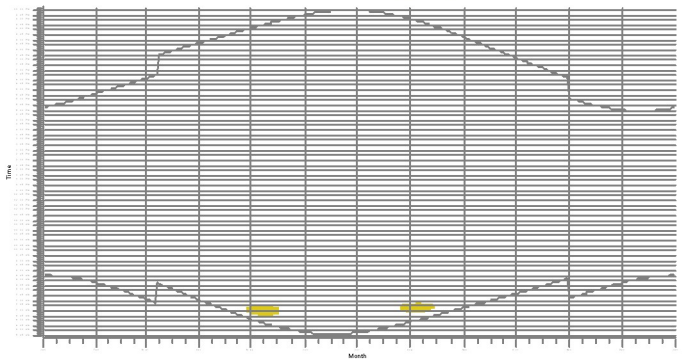


BG: 36 - Non-Participating



BH: 37 - Non-Participating



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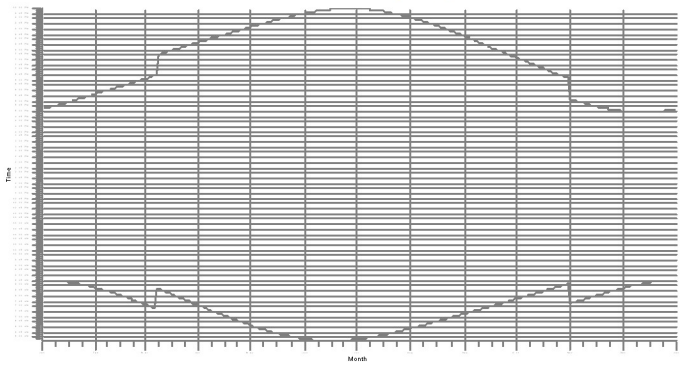
BI: 38 - Non-Participating



WTGs

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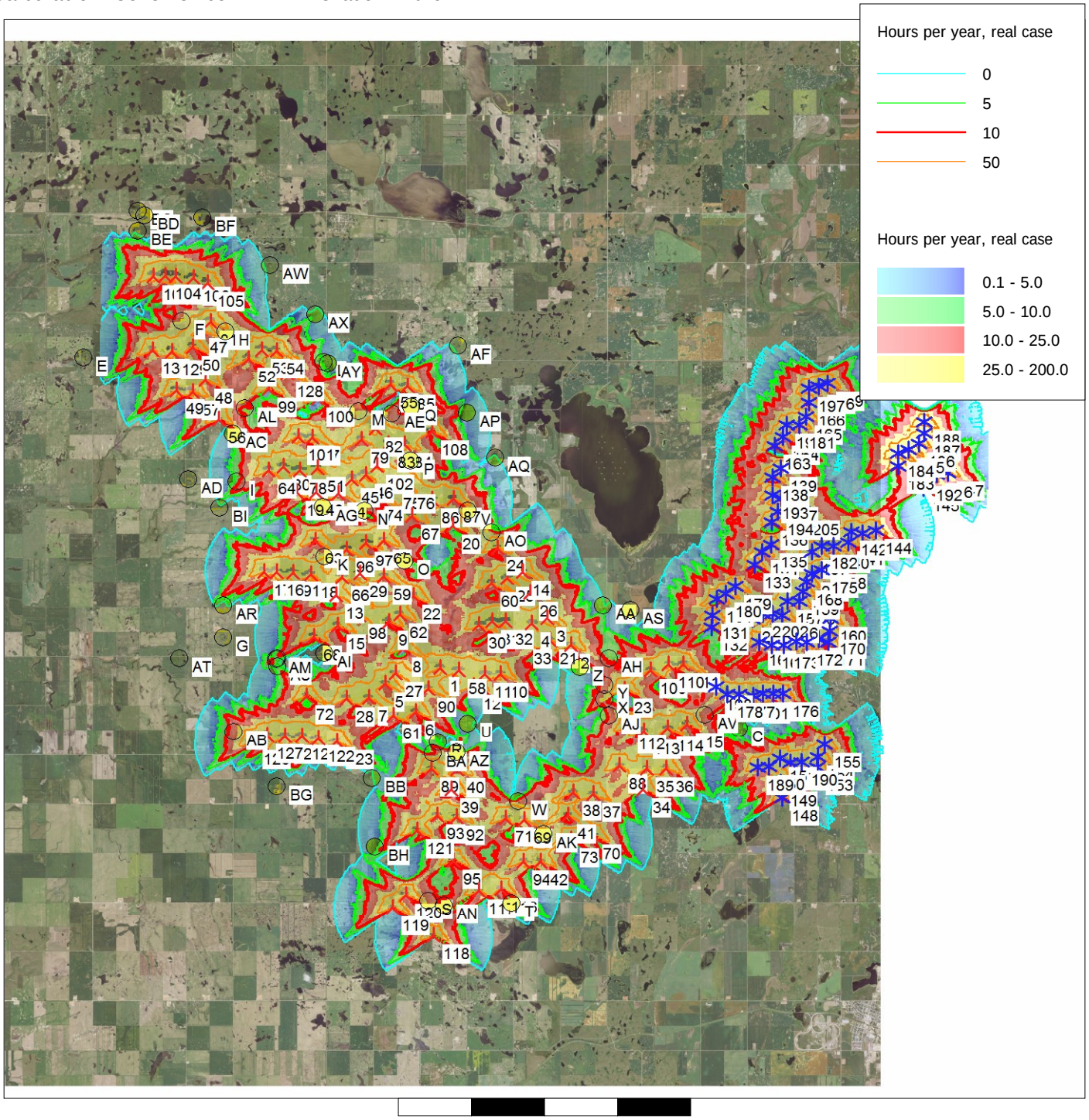
SHADOW - Map

Calculation: SG132-3.465 114m HH Shadow Flicker



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 640,676 North: 5,375,910

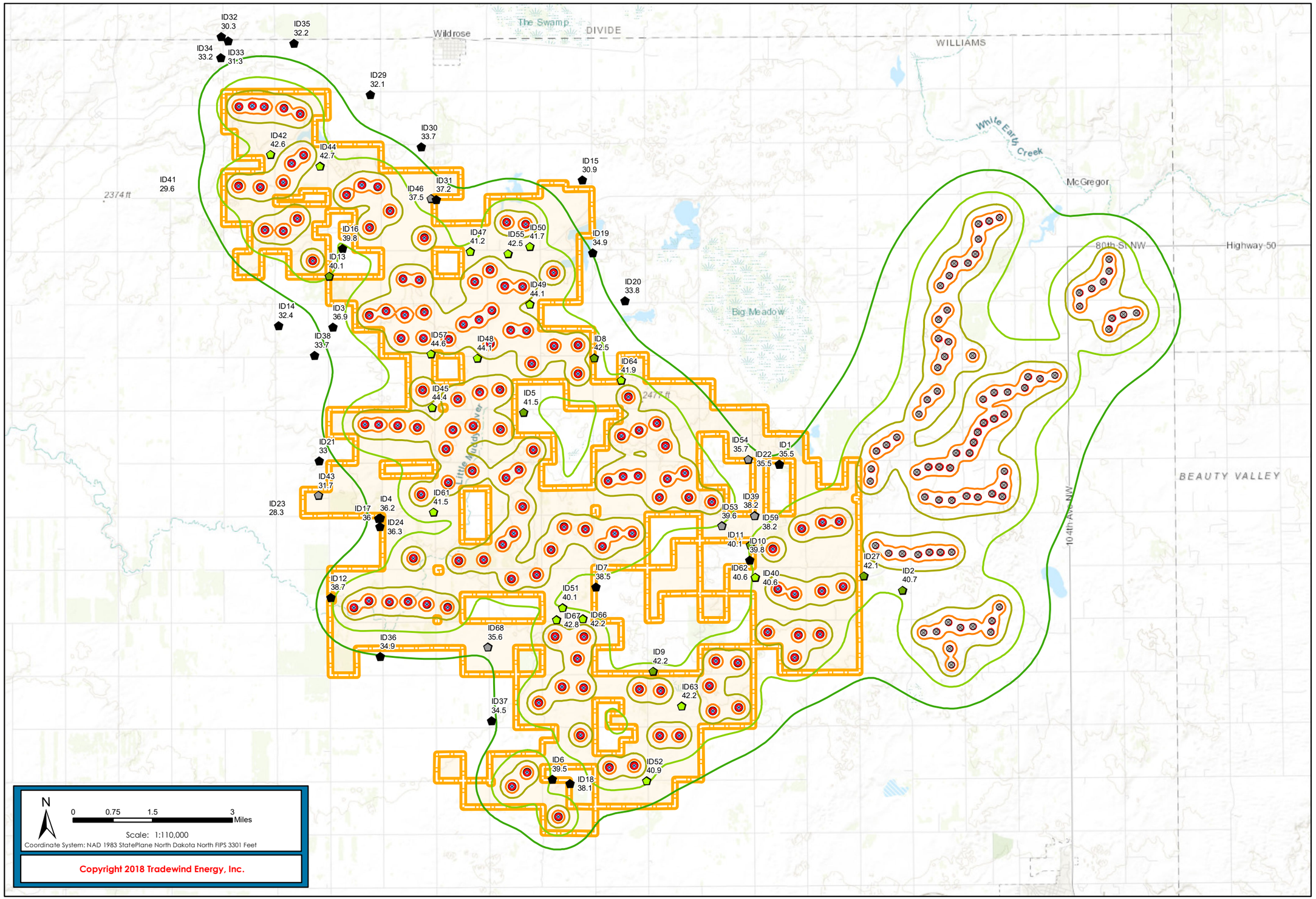
New WTG Existing WTG Shadow receptor

Flicker map level: Height Contours: 150921_TWE_LindahlWest_10ftHCLsfrom10mNED.wpo (3)

Sound Maps

Aurora Wind Project - Anticipated Maximum Sound Levels
G132 3.465 114m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

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Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Sound Receptor (Non-Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Receptor (Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Isolines

Sound Level (dBA)

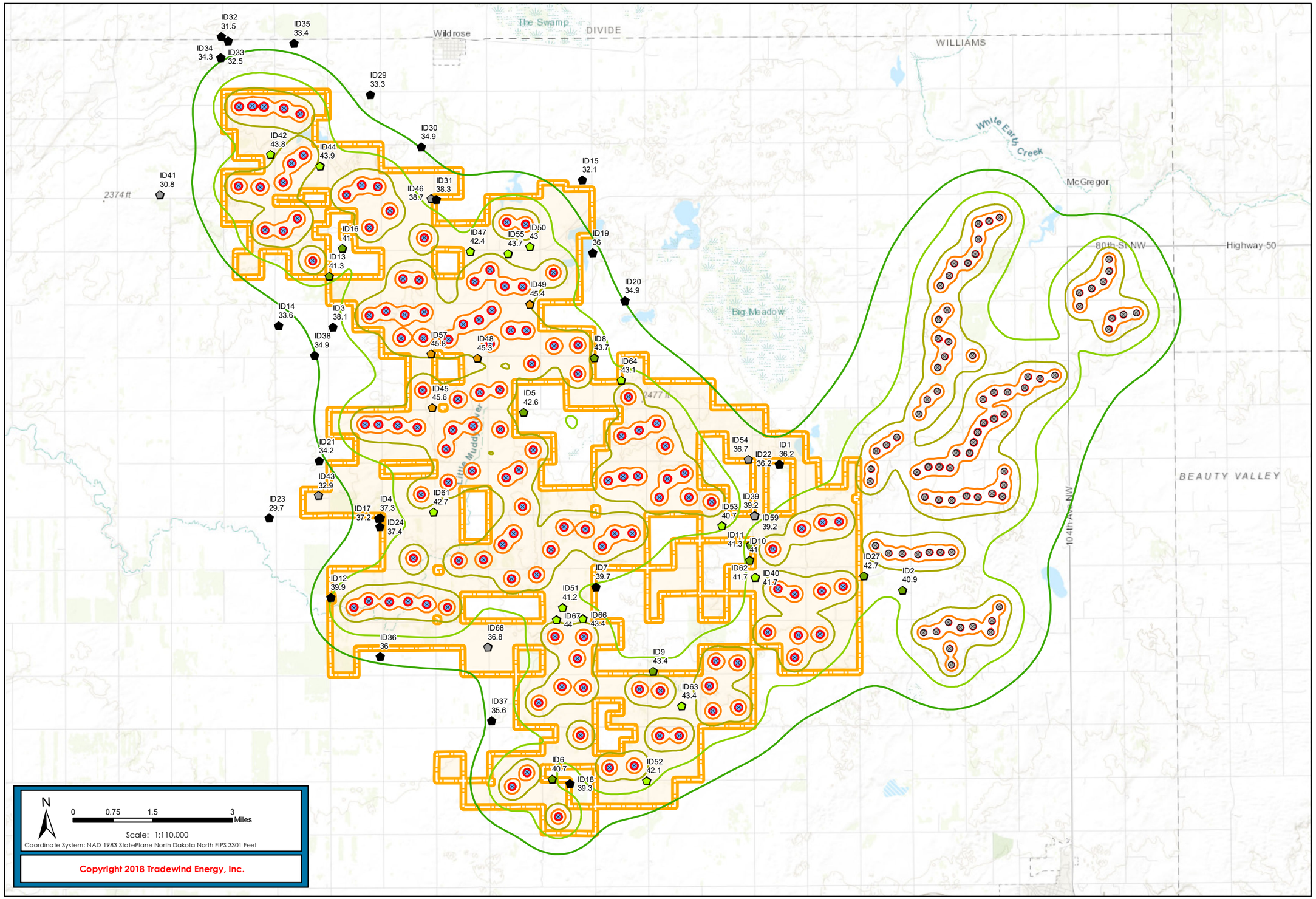
- 35
- 40
- 45
- 50
- 55

The following companies and organizations provided data that contributed to the production of this map.

U.S. Geological Survey (USGS)
Environmental Systems Research Institute (ESRI)
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

Aurora Wind Project - Anticipated Maximum Sound Levels
V136 4.0/4.2 82m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

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Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Sound Receptor (Non-Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Receptor (Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Isolines

Sound Level (dBA)

- 35
- 40
- 45
- 50
- 55

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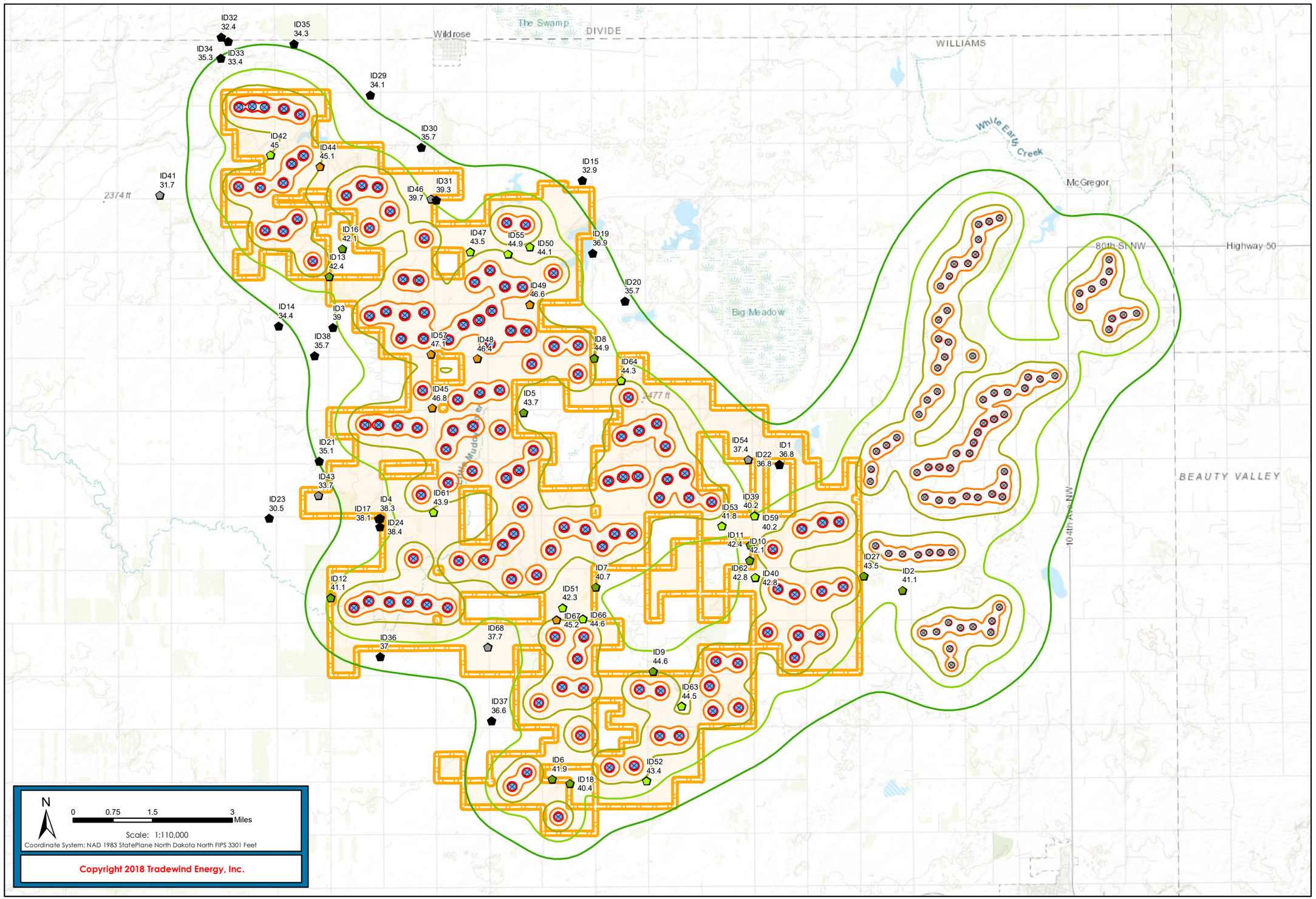
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

Aurora Wind Project - Anticipated Maximum Sound Levels
V136 3.45/3.6 82m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

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Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Sound Receptor (Non-Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Receptor (Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Isolines

Sound Level (dBA)

- 35
- 40
- 45
- 50
- 55

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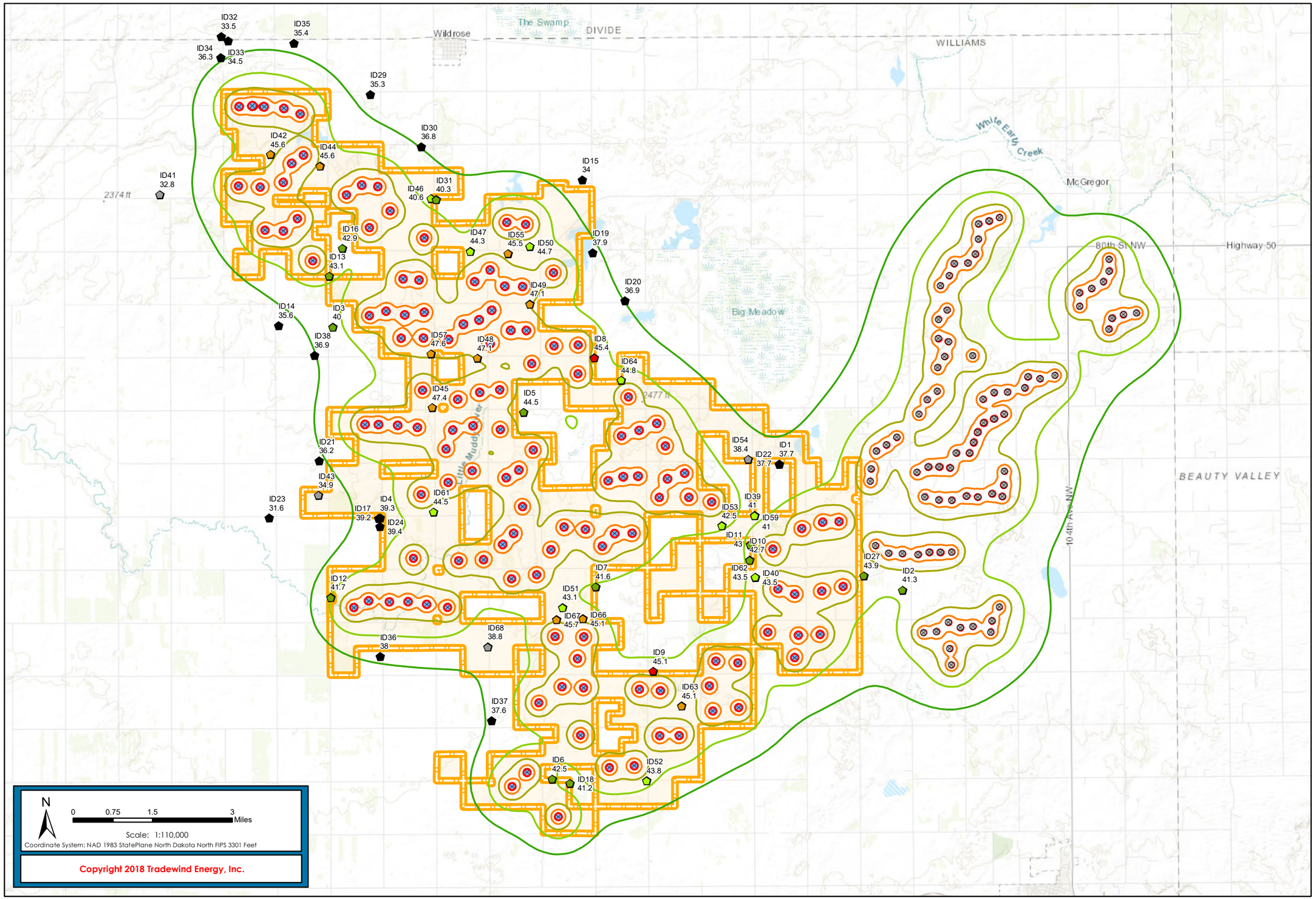
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

Aurora Wind Project - Anticipated Maximum Sound Levels
AW125 3.15 87.5m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

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Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Sound Receptor (Non-Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Receptor (Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Isolines

Sound Level (dBA)

- 35
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- 45
- 50
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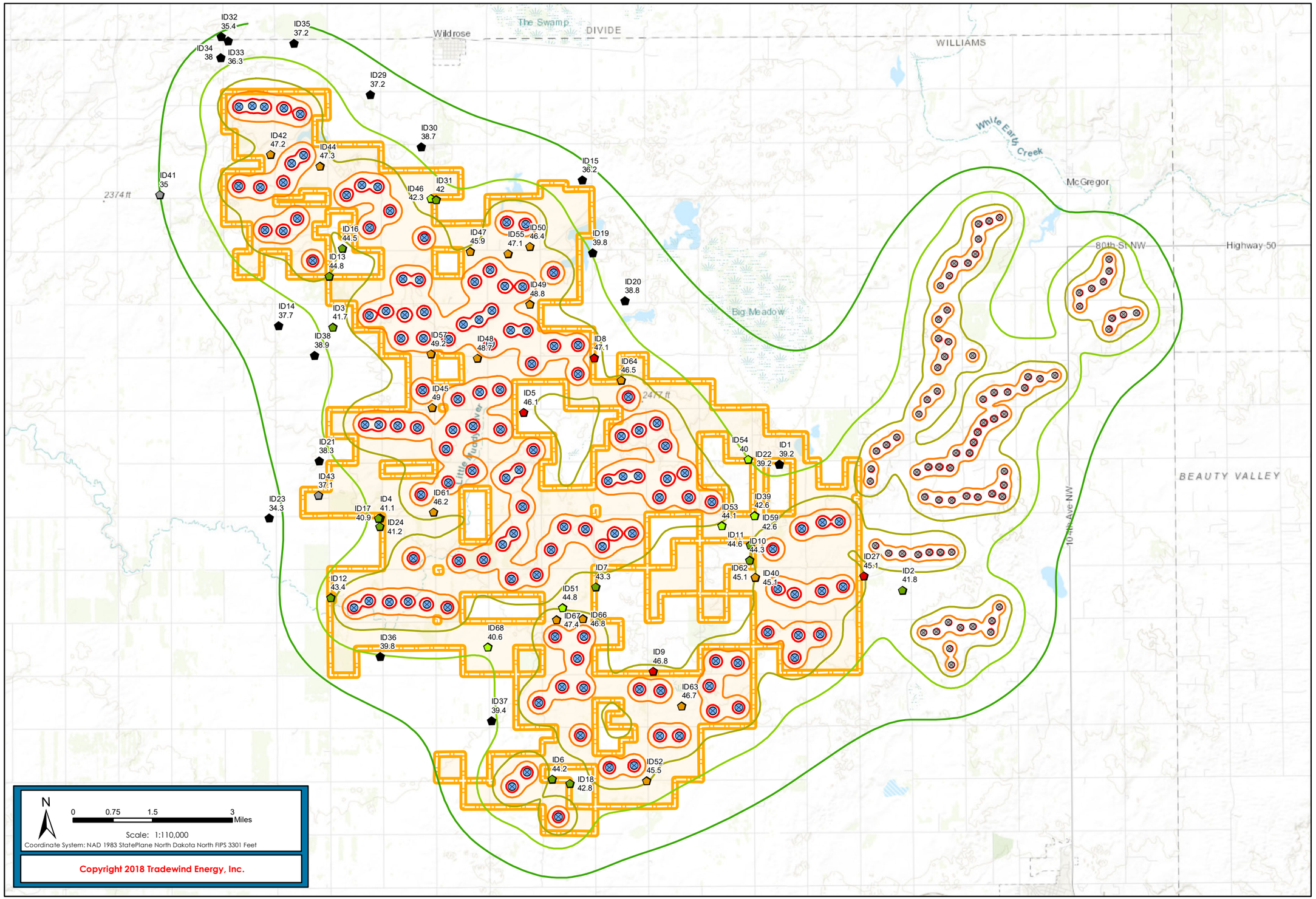
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

Aurora Wind Project - Anticipated Maximum Sound Levels
GE 2.5 127 89m HH

tradewind energy



N

0 0.75 1.5 3 Miles

Scale: 1:110,000

Coordinate System: NAD 1983 StatePlane North Dakota North FIPS 3301 Feet

Copyright 2018 Tradewind Energy, Inc.

Legend

- Aurora
- Aurora Wind Project Turbine (A031)
- Lindahl Wind Project Turbine

Sound Receptor (Non-Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Receptor (Participating)

Sound Level (dBA)

- Below 39.99
- 40.00 - 45.00
- 45.01+

Sound Isolines

Sound Level (dBA)

- 35
- 40
- 45
- 50
- 55

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Environmental Systems Research Institute (ESRI)
U.S. Department of Agriculture (USDA)
U.S. Federal Aviation Administration (FAA)
WhiteStar Corporation
CoreLogic
Ventyx Inc.

windPRO Sound Reports

Project: Description:

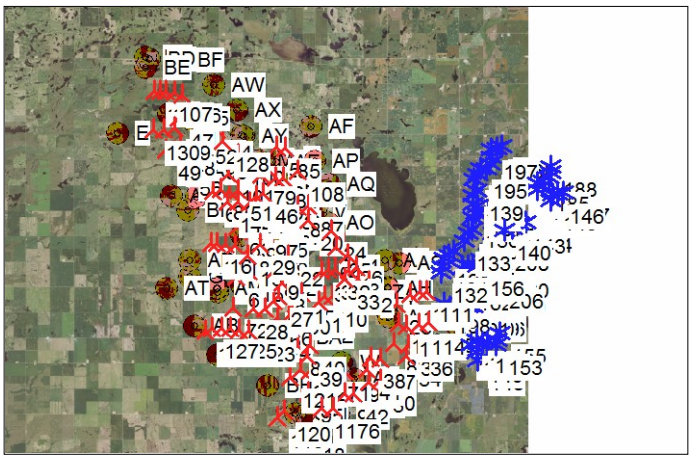
Aurora

Licensed user:
TradeWind Energy, Inc
16105 W. 113th Street, Suite 105
US-LENEXA, KS 66219
+1 913 424 5308
Kevin Walter / kwalter@tradewindenergy.com
Calculated:
9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

Noise calculation model:
ISO 9613-2 General
Wind speed:
95% rated power
Ground attenuation:
General, fixed, Ground factor: 0.5
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
1.5 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:500,000

New WTG
Existing WTG
Noise sensitive area

WTGs

	X(East)	Y(North)	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
1	637,619	5,373,512	727.5	T-43	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
2	642,085	5,374,363	728.5	T-41	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
3	641,252	5,375,220	737.7	T-63	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
4	640,729	5,375,038	740.7	T-62	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
5	635,764	5,372,945	724.6	T-45	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
6	636,817	5,372,047	728.5	T-35	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
7	635,193	5,372,473	710.2	T-47	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
8	636,346	5,374,109	734.6	T-56	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
9	635,830	5,374,972	728.5	T-55	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
10	639,692	5,373,363	740.7	T-39	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
11	639,157	5,373,344	739.4	T-38	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
12	638,790	5,372,951	734.6	T-37	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
13	633,988	5,375,810	737.6	T-70	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
14	640,372	5,376,713	738.1	T-77	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
15	634,074	5,374,798	721.2	T-53	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
16	631,934	5,376,511	729.8	T-67	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
17	631,510	5,376,507	731.5	T-66	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
18	633,108	5,376,447	723.9	T-69	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
19	632,563	5,379,145	737.6	T-93	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
20	637,951	5,378,169	715.2	T-80	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
21	641,389	5,374,486	743.7	T-58	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
22	636,640	5,375,835	734.6	T-73	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
23	643,972	5,372,967	712.3	T-28	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
24	639,495	5,377,499	738.7	T-78	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
25	639,840	5,376,489	737.6	T-76	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
26	640,649	5,376,031	731.5	T-79	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
27	636,095	5,373,292	733.9	T-46	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
28	634,438	5,372,432	701.0	T-57	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
29	634,798	5,376,526	725.4	T-71	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
30	638,928	5,374,941	737.6	T-59	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
31	639,384	5,375,074	737.6	T-60	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
32	639,838	5,375,100	737.6	T-61	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
33	640,492	5,374,466	743.6	T-40	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
34	644,695	5,369,685	736.0	T-15	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
35	644,792	5,370,371	743.7	T-16	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
36	645,456	5,370,405	735.1	T-17	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
37	642,975	5,369,494	737.6	T-12	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
38	642,303	5,369,536	734.9	T-13	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
39	638,102	5,369,527	710.5	T-26	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
40	638,282	5,370,192	712.5	T-25	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
41	642,122	5,368,780	734.6	T-10	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
42	641,239	5,367,252	719.1	T-8	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
43	633,243	5,379,162	737.6	T-94	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
44	634,001	5,379,136	737.6	T-95	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
45	634,443	5,379,605	731.5	T-96	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
46	634,918	5,379,749	728.5	T-121	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
47	629,136	5,384,387	713.2	T-142	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No

To be continued on next page...

Licensed user:
TradeWind Energy, Inc
16105 W. 113th Street, Suite 105
US-LENEXA, KS 66219
+1 913 424 5308
Kevin Walter / kwalter@tradewindenergy.com
Calculated:
9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

					WTG type							Noise data				
	X(East)	Y(North)	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
			[m]												
48	629,347	5,382,713	710.2	T-131	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
49	628,366	5,382,343	707.1	T-129	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
50	628,893	5,383,804	717.2	T-141	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
51	633,253	5,379,950	729.4	T-123	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
52	630,815	5,383,459	711.9	T-144	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
53	631,275	5,383,767	710.7	T-145	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
54	631,767	5,383,732	713.2	T-146	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
55	635,699	5,382,724	710.2	T-122	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
56	629,834	5,381,441	713.0	T-117	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
57	628,926	5,382,328	703.0	T-130	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
58	638,268	5,373,457	731.5	T-44	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
59	635,628	5,376,434	728.5	T-72	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
60	639,307	5,376,310	731.5	T-75	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
61	636,056	5,371,908	719.3	T-34	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
62	636,215	5,375,218	731.5	T-74	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
63	633,243	5,377,581	731.5	T-81	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
64	631,582	5,379,814	726.8	T-98	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
65	635,586	5,377,640	725.5	T-85	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
66	634,183	5,376,389	733.5	T-86	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
67	636,542	5,378,452	715.1	T-87	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
68	633,261	5,374,418	716.3	T-51	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
69	640,641	5,368,602	728.5	T-23	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
70	643,024	5,368,138	728.5	T-11	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
71	639,998	5,368,634	725.4	T-22	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
72	633,064	5,372,478	698.0	T-5	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
73	642,243	5,368,015	730.6	T-9	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
74	635,270	5,379,029	725.4	T-90	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
75	635,883	5,379,448	720.6	T-91	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
76	636,364	5,379,455	716.0	T-92	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
77	633,072	5,380,925	729.9	T-106	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
78	632,659	5,379,855	737.2	T-100	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
79	634,758	5,380,905	718.9	T-107	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
80	632,089	5,379,958	731.5	T-99	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
81	629,494	5,384,648	709.6	T-143	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
82	635,222	5,381,271	716.3	T-108	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
83	635,678	5,380,785	716.0	T-109	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
84	636,220	5,380,785	716.3	T-110	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
85	636,276	5,382,673	710.2	T-124	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
86	637,208	5,379,005	710.9	T-88	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
87	637,941	5,379,046	713.2	T-89	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
88	643,859	5,370,443	732.3	T-14	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
89	637,408	5,370,185	701.0	T-24	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
90	637,234	5,372,817	719.9	T-42	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
91	632,509	5,376,501	722.8	T-68	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
92	638,306	5,368,644	716.3	T-21	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
93	637,648	5,368,666	713.2	T-20	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
94	640,643	5,367,238	719.3	T-19	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
95	638,242	5,367,207	710.2	T-18	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
96	634,318	5,377,326	731.6	T-83	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
97	634,979	5,377,549	725.3	T-84	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
98	634,798	5,375,163	713.2	T-54	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
99	631,532	5,382,484	707.7	T-118	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
100	633,206	5,382,201	722.4	T-120	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
101	632,585	5,380,949	731.5	T-105	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
102	635,298	5,380,049	728.5	T-97	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
103	627,504	5,386,079	711.3	T-147	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
104	627,911	5,386,105	710.2	T-148	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
105	629,368	5,385,888	704.0	T-149	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
106	628,867	5,386,049	710.2	T-150	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
107	628,269	5,386,086	711.9	T-151	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
108	637,149	5,381,224	704.1	T-152	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
109	644,833	5,373,605	713.9	T-153	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
110	645,462	5,373,811	728.5	T-154	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
111	645,966	5,373,838	730.1	T-155	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
112	644,144	5,371,765	710.2	T-156	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
113	644,660	5,371,616	715.4	T-157	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
114	645,479	5,371,724	719.3	T-158	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
115	646,127	5,371,875	717.1	T-159	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
116	639,890	5,366,309	710.2	T-160	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
117	639,135	5,366,239	709.0	T-161	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
118	637,617	5,364,719	707.6	T-162	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
119	636,191	5,365,609	711.4	T-163	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
120	636,640	5,366,042	710.2	T-164	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
121	636,954	5,368,164	711.3	T-165	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
122	633,495	5,371,087	689.0	T-166	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
123	634,130	5,371,006	696.6	T-167	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No

To be continued on next page...

Licensed user:
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Calculated:
9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

					WTG type							Noise data				
	X(East)	Y(North)	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
124	632,359	5,371,139	688.8	T-168	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
125	632,926	5,371,158	686.0	T-169	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
126	631,283	5,370,947	682.8	T-170	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
127	631,732	5,371,159	684.7	T-171	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
128	632,154	5,382,999	713.2	T-172	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
129	628,195	5,383,647	711.6	T-173	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
130	627,535	5,383,666	710.2	T-174	Yes	GAMESA	G132-3,465	3,465	132.0	114.0	USER	Loudest Octave + 2dB (106.1+2) (13 m/s)	(95%)	108.0	No
131	646,913	5,375,455	745.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
132	646,888	5,375,080	743.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
133	648,328	5,377,151	749.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
134	648,570	5,377,592	749.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
135	648,872	5,377,853	752.9	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
136	648,872	5,378,572	753.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
137	649,189	5,379,368	749.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
138	648,868	5,380,034	743.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
139	649,124	5,380,328	729.4	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
140	651,007	5,377,868	748.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
141	651,525	5,378,000	750.5	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
142	651,616	5,378,348	758.5	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
143	651,987	5,378,290	755.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
144	652,436	5,378,405	749.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
145	654,047	5,379,834	743.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
146	654,478	5,380,290	740.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
147	654,876	5,380,346	731.4	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
148	649,468	5,369,552	735.9	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
149	649,403	5,370,046	745.1	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
150	648,989	5,370,563	740.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
151	649,348	5,370,846	749.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
152	649,714	5,370,690	746.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
153	650,635	5,370,574	746.1	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
154	650,667	5,370,918	744.2	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
155	650,882	5,371,340	743.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
156	649,309	5,375,532	733.1	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
157	649,484	5,375,990	732.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
158	649,889	5,375,994	741.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
159	650,008	5,376,322	740.0	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
160	650,956	5,375,465	750.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
161	648,982	5,374,557	737.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
162	648,553	5,374,643	733.0	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
163	648,903	5,381,054	722.4	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
164	649,170	5,381,363	721.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
165	649,950	5,382,038	713.3	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
166	650,030	5,382,496	712.9	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
167	650,267	5,377,632	746.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
168	650,119	5,376,640	740.5	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
169	650,663	5,383,159	707.1	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
170	650,947	5,375,049	753.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
171	650,911	5,374,694	758.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
172	650,163	5,374,664	746.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
173	649,378	5,374,555	741.2	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
174	649,818	5,374,694	743.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
175	650,613	5,377,049	737.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
176	649,406	5,372,982	725.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
177	647,909	5,372,903	716.3	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
178	647,487	5,372,910	715.5	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
179	647,672	5,376,428	744.3	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
180	647,365	5,376,192	740.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
181	649,728	5,381,758	721.2	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
182	650,599	5,377,842	746.4	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
183	653,143	5,380,511	713.2	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
184	653,130	5,380,927	710.2	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
185	653,497	5,381,062	704.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
186	653,850	5,381,276	700.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
187	654,022	5,381,604	696.2	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
188	654,011	5,381,966	694.9	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
189	648,594	5,370,523	731.5	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
190	650,092	5,370,737	743.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
191	647,056	5,376,002	741.1	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
192	654,134	5,380,179	733.9	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
193	648,870	5,379,452	759.0	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
194	649,079	5,378,913	759.0	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
195	649,308	5,381,738	716.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
196	650,346	5,383,045	709.6	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
197	650,021	5,382,956	710.0	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
198	647,090	5,373,129	713.2	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
199	649,061	5,372,960	722.4	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

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DECIBEL - Main Result

Calculation: SG132-3.465

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	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
200	648,724	5,372,961	720.7	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
201	648,383	5,372,886	719.3	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
202	648,975	5,375,560	735.2	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
203	648,641	5,375,554	726.1	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
204	648,297	5,375,376	728.5	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
205	649,928	5,378,956	741.8	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
206	650,591	5,374,779	748.5	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
207	650,301	5,376,922	735.1	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
208	650,917	5,377,197	740.0	VESTAS V100 2000 100.0 !...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

Calculation Results

Sound Level

Noise sensitive area No.	Name	X(East)	Y(North)	Z	Imission height	Demands Noise	Sound Level From WTGs	Distance to noise demand	Demands fulfilled ? Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
A	1 - Non-Participating	644,116	5,375,554	701.3	1.5	50.0	35.4	1,896	Yes
B	39 - Participating	643,400	5,373,971	711.5	1.5	50.0	38.1	982	Yes
C	2 - Non-Participating	647,930	5,371,801	718.0	1.5	50.0	40.7	890	Yes
D	40 - Participating	643,453	5,372,099	716.3	1.5	50.0	40.5	587	Yes
E	41 - Participating	625,162	5,383,364	711.9	1.5	50.0	29.4	2,216	Yes
F	42 - Participating	628,500	5,384,644	704.1	1.5	50.0	42.5	492	Yes
G	43 - Participating	630,148	5,374,327	691.9	1.5	50.0	31.4	2,390	Yes
H	44 - Participating	629,997	5,384,325	711.4	1.5	50.0	42.6	408	Yes
I	3 - Non-Participating	630,488	5,379,437	722.7	1.5	50.0	36.8	978	Yes
J	4 - Non-Participating	632,031	5,373,676	696.3	1.5	50.0	36.0	1,265	Yes
K	45 - Participating	633,554	5,377,057	735.4	1.5	50.0	44.3	427	Yes
L	46 - Participating	633,395	5,383,413	715.7	1.5	50.0	37.4	1,052	Yes
M	47 - Participating	634,615	5,381,825	716.9	1.5	50.0	41.2	634	Yes
N	48 - Participating	634,891	5,378,584	728.5	1.5	50.0	44.0	392	Yes
O	5 - Non-Participating	636,328	5,376,974	731.5	1.5	50.0	41.4	699	Yes
P	49 - Participating	636,455	5,380,259	709.9	1.5	50.0	44.1	387	Yes
Q	50 - Participating	636,416	5,382,006	707.4	1.5	50.0	41.7	504	Yes
R	51 - Participating	637,621	5,371,070	716.6	1.5	50.0	40.0	732	Yes
S	6 - Non-Participating	637,411	5,365,868	713.2	1.5	50.0	39.5	613	Yes
T	52 - Participating	640,276	5,365,862	710.2	1.5	50.0	40.8	415	Yes
U	7 - Non-Participating	638,615	5,371,717	720.3	1.5	50.0	38.4	1,060	Yes
V	8 - Non-Participating	638,435	5,378,666	709.4	1.5	50.0	42.4	444	Yes
W	9 - Non-Participating	640,413	5,369,191	728.5	1.5	50.0	42.1	449	Yes
X	10 - Non-Participating	643,279	5,372,615	722.4	1.5	50.0	39.8	598	Yes
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.5	50.0	40.1	522	Yes
Z	53 - Participating	642,413	5,373,644	734.1	1.5	50.0	39.5	610	Yes
AA	54 - Participating	643,167	5,375,685	714.9	1.5	50.0	35.6	1,533	Yes
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.5	50.0	38.6	580	Yes
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.5	50.0	40.0	507	Yes
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.5	50.0	32.1	2,041	Yes
AE	55 - Participating	635,760	5,381,775	711.0	1.5	50.0	42.5	551	Yes
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.5	50.0	30.7	2,011	Yes
AG	57 - Participating	633,480	5,378,691	739.8	1.5	50.0	44.6	334	Yes
AH	59 - Participating	643,400	5,373,968	711.4	1.5	50.0	38.1	979	Yes
AI	61 - Participating	633,645	5,373,895	713.7	1.5	50.0	41.4	473	Yes
AJ	62 - Participating	643,453	5,372,097	716.3	1.5	50.0	40.5	586	Yes
AK	63 - Participating	641,300	5,368,154	725.4	1.5	50.0	42.1	618	Yes
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.5	50.0	39.7	809	Yes
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.5	50.0	35.9	1,304	Yes
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.5	50.0	38.1	904	Yes
AO	64 - Participating	639,268	5,377,996	720.6	1.5	50.0	41.7	375	Yes
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.5	50.0	34.7	1,167	Yes
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.5	50.0	33.6	1,776	Yes
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.5	50.0	32.9	1,594	Yes

To be continued on next page...

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9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	X(East)	Y(North)	Z	Imission height	Noise	From WTGs	Distance to noise demand	Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.5	50.0	35.4	1,895	Yes
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.5	50.0	28.1	3,554	Yes
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.5	50.0	36.1	1,231	Yes
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.5	50.0	42.0	532	Yes
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.5	50.0	31.9	2,032	Yes
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.5	50.0	33.5	1,606	Yes
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.5	50.0	37.1	1,049	Yes
AZ	66 - Participating	638,244	5,370,747	710.8	1.5	50.0	42.1	378	Yes
BA	67 - Participating	637,448	5,370,698	712.2	1.5	50.0	42.7	337	Yes
BB	68 - Participating	635,378	5,369,828	692.6	1.5	50.0	35.5	1,539	Yes
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.5	50.0	30.2	2,009	Yes
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.5	50.0	31.2	1,826	Yes
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.5	50.0	33.1	1,397	Yes
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.5	50.0	32.1	1,816	Yes
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.5	50.0	34.8	1,486	Yes
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.5	50.0	34.3	1,357	Yes
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.5	50.0	33.5	1,872	Yes

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	6810	5799	10452	6003	15882	14390	7516	13229	9271	5591	5393	10764	8839	5759	3695	6847	8579	2442	7647	8099	2053	5218
2	2355	1372	6382	2645	19168	17037	11937	15664	12659	10077	8946	12547	10558	8341	6322	8153	9516	5546	9696	8691	4363	5643
3	2883	2484	7503	3819	18034	15857	11140	14477	11561	9350	7914	11352	9363	7196	5227	6957	8333	5514	10110	9409	4385	4451
4	3426	2876	7896	4008	17654	15551	10605	14192	11146	8804	7453	11132	9134	6830	4808	6747	8195	5040	9752	9188	3937	4293
5	8751	7705	12221	7736	14865	13771	5783	12758	8366	3804	4668	10733	8954	5707	4069	7347	9085	2639	7266	8398	3105	6315
6	8098	6859	11117	6637	16245	15095	7047	14045	9729	5055	5978	11870	10022	6815	4951	8220	9967	1266	6207	7087	1829	6814
7	9440	8343	12755	8269	14807	13890	5375	12941	8404	3383	4868	11086	9369	6119	4642	7888	9611	2805	6968	8340	3505	6990
8	7903	7055	11812	7386	14517	13136	6202	12028	7919	4337	4060	9760	7907	4706	2865	6151	7897	3296	8310	9136	3297	5013
9	8306	7636	12509	8146	13573	12136	5719	11023	6962	4014	3086	8785	6960	3732	2063	5324	7059	4294	9240	10137	4284	4520
10	4937	3758	8385	3968	17639	15891	9592	14634	11028	7667	7164	11860	9868	7093	4935	7618	9243	3089	7834	7524	1967	5450
11	5429	4289	8908	4473	17213	15533	9063	14300	10596	7134	6722	11601	9620	6757	4602	7424	9085	2744	7677	7566	1715	5371
12	5928	4721	9212	4740	17151	15577	8751	14377	10536	6798	6654	11771	9807	6851	4717	7673	9362	2214	7216	7243	1246	5726
13	10131	9590	14507	10166	11618	10400	4117	9404	5041	2896	1320	7626	6047	2917	2613	5087	6655	5972	10515	11769	6178	5285
14	3919	4084	9014	5548	16601	14278	10499	12869	10253	8877	6827	9673	7699	5792	4053	5284	6609	6278	11242	10852	5296	2752
15	10070	9362	14177	9760	12361	11314	3955	10362	5863	2331	2318	8641	7047	3873	3132	5957	7579	5146	9533	10878	5488	5829
16	12220	11744	16676	12335	9635	8829	2821	8051	3264	2836	1710	7055	5953	3612	4418	5873	7092	7871	11969	13528	8224	6849
17	12642	12158	17082	12731	9344	8676	2570	7963	3104	2878	2118	7159	6159	3969	4841	6208	7370	8180	12166	13790	8569	7254
18	11044	10585	15533	11221	10535	9404	3641	8470	3976	2973	756	6972	5585	2783	3262	5073	6469	7020	11420	12784	7260	5770
19	12098	12009	17033	12971	8519	6837	5389	5781	2095	5495	2311	4349	3376	2395	4346	4049	4800	9529	14134	15360	9582	5892
20	6696	6878	11838	8193	13804	11457	8699	10058	7570	7433	4536	6946	4949	3088	2016	2570	4133	7107	12313	12526	6487	693
21	2928	2075	7071	3156	18497	16411	11243	15053	11973	9394	8246	11983	9987	7683	5640	7595	9016	5086	9492	8696	3920	5119
22	7481	7012	11989	7770	13728	11995	6665	10781	7129	5090	3319	8244	6323	3259	1181	4429	6176	4865	9996	10615	4567	3352
23	2591	1156	4127	1011	21493	19385	13891	18009	14956	11962	11192	14866	12885	10678	8631	10473	11782	6628	9666	8009	5501	7947
24	5014	5263	10180	6696	15486	13113	9871	11696	9213	8386	5957	8496	6521	4730	3210	4106	5458	6697	11816	11664	5849	1577
25	4376	4360	9350	5685	16209	13969	9931	12582	9806	8301	6312	9460	7468	5375	3546	5067	6494	5856	10895	10636	4927	2592
26	3500	3437	8421	4830	17135	14892	10639	13500	10716	8934	7168	10349	8365	6298	4423	5955	7322	5812	10667	10177	4770	3442
27	8334	7337	11929	7454	14865	13659	6036	12606	8319	4082	4542	10475	8660	5428	3690	6977	8720	2696	7539	8526	2972	5862
28	10169	9093	13507	9021	14338	13579	4690	12695	8042	2710	4709	11030	9394	6169	4919	8083	9776	3462	7206	8789	4238	7405
29	9368	8973	13956	9721	11816	10275	5144	9158	5201	3973	1353	7028	5302	2060	1594	4084	5714	6143	10973	11989	6140	4219
30	5224	4576	9535	5344	16138	14244	8801	12955	9563	7012	5775	10119	8123	5438	3300	5865	7499	4085	9198	9179	3239	3758
31	4756	4165	9152	5041	16461	14493	9266	13179	9908	7484	6157	10266	8265	5701	3598	5955	7540	4375	9415	9256	3444	3715
32	4302	3737	8739	4699	16843	14820	9721	13489	10307	7936	6581	10517	8515	6050	3979	6169	7707	4599	9546	9249	3597	3832
33	3784	2950	7902	3791	17725	15729	10345	14400	11171	8498	7406	11420	9417	6952	4861	7061	8571	4447	9133	8607	3329	4677
34	5898	4478	3866	2715	23847	22047	15270	20745	17232	13278	13359	17781	15779	13241	11097	13406	14845	7208	8224	5844	6410	10948
35	5227	3860	3449	2186	23540	21660	15169	20337	16935	13182	13076	17320	15322	12864	10735	12933	14336	7204	8647	6382	6322	10451
36	5321	4117	2841	2623	24079	22142	15802	20803	17482	13818	13635	17739	15746	13361	11246	13346	14708	7863	9236	6890	6965	10842
37	6166	4497	5466	2648	22576	20954	13707	19708	15962	11716	12081	16897	14898	12165	10007	12586	14127	5581	6642	4526	4894	10234
38	6285	4569	6066	2809	22024	20465	13066	19240	15416	11075	11538	16490	14496	11697	9541	12214	13790	4927	6115	4197	4285	9916
39	8514	6915	10088	5936	18945	17909	9290	16872	12498	7354	8797	14662	12783	9610	7655	10858	12593	1616	3724	4261	2249	9145
40	7923	6362	9781	5511	18592	17452	9125	16383	12092	7157	8336	14095	12197	9051	7058	10232	11961	1099	4411	4767	1560	8476
41	7061	5346	6547	3576	22368	20910	13196	19714	15777	11216	11913	17037	15050	12182	10035	12802	14404	5049	5539	3453	4574	10551
42	8786	7058	8091	5328	22761	21559	13155	20442	16250	11227	12458	17964	16007	12989	10892	13859	15522	5260	4071	1691	5178	11754

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9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
43	11456	11407	16429	12415	9108	7249	5741	6098	2768	5618	2128	4253	2996	1747	3782	3395	4261	9201	13932	15046	9182	5216
44	10730	10724	15743	11784	9798	7785	6163	6554	3526	5805	2127	4319	2758	1047	3176	2699	3751	8841	13699	14683	8737	4458
45	10487	10582	15583	11727	10013	7792	6805	6484	3958	6401	2698	3949	2227	1115	3237	2116	3108	9108	14054	14930	8924	4101
46	10109	10263	15248	11462	10404	8072	7222	6720	4441	6724	3018	3968	2098	1165	3113	1620	2709	9090	14103	14885	8842	3680
47	17391	17662	22620	18868	4103	686	10112	863	5132	11096	8559	4369	6049	8173	10329	8403	7660	15791	20284	21617	15824	10918
48	16413	16551	21551	17654	4235	2108	8425	1738	3469	9428	7050	4108	5343	6913	9038	7520	7105	14284	18676	20086	14382	9949
49	17151	17208	22225	18237	3362	2305	8212	2567	3598	9410	7407	5142	6271	7531	9603	8354	8058	14586	18795	20335	14764	10720
50	17315	17526	22506	18682	3757	927	9561	1220	4650	10604	8201	4519	6055	7952	10096	8352	7735	15439	19856	21249	15513	10837
51	11718	11777	16788	12871	8782	6681	6424	5454	2812	6392	2908	3466	2317	2132	4279	3217	3772	9896	14683	15741	9825	5338
52	15473	15761	20709	16994	5653	2601	9157	1191	4035	9859	6964	2581	4137	6355	8512	6485	5787	14136	18787	19980	14098	9002
53	15243	15588	20509	16866	6127	2911	9508	1395	4401	10120	7087	2149	3864	6320	8467	6256	5434	14195	18922	20041	14110	8791
54	14812	15186	20091	16490	6615	3392	9544	1866	4481	10060	6911	1659	3428	6022	8154	5835	4960	13951	18735	19793	13831	8374
55	11057	11658	16399	13154	10556	7451	10066	5923	6161	9763	6059	2405	1408	4218	5784	2578	1015	11811	16943	17473	11387	4894
56	15448	15487	20504	16515	5052	3470	7121	2889	2108	8070	5750	4071	4797	5809	7882	6726	6607	12969	17318	18755	13103	9037
57	16633	16714	21726	17768	3903	2354	8095	2265	3287	9193	7015	4599	5712	7043	9136	7809	7497	14226	18519	20000	14370	10190
58	6212	5157	9803	5360	16430	14852	8167	13658	9813	6241	5932	11085	9131	6140	4017	7040	8748	2473	7637	7856	1774	5212
59	8534	8153	13146	8946	12552	10873	5871	9694	5953	4532	2165	7327	5485	2273	884	3914	5628	5722	10715	11549	5584	3586
60	4868	4714	9731	5909	15807	13648	9371	12285	9357	7738	5801	9242	7241	4967	3052	4872	6388	5504	10612	10493	4645	2513
61	8846	7628	11875	7399	15809	14809	6384	13817	9365	4397	5725	11809	10021	6777	5073	8361	10105	1775	6190	7373	2566	7165
62	7908	7292	12204	7882	13731	12181	6132	11027	7113	4459	3234	8666	6798	3617	1760	5047	6791	4380	9426	10200	4245	4101
63	11060	10780	15784	11589	9937	8508	4491	7484	3322	4089	610	5834	4460	1930	3144	4182	5445	7847	12433	13668	7953	5304
64	13238	13184	18207	14158	7336	5729	5672	4781	1157	6155	3390	4029	3639	3531	5531	4894	5308	10627	15115	16440	10726	6949
65	8781	8632	13656	9622	11892	9964	6369	8714	5406	5325	2114	6174	4296	1172	997	2759	4444	6878	11913	12678	6653	3027
66	9968	9529	14493	10215	11403	10022	4532	8972	4790	3463	917	7068	5453	2306	2223	4488	6044	6334	11005	12164	6440	4823
67	8110	8192	13189	9388	12395	10150	7609	8794	6133	6569	3297	5875	3884	1656	1493	1810	3557	7460	12614	13132	7047	1905
68	10914	10149	14901	10452	12068	11280	3115	10431	5734	1437	2655	8996	7530	4474	3992	6658	8218	5497	9504	11064	5997	6694
69	7773	6037	7961	4488	21390	20119	11953	18987	14849	9994	11032	16488	14531	11520	9418	12386	14055	3900	4231	2764	3715	10303
70	7496	5846	6123	3984	23472	21987	14287	20779	16877	12310	13009	18057	16064	13239	11087	13787	15363	6148	6055	3569	5679	11486
71	8053	6329	8541	4893	20907	19711	11377	18607	14393	9428	10605	16187	14247	11184	9112	12153	13844	3403	3787	2786	3378	10153
72	11472	10444	14882	10396	13452	12994	3453	12238	7421	1582	4606	10940	9475	6374	5556	8489	10101	4770	7911	9787	5603	8194
73	7769	6068	6832	4260	22965	21574	13643	20396	16391	11677	12541	17760	15777	12875	10736	13544	15157	5540	5288	2916	5183	11312
74	9504	9575	14579	10723	10998	8796	6953	7474	4799	6257	2614	4768	2871	584	2311	1708	3190	8299	13334	14087	8041	3185
75	9107	9301	14270	10551	11414	9028	7689	7644	5395	6940	3338	4681	2694	1315	2514	992	2613	8557	13666	14279	8200	2669
76	8678	8920	13870	10216	11865	9422	8059	8016	5876	7223	3694	4948	2946	1711	2481	810	2552	8478	13627	14145	8059	2216
77	12281	12451	17436	13626	8278	5894	7218	4584	2982	7324	3898	2508	1786	2965	5120	3448	3514	10855	15670	16698	10748	5819
78	12237	12247	17265	13291	8278	6343	6072	5203	2211	6211	2938	3633	2776	2568	4665	3817	4329	10089	14772	15932	10085	5897
79	10779	11079	16012	12375	9906	7291	8033	5863	4515	7727	4032	2854	931	2325	4233	1816	1990	10243	15269	16023	9965	4304
80	12808	12798	17818	13817	7719	5903	5956	4843	1683	6282	3250	3694	3141	3121	5184	4377	4787	10469	15061	16301	10512	6476
81	17219	17532	22471	18771	4518	995	10343	598	5305	11262	8609	4092	5848	8118	10276	8229	7409	15825	20381	21661	15825	10757
82	10573	10962	15849	12324	10275	7521	8601	6052	5077	8239	4532	2815	821	2707	4438	1595	1402	10480	15558	16217	10140	4136
83	9928	10298	15193	11658	10828	8150	8503	6694	5362	7990	4291	3481	1487	2337	3866	938	1426	9908	15017	15616	9532	3477
84	9471	9898	14760	11303	11355	8631	8865	7160	5888	8251	4583	3859	1912	2571	3812	576	1237	9815	14964	15465	9379	3065
85	10590	11246	15939	12780	11135	8022	10355	6493	6631	9949	6241	2974	1865	4317	5700	2421	682	11681	16844	17281	11204	4552
86	7722	7980	12918	9311	12811	10375	8470	8962	6734	7430	4141	5829	3831	2355	2213	1463	3104	7945	13138	13496	7423	1272
87	7094	7454	12341	8869	13488	10976	9110	9538	7463	7985	4816	6303	4333	3084	2626	1918	3330	7982	13189	13390	7360	623
88	5118	3558	4291	1705	22728	20919	14251	19619	16115	12263	12245	16665	14663	12113	9969	12296	13752	6270	7907	5817	5397	9852
89	8592	7088	10646	6341	17991	16983	8358	15965	11554	6411	7879	13823	11970	8768	6875	10120	11863	911	4317	5188	1951	8543
90	7407	6274	10745	6261	16030	14703	7245	13595	9452	5273	5614	11270	9381	6225	4255	7483	9226	1789	6951	7591	1766	5972
91	11646	11181	16122	11796	10054	9076	3210	8217	3564	2866	1184	6968	5725	3165	3848	5449	6750	7459	11709	13173	7758	6309
92	9028	7371	10129	6199	19735	18767	9943	17747	13328	8044	9663	15564	13688	10511	8562	11762	13496	2521	2917	3409	3088	10023
93	9448	7825	10749	6744	19286	18412	9397	17428	12934	7527	9336	15348	13504	10294	8412	11654	13397	2404	2808	3843	3200	10031
94	9012	7276	8598	5615	22355	21224	12665	20133	15873	10753	12111	17725	15784	12722	10650	13679	15362	4881	3511	1424	4917	11640
95	10207	8507	10723	7148	20788	19974	10779	19000	14481	8968	10909	16915	15061	11861	9953	13174	14912	3913	1576	2439	4525	11461
96	9957	9682	14692	10525	10967	9349	5137	8225	4373	4307	809	6156	4509	1383	2041	3630	5129	7075	11868	12920	7067	4330
97	9352	9149	14170	10075	11410	9609	5807	8411	4872	4867	1507	6074	4292	1039	1466	3086	4683	6997	11931	12831	6873	3632
98	9326	8684	13556	9181	12654	11383	4725	10344	6070	3141	2266	8369	6665	3423	2371	5359	7032	4972	9655	10794	5143	5050
99	14366	14605	19571	15810	6431	3723	8274	2397	3220	8822	5791	2082	3153	5147	7305	5402	4907	12936	17625	18782	12888	7888
100	12776	13102	18028	14390	8127	5302	8448	3848	3876	8606	5156	1226	1459	3991	6089	3786	3216	11975	16866	17804	11798	6312
101	12730	12870	17865	14015	7806	5509	7057	4254	2585	7294	4011	2594	2211	3303	5460	3931	3974	11089	15834	16934	11027	6279
102	9898	10129	15088	11390	10664	8205	7699	6810	4848	7162	3463	3864	1902	1521	3244	1176	2254	9275	14338	15036	8969	3429
103	19666	19982	24923	21209	3585	1747	12047	3048	7282	13204	10863	6467	8287	10524	12680	10677	9799	18101	22509	23914	18159	13208
104	19338	19676	24606	20923	3882	1576	11990	2743	7149	13095	10664	6110	7955	10262	12419	10353	9442	17899	22356	23722	17934	12888
105	18008	18410	23303	19712	4905	1518	11588	1685	6548	12500	9773	4727	6637	9157	11310	9051	8046	16962	21576	22805	16922	11592
106	18512	18897	23800	20183	4575	1452	11792	2061	6808	12771	10140	5240	7134	9592	11748	9545	8563	17350	21915	23188	17333	12085
107	19028	19384	24304	20645	4131	1461	11909	2468	7010	12968	10463	5782	7645	10007	12165	10049	9112	17691	22189	23521	17707	12586
108	8983	9575	14319	11091	12177	9301	9828	7796	6896	9120	5503	4345	2604	3474	4329	1188	1072	10165	15358	15678	9620	2863
109	2077	1479	3585	2043	21959	19714	14703	18304	15485	12802	11795	15067	13114	11119	9148	10699	11892	7644	10722	8985	6498	8158
110	2202	2069	3183	2640	22436	20127	15323	18701	15996	13432	12343	15421	13486	11599	9667	11077	12206	8306	11310	9492	7160	8542
111	2524	2570	2830	3057	22882	20539	15826	19105	16460	13936	12823	15802	13879	12049	10136	11476	12567	8792	11693	9798	7651	8946

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Calculated:
9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
112	3790	2329	3786	768	22246	20264	14229	18919	15664	12263	11839	15850	13857	11495	9393	11458	12830	6560	8950	7058	5529	8957
113	3976	2672	3276	1300	22764	20758	14763	19405	16187	12796	12367	16312	14322	12000	9906	11918	13264	7060	9251	7234	6045	9406
114	4066	3062	2453	2061	23416	21336	15551	19962	16859	13589	13063	16813	14834	12616	10550	12421	13707	7885	9969	7838	6864	9891
115	4193	3440	1805	2684	23907	21766	16166	20376	17371	14211	13599	17182	15216	13087	11046	12800	14034	8544	10586	8391	7514	10261
116	10165	8428	9737	6798	22535	21586	12617	20554	16148	10772	12477	18296	16388	13255	11245	14367	16078	5274	2518	590	5556	12443
117	10563	8831	10407	7279	22102	21257	12090	20263	15778	10284	12173	18108	16228	13054	11096	14274	16000	5062	1763	1202	5502	12447
118	12635	10912	12511	9409	22423	21912	12169	21035	16354	10556	12990	19165	17368	14131	12323	15584	17329	6352	1168	2895	7069	13972
119	12716	11041	13272	9739	20902	20530	10607	19714	14958	9077	11748	18022	16292	13040	11366	14653	16399	5645	1247	4092	6571	13249
120	12099	10420	12675	9116	20780	20305	10525	19452	14740	8917	11439	17671	15912	12664	10936	14219	15966	5123	790	3641	6009	12751
121	10292	8677	11564	7598	19238	18523	9182	17595	12996	7391	9521	15659	13860	10623	8833	12106	13853	2982	2340	4042	3923	10607
122	11523	10317	14454	10010	14838	14448	4658	13692	8875	2974	5971	12326	10796	7627	6533	9639	11304	4127	6525	8561	5159	9047
123	10973	9733	13823	9387	15269	14755	5185	13946	9184	3396	6079	12429	10830	7617	6360	9541	11235	3492	6096	8015	4541	8787
124	12559	11398	15585	11135	14187	14046	3879	13396	8507	2558	6038	12317	10921	7864	7057	9998	11600	5263	7301	9515	6283	9673
125	12022	10845	15018	10569	14467	14194	4214	13489	8631	2673	5933	12264	10800	7682	6738	9762	11396	4696	6935	9059	5716	9313
126	13635	12489	16669	12224	13844	13977	3565	13440	8528	2830	6519	12644	11377	8447	7860	10653	12193	6340	7959	10331	7373	10523
127	13141	12002	16211	11758	13862	13867	3542	13280	8372	2535	6173	12366	11049	8070	7412	10253	11816	5890	7761	10053	6906	10064
128	14090	14421	19347	15700	7002	4008	8902	2532	3933	9325	6105	1308	2727	5195	7330	5100	4376	13123	17920	18965	13002	7630
129	17860	18023	23019	19136	3046	1042	9524	1925	4795	10684	8495	5206	6674	8395	10521	8929	8384	15718	20026	21501	15841	11388
130	18459	18593	23596	19677	2392	1373	9699	2548	5158	10956	8940	5865	7316	8941	11050	9549	9035	16137	20355	21894	16296	11992
131	2799	3814	3793	4820	23145	20579	16803	19101	16901	14988	13455	15687	13850	12423	10694	11509	12374	10274	13498	11665	9101	9066
132	2813	3660	3441	4548	23252	20727	16757	19256	16969	14923	13480	15859	14004	12498	10729	11648	12556	10097	13217	11345	8930	9183
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134	4899	6312	5827	7508	24109	21274	18710	19756	18176	16997	15026	16253	14583	13715	12258	12405	12931	12744	16186	14367	11560	10192
135	5283	6709	6125	7904	24343	21475	19054	19955	18453	17352	15339	16446	14800	14000	12575	12648	13131	13137	16583	14754	11952	10469
136	5633	7149	6837	8442	24190	21258	19200	19733	18405	17539	15393	16217	14623	13981	12646	12531	12921	13523	17110	15345	12337	10438
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150	6976	6547	1629	5745	27048	24862	19214	23455	20519	17242	16746	20207	18261	16220	14192	15847	17001	11379	12494	9901	10438	13307
151	7039	6719	1709	6027	27234	25001	19513	23583	20725	17547	16971	20309	18374	16398	14390	15964	17082	11729	12934	10351	10768	13426
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165	8723	10391	10435	11875	24824	21609	21251	20084	19635	19774	17136	16612	15337	15450	14533	13612	13534	16501	20462	18849	15330	11999
166	9120	10800	10900	12303	24883	21637	21495	20117	19780	20044	17350	16660	15429	15636	14773	13758	13623	16868	20874	19284	15700	12212
167	6493	7782	6283	8778	25751	22869	20389	21347	19861	18661	16723	17835	16204	15405	13955	14060	14525	14247	17427	15440	13068	11878
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169	10036	11712	11683	13204	25502	22214	22336	20700	20516	20907	18165	17270	16104	16422	15613	14501	14294	17783	21786	20177	16616	13028
170	6850	7624	4433	8054	27093	24412	20812	22912	20924	18966	17508	19443	17682	16440	14745	15400	16111	13907	16356	14081	12774	13025
171	6850	7546	4154	7897	27170	24521	20767	23026	20967	18908	17517	19566	17788	16486	14761	15490	16235	13775	16130	13825	12652	13094
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174	5767	6459	3455	6874	26136	23526	19674	22038	19904	17817	16435	18594	16792	15426	13682	14476	15267	12724	15227	13003	11592	12057
175	6667	7843	5895	8705	26223	23382	20646	21863	20266	18886	17059	18357	16696	15797	14286	14518	15038	14302	17301	15232	13130	12286
176	5883	6088	1890	6019	26374	23940	19306	22482	19990	17390	16368	19110	17233	15559	13675	14856	15818	11939	13946	11579	10865	12357
177	4628	4634	1102	4529	25038	22685	17819	21245	18607	15897	14944	17920	16011	14204	12276	13613	14662	10450	12638	10385	9370	11090
178	4284	4223	1195	4115	24652	22321	17397	20886	18209	15475	14537	17576	15658	13815	11877	13256	14329	10036	12294	10084	8952	10728
179	3662	4928	4634	6045	23555	20859	17650	19360	17446	15881	14132	15894	14128	12962	11358	11853	12563	11390	14724	12898	10209	9505
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To be continued on next page...

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9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
181	8366	10034	10119	11519	24619	21424	20943	19898	19380	19456	16843	16417	15113	15173	14229	13357	13315	16150	20105	18495	14978	11709
182	6875	8174	6605	9168	26030	23123	20752	21599	20175	19030	17063	18084	16473	15726	14298	14349	14782	14639	17813	15815	13459	12193
183	10299	11735	10151	12832	28126	24988	23813	23459	22681	22191	19891	19960	18575	18353	17184	16690	16794	18168	21493	19498	16983	14824
184	10494	11961	10504	13099	28074	24910	23911	23382	22691	22310	19955	19891	18537	18389	17261	16688	16749	18376	21769	19804	17190	14868
185	10879	12338	10806	13462	28428	25253	24301	23726	23066	22701	20341	20239	18897	18770	17649	17061	17107	18758	22128	20146	17573	15252
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187	11608	13081	11542	14215	28915	25704	24960	24180	23634	23377	20968	20707	19409	19368	18291	17619	17612	19493	22882	20900	18307	15863
188	11791	13286	11845	14451	28883	25652	25056	24130	23658	23491	21038	20667	19396	19417	18374	17639	17595	19681	23124	21166	18495	15922
189	6735	6235	1439	5377	26720	24560	18834	23159	20181	16861	16398	19929	17976	15898	13859	15561	16738	10986	12114	9536	10050	13020
190	7676	7433	2409	6777	27946	25684	20265	24258	21448	18299	17705	20964	19039	17107	15112	16633	17721	12475	13584	10960	11519	14099
191	2974	4182	4291	5312	23099	20470	16991	18982	16921	15204	13543	15542	13736	12436	10772	11424	12218	10646	13990	12198	9466	9024
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194	5993	7528	7204	8837	24328	21363	19479	19835	18598	17835	15636	16317	14754	14192	12898	12696	13036	13885	17502	15743	12700	10647
195	8075	9759	10033	11279	24201	21011	20544	19484	18961	19066	16435	16002	14694	14758	13828	12938	12895	15824	19835	18266	14655	11299
196	9744	11427	11501	12936	25187	21906	22000	20390	20184	20573	17828	16956	15779	16086	15277	14168	13969	17474	21503	19917	16308	12691
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198	3838	3785	1572	3781	24200	21868	16985	20434	17760	15069	14095	17127	15207	13363	11429	12804	13883	9690	12100	9963	8592	10275
199	5584	5751	1620	5674	26065	23649	18962	22195	19670	17045	16039	18833	16949	15245	13351	14567	15548	11595	13639	11295	10520	12061
200	5288	5420	1406	5342	25757	23357	18627	21906	19352	16709	15714	18554	16663	14933	13030	14276	15275	11263	13354	11036	10186	11766
201	5033	5100	1175	4992	25476	23100	18292	21654	19056	16371	15404	18316	16415	14646	12730	14023	15046	10913	13024	10726	9837	11506
202	4860	5798	3902	6518	25060	22401	18868	20905	18890	17049	15494	17448	15668	14406	12727	13373	14118	12210	15089	13028	11050	10989
203	4525	5475	3820	6233	24744	22098	18534	20605	18564	16716	15162	17153	15364	14080	12395	13063	13824	11897	14830	12803	10735	10671
204	4185	5095	3594	5849	24476	21860	18180	20372	18267	16355	14839	16932	15126	13785	12076	12810	13606	11512	14454	12445	10351	10397
205	6735	8214	7429	9431	25155	22170	20315	20642	19446	18660	16483	17123	15579	15041	13744	13536	13852	14616	18110	16268	13431	11497
206	6521	7236	3993	7625	26839	24194	20448	22699	20636	18593	17188	19242	17461	16154	14431	15161	15911	13489	15910	13635	12361	12763
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WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
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2	5436	2117	1749	790	1709	11918	13483	14196	9745	10528	9632	1373	8453	2647	6259	13590	10119	9561	4598	8383	6649	11986
3	6088	3301	2944	1957	1971	11387	12341	13120	8552	9424	8512	2486	7722	3821	7067	12426	9392	10037	3412	7252	5538	11111
4	5856	3518	3213	2186	2523	10833	11971	12688	8372	9428	8117	2877	7176	4009	6908	12087	8846	9703	3299	7229	5555	10592
5	5976	7523	7520	6686	7895	5453	9705	9512	8831	11327	6183	7704	2323	7736	7322	10215	3843	7530	6149	9275	8280	6125
6	4593	6487	6549	5820	7319	6285	11043	10894	9786	12063	7434	6858	3671	6637	5938	11524	5093	6409	6435	9927	8738	7459
7	6167	8087	8113	7315	8597	4772	9805	9448	9320	11910	6449	8342	2102	8269	7480	10369	3420	7278	6864	9895	8956	5826
8	6382	7092	7011	6085	7001	6438	9134	9223	7689	10077	5404	7055	2710	7386	7747	9549	4379	8522	4863	7998	6978	6332
9	7378	7813	7687	6716	7372	6439	8146	8311	6804	9332	4399	7636	2436	8147	8741	8548	4056	9473	4579	7325	6473	5702
10	4234	3664	3601	2736	4180	9353	12067	12452	9286	10829	8184	3757	6071	3969	5452	12330	7709	7818	4653	8603	7062	9760
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13	9225	9825	9684	8699	9180	5699	6337	6315	6223	9156	2925	9590	1946	10167	10587	6848	2929	10823	5715	7445	7055	3870
14	7523	5024	4648	3685	2978	11215	10903	11859	6849	7724	7171	4087	7294	5550	8609	10915	8919	11236	1693	5535	3845	10317
15	8463	9460	9365	8418	9136	4985	7233	7014	7178	10043	3937	9362	1000	9760	9817	7789	2371	9855	6100	8243	7694	3974
16	11202	11996	11853	10864	11264	5441	4758	4279	6508	9663	2673	11745	3125	12336	12553	5458	2842	12339	7484	8337	8367	2120
17	11524	12396	12259	11273	11687	5348	4638	3986	6770	9937	2942	12158	3373	12732	12870	5385	2877	12548	7901	8669	8746	1774
18	10296	10869	10714	9718	10088	5787	5322	5229	5952	9030	2274	10586	2607	11222	11657	5888	2994	11753	6352	7520	7382	3153
19	12677	12549	12312	11282	11155	8149	2888	3739	4141	7306	1024	12010	5360	12972	14041	3253	5505	14448	6803	6374	6889	4479
20	9310	7697	7365	6355	5778	10115	8113	9205	4220	5885	4502	6880	6068	8194	10561	8095	7470	12430	1328	3707	2637	8294
21	5385	2660	2353	1325	2144	11283	12819	13503	9210	10160	8958	2076	7768	3157	6333	12944	9436	9397	4101	7981	6275	11283
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27	5956	7216	7190	6328	7467	5881	9613	9527	8490	10925	5999	7336	2523	7455	7314	10086	4123	7777	5675	8853	7825	6307
28	6797	8843	8868	8066	9315	4035	9492	8990	9436	12148	6332	9092	1665	9021	8086	10106	2744	7560	7368	10197	9364	5208
29	9238	9339	9154	8142	8411	6761	6309	6646	5337	8170	2535	8974	2873	9722	10600	6686	4006	11238	4706	6395	5974	4796
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33	5276	3346	3112	2089	2940	10421	12066	12681	8708	9914	8186	2950	6871	3792	6364	12228	8540	9088	3736	7701	6061	10390
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36	5187	3102	3453	4445	5755	14896	18452	18927	14944	15567	14563	4114	12316	2622	4726	18638	13857	8834	9794	13488	11734	16100
37	2580	3135	3607	4188	6194	12514	17082	17300	14244	15396	13219	4494	10317	2646	2146	17383	11753	6269	9275	13207	11512	14117
38	1922	3229	3685	4110	6209	11843	16562	16730	13879	15151	12715	4565	9694	2807	1708	16886	11112	5773	8988	12946	11277	13491
39	2335	6027	6286	5961	7973	7712	13846	13586	12470	14528	10264	6912	6241	5936	3480	14345	7385	3790	8549	12333	10957	9878

To be continued on next page...

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9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
40	2354	5553	5778	5383	7351	7770	13406	13236	11855	13866	9762	6359	5935	5511	3642	13876	7190	4464	7866	11665	10277	9651
41	1758	4005	4461	4873	6983	11798	16968	17048	14469	15828	13149	5342	9901	3574	1034	17324	11251	5159	9648	13616	11964	13676
42	2107	5737	6183	6499	8650	11377	17537	17405	15523	17117	13822	7055	10090	5327	903	17973	11258	3616	10923	14892	13300	13753
43	12282	11983	11734	10703	10516	8357	3428	4415	3629	6805	528	11408	5282	12417	13642	3666	5634	14225	6138	5758	6218	4893
44	11833	11341	11078	10046	9794	8604	4101	5174	3172	6321	686	10726	5253	11785	13187	4238	5825	13967	5389	5114	5483	5388
45	12005	11267	10982	9953	9565	9212	4326	5607	2539	5680	1328	10584	5765	11729	13348	4328	6422	14303	5087	4493	4957	6031
46	11903	10991	10692	9667	9196	9549	4739	6087	2195	5279	1785	10265	5991	11463	13236	4675	6748	14334	4690	4012	4465	6475
47	18924	18402	18105	17079	16511	13227	3601	4932	7120	8843	7164	17665	11420	18869	20286	3011	11091	20628	11980	9537	10944	9067
48	17474	17208	16937	15905	15505	11540	1987	3288	6482	8729	5768	16552	9810	17655	18838	1642	9422	19031	10986	9025	10248	7380
49	17836	17806	17555	16523	16231	11322	2395	2917	7416	9758	6285	17210	9962	18238	19200	2422	9400	19173	11738	9977	11136	7189
50	18609	18226	17941	16912	16422	12678	3162	4340	7160	9083	6870	17528	10990	18683	19972	2696	10597	20210	11891	9636	10977	8520
51	12924	12423	12152	11120	10792	9110	3090	4442	3101	6254	1279	11779	6067	12873	14279	3147	6406	14967	6324	5424	6098	5531
52	17197	16522	16217	15194	14596	12222	2507	4457	5224	7182	5463	15763	9974	16995	18553	1626	9860	19104	10065	7685	9046	8111
53	17204	16385	16069	15051	14379	12547	2923	4945	4907	6703	5535	15590	10153	16867	18555	2007	10123	19225	9859	7309	8728	8467
54	16918	16005	15682	14667	13955	12548	3083	5176	4447	6214	5325	15188	10015	16491	18264	2160	10065	19027	9444	6827	8262	8512
55	14331	12636	12262	11293	10263	12572	5624	7596	950	2634	4603	11661	9065	13155	15610	5044	9785	17133	5924	2771	4306	9212
56	16186	16084	15831	14799	14523	10228	678	2213	5936	8548	4567	15488	8453	16517	17551	983	8065	17677	10044	8507	9555	6072
57	17452	17332	17073	16042	15715	11212	1948	2865	6857	9210	5829	16716	9664	17769	18816	1874	9185	18887	11214	9417	10582	7058
58	4775	5081	5027	4149	5382	7998	10936	11182	8689	10602	7094	5157	4645	5360	6109	11268	6283	7723	4648	8401	7039	8350
59	8681	8552	8354	7336	7577	7240	6979	7436	5343	7973	3115	8154	3222	8947	10037	7289	4569	10944	3962	6060	5439	5587
60	7205	5425	5117	4093	3911	10090	10112	10934	6516	7859	6295	4716	6156	5911	8396	10200	7779	10656	1687	5633	4105	9212
61	5135	7257	7322	6590	8052	5514	10733	10451	9872	12297	7256	7627	3125	7399	6449	11264	4432	6453	6884	10206	9117	6856
62	7345	7529	7381	6395	6968	6895	8236	8512	6573	9009	4420	7293	2891	7883	8704	8592	4500	9636	4128	6968	6061	6075
63	11037	11198	10999	9980	10104	6876	4478	4791	4892	8017	1135	10781	3708	11590	12402	4939	4107	12744	6040	6646	6718	3804
64	13815	13736	13496	12465	12300	8633	1710	2766	4615	7669	2206	13185	6268	14160	15180	2191	6158	15450	7899	7051	7775	4666
65	9731	9189	8941	7910	7829	8124	6223	6991	4139	6843	2354	8634	4219	9624	11075	6414	5358	12134	3699	5031	4663	5896
66	9520	9848	9679	8675	9012	6283	5996	6167	5612	8550	2407	9529	2552	10216	10885	6446	3494	11297	5333	6863	6537	4166
67	10038	8914	8614	7589	7180	9355	6697	7770	3414	5782	3071	8194	5400	9389	11345	6721	6602	12790	2765	3847	3413	7100
68	8859	10179	10109	9184	9987	4156	7195	6711	7770	10726	4278	10148	648	10453	10191	7836	1476	9866	6992	9003	8534	3263
69	631	4802	5206	5345	7520	10398	16112	16041	14049	15681	12372	6034	8773	4486	797	16531	10026	3925	9494	13456	11886	12495
70	2816	4484	4957	5541	7549	12822	18058	18154	15452	16699	14229	5842	11006	3982	1725	18403	12344	5609	10550	14501	12820	14777
71	694	5158	5534	5562	7730	9769	15684	15552	13808	15553	11984	6326	8249	4892	1388	16127	9460	3543	9391	13328	11800	11941
72	8051	10216	10237	9422	10600	2772	8942	8166	9681	12574	6227	10443	1532	10396	9302	9643	1605	8325	8304	10757	10115	4116
73	2176	4715	5179	5632	7726	12098	17609	17630	15212	16599	13812	6065	10417	4258	953	17985	11710	4855	10416	14385	12738	14165
74	11102	10261	9974	8945	8576	9090	5302	6447	2790	5706	1822	9577	5385	10725	12435	5334	6284	13558	4130	4167	4293	6296
75	11214	10070	9757	8737	8199	9771	5749	7045	2330	5058	2520	9303	5987	10552	12527	5676	6968	13864	3684	3434	3583	7030
76	11034	9726	9402	8387	7778	10045	6212	7526	2398	4873	2984	8922	6189	10217	12332	6113	7253	13807	3250	3105	3121	7439
77	13842	13162	12871	11843	11374	10000	2727	4479	2819	5814	2271	12453	7053	13627	15193	2509	7336	15951	6854	5340	6282	6275
78	13185	12853	12595	11563	11305	8862	2579	3841	3647	6772	1424	12248	6041	13293	14546	2762	6221	15075	6865	6015	6698	5137
79	13008	11888	11565	10550	9898	10528	4413	6093	1327	4500	2557	11082	7098	12377	14332	4131	7747	15498	5367	3697	4601	7202
80	13610	13384	13133	12101	11874	8847	2029	3288	4096	7169	1882	12799	6259	13818	14973	2315	6289	15380	7443	6524	7259	4978
81	18925	18299	17993	16970	16349	13453	3750	5225	6893	8499	7168	17534	11526	18772	20284	3074	11259	20715	11823	9267	10711	9294
82	13149	11826	11486	10483	9713	11052	4883	6635	737	3913	3114	10965	7543	12326	14458	4524	8261	15770	5206	3163	4200	7782
83	12524	11159	10820	9816	9061	10820	5336	6967	994	3994	3036	10301	7184	11659	13826	5055	8015	15217	4546	2861	3674	7740
84	12329	10797	10446	9452	8618	11085	5878	7500	1092	3709	3449	9901	7355	11305	13615	5586	8278	15145	4131	2367	3135	8136
85	14104	12257	11873	10918	9815	12772	6162	8101	1036	2187	4866	11249	9164	12782	15365	5605	9972	17017	5553	2211	3801	9532
86	10324	8814	8479	7472	6822	10207	7145	8383	3127	5107	3741	7982	6230	9312	11597	7066	7463	13286	2294	3066	2551	7943
87	10161	8358	8002	7013	6214	10727	7841	9112	3494	5008	4475	7456	6707	8870	11399	7728	8020	13306	1693	2838	1953	8619
88	3667	2248	2708	3513	5287	13300	17146	17523	13930	14830	13258	3555	10783	1703	3434	17380	12301	7549	8839	12683	10951	14578
89	3165	6354	6553	6084	7964	6906	12914	12632	11707	13881	9369	7086	5285	6341	4390	13427	6443	4478	8030	11709	10410	8930
90	4823	6049	6055	5245	6591	6835	10693	10709	9079	11262	6971	6273	3748	6261	6187	11117	5313	7113	5565	9107	7883	7539
91	10767	11450	11301	10308	10690	5603	4988	4718	6196	9322	2395	11182	2843	11797	12123	5621	2879	12061	6923	7911	7867	2620
92	2176	6363	6672	6471	8556	8148	14695	14379	13376	15414	11146	7368	7022	6198	3033	15210	8073	2925	9402	13214	11816	10582
93	2814	6877	7162	6891	8929	7519	14330	13937	13245	15392	10857	7822	6586	6743	3687	14874	7554	2942	9470	13209	11869	10068
94	1966	5988	6418	6647	8816	10827	17185	16996	15336	17028	13509	7273	9660	5613	1127	17643	10783	3078	10846	14802	13243	13286
95	2941	7390	7746	7671	9805	8655	15890	15450	14779	16850	12432	8504	8116	7147	3201	16442	8992	1495	10838	14651	13253	11504
96	10166	10125	9916	8893	9001	7141	5408	5882	4677	7657	1601	9683	3496	10527	11528	5760	4335	12144	4996	6053	5891	4608
97	9969	9656	9425	8397	8398	7689	5775	6433	4298	7161	1885	9150	3890	10076	11324	6033	4898	12178	4312	5459	5213	5302
98	8197	8855	8734	7765	8385	5758	7338	7351	6682	9441	3766	8684	1714	9182	9560	7813	3181	9937	5293	7570	6939	4661
99	15987	15342	15045	14019	13476	11284	1902	4047	4287	6629	4264	14607	8845	15811	17343	1029	8826	17933	8943	6827	8071	7242
100	14874	13906	13586	12570	11904	11271	3103	5155	2589	5114	3522	13104	8318	14391	16213	2499	8618	17133	7378	5136	6383	7481
101	14126	13558	13275	12245	11819	9913	2239	4031	3281	6218	2429	12872	7133	14017	15481	2053	7304	16129	7306	5817	6769	6084
102	12004	10908	10593	9574	8999	9992	5041	6486	1787	4816	2269	10131	6373	11391	13325	4901	7187	14554	4470	3531	4052	6958
103	21258	20740	20438	19414	18799	15155	5824	6748	9311	10663	9503	19984	13644	21211	22620	5334	13195	22867	14274	11621	13116	11023
104	21034	20450	20143	19121	18476	15104	5660	6705	8964	10269	9274	19679	13490	20924	22395	5119	13088	22708	13956	11253	12762	10959
105	20020	19228	18906	17891	17162	14699	4989	6446	7601	8797	8290	18412	12733	19713	21375	4277	12497	21902	12661	9827	11369	10541
106	20433	19703	19385	18368	17661	14908	5265	6584	8110	9321	8685	18899	13059	20185	21791	4609	12767	22250	13154	10350	11886	10748
107	20808	20169	19859	18838	18170	15026	5498	6646	8643	9914	9047	19386	13324	20647	22168	4914	12962	22534	13654	10914	12433	10873
108	12469	10569	10189	9229	8180	11950	6806	8496	1495	2947	4459	9578	8124	11093	13714	6444	9148	15505	3862	1341	2329	9126

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Calculated:
9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
109	6247	1843	1635	2421	2665	14445	16264	17035	12210	12500	12440	1479	11193	2044	6497	16326	12844	10449	7089	10506	8754	14797
110	6845	2490	2297	3054	2963	15100	16737	17560	12553	12690	12938	2069	11818	2641	7024	16772	13474	11024	7475	10752	9010	15400
111	7242	2953	2787	3559	3353	15601	17182	18029	12930	12972	13396	2570	12322	3058	7355	17204	13978	11392	7884	11073	9341	15899
112	4533	1213	1580	2556	4040	13571	16602	17134	13058	13753	12716	2325	10714	767	4597	16771	12303	8638	7913	11648	9898	14461
113	4891	1704	2017	3027	4334	14082	17114	17662	13507	14123	13231	2668	11249	1299	4824	17274	12836	8916	8354	12040	10286	14997
114	5664	2374	2586	3618	4586	14904	17748	18354	13982	14436	13875	3059	12032	2060	5497	17879	13629	9614	8827	12401	10645	15766
115	6314	2943	3093	4114	4824	15557	18227	18882	14335	14657	14367	3438	12645	2683	6096	18335	14251	10220	9193	12666	10913	16364
116	2929	7159	7581	7757	9932	10533	17516	17183	16009	17849	13943	8425	9827	6797	2322	18025	10799	2018	11704	15627	14118	13314
117	3216	7604	8007	8098	10271	9906	17176	16761	15899	17853	13676	8827	9421	7278	2890	17715	10309	1282	11758	15639	14177	12820
118	5274	9717	10107	10133	12291	9591	17828	17162	17158	19339	14572	10908	10000	9408	5037	18449	10573	1076	13380	17154	15790	13018
119	5536	9966	10306	10162	12255	7947	16460	15686	16172	18531	13360	11038	8669	9738	5707	17119	9090	1768	12764	16389	15136	11489
120	4914	9342	9684	9546	11645	7981	16225	15526	15758	18062	13038	10417	8405	9115	5116	16861	8934	1349	12240	15906	14623	11373
121	3608	7734	8019	7736	9756	7074	14434	13914	13664	15924	11086	8674	6619	7597	4346	15020	7414	2622	10102	13763	12481	9921
122	7174	9903	9990	9278	10710	2915	10398	9585	10926	13719	7604	10316	2812	10010	8338	11097	2990	6963	9004	11807	11005	5444
123	6540	9290	9386	8693	10177	3554	10683	9978	10892	13603	7712	9732	2930	9387	7717	11349	3417	6508	8676	11636	10752	5916
124	8286	11019	11096	10361	11725	1779	10061	9040	11167	14082	7634	11397	3041	11135	9426	10819	2558	7775	9735	12270	11605	4782
125	7741	10455	10534	9807	11197	2344	10172	9259	10990	13849	7554	10844	2830	10569	8896	10900	2681	7391	9327	11987	11259	5055
126	9297	12111	12189	11452	12794	759	10093	8862	11718	14716	8050	12488	3778	12224	10399	10902	2813	8463	10652	12989	12428	4574
127	8901	11638	11710	10966	12298	1152	9935	8796	11355	14326	7732	12001	3338	11759	10028	10723	2524	8251	10176	12570	11977	4508
128	16090	15219	14902	13884	13221	11864	2698	4847	3808	5913	4508	14424	9226	15701	17437	1837	9331	18208	8697	6281	7630	7884
129	18929	18689	18416	17385	16959	12636	3415	4232	7794	9786	7246	18025	11172	19138	20293	3120	10675	20395	12433	10293	11598	8497
130	19375	19236	18970	17939	17552	12795	3877	4399	8439	10444	7752	18595	11524	19679	20739	3686	10944	20735	13032	10946	12238	8690
131	9028	4612	4334	4851	3753	16865	17469	18515	12820	12405	13818	3815	13360	4821	9210	17392	15030	13215	8056	10708	9059	16771
132	8753	4371	4119	4700	3770	16751	17568	18575	12987	12650	13886	3661	13297	4549	8900	17510	14965	12925	8159	10916	9249	16749
133	11226	6788	6478	6877	5365	18704	18389	19627	13392	12446	14928	5867	15040	7022	11417	18207	16706	15422	9099	11050	9569	18272
134	11710	7265	6946	7314	5730	19076	18539	19821	13476	12413	15130	6314	15377	7509	11914	18334	17039	15912	9311	11093	9659	18561
135	12108	7663	7345	7709	6103	19448	18791	20100	13687	12541	15415	6712	15734	7905	12305	18571	17394	16307	9605	11277	9877	18893
136	12633	8172	7831	8125	6394	19704	18684	20055	13498	12201	15393	7152	15930	8444	12880	18430	17580	16849	9621	11042	9715	19001
137	13439	8975	8622	8870	7059	20304	18913	20352	13644	12157	15724	7917	16480	9261	13712	18620	18119	17662	10015	11140	9911	19461
138	13750	9289	8913	9083	7170	20290	18547	20038	13223	11614	15447	8167	16415	9608	14086	18224	18039	17984	9814	10694	9542	19296
139	14140	9678	9303	9472	7553	20648	18790	20305	13442	11758	15730	8557	16763	9996	14472	18452	18383	18373	10128	10901	9791	19617
140	13695	9345	9085	9576	8139	21473	20897	22227	15741	14429	17547	8549	17812	9507	13734	20658	19476	17818	11740	13290	11949	21014
141	14181	9849	9596	10100	8673	22006	21390	22735	16211	14844	18059	9071	18346	10001	14196	21142	20010	18289	12257	13747	12429	21543
142	14470	10118	9855	10335	8858	22201	21434	22806	16222	14789	18139	9311	18515	10281	14503	21172	20177	18591	12353	13741	12455	21678
143	14723	10395	10141	10642	9197	22535	21810	23180	16598	15155	18512	9614	18862	10544	14730	21548	20525	18826	12723	14115	12832	22039
144	15149	10835	10586	11097	9660	22998	22242	23623	17014	15528	18959	10068	19326	10977	15137	21972	20988	19239	13175	14522	13257	22499
145	17297	12965	12704	13179	11645	24989	23730	25213	18391	16620	20600	12157	21250	13119	17290	23400	22904	21393	14893	15847	14726	24318
146	17918	13578	13313	13775	12213	25552	24143	25655	18778	16930	21060	12756	21794	13737	17916	23795	23444	22018	15383	16224	15146	24828
147	18266	13939	13679	14151	12603	25944	24539	26054	19170	17307	21461	13130	22191	14091	18248	24189	23841	22354	15784	16615	15544	25229
148	9063	6906	7126	8157	8793	18961	22285	22889	18367	18506	18416	7505	16410	6532	8288	22403	17958	12129	13242	16598	14857	20185
149	9032	6641	6836	7862	8408	18858	21979	22620	17993	18081	18119	7171	16223	6294	8322	22081	17787	12233	12881	16190	14454	19985
150	8685	6068	6241	7262	7754	18418	21364	22030	17342	17418	17510	6545	15702	5745	8058	21455	17282	12043	12237	15530	13795	19452
151	9088	6322	6467	7479	7850	18769	21543	22248	17439	17432	17702	6718	15997	6026	8487	21616	17587	12486	12359	15577	13852	19733
152	9422	6717	6865	7877	8235	19139	21940	22646	17822	17790	18099	7115	16387	6418	8789	22011	17974	12760	12748	15947	14225	20126
153	10316	7634	7771	8777	9049	20063	22810	23541	18621	18495	18979	7992	17313	7342	9644	22867	18901	13571	13576	16695	14986	21048
154	10399	7580	7697	8693	8886	20086	22683	23443	18442	18268	18863	7881	17281	7309	9766	22727	18879	13727	13418	16488	14787	21003
155	10688	7709	7799	8777	8854	20299	22693	23494	18374	18120	18891	7931	17426	7468	10098	22718	19036	14089	13386	16376	14688	21129
156	10925	6699	6504	7150	6143	19211	19734	20845	14918	14183	16141	6113	15750	6789	10890	19615	17420	14994	10338	12670	11106	19167
157	11337	7064	6847	7450	6324	19489	19782	20937	14894	14056	16231	6412	15978	7178	11331	19641	17648	15428	10411	12603	11074	19352
158	11666	7424	7218	7837	6729	19883	20173	21336	15267	14387	16630	6799	16380	7524	11630	20027	18050	15735	10808	12961	11445	19757
159	11955	7683	7463	8053	6870	20079	20210	21403	15257	14306	16697	7015	16543	7798	11940	20048	18213	16040	10870	12923	11433	19888
160	12270	8190	8034	8736	7793	20807	21340	22478	16455	15568	17772	7704	17383	8225	12113	21203	19052	16237	11959	14152	12634	20815
161	10111	6025	5887	6633	5924	18696	19718	20734	15065	14541	16044	5614	15352	6052	10001	19647	17016	14119	10305	12914	11289	18858
162	9798	5651	5495	6221	5485	18289	19283	20296	14647	14160	15607	5197	14927	5700	9733	19216	16592	13842	9871	12511	10877	18425
163	14589	10142	9749	9850	7857	20783	18557	20128	13163	11335	15603	8972	16854	10485	14974	18186	18455	18825	10108	10603	9591	19601
164	14995	10547	10156	10259	8263	21165	18827	20421	13416	11517	15916	9380	17228	10888	15376	18442	18825	19232	10458	10851	9882	19947
165	16001	11546	11161	11281	9294	22174	19632	21269	14193	12147	16807	10394	18226	11876	16359	19218	19815	20237	11421	11621	10740	20898
166	16418	11968	11578	11678	9669	22470	19741	21408	14288	12158	16982	10803	18506	12305	16791	19308	20084	20654	11665	11717	10897	21124
167	12976	8603	8333	8809	7362	20696	20203	21508	15087	13871	16821	7784	17038	8779	13049	19981	18703	17119	11005	12662	11282	20251
168	12235	7936	7704	8268	7017	20268	20247	21468	15250	14231	16765	7231	16702	8067	12239	20070	18371	16334	10935	12892	11427	20017
169	17327	12874	12487	12594	10586	23351	20432	22136	14968	12723	17755	11716	19377	13205	17688	19974	20947	21563	12510	12401	11658	21948
170	12054	8045	7912	8649	7806	20717	21442	22546	16610	15794	17843	7624	17341	8054	11858	21322	19008	15983	12045	14336	12793	20807
171	11854	7911	7797	8563	7807	20620	21509	22583	16725	15970	17884	7547	17286	7898	11626	21404	18950	15750	12102	14477	12914	20780
172	11181	7182	7059	7817	7070	19877	20804	21859	16063	15388	17162	6799	16536	7184	10997	20710	18201	15123	11393	13847	12262	20033
173	10448	6401	6270	7025	6313	19085	20093	21119	15414	14844	16428	6008	15748	6415	10307	20016	17412	14430	10680	13243	11630	19254
174	10897	6862	6731	7479	6724	19543	20467	21516	15741	15098	16820	6460	16194	6875	10740	20377	17859	14864	11055	13538	11944	19688
175	12877	8571	8333	8879	7570	20856	20648	21909	15587	14452	17212	7844	17260	8706	12879	20448	18928	16975	11385	13190	11772	20539
176	9760	6139	6125	7025	6800	18904	20677	21566	16235	15917	16919	6087	15789	6019	9436	20666	17431	13550	11311	14194	12519	19413
177	8366	4640	4631	5546	5498	17406	19338	20169	15045	14937	15547	4634	14300	4529	8139	19360	15939	12264	10031	13113	11401	17939

To be continued on next page...

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Calculated:
9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
178	7993	4219	4209	5127	5134	16986	18953	19768	14701	14654	15153	4222	13878	4115	7805	18983	15517	11929	9665	12802	11082	17520
179	10251	5817	5516	5950	4566	17859	17918	19078	13058	12339	14372	4930	14255	6046	10444	17781	15924	14445	8549	10805	9243	17561
180	9867	5431	5129	5569	4228	17497	17684	18814	12878	12249	14108	4547	13912	5663	10070	17562	15581	14065	8295	10664	9074	17242
181	15644	11190	10804	10925	8941	21844	19397	21016	13968	11978	16535	10037	17903	11521	16004	18995	19496	19880	11116	11398	10481	20600
182	13365	8995	8726	9200	7739	21077	20497	21822	15352	14073	17141	8176	17408	9169	13429	20263	19072	17503	11332	12909	11556	20605
183	17036	12636	12343	12740	11082	24391	22802	24328	17429	15579	19747	11737	20591	12833	17117	22449	22233	21187	14101	14874	13810	23567
184	17305	12890	12587	12958	11258	24540	22784	24336	17391	15477	19777	11963	20716	13100	17410	22415	22352	21470	14168	14829	13806	23649
185	17668	13258	12959	13337	11646	24930	23151	24711	17752	15811	20157	12341	21107	13463	17760	22776	22743	21826	14555	15187	14179	24037
186	18073	13667	13369	13750	12058	25339	23505	25078	18097	16119	20534	12753	21512	13869	18158	23123	23147	22228	14946	15530	14542	24431
187	18421	14009	13707	14076	12364	25629	23684	25276	18264	16237	20749	13083	21788	14216	18515	23290	23419	22580	15189	15694	14738	24679
188	18658	14235	13926	14275	12531	25766	23685	25297	18252	16174	20791	13288	21907	14452	18771	23278	23533	22828	15268	15681	14759	24762
189	8289	5712	5899	6925	7490	18025	21040	21686	17069	17202	17180	6233	15325	5376	7670	21141	16900	11666	11951	15291	13550	19080
190	9802	7067	7205	8211	8511	19515	22252	22977	18091	18007	18418	7432	16748	6777	9164	22314	18339	13126	13033	16187	14472	20482
191	9515	5073	4768	5207	3902	17147	17440	18545	12686	12139	13840	4184	13576	5313	9733	17334	15246	13717	8039	10508	8895	16926
192	17579	13231	12964	13420	11852	25191	23802	25307	18444	16620	20708	12402	21432	13394	17588	23459	23082	21686	15025	15893	14803	24468
193	13298	8833	8469	8685	6835	20046	18589	20033	13315	11830	15410	7746	16208	9135	13600	18293	17844	17527	9712	10811	9586	19167
194	13024	8562	8218	8497	6736	20024	18848	20249	13624	12239	15601	7531	16230	8838	13277	18577	17876	17242	9854	11145	9861	19264
195	15381	10936	10542	10633	8623	21467	18977	20597	13549	11571	16119	9762	17518	11280	15770	18575	19107	19618	10715	10979	10063	20195
196	17048	12599	12208	12301	10282	23021	20105	21805	14642	12415	17420	11431	19044	12938	17424	19650	20613	21285	12174	12075	11323	21611
197	16787	12345	11950	12025	9992	22696	19772	21469	14310	12099	17082	11164	18716	12691	17181	19320	20283	21024	11842	11742	10986	21275
198	7753	3846	3808	4706	4682	16615	18500	19321	14253	14230	14703	3785	13468	3781	7634	18529	15111	11750	9213	12366	10642	17097
199	9434	5792	5780	6683	6493	18558	20367	21244	15957	15686	16602	5750	15445	5674	9129	20363	17087	13248	11012	13939	12256	19073
200	9127	5457	5444	6349	6189	18223	20058	20923	15677	15449	16286	5419	15109	5342	8845	20060	16750	12967	10713	13681	11990	18739
201	8785	5111	5105	6018	5919	17875	19776	20623	15439	15268	15994	5099	14773	4992	8518	19789	16412	12642	10450	13474	11772	18410
202	10672	6413	6207	6837	5810	18893	19406	20513	14605	13901	15809	5799	15421	6518	10666	19291	17091	14762	10008	12368	10796	18834
203	10402	6115	5899	6514	5475	18566	19087	20186	14305	13642	15482	5476	15088	6234	10424	18977	16758	14509	9686	12085	10501	18500
204	10021	5728	5512	6134	5139	18191	18811	19885	14077	13488	15184	5096	14728	5850	10056	18714	16397	14136	9402	11889	10283	18155
205	13635	9188	8866	9203	7510	20827	19688	21096	14446	12997	16450	8216	17052	9433	13825	19409	18701	17834	10703	11955	10695	20107
206	11611	7626	7502	8256	7479	20318	21178	22252	16399	15661	17553	7237	16970	7625	11411	21074	18635	15537	11771	14157	12590	20458
207	12552	8238	7998	8542	7241	20520	20367	21614	15330	14244	16914	7507	16930	8377	12566	20175	18599	16658	11085	12949	11511	20218
208	13208	8908	8671	9217	7896	21189	20919	22196	15834	14650	17502	8182	17586	9040	13202	20710	19254	17301	11677	13422	12023	20855

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
1	6812	8954	5590	9227	14393	12323	10669	2835	2820	4312	18171	17936	17655	16822	6821	6270	9202
2	2356	13440	10098	5140	16139	13918	12411	5275	5910	8096	20528	20279	20101	18834	11098	9417	12857
3	2885	12689	9395	6270	14946	12725	11216	5390	5909	7974	19335	19086	18910	17639	10788	9529	11801
4	3428	12147	8847	6655	14750	12539	11001	4959	5441	7468	19076	18827	18638	17419	10249	9074	11356
5	8752	7129	3765	11015	14246	12318	10663	3314	2808	3140	17634	17409	17079	16485	5029	5350	8106
6	8100	8299	4982	9939	15436	13450	11789	1931	1490	2644	18944	18716	18397	17741	5354	4629	9487
7	9441	6625	3304	11564	14541	12670	11025	3506	2871	2652	17771	17551	17203	16703	4291	4885	8057
8	7905	7697	4370	10579	13341	11339	9678	3861	3585	4389	16953	16721	16422	15685	6270	6560	7813
9	8308	7292	4102	11267	12351	10366	8707	4866	4571	5164	15949	15717	15419	14682	6629	7378	6908
10	4938	11029	7662	7155	15518	13359	11745	2990	3484	5577	19577	19334	19094	18078	8511	7108	11061
11	5430	10495	7128	7681	15258	13119	11491	2753	3150	5162	19247	19006	18754	17787	8030	6793	10602
12	5929	10146	6777	7998	15422	13306	11667	2270	2622	4625	19324	19086	18821	17913	7521	6265	10490
13	10133	5759	3084	13263	11011	9199	7578	6614	6173	6141	14265	14041	13709	13156	6601	8354	4907
14	3920	12111	8966	7809	13245	11020	9534	6334	6688	8506	17688	17438	17278	15954	10975	10319	10598
15	10072	5537	2461	12941	12017	10215	8593	5814	5311	5139	15192	14972	14627	14132	5667	7344	5605
16	12222	4369	3084	15431	10033	8528	7053	8547	8013	7518	12720	12511	12130	11863	7033	9609	2875
17	12644	4059	3122	15838	10027	8599	7166	8862	8308	7718	12563	12359	11965	11774	7053	9772	2603
18	11046	5271	3206	14288	10216	8516	6943	7672	7204	6997	13283	13064	12716	12254	7037	9173	3821
19	12100	6768	5741	15794	7467	5840	4345	10139	9758	9733	10670	10442	10129	9532	9675	11920	2682
20	6698	10344	7586	10629	10572	8368	6816	7428	7489	8729	14909	14659	14484	13233	10466	10843	8022
21	2929	12754	9419	5826	15596	13381	11851	4886	5467	7605	19935	19686	19498	18271	10537	9041	12160
22	7482	8279	5201	10743	11876	9803	8149	5334	5200	6138	15728	15489	15227	14327	7800	8309	7242
23	2591	15320	11951	2882	18438	16213	14728	6143	6907	9149	22864	22614	22441	21149	12356	10003	15114
24	5016	11506	8503	8980	12073	9851	8357	6867	7103	8706	16510	16260	16102	14778	10896	10663	9616
25	4378	11539	8389	8129	13065	10849	9326	5960	6266	8017	17437	17188	17012	15748	10429	9878	10119
26	3501	12225	9004	7201	13938	11716	10213	5806	6220	8140	18344	18094	17925	16635	10756	9863	11008
27	8336	7436	4067	10714	14021	12058	10399	3331	2926	3537	17505	17278	16960	16307	5508	5720	8116
28	10170	5892	2606	12318	14407	12606	10979	4162	3474	2768	17469	17255	16890	16483	3755	4954	7620
29	9370	6790	4155	12710	10541	8613	6962	6728	6403	6723	14084	13852	13555	12830	7539	8956	5275
30	5226	10348	7062	8288	13776	11611	10002	4249	4493	6224	17888	17644	17416	16354	8729	8088	9697
31	4758	10817	7536	7906	13917	11734	10145	4475	4785	6601	18100	17854	17639	16526	9170	8409	10074
32	4304	11271	7985	7495	14159	11964	10392	4635	5009	6905	18397	18150	17945	16791	9549	8649	10492

To be continued on next page...

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Calculated:
9/15/2018 12:54 AM/3.0.654

DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
33	3785	11857	8525	6655	15058	12858	11293	4345	4844	6904	19308	19061	18856	17697	9746	8471	11326
34	5897	16503	13207	3260	21409	19200	17652	6538	7317	9318	25666	25420	25206	24062	12579	9398	17230
35	5226	16448	13123	2691	20935	18719	17188	6559	7351	9429	25243	24996	24794	23606	12705	9667	16971
36	5320	17093	13762	2226	21338	19117	17605	7220	8013	10094	25694	25446	25254	24027	13370	10314	17539
37	6166	14890	11631	4655	20551	18371	16778	4894	5656	7604	24651	24408	24166	23139	10857	7681	15891
38	6285	14233	10986	5193	20148	17981	16374	4236	4992	6931	24186	23945	23693	22710	10185	7044	15320
39	8515	10282	7218	9059	18248	16237	14577	1228	1341	2741	21766	21539	21215	20569	5984	3213	12191
40	7924	10206	7040	8709	17698	15665	14006	556	975	2927	21293	21064	20751	20054	6205	3780	11832
41	7061	14297	11111	5765	20696	18544	16925	4348	5051	6825	24662	24423	24158	23228	10028	6696	15636
42	8786	14089	11088	7418	21608	19506	17862	4602	5122	6402	25374	25141	24845	24054	9389	5719	16001
43	11458	7195	5861	15194	7578	5804	4225	9789	9452	9575	11030	10796	10509	9781	9747	11786	3352
44	10732	7681	6039	14511	7813	5902	4263	9401	9115	9409	11502	11263	11002	10146	9838	11637	4098
45	10489	8325	6631	14360	7533	5532	3874	9639	9401	9822	11421	11179	10946	9965	10388	12054	4617
46	10111	8762	6949	14032	7603	5533	3875	9597	9398	9932	11635	11389	11177	10107	10644	12164	5112
47	17392	10787	11335	21416	3182	3973	4531	16402	16016	15841	4410	4187	3866	3652	15203	17964	5860
48	16415	9128	9665	20330	4378	4347	4258	14912	14492	14227	6000	5791	5417	5330	13521	16330	4173
49	17153	8738	9639	20994	5224	5382	5289	15233	14769	14346	6035	5853	5410	5748	13399	16392	4076
50	17317	10197	10840	21293	3764	4331	4679	16061	15652	15408	4819	4609	4239	4242	14683	17511	5326
51	11720	7825	6636	15561	6817	5017	3439	10469	10159	10342	10401	10163	9898	9077	10531	12558	3584
52	15475	10081	10105	19508	3146	2708	2739	14724	14383	14375	6135	5895	5652	4878	14040	16546	4954
53	15244	10487	10367	19316	2774	2153	2311	14768	14455	14531	6213	5967	5772	4777	14313	16718	5354
54	14814	10586	10308	18903	2815	1790	1821	14511	14219	14366	6590	6341	6173	5046	14257	16566	5464
55	11058	11512	9994	15255	5680	3456	2243	12244	12153	12900	10345	10092	10021	8445	13720	15125	7093
56	15450	7917	8308	19273	5354	4781	4192	13605	13168	12869	7361	7153	6774	6635	12177	14967	2860
57	16634	8722	9427	20499	4923	4908	4744	14865	14419	14068	6206	6010	5599	5715	13240	16142	3881
58	6214	9604	6238	8576	14731	12628	10983	2710	2878	4639	18605	18367	18099	17206	7324	6465	9779
59	8535	7513	4688	11900	10916	8906	7245	6260	6018	6611	14638	14401	14125	13297	7790	8834	6080
60	4870	10978	7827	8500	12872	10669	9113	5663	5912	7579	17169	16921	16731	15525	9916	9493	9638
61	8847	7584	4304	10702	15323	13393	11738	2477	1845	2188	18680	18456	18120	17553	4626	4340	9053
62	7910	7718	4552	10959	12264	10241	8581	4910	4686	5455	15966	15732	15447	14646	7050	7649	7120
63	11062	6059	4327	14539	9123	7384	5803	8469	8067	8042	12359	12133	11810	11235	8179	10240	3451
64	13240	6855	6402	16970	6719	5359	4070	11252	10841	10684	9595	9372	9037	8581	10349	12837	2052
65	8783	8008	5513	12417	9793	7744	6085	7388	7188	7815	13660	13420	13169	12237	8867	10040	5724
66	9969	6178	3661	13247	10497	8646	7015	6952	6562	6669	13866	13638	13321	12696	7211	8892	4776
67	8112	9245	6752	11968	9533	7381	5760	7891	7807	8702	13696	13449	13246	12114	10003	10899	6602
68	10916	4666	1580	13672	12245	10547	8962	6189	5601	5055	15172	14959	14588	14232	5069	7186	5327
69	7773	12980	9871	7100	20133	18030	16386	3216	3819	5403	23924	23690	23399	22587	8568	5207	14633
70	7496	15366	12201	5524	21715	19552	17942	5446	6136	7831	25726	25486	25228	24268	10989	7513	16742
71	8053	12377	9299	7645	19820	17739	16089	2746	3280	4772	23534	23302	23002	22238	7925	4585	14147
72	11474	4542	1404	13693	14144	12486	10909	5462	4732	3518	16881	16677	16282	16050	3143	5466	6858
73	7769	14685	11559	6162	21417	19274	17649	4843	5494	7100	25343	25105	24833	23933	10230	6725	16219
74	9506	8543	6471	13355	8405	6330	4674	8800	8611	9202	12402	12158	11934	10900	10056	11432	5348
75	9109	9283	7148	13059	8339	6193	4567	9016	8890	9634	12526	12278	12086	10923	10656	11854	6005
76	8680	9665	7423	12665	8597	6420	4825	8908	8824	9677	12870	12621	12443	11222	10841	11884	6483
77	12282	8539	7569	16221	5828	4038	2497	11417	11125	11334	9527	9285	9045	8130	11485	13550	3911
78	12239	7412	6458	16033	6781	5125	3632	10684	10334	10389	10128	9895	9604	8910	10389	12587	3002
79	10781	9504	7959	14814	6511	4397	2749	10740	10556	11094	10707	10458	10280	9083	11726	13327	5348
80	12810	7211	6530	16585	6603	5100	3718	11078	10699	10650	9729	9501	9190	8604	10478	12828	2551
81	17221	11069	11503	21273	2742	3586	4253	16426	16059	15946	4386	4152	3883	3410	15394	18085	6082
82	10575	10083	8468	14665	6453	4275	2686	10950	10806	11445	10812	10561	10412	9101	12193	13675	5926
83	9929	10033	8212	14006	7115	4927	3351	10361	10242	10961	11474	11223	11070	9768	11853	13186	6146
84	9473	10418	8467	13581	7447	5235	3719	10240	10162	10989	11893	11641	11504	10139	12026	13203	6655
85	10592	11834	10174	14806	6152	3942	2812	12088	12033	12877	10864	10611	10553	8931	13833	15092	7541
86	7723	10103	7610	11716	9457	7257	5698	8322	8311	9357	13797	13548	13378	12115	10800	11527	7280
87	7096	10750	8155	11152	9886	7666	6164	8305	8363	9568	14325	14074	13924	12585	11199	11697	8013
88	5117	15520	12200	3393	20298	18092	16538	5624	6416	8504	24540	24295	24079	22944	11781	8801	16125
89	8593	9389	6280	9564	17388	15403	13743	1008	514	2061	20846	20621	20292	19677	5336	3194	11238
90	7408	8604	5239	9540	14872	12842	11182	2303	2130	3518	18521	18289	17989	17242	6107	5487	9297
91	11647	4809	3110	14877	10084	8480	6953	8124	7621	7264	12966	12751	12387	12021	7032	9400	3306
92	9029	10845	7892	9171	19146	17140	15480	2104	2226	3159	22630	22405	22075	21454	6244	2965	12992
93	9449	10254	7365	9772	18900	16929	15269	2165	2041	2550	22287	22065	21724	21161	5590	2371	12560

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DECIBEL - Main Result

Calculation: SG132-3.465

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
94	9013	13567	10607	7880	21359	19277	17627	4251	4710	5868	25055	24824	24519	23772	8815	5125	15597
95	10208	11520	8791	9875	20473	18495	16835	3540	3580	3882	23852	23631	23287	22735	6532	2739	14083
96	9959	6764	4520	13447	9633	7739	6098	7662	7331	7573	13152	12919	12624	11900	8149	9801	4554
97	9354	7441	5067	12928	9640	7657	5999	7545	7283	7731	13356	13119	12849	12008	8561	9964	5144
98	9328	6326	3267	12314	11843	9952	8307	5601	5192	5366	15233	15006	14685	14066	6283	7598	5941
99	14367	9325	9070	18363	4050	2916	2208	13520	13188	13227	7344	7105	6856	6050	13017	15411	4213
100	12777	9717	8852	16833	4661	2765	1224	12514	12261	12563	8688	8439	8257	7116	12768	14785	4874
101	12732	8319	7541	16646	5692	4043	2612	11666	11346	11466	9201	8963	8703	7885	11479	13670	3548
102	9900	9244	7384	13880	7521	5397	3756	9758	9596	10222	11687	11439	11249	10089	11038	12452	5554
103	19668	12523	13437	23725	4008	5674	6626	18720	18316	18058	2201	2020	1588	2551	17229	20147	7882
104	19339	12518	13330	23411	3600	5281	6268	18511	18121	17909	2318	2107	1756	2290	17150	20013	7792
105	18010	12298	12742	22120	2213	3812	4881	17551	17206	17148	3366	3118	2962	2163	16638	19299	7328
106	18513	12440	13011	22614	2663	4338	5395	17947	17587	17479	2901	2657	2462	2009	16885	19616	7543
107	19030	12482	13206	23113	3248	4927	5939	18298	17919	17745	2507	2280	1995	2137	17047	19862	7687
108	8984	11399	9327	13171	7763	5536	4191	10534	10531	11533	12379	12127	12030	10519	12777	13720	7677
109	2076	16167	12805	2372	18582	16354	14924	7182	7937	10182	23105	22853	22705	21325	13368	11072	15703
110	2201	16798	13438	2055	18900	16674	15275	7842	8598	10843	23469	23217	23081	21656	14030	11714	16239
111	2522	17302	13943	1806	19258	17035	15655	8318	9079	11322	23853	23600	23472	22021	14518	12158	16714
112	3789	15588	12228	2648	19451	17231	15716	5987	6780	8978	23806	23558	23368	22138	12241	9567	15756
113	3975	16118	12759	2178	19902	17680	16176	6474	7270	9452	24284	24035	23850	22599	12722	9973	16285
114	4065	16919	13557	1365	20375	18148	16674	7301	8096	10277	24816	24566	24395	23093	13548	10769	16985
115	4191	17547	14183	712	20718	18490	17041	7963	8758	10942	25206	24955	24795	23451	14212	11426	17522
116	10166	13391	10605	9054	21902	19864	18206	4734	5023	5722	25446	25220	24893	24246	8394	4547	15801
117	10564	12804	10107	9682	21688	19683	18023	4595	4767	5195	25130	24907	24569	23984	7729	3852	15392
118	12636	12617	10347	11818	22660	20750	19095	6061	5982	5578	25804	25592	25219	24815	7273	3557	15848
119	12717	10984	8857	12457	21447	19605	17962	5533	5242	4297	24421	24214	23825	23514	5619	2098	14401
120	12099	10994	8707	11848	21130	19256	17607	4971	4725	3991	24197	23987	23608	23242	5680	1912	14218
121	10293	9918	7208	10604	19167	17244	15588	2888	2582	2292	22409	22192	21835	21358	5012	1530	12560
122	11524	5448	2762	13307	15577	13883	12289	4762	3973	2265	18334	18130	17733	17504	2116	4038	8296
123	10974	6053	3206	12682	15751	13998	12383	4123	3333	1716	18646	18438	18053	17750	2525	3683	8658
124	12560	4444	2313	14435	15419	13842	12295	5898	5109	3291	17909	17714	17295	17205	1677	4752	7827
125	12024	4916	2441	13868	15443	13806	12234	5334	4546	2789	18071	17872	17464	17302	1862	4409	8003
126	13636	3734	2591	15523	15588	14130	12634	6964	6170	4245	17798	17614	17173	17227	1688	5408	7753
127	13142	3926	2289	15059	15377	13869	12352	6525	5735	3881	17709	17521	17089	17079	1723	5205	7638
128	14091	10016	9572	18152	3596	2165	1448	13683	13393	13560	7378	7130	6940	5874	13520	15765	4940
129	17862	10048	10916	21799	4377	5046	5365	16353	15917	15575	4729	4543	4111	4492	14701	17645	5357
130	18461	10119	11182	22373	4881	5681	6024	16781	16324	15907	4577	4417	3938	4657	14909	17946	5624
131	2797	18340	15021	3246	18993	16797	15532	9865	10593	12834	23708	23455	23370	21780	15956	13829	17259
132	2811	18281	14950	2870	19194	16992	15705	9669	10407	12652	23891	23638	23545	21979	15796	13599	17306
133	4503	19979	16718	5183	19280	17145	16033	11946	12650	14877	24089	23837	23803	22065	17934	15969	18444
134	4897	20299	17057	5678	19283	17167	16093	12389	13085	15307	24107	23856	23833	22064	18343	16428	18656
135	5281	20647	17414	6025	19434	17332	16285	12785	13480	15700	24266	24016	24001	22210	18730	16826	18946
136	5632	20807	17611	6703	19123	17049	16055	13198	13875	16080	23968	23719	23719	21889	19062	17274	18932
137	6346	21316	18159	7559	19099	17066	16142	13933	14595	16786	23954	23706	23727	21847	19728	18029	19265
138	6530	21199	18088	8102	18558	16553	15676	14111	14750	16916	23415	23168	23201	21294	19798	18234	18983
139	6918	21533	18434	8454	18698	16713	15867	14497	15135	17297	23555	23309	23351	21424	20171	18622	19263
140	7268	22744	19490	7077	21359	19293	18303	14615	15338	17576	26207	25958	25963	24121	20668	18573	21079
141	7801	23277	20024	7501	21781	19728	18759	15133	15858	18097	26633	26384	26395	24536	21195	19079	21593
142	8002	23434	20195	7828	21731	19694	18750	15381	16101	18337	26586	26338	26357	24480	21420	19346	21677
143	8332	23787	20541	8020	22097	20064	19124	15677	16402	18641	26953	26705	26725	24844	21735	19624	22049
144	8794	24249	21005	8405	22473	20450	19527	16127	16854	19093	27329	27082	27108	25213	22192	20064	22497
145	10813	26134	22931	10549	23536	21599	20799	18230	18948	21182	28385	28142	28205	26228	24251	22193	24140
146	11393	26663	23474	11177	23826	21917	21153	18832	19546	21778	28668	28426	28500	26501	24837	22805	24598
147	11778	27063	23871	11495	24196	22294	21538	19204	19921	22155	29036	28794	28871	26865	25220	23167	24999
148	8041	21195	17864	3801	24734	22507	21081	11288	12075	14093	29259	29008	28855	27481	17351	14074	21515
149	7634	21042	17700	3423	24349	22123	20711	11182	11973	14027	28896	28645	28498	27102	17295	14087	21253
150	6974	20551	17200	2778	23695	21469	20062	10747	11542	13631	28250	27998	27853	26449	16906	13781	20668
151	7037	20866	17510	2932	23773	21550	20162	11104	11901	14007	28357	28105	27969	26535	17284	14194	20893
152	7415	21251	17895	3329	24152	21929	20546	11471	12266	14362	28742	28490	28356	26916	17638	14517	21291
153	8202	22178	18823	4213	24928	22709	21347	12392	13188	15276	29547	29294	29169	27699	18550	15395	22191
154	8024	22165	18805	4122	24734	22518	21168	12424	13220	15328	29368	29116	28996	27508	18604	15495	22098

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DECIBEL - Main Result

Calculation: SG132-3.465

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WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
155	7970	22332	18968	4220	24639	22428	21100	12652	13449	15578	29298	29045	28934	27418	18856	15800	22159
156	5191	20732	17407	4189	20945	18782	17601	12055	12808	15053	25722	25469	25413	23735	18225	15898	19607
157	5384	20954	17641	4661	20860	18710	17561	12403	13148	15393	25654	25402	25356	23648	18546	16282	19715
158	5789	21357	18043	4912	21208	19065	17927	12772	13521	15767	26009	25757	25715	23996	18927	16632	20116
159	5940	21514	18210	5242	21151	19019	17904	13018	13761	16006	25962	25711	25676	23936	19154	16901	20195
160	6840	22368	19036	5314	22397	20255	19118	13560	14325	16567	27200	26948	26906	25184	19767	17315	21246
161	4966	20339	16990	3234	21204	19016	17773	11394	12163	14403	25938	25685	25607	23993	17612	15144	19463
162	4528	19914	16568	3024	20801	18610	17357	11020	11785	14027	25528	25275	25193	23589	17227	14805	19025
163	7291	21563	18516	9099	18259	16312	15525	14827	15442	17577	23112	22868	22924	20965	20388	18969	19123
164	7699	21921	18888	9464	18425	16501	15747	15234	15848	17980	23273	23030	23096	21117	20784	19376	19429
165	8722	22892	19882	10332	19004	17135	16452	16264	16879	19011	23837	23596	23682	21662	21810	20405	20306
166	9119	23138	20155	10793	18979	17142	16501	16642	17248	19369	23800	23561	23657	21616	22142	20788	20467
167	6492	21973	18716	6459	20784	18698	17674	13855	14574	16811	25625	25375	25369	23554	19896	17827	20349
168	6099	21666	18372	5561	21097	18976	17884	13256	13995	16239	25917	25666	25639	23879	19372	17162	20272
169	10035	23981	21022	11624	19473	17689	17112	17559	18164	20282	24269	24033	24147	22073	23045	21705	21222
170	6848	22328	18986	5062	22597	20445	19285	13411	14183	16421	27388	27136	27087	25386	19635	17121	21302
171	6848	22272	18924	4842	22749	20589	19409	13268	14044	16278	27529	27277	27221	25539	19503	16938	21329
172	6110	21523	18175	4199	22130	19959	18756	12546	13319	15556	26895	26642	26579	24920	18775	16248	20599
173	5355	20734	17385	3518	21532	19350	18118	11767	12538	14777	26277	26024	25950	24322	17991	15496	19851
174	5765	21180	17833	3943	21823	19649	18438	12229	12999	15238	26582	26330	26263	24614	18452	15952	20255
175	6666	22215	18933	6188	21350	19249	18196	13882	14617	16860	26184	25933	25918	24126	19984	17798	20730
176	5881	20750	17382	2762	22468	20262	18958	11384	12174	14379	27150	26898	26797	25251	17640	14883	20256
177	4627	19257	15888	1346	21343	19125	17771	9903	10691	12903	25971	25718	25598	24115	16158	13467	18846
178	4283	18835	15466	1012	21015	18795	17427	9493	10280	12495	25626	25374	25249	23783	15747	13083	18441
179	3660	19214	15927	4314	19082	16917	15737	11007	11720	13953	23857	23604	23548	21872	17035	15011	17862
180	3310	18877	15582	4026	18950	16774	15569	10623	11337	13572	23708	23456	23391	21740	16659	14624	17588
181	8365	22584	19561	9999	18857	16967	16256	15910	16527	18662	23697	23455	23533	21528	21468	20051	20041
182	6874	22338	19087	6818	20997	18924	17923	14248	14966	17202	25843	25593	25594	23762	20285	18220	20672
183	10298	25432	22270	10473	22480	20565	19799	17813	18510	20730	27324	27082	27153	25160	23743	21838	23283
184	10493	25535	22393	10798	22359	20466	19730	18034	18723	20936	27197	26956	27035	25026	23928	22076	23308
185	10877	25925	22784	11126	22681	20800	20078	18413	19105	21319	27515	27275	27359	25340	24315	22450	23687
186	11290	26325	23189	11511	22974	21108	20406	18826	19517	21732	27802	27563	27652	25622	24727	22861	24061
187	11607	26587	23464	11876	23070	21224	20547	19153	19841	22052	27891	27652	27749	25705	25036	23196	24271
188	11790	26687	23581	12157	22984	21158	20507	19351	20032	22238	27796	27558	27662	25605	25203	23407	24307
189	6734	20166	16817	2498	23431	21204	19785	10352	11147	13234	27967	27716	27566	26180	16509	13387	20321
190	7675	21618	18262	3650	24408	22187	20816	11848	12644	14742	29014	28762	28633	27176	18018	14895	21625
191	2973	18545	15245	3801	18798	16614	15386	10260	10975	13209	23541	23288	23216	21588	16300	14263	17309
192	11033	26302	23112	10860	23523	21604	20829	18479	19192	21423	28368	28126	28196	26205	24478	22457	24247
193	6147	21032	17886	7542	18772	16738	15813	13737	14391	16573	23627	23379	23399	21522	19496	17844	18950
194	5992	21091	17910	7092	19173	17118	16155	13568	14240	16439	24024	23775	23785	21932	19408	17650	19142
195	8074	22185	19173	9862	18457	16559	15841	15596	16204	18328	23299	23057	23132	21133	21114	19741	19623
196	9743	23645	20688	11413	19181	17386	16797	17254	17856	19969	23983	23747	23857	21790	22722	21402	20888
197	9468	23311	20359	11229	18878	17073	16474	16963	17560	19666	23685	23448	23555	21495	22408	21113	20551
198	3836	18431	15063	976	20572	18350	16979	9161	9944	12168	25177	24925	24799	23338	15410	12814	17996
199	5582	20406	17038	2425	22206	19997	18681	11041	11831	14037	26877	26624	26519	24987	17297	14553	19930
200	5286	20069	16701	2108	21941	19729	18403	10712	11501	13709	26600	26347	26238	24719	16967	14241	19607
201	5031	19730	16362	1762	21721	19506	18165	10362	11151	13359	26365	26112	25998	24496	16617	13896	19302
202	4858	20403	17079	4017	20648	18481	17291	11761	12511	14756	25419	25166	25107	23438	17920	15624	19274
203	4524	20070	16747	3837	20368	18197	16996	11454	12201	14446	25132	24880	24817	23159	17604	15334	18945
204	4184	19711	16384	3520	20178	17997	16775	11068	11815	14060	24927	24674	24604	22968	17220	14948	18635
205	6733	21924	18732	7453	19938	17900	16961	14279	14965	17176	24792	24544	24562	22689	20174	18337	19991
206	6520	21956	18610	4616	22432	20269	19085	12988	13762	15998	27209	26956	26899	25222	19218	16684	20998
207	6333	21888	18603	5896	21129	19019	17950	13546	14281	16523	25957	25706	25686	23907	19647	17466	20429
208	6996	22539	19260	6494	21559	19467	18432	14220	14955	17198	26397	26147	26138	24331	20322	18134	21023

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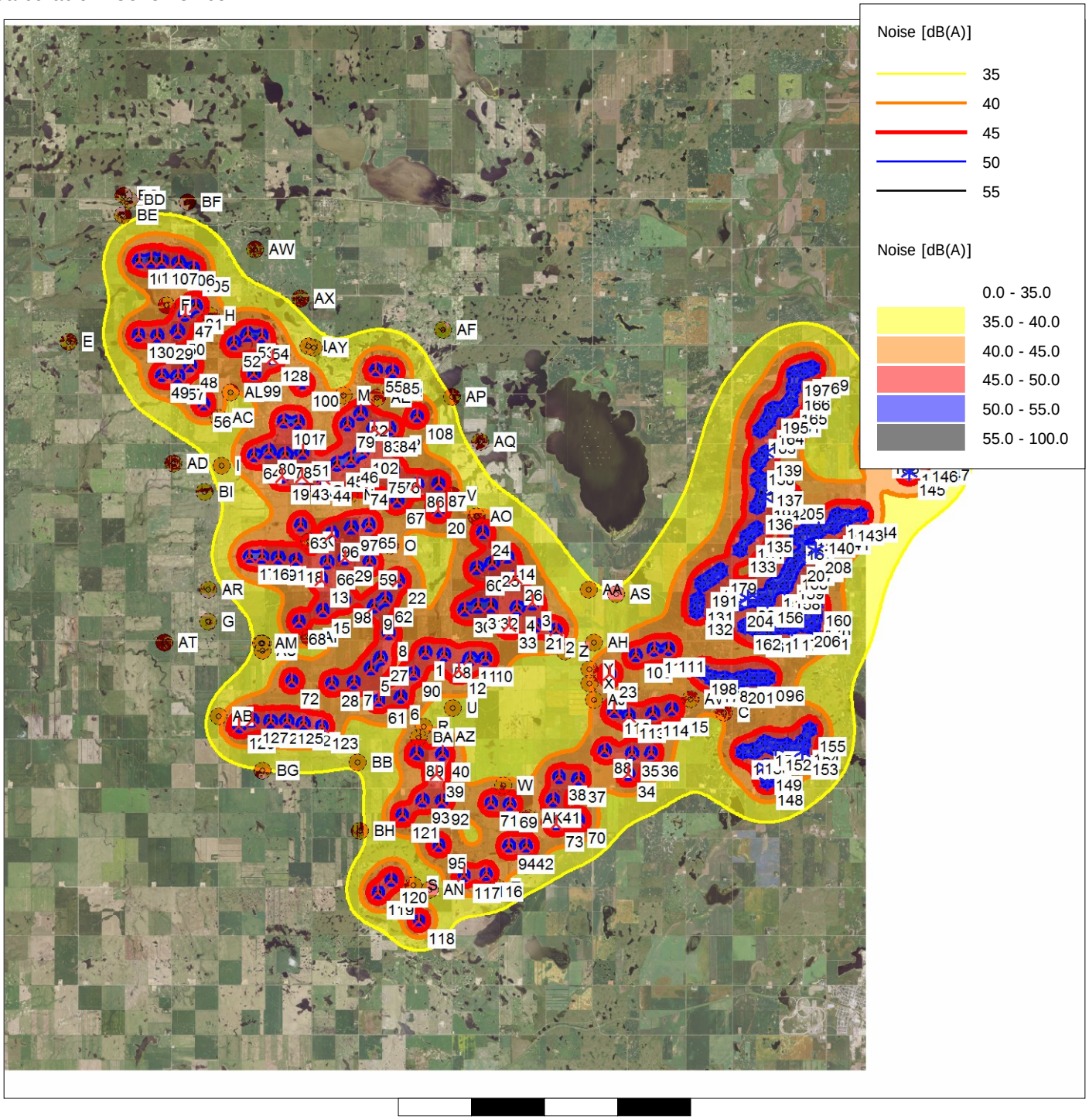
Calculated:
9/15/2018 12:54 AM/3.0.654

DECIBEL - Map 95% rated power

Calculation: SG132-3.465



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 641,190 North: 5,375,412

New WTG Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 95% rated power
Height above sea level from active line object

Project: Description:

Aurora

Licensed user:
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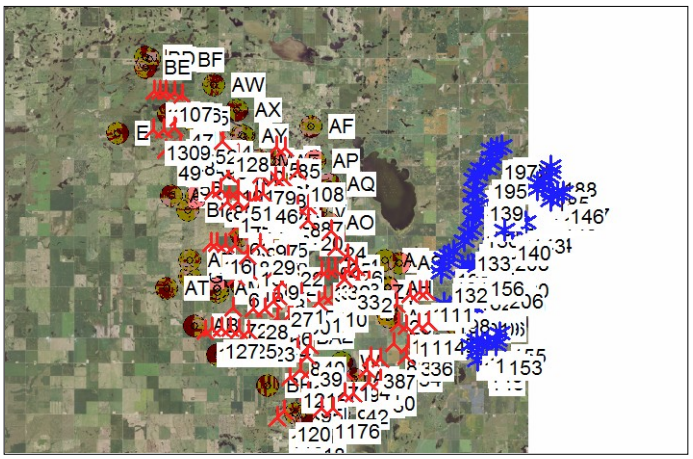
Kevin Walter / kwalter@tradewindenergy.com
Calculated:
9/15/2018 12:04 AM/3.0.654

DECIBEL - Main Result

Calculation: V136-4.0/4.2

Noise calculation model:
ISO 9613-2 General
Wind speed:
95% rated power
Ground attenuation:
General, fixed, Ground factor: 0.5
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
1.5 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:500,000

New WTG
Existing WTG
Noise sensitive area

WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
1	637,619	5,373,512	727.5	T-43	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
2	642,085	5,374,363	728.5	T-41	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
3	641,252	5,375,220	737.7	T-63	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
4	640,729	5,375,038	740.7	T-62	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
5	635,764	5,372,945	724.6	T-45	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
6	636,817	5,372,047	728.5	T-35	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
7	635,193	5,372,473	710.2	T-47	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
8	636,346	5,374,109	734.6	T-56	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
9	635,830	5,374,972	728.5	T-55	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
10	639,692	5,373,363	740.7	T-39	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
11	639,157	5,373,344	739.4	T-38	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
12	638,790	5,372,951	734.6	T-37	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
13	633,988	5,375,810	737.6	T-70	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
14	640,372	5,376,713	738.1	T-77	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
15	634,074	5,374,798	721.2	T-53	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
16	631,934	5,376,511	729.8	T-67	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
17	631,510	5,376,507	731.5	T-66	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
18	633,108	5,376,447	723.9	T-69	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
19	632,563	5,379,145	737.6	T-93	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
20	637,951	5,378,169	715.2	T-80	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
21	641,389	5,374,486	743.7	T-58	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
22	636,640	5,375,835	734.6	T-73	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
23	643,972	5,372,967	712.3	T-28	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
24	639,495	5,377,499	738.7	T-78	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
25	639,840	5,376,489	737.6	T-76	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
26	640,649	5,376,031	731.5	T-79	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
27	636,095	5,373,292	733.9	T-46	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
28	634,438	5,372,432	701.0	T-57	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
29	634,798	5,376,526	725.4	T-71	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
30	638,928	5,374,941	737.6	T-59	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
31	639,384	5,375,074	737.6	T-60	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
32	639,838	5,375,100	737.6	T-61	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
33	640,492	5,374,466	743.6	T-40	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
34	644,695	5,369,685	736.0	T-15	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
35	644,792	5,370,371	743.7	T-16	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
36	645,456	5,370,405	735.1	T-17	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
37	642,975	5,369,494	737.6	T-12	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
38	642,303	5,369,536	734.9	T-13	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
39	638,102	5,369,527	710.5	T-26	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
40	638,282	5,370,192	712.5	T-25	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
41	642,122	5,368,780	734.6	T-10	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
42	641,239	5,367,252	719.1	T-8	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
43	633,243	5,379,162	737.6	T-94	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

					WTG type							Noise data				
	X(East)	Y(North)	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
44	634,001	5,379,136	737.6	T-95	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
45	634,443	5,379,605	731.5	T-96	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
46	634,918	5,379,749	728.5	T-121	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
47	629,136	5,384,387	713.2	T-142	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
48	629,347	5,382,713	710.2	T-131	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
49	628,366	5,382,343	707.1	T-129	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
50	628,893	5,383,804	717.2	T-141	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
51	633,253	5,379,950	729.4	T-123	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
52	630,815	5,383,459	711.9	T-144	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
53	631,275	5,383,767	710.7	T-145	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
54	631,767	5,383,732	713.2	T-146	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
55	635,699	5,382,724	710.2	T-122	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
56	629,834	5,381,441	713.0	T-117	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
57	628,926	5,382,328	703.0	T-130	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
58	638,268	5,373,457	731.5	T-44	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
59	635,628	5,376,434	728.5	T-72	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
60	639,307	5,376,310	731.5	T-75	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
61	636,056	5,371,908	719.3	T-34	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
62	636,215	5,375,218	731.5	T-74	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
63	633,243	5,377,581	731.5	T-81	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
64	631,582	5,379,814	726.8	T-98	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
65	635,586	5,377,640	725.5	T-85	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
66	634,183	5,376,389	733.5	T-86	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
67	636,542	5,378,452	715.1	T-87	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
68	633,261	5,374,418	716.3	T-51	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
69	640,641	5,368,602	728.5	T-23	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
70	643,024	5,368,138	728.5	T-11	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
71	639,998	5,368,634	725.4	T-22	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
72	633,064	5,372,478	698.0	T-5	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
73	642,243	5,368,015	730.6	T-9	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
74	635,270	5,379,029	725.4	T-90	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
75	635,883	5,379,448	720.6	T-91	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
76	636,364	5,379,455	716.0	T-92	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
77	633,072	5,380,925	729.9	T-106	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
78	632,659	5,379,855	737.2	T-100	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
79	634,758	5,380,905	718.9	T-107	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
80	632,089	5,379,958	731.5	T-99	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
81	629,494	5,384,648	709.6	T-143	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
82	635,222	5,381,271	716.3	T-108	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
83	635,678	5,380,785	716.0	T-109	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
84	636,220	5,380,785	716.3	T-110	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
85	636,276	5,382,673	710.2	T-124	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
86	637,208	5,379,005	710.9	T-88	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
87	637,941	5,379,046	713.2	T-89	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
88	643,859	5,370,443	732.3	T-14	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
89	637,408	5,370,185	701.0	T-24	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
90	637,234	5,372,817	719.9	T-42	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
91	632,509	5,376,501	722.8	T-68	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
92	638,306	5,368,644	716.3	T-21	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
93	637,648	5,368,666	713.2	T-20	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
94	640,643	5,367,238	719.3	T-19	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
95	638,242	5,367,207	710.2	T-18	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
96	634,318	5,377,326	731.6	T-83	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
97	634,979	5,377,549	725.3	T-84	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
98	634,798	5,375,163	713.2	T-54	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
99	631,532	5,382,484	707.7	T-118	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
100	633,206	5,382,201	722.4	T-120	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
101	632,585	5,380,949	731.5	T-105	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
102	635,298	5,380,049	728.5	T-97	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
103	627,504	5,386,079	711.3	T-147	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
104	627,911	5,386,105	710.2	T-148	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
105	629,368	5,385,888	704.0	T-149	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
106	628,867	5,386,049	710.2	T-150	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
107	628,269	5,386,086	711.9	T-151	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
108	637,149	5,381,224	704.1	T-152	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
109	644,833	5,373,605	713.9	T-153	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
110	645,462	5,373,811	728.5	T-154	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
111	645,966	5,373,838	730.1	T-155	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
112	644,144	5,371,765	710.2	T-156	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
113	644,660	5,371,616	715.4	T-157	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No

To be continued on next page...

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9/15/2018 12:04 AM/3.0.654

DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

					WTG type							Noise data				
	X(East)	Y(North)	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
114	645,479	5,371,724	719.3	T-158	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
115	646,127	5,371,875	717.1	T-159	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
116	639,890	5,366,309	710.2	T-160	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
117	639,135	5,366,239	709.0	T-161	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
118	637,617	5,364,719	707.6	T-162	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
119	636,191	5,365,609	711.4	T-163	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
120	636,640	5,366,042	710.2	T-164	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
121	636,954	5,368,164	711.3	T-165	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
122	633,495	5,371,087	689.0	T-166	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
123	634,130	5,371,006	696.6	T-167	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
124	632,359	5,371,139	688.8	T-168	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
125	632,926	5,371,158	686.0	T-169	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
126	631,283	5,370,947	682.8	T-170	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
127	631,732	5,371,159	684.7	T-171	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
128	632,154	5,382,999	713.2	T-172	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
129	628,195	5,383,647	711.6	T-173	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
130	627,535	5,383,666	710.2	T-174	Yes	VESTAS	V136-4.0-4,000	4,000	136.0	82.0	USER	Mode 0 Std Blades 106.9+2dB	(95%)	108.9	No
131	646,913	5,375,455	745.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
132	646,888	5,375,080	743.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
133	648,328	5,377,151	749.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
134	648,570	5,377,592	749.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
135	648,872	5,377,853	752.9	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
136	648,872	5,378,572	753.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
137	649,189	5,379,368	749.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
138	648,868	5,380,034	743.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
139	649,124	5,380,328	729.4	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
140	651,007	5,377,868	748.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
141	651,525	5,378,000	750.5	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
142	651,616	5,378,348	758.5	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
143	651,987	5,378,290	755.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
144	652,436	5,378,405	749.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
145	654,047	5,379,834	743.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
146	654,478	5,380,290	740.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
147	654,876	5,380,346	731.4	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
148	649,468	5,369,552	735.9	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
149	649,403	5,370,046	745.1	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
150	648,989	5,370,563	740.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
151	649,348	5,370,846	749.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
152	649,714	5,370,690	746.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
153	650,635	5,370,574	746.1	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
154	650,667	5,370,918	744.2	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
155	650,882	5,371,340	743.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
156	649,309	5,375,532	733.1	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
157	649,484	5,375,990	732.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
158	649,889	5,375,994	741.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
159	650,008	5,376,322	740.0	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
160	650,956	5,375,465	750.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
161	648,982	5,374,557	737.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
162	648,553	5,374,643	733.0	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
163	648,903	5,381,054	722.4	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
164	649,170	5,381,363	721.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
165	649,950	5,382,038	713.3	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
166	650,030	5,382,496	712.9	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
167	650,267	5,377,632	746.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
168	650,119	5,376,640	740.5	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
169	650,663	5,383,159	707.1	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
170	650,947	5,375,049	753.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
171	650,911	5,374,694	758.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
172	650,163	5,374,664	746.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
173	649,378	5,374,555	741.2	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
174	649,818	5,374,694	743.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
175	650,613	5,377,049	737.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
176	649,406	5,372,982	725.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
177	647,909	5,372,903	716.3	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
178	647,487	5,372,910	715.5	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
179	647,672	5,376,428	744.3	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
180	647,365	5,376,192	740.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
181	649,728	5,381,758	721.2	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
182	650,599	5,377,842	746.4	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
183	653,143	5,380,511	713.2	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
184	653,130	5,380,927	710.2	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
185	653,497	5,381,062	704.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
186	653,850	5,381,276	700.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
187	654,022	5,381,604	696.2	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
188	654,011	5,381,966	694.9	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
189	648,594	5,370,523	731.5	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
190	650,092	5,370,737	743.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
191	647,056	5,376,002	741.1	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
192	654,134	5,380,179	733.9	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
193	648,870	5,379,452	759.0	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
194	649,079	5,378,913	759.0	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
195	649,308	5,381,738	716.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
196	650,346	5,383,045	709.6	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
197	650,021	5,382,956	710.0	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
198	647,090	5,373,129	713.2	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
199	649,061	5,372,960	722.4	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
200	648,724	5,372,961	720.7	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
201	648,383	5,372,886	719.3	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
202	648,975	5,375,560	735.2	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
203	648,641	5,375,554	726.1	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
204	648,297	5,375,376	728.5	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
205	649,928	5,378,956	741.8	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
206	650,591	5,374,779	748.5	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
207	650,301	5,376,922	735.1	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
208	650,917	5,377,197	740.0	VESTAS V100 2000 100.0...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

Calculation Results

Sound Level

Noise sensitive area No.	Name	X(East)	Y(North)	Z	Imission height	Demands Noise	Sound Level From WTGs	Distance to noise demand	Demands fulfilled ? Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
A	1 - Non-Participating	644,116	5,375,554	701.3	1.5	50.0	36.2	1,844	Yes
B	39 - Participating	643,400	5,373,971	711.5	1.5	50.0	39.2	933	Yes
C	2 - Non-Participating	647,930	5,371,801	718.0	1.5	50.0	40.9	889	Yes
D	40 - Participating	643,453	5,372,099	716.3	1.5	50.0	41.7	537	Yes
E	41 - Participating	625,162	5,383,364	711.9	1.5	50.0	30.8	2,168	Yes
F	42 - Participating	628,500	5,384,644	704.1	1.5	50.0	43.8	437	Yes
G	43 - Participating	630,148	5,374,327	691.9	1.5	50.0	32.9	2,338	Yes
H	44 - Participating	629,997	5,384,325	711.4	1.5	50.0	43.9	355	Yes
I	3 - Non-Participating	630,488	5,379,437	722.7	1.5	50.0	38.1	927	Yes
J	4 - Non-Participating	632,031	5,373,676	696.3	1.5	50.0	37.3	1,214	Yes
K	45 - Participating	633,554	5,377,057	735.4	1.5	50.0	45.6	372	Yes
L	46 - Participating	633,395	5,383,413	715.7	1.5	50.0	38.7	1,001	Yes
M	47 - Participating	634,615	5,381,825	716.9	1.5	50.0	42.4	578	Yes
N	48 - Participating	634,891	5,378,584	728.5	1.5	50.0	45.3	336	Yes
O	5 - Non-Participating	636,328	5,376,974	731.5	1.5	50.0	42.6	648	Yes
P	49 - Participating	636,455	5,380,259	709.9	1.5	50.0	45.4	333	Yes
Q	50 - Participating	636,416	5,382,006	707.4	1.5	50.0	43.0	453	Yes
R	51 - Participating	637,621	5,371,070	716.6	1.5	50.0	41.2	682	Yes
S	6 - Non-Participating	637,411	5,365,868	713.2	1.5	50.0	40.7	565	Yes
T	52 - Participating	640,276	5,365,862	710.2	1.5	50.0	42.1	367	Yes
U	7 - Non-Participating	638,615	5,371,717	720.3	1.5	50.0	39.7	1,008	Yes
V	8 - Non-Participating	638,435	5,378,666	709.4	1.5	50.0	43.7	391	Yes
W	9 - Non-Participating	640,413	5,369,191	728.5	1.5	50.0	43.4	394	Yes
X	10 - Non-Participating	643,279	5,372,615	722.4	1.5	50.0	41.0	550	Yes
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.5	50.0	41.3	475	Yes
Z	53 - Participating	642,413	5,373,644	734.1	1.5	50.0	40.7	562	Yes
AA	54 - Participating	643,167	5,375,685	714.9	1.5	50.0	36.7	1,484	Yes
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.5	50.0	39.9	530	Yes
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.5	50.0	41.3	457	Yes
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.5	50.0	33.6	1,993	Yes

To be continued on next page...

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9/15/2018 12:04 AM/3.0.654

DECIBEL - Main Result

Calculation: V136-4.0/4.2

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Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	X(East)	Y(North)	Z	Imission height	Noise	From WTGs	Distance to noise demand	Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
AE	55 - Participating	635,760	5,381,775	711.0	1.5	50.0	43.7	495	Yes
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.5	50.0	32.1	1,962	Yes
AG	57 - Participating	633,480	5,378,691	739.8	1.5	50.0	45.8	275	Yes
AH	59 - Participating	643,400	5,373,968	711.4	1.5	50.0	39.2	929	Yes
AI	61 - Participating	633,645	5,373,895	713.7	1.5	50.0	42.7	421	Yes
AJ	62 - Participating	643,453	5,372,097	716.3	1.5	50.0	41.7	535	Yes
AK	63 - Participating	641,300	5,368,154	725.4	1.5	50.0	43.4	569	Yes
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.5	50.0	41.0	761	Yes
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.5	50.0	37.2	1,253	Yes
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.5	50.0	39.3	856	Yes
AO	64 - Participating	639,268	5,377,996	720.6	1.5	50.0	43.1	325	Yes
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.5	50.0	36.0	1,120	Yes
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.5	50.0	34.9	1,725	Yes
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.5	50.0	34.2	1,544	Yes
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.5	50.0	36.2	1,843	Yes
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.5	50.0	29.7	3,504	Yes
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.5	50.0	37.4	1,182	Yes
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.5	50.0	42.7	483	Yes
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.5	50.0	33.3	1,982	Yes
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.5	50.0	34.9	1,555	Yes
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.5	50.0	38.3	1,001	Yes
AZ	66 - Participating	638,244	5,370,747	710.8	1.5	50.0	43.4	327	Yes
BA	67 - Participating	637,448	5,370,698	712.2	1.5	50.0	44.0	287	Yes
BB	68 - Participating	635,378	5,369,828	692.6	1.5	50.0	36.8	1,490	Yes
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.5	50.0	31.5	1,956	Yes
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.5	50.0	32.5	1,772	Yes
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.5	50.0	34.3	1,346	Yes
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.5	50.0	33.4	1,762	Yes
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.5	50.0	36.0	1,431	Yes
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.5	50.0	35.6	1,310	Yes
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.5	50.0	34.9	1,821	Yes

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	6810	5799	10452	6003	15882	14390	7516	13229	9271	5591	5393	10764	8839	5759	3695	6847	8579	2442	7647	8099	2053	5218
2	2355	1372	6382	2645	19168	17037	11937	15664	12659	10077	8946	12547	10558	8341	6322	8153	9516	5546	9696	8691	4363	5643
3	2883	2484	7503	3819	18034	15857	11140	14477	11561	9350	7914	11352	9363	7196	5227	6957	8333	5514	10110	9409	4385	4451
4	3426	2876	7896	4008	17654	15551	10605	14192	11146	8804	7453	11132	9134	6830	4808	6747	8195	5040	9752	9188	3937	4293
5	8751	7705	12221	7736	14865	13771	5783	12758	8366	3804	4668	10733	8954	5707	4069	7347	9085	2639	7266	8398	3105	6315
6	8098	6859	11117	6637	16245	15095	7047	14045	9729	5055	5978	11870	10022	6815	4951	8220	9967	1266	6207	7087	1829	6814
7	9440	8343	12755	8269	14807	13890	5375	12941	8404	3383	4868	11086	9369	6119	4642	7888	9611	2805	6968	8340	3505	6990
8	7903	7055	11812	7386	14517	13136	6202	12028	7919	4337	4060	9760	7907	4706	2865	6151	7897	3296	8310	9136	3297	5013
9	8306	7636	12509	8146	13573	12136	5719	11023	6962	4014	3086	8785	6960	3732	2063	5324	7059	4294	9240	10137	4284	4520
10	4937	3758	8385	3968	17639	15891	9592	14634	11028	7667	7164	11860	9868	7093	4935	7618	9243	3089	7834	7524	1967	5450
11	5429	4289	8908	4473	17213	15533	9063	14300	10596	7134	6722	11601	9620	6757	4602	7424	9085	2744	7677	7566	1715	5371
12	5928	4721	9212	4740	17151	15577	8751	14377	10536	6798	6654	11771	9807	6851	4717	7673	9362	2214	7216	7243	1246	5726
13	10131	9590	14507	10166	11618	10400	4117	9404	5041	2896	1320	7626	6047	2917	2613	5087	6655	5972	10515	11769	6178	5285
14	3919	4084	9014	5548	16601	14278	10499	12869	10253	8877	6827	9673	7699	5792	4053	5284	6609	6278	11242	10852	5296	2752
15	10070	9362	14177	9760	12361	11314	3955	10362	5863	2331	2318	8641	7047	3873	3132	5957	7579	5146	9533	10878	5488	5829
16	12220	11744	16676	12335	9635	8829	2821	8051	3264	2836	1710	7055	5953	3612	4418	5873	7092	7871	11969	13528	8224	6849
17	12642	12158	17082	12731	9344	8676	2570	7963	3104	2878	2118	7159	6159	3969	4841	6208	7370	8180	12166	13790	8569	7254
18	11044	10585	15533	11221	10535	9404	3641	8470	3976	2973	756	6972	5585	2783	3262	5073	6469	7020	11420	12784	7260	5770
19	12098	12009	17033	12971	8519	6837	5389	5781	2095	5495	2311	4349	3376	2395	4346	4049	4800	9529	14134	15360	9582	5892
20	6696	6878	11838	8193	13804	11457	8699	10058	7570	7433	4536	6946	4949	3088	2016	2570	4133	7107	12313	12526	6487	693
21	2928	2075	7071	3156	18497	16411	11243	15053	11973	9394	8246	11983	9987	7683	5640	7595	9016	5086	9492	8696	3920	5119
22	7481	7012	11989	7770	13728	11995	6665	10781	7129	5090	3319	8244	6323	3259	1181	4429	6176	4865	9996	10615	4567	3352
23	2591	1156	4127	1011	21493	19385	13891	18009	14956	11962	11192	14866	12885	10678	8631	10473	11782	6628	9666	8009	5501	7947
24	5014	5263	10180	6696	15486	13113	9871	11696	9213	8386	5957	8496	6521	4730	3210	4106	5458	6697	11816	11664	5849	1577
25	4376	4360	9350	5685	16209	13969	9931	12582	9806	8301	6312	9460	7468	5375	3546	5067	6494	5856	10895	10636	4927	2592
26	3500	3437	8421	4830	17135	14892	10639	13500	10716	8934	7168	10349	8365	6298	4423	5955	7322	5812	10667	10177	4770	3442
27	8334	7337	11929	7454	14865	13659	6036	12606	8319	4082	4542	10475	8660	5428	3690	6977	8720	2696	7539	8526	2972	5862

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
28	10169	9093	13507	9021	14338	13579	4690	12695	8042	2710	4709	11030	9394	6169	4919	8083	9776	3462	7206	8789	4238	7405
29	9368	8973	13956	9721	11816	10275	5144	9158	5201	3973	1353	7028	5302	2060	1594	4084	5714	6143	10973	11989	6140	4219
30	5224	4576	9535	5344	16138	14244	8801	12955	9563	7012	5775	10119	8123	5438	3300	5865	7499	4085	9198	9179	3239	3758
31	4756	4165	9152	5041	16461	14493	9266	13179	9908	7484	6157	10266	8265	5701	3598	5955	7540	4375	9415	9256	3444	3715
32	4302	3737	8739	4699	16843	14820	9721	13489	10307	7936	6581	10517	8515	6050	3979	6169	7707	4599	9546	9249	3597	3832
33	3784	2950	7902	3791	17725	15729	10345	14400	11171	8498	7406	11420	9417	6952	4861	7061	8571	4447	9133	8607	3329	4677
34	5898	4478	3866	2715	23847	22047	15270	20745	17232	13278	13359	17781	15779	13241	11097	13406	14845	7208	8224	5844	6410	10948
35	5227	3860	3449	2186	23540	21660	15169	20337	16935	13182	13076	17320	15322	12864	10735	12933	14336	7204	8647	6382	6322	10451
36	5321	4117	2841	2623	24079	22142	15802	20803	17482	13818	13635	17739	15746	13361	11246	13346	14708	7863	9236	6890	6965	10842
37	6166	4497	5466	2648	22576	20954	13707	19708	15962	11716	12081	16897	14898	12165	10007	12586	14127	5581	6642	4526	4894	10234
38	6285	4569	6066	2809	22024	20465	13066	19240	15416	11075	11538	16490	14496	11697	9541	12214	13790	4927	6115	4197	4285	9916
39	8514	6915	10088	5936	18945	17909	9290	16872	12498	7354	8797	14662	12783	9610	7655	10858	12593	1616	3724	4261	2249	9145
40	7923	6362	9781	5511	18592	17452	9125	16383	12092	7157	8336	14095	12197	9051	7058	10232	11961	1099	4411	4767	1560	8476
41	7061	5346	6547	3576	22368	20910	13196	19714	15777	11216	11913	17037	15050	12182	10035	12802	14404	5049	5539	3453	4574	10551
42	8786	7058	8091	5328	22761	21559	13155	20442	16250	11227	12458	17964	16007	12989	10892	13859	15522	5260	4071	1691	5178	11754
43	11456	11407	16429	12415	9108	7249	5741	6098	2768	5618	2128	4253	2996	1747	3782	3395	4261	9201	13932	15046	9182	5216
44	10730	10724	15743	11784	9798	7785	6163	6554	3526	5805	2127	4319	2758	1047	3176	2699	3751	8841	13699	14683	8737	4458
45	10487	10582	15583	11727	10013	7792	6805	6484	3958	6401	2698	3949	2227	1115	3237	2116	3108	9108	14054	14930	8924	4101
46	10109	10263	15248	11462	10404	8072	7222	6720	4441	6724	3018	3968	2098	1165	3113	1620	2709	9090	14103	14885	8842	3680
47	17391	17662	22620	18868	4103	686	10112	863	5132	11096	8559	4369	6049	8173	10329	8403	7660	15791	20284	21617	15824	10918
48	16413	16551	21551	17654	4235	2108	8425	1738	3469	9428	7050	4108	5343	6913	9038	7520	7105	14284	18676	20086	14382	9949
49	17151	17208	22225	18237	3362	2305	8212	2567	3598	9410	7407	5142	6271	7531	9603	8354	8058	14586	18795	20335	14764	10720
50	17315	17526	22506	18682	3757	927	9561	1220	4650	10604	8201	4519	6055	7952	10096	8352	7735	15439	19856	21249	15513	10837
51	11718	11777	16788	12871	8782	6681	6424	5454	2812	6392	2908	3466	2317	2132	4279	3217	3772	9896	14683	15741	9825	5338
52	15473	15761	20709	16994	5653	2601	9157	1191	4035	9859	6964	2581	4137	6355	8512	6485	5787	14136	18787	19980	14098	9002
53	15243	15588	20509	16866	6127	2911	9508	1395	4401	10120	7087	2149	3864	6320	8467	6256	5434	14195	18922	20041	14110	8791
54	14812	15186	20091	16490	6615	3392	9544	1866	4481	10060	6911	1659	3428	6022	8154	5835	4960	13951	18735	19793	13831	8374
55	11057	11658	16399	13154	10556	7451	10066	5923	6161	9763	6059	2405	1408	4218	5784	2578	1015	11811	16943	17473	11387	4894
56	15448	15487	20504	16515	5052	3470	7121	2889	2108	8070	5750	4071	4797	5809	7882	6726	6607	12969	17318	18755	13103	9037
57	16633	16714	21726	17768	3903	2354	8095	2265	3287	9193	7015	4599	5712	7043	9136	7809	7497	14226	18519	20000	14370	10190
58	6212	5157	9803	5360	16430	14852	8167	13658	9813	6241	5932	11085	9131	6140	4017	7040	8748	2473	7637	7856	1774	5212
59	8534	8153	13146	8946	12552	10873	5871	9694	5953	4532	2165	7327	5485	2273	884	3914	5628	5722	10715	11549	5584	3586
60	4868	4714	9731	5909	15807	13648	9371	12285	9357	7738	5801	9242	7241	4967	3052	4872	6388	5504	10612	10493	4645	2513
61	8846	7628	11875	7399	15809	14809	6384	13817	9365	4397	5725	11809	10021	6777	5073	8361	10105	1775	6190	7373	2566	7165
62	7908	7292	12204	7882	13731	12181	6132	11027	7113	4459	3234	8666	6798	3617	1760	5047	6791	4380	9426	10200	4245	4101
63	11060	10780	15784	11589	9937	8508	4491	7484	3322	4089	610	5834	4460	1930	3144	4182	5445	7847	12433	13668	7953	5304
64	13238	13184	18207	14158	7336	5729	5672	4781	1157	6155	3390	4029	3639	3531	5531	4894	5308	10627	15115	16440	10726	6949
65	8781	8632	13656	9622	11892	9964	6369	8714	5406	5325	2114	6174	4296	1172	997	2759	4444	6878	11913	12678	6653	3027
66	9968	9529	14493	10215	11403	10022	4532	8972	4790	3463	917	7068	5453	2306	2223	4488	6044	6334	11005	12164	6440	4823
67	8110	8192	13189	9388	12395	10150	7609	8794	6133	6569	3297	5875	3884	1656	1493	1810	3557	7460	12614	13132	7047	1905
68	10914	10149	14901	10452	12068	11280	3115	10431	5734	1437	2655	8996	7530	4474	3992	6658	8218	5497	9504	11064	5997	6694
69	7773	6037	7961	4488	21390	20119	11953	18987	14849	9994	11032	16488	14531	11520	9418	12386	14055	3900	4231	2764	3715	10303
70	7496	5846	6123	3984	23472	21987	14287	20779	16877	12310	13009	18057	16064	13239	11087	13787	15363	6148	6055	3569	5679	11486
71	8053	6329	8541	4893	20907	19711	11377	18607	14393	9428	10605	16187	14247	11184	9112	12153	13844	3403	3787	2786	3378	10153
72	11472	10444	14882	10396	13452	12994	3453	12238	7421	1582	4606	10940	9475	6374	5556	8489	10101	4770	7911	9787	5603	8194
73	7769	6068	6832	4260	22965	21574	13643	20396	16391	11677	12541	17760	15777	12875	10736	13544	15157	5540	5288	2916	5183	11312
74	9504	9575	14579	10723	10998	8796	6953	7474	4799	6257	2614	4768	2871	584	2311	1708	3190	8299	13334	14087	8041	3185
75	9107	9301	14270	10551	11414	9028	7689	7644	5395	6940	3338	4681	2694	1315	2514	992	2613	8557	13666	14279	8200	2669
76	8678	8920	13870	10216	11865	9422	8059	8016	5876	7223	3694	4948	2946	1711	2481	810	2552	8478	13627	14145	8059	2216
77	12281	12451	17436	13626	8278	5894	7218	4584	2982	7324	3898	2508	1786	2965	5120	3448	3514	10855	15670	16698	10748	5819
78	12237	12247	17265	13291	8278	6343	6072	5203	2211	6211	2938	3633	2776	2568	4665	3817	4329	10089	14772	15932	10085	5897
79	10779	11079	16012	12375	9906	7291	8033	5863	4515	7727	4032	2854	931	2325	4233	1816	1990	10243	15269	16023	9965	4304
80	12808	12798	17818	13817	7719	5903	5956	4843	1683	6282	3250	3694	3141	3121	5184	4377	4787	10469	15061	16301	10512	6476
81	17219	17532	22471	18771	4518	995	10343	598	5305	11262	8609	4092	5848	8118	10276	8229	7409	15825	20381	21661	15825	10757
82	10573	10962	15849	12324	10275	7521	8601	6052	5077	8239	4532	2815	821	2707	4438	1595	1402	10480	15558	16217	10140	4136
83	9928	10298	15193	11658	10828	8150	8503	6694	5362	7990	4291	3481	1487	2337	3866	938	1426	9908	15017	15616	9532	3477
84	9471	9898	14760	11303	11355	8631	8865	7160	5888	8251	4583	3859	1912	2571	3812	576	1237	9815	14964	15465	9379	3065
85	10590	11246	15939	12780	11135	8022	10355	6493	6631	9949	6241	2974	1865	4317	5700	2421	682	11681	16844	17281	11204	4552
86	7722	7980	12918	9311	12811	10375	8470	8962	6734	7430	4141	5829	3831	2355	2213	1463	3104	7945	13138	13496	7423	1272
87	7094	7454	12341	8869	13488	10976	9110	9538	7463	7985	4816	6303	4333	3084	2626	1918	3330	7982	13189	13390	7360	623
88	5118	3558	4291	1705	22728	20919	14251	19619	16115	12263	12245	16665	14663	12113	9969	12296	13752	6270	7907	5817	5397	9852
89	8592	7088	10646	6341	17991	16983	8358	15965	11554	6411	7879	13823	11970	8768	6875	10120	11863	911	4317	5188	1951	8543
90	7407	6274	10745	6261	16030	14703	7245	13595	9452	5273	5614	11270	9381	6225	4255	7483	9226	1789	6951	7591	1766	5972
91	11646	11181	16122	11796	10054	9076	3210	8217	3564	2866	1184	6968	5725	3165	3848	5449	6750	7459	11709	13173	7758	6309
92	9028	7371	10129	6199	19735	18767	9943	17747	13328	8044	9663	15564	13688	10511	8562	11762	13496	2521	2917	3409	3088	10023
93	9448	7825	10749	6744	19286	18412	9397	17428	12934	7527	9336	15348	13504	10294	8412	11654	13397	2404	2808	3843	3200	10031
94	9012	7276	8598	5615	22355	21224	12665	20133	15873	10753	12111	17725	15784	12722	10650	13679	15362	4881	3511	1424	4917	11640
95	10207	8507	10723	7148	20788	19974	10779	19000	14481	8968	10909	16915	15061	11861	9953	13174	14912	3913	1576	2439	4525	11461
96	9957	9682	14692	10525	10967	9349	5137	8225	4373	4307	809	6156	4509	1383	2041	3630	5129	7075	11868	12920	7067	4330

To be continued on next page...

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9/15/2018 12:04 AM/3.0.654

DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
97	9352	9149	14170	10075	11410	9609	5807	8411	4872	4867	1507	6074	4292	1039	1466	3086	4683	6997	11931	12831	6873	3632
98	9326	8684	13556	9181	12654	11383	4725	10344	6070	3141	2266	8369	6665	3423	2371	5359	7032	4972	9655	10794	5143	5050
99	14366	14605	19571	15810	6431	3723	8274	2397	3220	8822	5791	2082	3153	5147	7305	5402	4907	12936	17625	18782	12888	7888
100	12776	13102	18028	14390	8127	5302	8448	3848	3876	8606	5156	1226	1459	3991	6089	3786	3216	11975	16866	17804	11798	6312
101	12730	12870	17865	14015	7806	5509	7057	4254	2585	7294	4011	2594	2211	3303	5460	3931	3974	11089	15834	16934	11027	6279
102	9898	10129	15088	11390	10664	8205	7699	6810	4848	7162	3463	3864	1902	1521	3244	1176	2254	9275	14338	15036	8969	3429
103	19666	19982	24923	21209	3585	1747	12047	3048	7282	13204	10863	6467	8287	10524	12680	10677	9799	18101	22509	23914	18159	13208
104	19338	19676	24606	20923	3882	1576	11990	2743	7149	13095	10664	6110	7955	10262	12419	10353	9442	17899	22356	23722	17934	12888
105	18008	18410	23303	19712	4905	1518	11588	1685	6548	12500	9773	4727	6637	9157	11310	9051	8046	16962	21576	22805	16922	11592
106	18512	18897	23800	20183	4575	1452	11792	2061	6808	12771	10140	5240	7134	9592	11748	9545	8563	17350	21915	23188	17333	12085
107	19028	19384	24304	20645	4131	1461	11909	2468	7010	12968	10463	5782	7645	10007	12165	10049	9112	17691	22189	23521	17707	12586
108	8983	9575	14319	11091	12177	9301	9828	7796	6896	9120	5503	4345	2604	3474	4329	1188	1072	10165	15358	15678	9620	2863
109	2077	1479	3585	2043	21959	19714	14703	18304	15485	12802	11795	15067	13114	11119	9148	10699	11892	7644	10722	8985	6498	8158
110	2202	2069	3183	2640	22436	20127	15323	18701	15996	13432	12343	15421	13486	11599	9667	11077	12206	8306	11310	9492	7160	8542
111	2524	2570	2830	3057	22882	20539	15826	19105	16460	13936	12823	15802	13879	12049	10136	11476	12567	8792	11693	9798	7651	8946
112	3790	2329	3786	768	22246	20264	14229	18919	15664	12263	11839	15850	13857	11495	9393	11458	12830	6560	8950	7058	5529	8957
113	3976	2672	3276	1300	22764	20758	14763	19405	16187	12796	12367	16312	14322	12000	9906	11918	13264	7060	9251	7234	6045	9406
114	4066	3062	2453	2061	23416	21336	15551	19962	16859	13589	13063	16813	14834	12616	10550	12421	13707	7885	9969	7838	6864	9891
115	4193	3440	1805	2684	23907	21766	16166	20376	17371	14211	13599	17182	15216	13087	11046	12800	14034	8544	10586	8391	7514	10261
116	10165	8428	9737	6798	22535	21586	12617	20554	16148	10772	12477	18296	16388	13255	11245	14367	16078	5274	2518	590	5556	12443
117	10563	8831	10407	7279	22102	21257	12090	20263	15778	10284	12173	18108	16228	13054	11096	14274	16000	5062	1763	1202	5502	12447
118	12635	10912	12511	9409	22423	21912	12169	21035	16354	10556	12990	19165	17368	14131	12323	15584	17329	6352	1168	2895	7069	13972
119	12716	11041	13272	9739	20902	20530	10607	19714	14958	9077	11748	18022	16292	13040	11366	14653	16399	5645	1247	4092	6571	13249
120	12099	10420	12675	9116	20780	20305	10525	19452	14740	8917	11439	17671	15912	12664	10936	14219	15966	5123	790	3641	6009	12751
121	10292	8677	11564	7598	19238	18523	9182	17595	12996	7391	9521	15659	13860	10623	8833	12106	13853	2982	2340	4042	3923	10607
122	11523	10317	14454	10010	14838	14448	4658	13692	8875	2974	5971	12326	10796	7627	6533	9639	11304	4127	6525	8561	5159	9047
123	10973	9733	13823	9387	15269	14755	5185	13946	9184	3396	6079	12429	10830	7617	6360	9541	11235	3492	6096	8015	4541	8787
124	12559	11398	15585	11135	14187	14046	3879	13396	8507	2558	6038	12317	10921	7864	7057	9998	11600	5263	7301	9515	6283	9673
125	12022	10845	15018	10569	14467	14194	4214	13489	8631	2673	5933	12264	10800	7682	6738	9762	11396	4696	6935	9059	5716	9313
126	13635	12489	16669	12224	13844	13977	3565	13440	8528	2830	6519	12644	11377	8447	7860	10653	12193	6340	7959	10331	7373	10523
127	13141	12002	16211	11758	13862	13867	3542	13280	8372	2535	6173	12366	11049	8070	7412	10253	11816	5890	7761	10053	6906	10064
128	14090	14421	19347	15700	7002	4008	8902	2532	3933	9325	6105	1308	2727	5195	7330	5100	4376	13123	17920	18965	13002	7630
129	17860	18023	23019	19136	3046	1042	9524	1925	4795	10684	8495	5206	6674	8395	10521	8929	8384	15718	20026	21501	15841	11388
130	18459	18593	23596	19677	2392	1373	9699	2548	5158	10956	8940	5865	7316	8941	11050	9549	9035	16137	20355	21894	16296	11992
131	2799	3814	3793	4820	23145	20579	16803	19101	16901	14988	13455	15687	13850	12423	10694	11509	12374	10274	13498	11665	9101	9066
132	2813	3660	3441	4548	23252	20727	16757	19256	16969	14923	13480	15859	14004	12498	10729	11648	12556	10097	13217	11345	8930	9183
133	4505	5865	5365	7021	23985	21197	18399	19685	17986	16664	14774	16193	14488	13513	12002	12273	12864	12313	15700	13867	11130	10009
134	4899	6312	5827	7508	24109	21274	18710	19756	18176	16997	15026	16253	14583	13715	12258	12405	12931	12744	16186	14367	11560	10192
135	5283	6709	6125	7904	24343	21475	19054	19955	18453	17352	15339	16446	14800	14000	12575	12648	13131	13137	16583	14754	11952	10469
136	5633	7149	6837	8442	24190	21258	19200	19733	18405	17539	15393	16217	14623	13981	12646	12531	12921	13523	17110	15345	12337	10438
137	6347	7915	7672	9260	24357	21352	19698	19822	18701	18078	15805	16304	14780	14320	13083	12765	13043	14236	17916	16183	13052	10777
138	6531	8164	8287	9607	23939	20884	19571	19353	18390	17997	15600	15838	14365	14052	12908	12415	12607	14382	18219	16573	13202	10523
139	6919	8554	8610	9994	24154	21071	19903	19541	18657	18342	15910	16029	14586	14339	13229	12669	12819	14766	18609	16958	13586	10818
140	7270	8548	6803	9506	26424	23506	21158	21981	20579	19434	17472	18465	16863	16132	14707	14748	15167	15013	18135	16104	13835	12598
141	7803	9069	7167	10000	26903	23965	21691	22438	21086	19968	17996	18921	17337	16644	15232	15238	15631	15535	18612	16550	14358	13107
142	8004	9309	7513	10281	26925	23959	21842	22430	21156	20135	18108	18912	17353	16726	15350	15281	15634	15774	18909	16867	14594	13185
143	8334	9612	7653	10544	27301	24333	22196	22804	21530	20483	18475	19286	17728	17099	15715	15657	16009	16078	19152	17077	14900	13558
144	8796	10066	7995	10976	27722	24737	22659	23208	21973	20946	18930	19689	18146	17546	16172	16089	16420	16531	19569	17471	15355	14004
145	10815	12155	10097	13118	29101	25997	24526	24467	23563	22862	20681	20961	19534	19197	17949	17598	17765	18618	21722	19619	17437	15657
146	11394	12754	10722	13736	29478	26342	25051	24813	24006	23402	21173	21314	19923	19662	18452	18024	18144	19214	22346	20246	18032	16126
147	11780	13128	11013	14090	29868	26725	25451	25196	24406	23800	21575	21700	20315	20063	18853	18422	18535	19591	22687	20567	18409	16528
148	8042	7507	2724	6533	27957	25836	19902	24442	21401	17919	17595	21225	19268	17149	15092	16852	18041	11944	12608	9906	11067	14312
149	7635	7173	2291	6295	27659	25497	19726	24094	21119	17748	17331	20855	18906	16838	14798	16492	17656	11827	12700	10041	10917	13951
150	6976	6547	1629	5745	27048	24862	19214	23455	20519	17242	16746	20207	18261	16220	14192	15847	17001	11379	12494	9901	10438	13307
151	7039	6719	1709	6027	27234	25001	19513	23583	20725	17547	16971	20309	18374	16398	14390	15964	17082	11729	12934	10351	10768	13426
152	7417	7116	2102	6418	27631	25393	19902	23973	21123	17934	17370	20693	18761	16794	14788	16352	17462	12099	13215	10602	11147	13815
153	8204	7993	2970	7343	28504	26229	20828	24800	22011	18861	18270	21496	19576	17665	15674	17172	18245	13023	14037	11381	12074	14640
154	8026	7882	2875	7310	28380	26073	20800	24638	21904	18839	18181	21318	19407	17540	15566	17007	18057	13046	14185	11556	12078	14480
155	7972	7932	2988	7468	28392	26038	20948	24593	21943	18996	18247	21250	19353	17556	15607	16962	17974	13264	14540	11938	12273	14444
156	5193	6112	3978	6788	25385	22717	19199	21220	19222	17377	15828	17758	15984	14737	13061	13695	14427	12510	15329	13233	11354	11317
157	5386	6411	4468	7178	25416	22699	19408	21195	19306	17606	15966	17719	15973	14822	13193	13711	14387	12843	15755	13689	11679	11369
158	5790	6797	4628	7523	25803	23073	19812	21567	19705	18008	16370	18086	16349	15220	13597	14095	14754	13219	16070	13967	12058	11762
159	5942	7014	4975	7798	25825	23063	19960	21553	19767	18171	16470	18063	16347	15285	13696	14113	14733	13454	16370	14287	12288	11809
160	6841	7703	4753	8224	26977	24261	20840	22756	20851	19010	17475	19277	17535	16366	14707	15274	15944	14041	16601	14363	12898	12925
161	4968	5613	2950	6051	25397	22832	18836	21352	19128	16974	15630	17928	16101	14656	12884	13764	14609	11884	14471	12305	10749	11320
162	4529	5197	2910	5700	24964	22409	18408	20930	18690	16550	15192	17512	15679	14219	12445	13338	14196	11501	14183	12068	10360	10889
163	7291	8969	9304	10483	23853	20717	19925	19187	18486	18415	15861	15686	14309	14228	13221	12473	12523	15065	19044	17471	13893	10737
164	7700	9377	9642	10886	24091	20929	20282	19401	18781	18784	16199	15908	14562	14547	13572	12763	12770	15470	19452	17872	14299	11069
165	8723	10391	10435	11875	24824	21609	21251	20084	19635	19774	17136	16612	15337	15450	14533	13612	13534	16501	20462	18849	15330	11999

To be continued on next page...

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Calculated:
9/15/2018 12:04 AM/3.0.654

DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
166	9120	10800	10900	12303	24883	21637	21495	20117	19780	20044	17350	16660	15429	15636	14773	13758	13623	16868	20874	19284	15700	12212
167	6493	7782	6283	8778	25751	22869	20389	21347	19861	18661	16723	17835	16204	15405	13955	14060	14525	14247	17427	15440	13068	11878
168	6101	7229	5311	8066	25847	23054	20105	21540	19829	18329	16570	18044	16348	15351	13795	14135	14717	13682	16659	14596	12513	11859
169	10036	11712	11683	13204	25502	22214	22336	20700	20516	20907	18165	17270	16104	16422	15613	14501	14294	17783	21786	20177	16616	13028
170	6850	7624	4433	8054	27093	24412	20812	22912	20924	18966	17508	19443	17682	16440	14745	15400	16111	13907	16356	14081	12774	13025
171	6850	7546	4154	7897	27170	24521	20767	23026	20967	18908	17517	19566	17788	16486	14761	15490	16235	13775	16130	13825	12652	13094
172	6112	6798	3631	7184	26472	23852	20018	22361	20246	18159	16780	18913	17118	15767	14027	14806	15585	13046	15491	13238	11918	12392
173	5357	6007	3112	6415	25769	23189	19232	21705	19511	17370	16021	18274	16456	15037	13273	14126	14952	12263	14788	12587	11131	11691
174	5767	6459	3455	6874	26136	23526	19674	22038	19904	17817	16435	18594	16792	15426	13682	14476	15267	12724	15227	13003	11592	12057
175	6667	7843	5895	8705	26223	23382	20646	21863	20266	18886	17059	18357	16696	15797	14286	14518	15038	14302	17301	15232	13130	12286
176	5883	6088	1890	6019	26374	23940	19306	22482	19990	17390	16368	19110	17233	15559	13675	14856	15818	11939	13946	11579	10865	12357
177	4628	4634	1102	4529	25038	22685	17819	21245	18607	15897	14944	17920	16011	14204	12276	13613	14662	10450	12638	10385	9370	11090
178	4284	4223	1195	4115	24652	22321	17397	20886	18209	15475	14537	17576	15658	13815	11877	13256	14329	10036	12294	10084	8952	10728
179	3662	4928	4634	6045	23555	20859	17650	19360	17446	15881	14132	15894	14128	12962	11358	11853	12563	11390	14724	12898	10209	9505
180	3311	4545	4428	5662	23333	20672	17318	19178	17186	15539	13838	15726	13938	12701	11065	11643	12397	11008	14341	12529	9828	9267
181	8366	10034	10119	11519	24619	21424	20943	19898	19380	19456	16843	16417	15113	15173	14229	13357	13315	16150	20105	18495	14978	11709
182	6875	8174	6605	9168	26030	23123	20752	21599	20175	19030	17063	18084	16473	15726	14298	14349	14782	14639	17813	15815	13459	12193
183	10299	11735	10151	12832	28126	24988	23813	23459	22681	22191	19891	19960	18575	18353	17184	16690	16794	18168	21493	19498	16983	14824
184	10494	11961	10504	13099	28074	24910	23911	23382	22691	22310	19955	19891	18537	18389	17261	16688	16749	18376	21769	19804	17190	14868
185	10879	12338	10806	13462	28428	25253	24301	23726	23066	22701	20341	20239	18897	18770	17649	17061	17107	18758	22128	20146	17573	15252
186	11292	12750	11173	13869	28764	25573	24700	24048	23434	23105	20730	20566	19243	19149	18043	17425	17449	19171	22532	20540	17986	15635
187	11608	13081	11542	14215	28915	25704	24960	24180	23634	23377	20968	20707	19409	19368	18291	17619	17612	19493	22882	20900	18307	15863
188	11791	13286	11845	14451	28883	25652	25056	24130	23658	23491	21038	20667	19396	19417	18374	17639	17595	19681	23124	21166	18495	15922
189	6735	6235	1439	5377	26720	24560	18834	23159	20181	16861	16398	19929	17976	15898	13859	15561	16738	10986	12114	9536	10050	13020
190	7676	7433	2409	6777	27946	25684	20265	24258	21448	18299	17705	20964	19039	17107	15112	16633	17721	12475	13584	10960	11519	14099
191	2974	4182	4291	5312	23099	20470	16991	18982	16921	15204	13543	15542	13736	12436	10772	11424	12218	10646	13990	12198	9466	9024
192	11035	12400	10425	13394	29147	26021	24690	24491	23658	23040	20816	20990	19588	19309	18093	17679	17812	18859	22011	19926	17676	15772
193	6148	7744	7709	9133	24029	21022	19412	19493	18383	17803	15503	15975	14452	14006	12785	12442	12714	14028	17772	16080	12845	10465
194	5993	7528	7204	8837	24328	21363	19479	19835	18598	17835	15636	16317	14754	14192	12898	12696	13036	13885	17502	15743	12700	10647
195	8075	9759	10033	11279	24201	21011	20544	19484	18961	19066	16435	16002	14694	14758	13828	12938	12895	15824	19835	18266	14655	11299
196	9744	11427	11501	12936	25187	21906	22000	20390	20184	20573	17828	16956	15779	16086	15277	14168	13969	17474	21503	19917	16308	12691
197	9469	11161	11350	12690	24863	21588	21666	20071	19848	20243	17492	16633	15447	15749	14943	13832	13638	17177	21237	19677	16013	12355
198	3838	3785	1572	3781	24200	21868	16985	20434	17760	15069	14095	17127	15207	13363	11429	12804	13883	9690	12100	9963	8592	10275
199	5584	5751	1620	5674	26065	23649	18962	22195	19670	17045	16039	18833	16949	15245	13351	14567	15548	11595	13639	11295	10520	12061
200	5288	5420	1406	5342	25757	23357	18627	21906	19352	16709	15714	18554	16663	14933	13030	14276	15275	11263	13354	11036	10186	11766
201	5033	5100	1175	4992	25476	23100	18292	21654	19056	16371	15404	18316	16415	14646	12730	14023	15046	10913	13024	10726	9837	11506
202	4860	5798	3902	6518	25060	22401	18868	20905	18890	17049	15494	17448	15668	14406	12727	13373	14118	12210	15089	13028	11050	10989
203	4525	5475	3820	6233	24744	22098	18534	20605	18564	16716	15162	17153	15364	14080	12395	13063	13824	11897	14830	12803	10735	10671
204	4185	5095	3594	5849	24476	21860	18180	20372	18267	16355	14839	16932	15126	13785	12076	12810	13606	11512	14454	12445	10351	10397
205	6735	8214	7429	9431	25155	22170	20315	20642	19446	18660	16483	17123	15579	15041	13744	13536	13852	14616	18110	16268	13431	11497
206	6521	7236	3993	7625	26839	24194	20448	22699	20636	18593	17188	19242	17461	16154	14431	15161	15911	13489	15910	13635	12361	12763
207	6335	7506	5643	8376	25952	23129	20320	21612	19972	18557	16748	18110	16435	15500	13974	14243	14787	13965	16981	14928	12793	11994
208	6997	8180	6168	9039	26484	23623	20967	22102	20552	19212	17364	18593	16946	16086	14592	14783	15278	14640	17629	15548	13468	12569

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
1	5146	5731	5679	4796	5958	7394	10436	10609	8470	10548	6629	5798	3993	6003	6501	10802	5632	7780	4778	8375	7112	7706
2	5436	2117	1749	790	1709	11918	13483	14196	9745	10528	9632	1373	8453	2647	6259	13590	10119	9561	4598	8383	6649	11986
3	6088	3301	2944	1957	1971	11387	12341	13120	8552	9424	8512	2486	7722	3821	7067	12426	9392	10037	3412	7252	5538	11111
4	5856	3518	3213	2186	2523	10833	11971	12688	8372	9428	8117	2877	7176	4009	6908	12087	8846	9703	3299	7229	5555	10592
5	5976	7523	7520	6686	7895	5453	9705	9512	8831	11327	6183	7704	2323	7736	7322	10215	3843	7530	6149	9275	8280	6125
6	4593	6487	6549	5820	7319	6285	11043	10894	9786	12063	7434	6858	3671	6637	5938	11524	5093	6409	6435	9927	8738	7459
7	6167	8087	8113	7315	8597	4772	9805	9448	9320	11910	6449	8342	2102	8269	7480	10369	3420	7278	6864	9895	8956	5826
8	6382	7092	7011	6085	7001	6438	9134	9223	7689	10077	5404	7055	2710	7386	7747	9549	4379	8522	4863	7998	6978	6332
9	7378	7813	7687	6716	7372	6439	8146	8311	6804	9332	4399	7636	2436	8147	8741	8548	4056	9473	4579	7325	6473	5702
10	4234	3664	3601	2736	4180	9353	12067	12452	9286	10829	8184	3757	6071	3969	5452	12330	7709	7818	4653	8603	7062	9760
11	4339	4186	4133	3270	4643	8828	11670	11998	9090	10776	7799	4288	5540	4473	5616	11960	7175	7699	4653	8553	7073	9241
12	4096	4501	4494	3688	5161	8383	11663	11895	9331	11134	7820	4720	5232	4740	5414	11993	6839	7259	5068	8919	7484	8982
13	9225	9825	9684	8699	9180	5699	6337	6315	6223	9156	2925	9590	1946	10167	10587	6848	2929	10823	5715	7445	7055	3870
14	7523	5024	4648	3685	2978	11215	10903	11859	6849	7724	7171	4087	7294	5550	8609	10915	8919	11236	1693	5535	3845	10317
15	8463	9460	9365	8418	9136	4985	7233	7014	7178	10043	3937	9362	1000	9760	9817	7789	2371	9855	6100	8243	7694	3974
16	11202	11996	11853	10864	11264	5441	4758	4279	6508	9663	2673	11745	3125	12336	12553	5458	2842	12339	7484	8337	8367	2120
17	11524	12396	12259	11273	11687	5348	4638	3986	6770	9937	2942	12158	3373	12732	12870	5385	2877	12548	7901	8669	8746	1774
18	10296	10869	10714	9718	10088	5787	5322	5229	5952	9030	2274	10586	2607	11222	11657	5888	2994	11753	6352	7520	7382	3153
19	12677	12549	12312	11282	11155	8149	2888	3739	4141	7306	1024	12010	5360	12972	14041	3253	5505	14448	6803	6374	6889	4479
20	9310	7697	7365	6355	5778	10115	8113	9205	4220	5885	4502	6880	6068	8194	10561	8095	7470	12430	1328	3707	2637	8294
21	5385	2660	2353	1325	2144	11283	12819	13503	9210	10160	8958	2076	7768	3157	6333	12944	9436	9397	4101	7981	6275	11283
22	7641	7378	7187	6174	6529	7603	8140	8606	6006	8327	4260	7012	3569	7771	8984	8420	5130	10180	3403	6255	5313	6514
23	5189	777	701	1700	2835	13500	15816	16470	12043	12607	11952	1153	10369	1013	5505	15934	12003	9404	6886	10530	8775	14038
24	8360	6179	5814	4835	4096	10890	9794	10837	5678	6730	6132	5265	6872	6697	9519	9775	8426	11860	546	4511	2920	9591

To be continued on next page...

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Calculated:
9/15/2018 12:04 AM/3.0.654

DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
25	7321	5180	4838	3835	3423	10642	10510	11398	6678	7793	6731	4362	6717	5687	8462	10560	8342	10913	1612	5577	3959	9762
26	6845	4312	3949	2968	2542	11148	11437	12300	7543	8458	7646	3439	7323	4832	7905	11489	8976	10639	2401	6270	4577	10527
27	5956	7216	7190	6328	7467	5881	9613	9527	8490	10925	5999	7336	2523	7455	7314	10086	4123	7777	5675	8853	7825	6307
28	6797	8843	8868	8066	9315	4035	9492	8990	9436	12148	6332	9092	1665	9021	8086	10106	2744	7560	7368	10197	9364	5208
29	9238	9339	9154	8142	8411	6761	6309	6646	5337	8170	2535	8974	2873	9722	10600	6686	4006	11238	4706	6395	5974	4796
30	5939	4934	4732	3719	4305	9128	10503	11058	7533	9164	6614	4577	5386	5345	7190	10709	7054	9252	3075	6943	5490	8796
31	5973	4607	4375	3350	3833	9599	10805	11423	7618	9090	6923	4166	5859	5042	7181	10979	7527	9443	2924	6864	5341	9246
32	5938	4245	3989	2958	3381	10027	11174	11834	7823	9147	7302	3738	6309	4700	7099	11324	7978	9548	2952	6924	5339	9699
33	5276	3346	3112	2089	2940	10421	12066	12681	8708	9914	8186	2950	6871	3792	6364	12228	8540	9088	3736	7701	6061	10390
34	4311	3254	3685	4570	6191	14197	18271	18631	15034	15864	14384	4474	11826	2713	3725	18508	13316	7811	9926	13736	11995	15626
35	4536	2706	3108	4046	5556	14235	17932	18364	14548	15288	14042	3856	11691	2184	4137	18140	13221	8259	9415	13179	11431	15481
36	5187	3102	3453	4445	5755	14896	18452	18927	14944	15567	14563	4114	12316	2622	4726	18638	13857	8834	9794	13488	11734	16100
37	2580	3135	3607	4188	6194	12514	17082	17300	14244	15396	13219	4494	10317	2646	2146	17383	11753	6269	9275	13207	11512	14117
38	1922	3229	3685	4110	6209	11843	16562	16730	13879	15151	12715	4565	9694	2807	1708	16886	11112	5773	8988	12946	11277	13491
39	2335	6027	6286	5961	7973	7712	13846	13586	12470	14528	10264	6912	6241	5936	3480	14345	7385	3790	8549	12333	10957	9878
40	2354	5553	5778	5383	7351	7770	13406	13236	11855	13866	9762	6359	5935	5511	3642	13876	7190	4464	7866	11665	10277	9651
41	1758	4005	4461	4873	6983	11798	16968	17048	14469	15828	13149	5342	9901	3574	1034	17324	11251	5159	9648	13616	11964	13676
42	2107	5737	6183	6499	8650	11377	17537	17405	15523	17117	13822	7055	10090	5327	903	17973	11258	3616	10923	14892	13300	13753
43	12282	11983	11734	10703	10516	8357	3428	4415	3629	6805	528	11408	5282	12417	13642	3666	5634	14225	6138	5758	6218	4893
44	11833	11341	11078	10046	9794	8604	4101	5174	3172	6321	686	10726	5253	11785	13187	4238	5825	13967	5389	5114	5483	5388
45	12005	11267	10982	9953	9565	9212	4326	5607	2539	5680	1328	10584	5765	11729	13348	4328	6422	14303	5087	4493	4957	6031
46	11903	10991	10692	9667	9196	9549	4739	6087	2195	5279	1785	10265	5991	11463	13236	4675	6748	14334	4690	4012	4465	6475
47	18924	18402	18105	17079	16511	13227	3601	4932	7120	8843	7164	17665	11420	18869	20286	3011	11091	20628	11980	9537	10944	9067
48	17474	17208	16937	15905	15505	11540	1987	3288	6482	8729	5768	16552	9810	17655	18838	1642	9422	19031	10986	9025	10248	7380
49	17836	17806	17555	16523	16231	11322	2395	2917	7416	9758	6285	17210	9962	18238	19200	2422	9400	19173	11738	9977	11136	7189
50	18609	18226	17941	16912	16422	12678	3162	4340	7160	9083	6870	17528	10990	18683	19972	2696	10597	20210	11891	9636	10977	8520
51	12924	12423	12152	11120	10792	9110	3090	4442	3101	6254	1279	11779	6067	12873	14279	3147	6406	14967	6324	5424	6098	5531
52	17197	16522	16217	15194	14596	12222	2507	4457	5224	7182	5463	15763	9974	16995	18553	1626	9860	19104	10065	7685	9046	8111
53	17204	16385	16069	15051	14379	12547	2923	4945	4907	6703	5535	15590	10153	16867	18555	2007	10123	19225	9859	7309	8728	8467
54	16918	16005	15682	14667	13955	12548	3083	5176	4447	6214	5325	15188	10015	16491	18264	2160	10065	19027	9444	6827	8262	8512
55	14331	12636	12262	11293	10263	12572	5624	7596	950	2634	4603	11661	9065	13155	15610	5044	9785	17133	5924	2771	4306	9212
56	16186	16084	15831	14799	14523	10228	678	2213	5936	8548	4567	15488	8453	16517	17551	983	8065	17677	10044	8507	9555	6072
57	17452	17332	17073	16042	15715	11212	1948	2865	6857	9210	5829	16716	9664	17769	18816	1874	9185	18887	11214	9417	10582	7058
58	4775	5081	5027	4149	5382	7998	10936	11182	8689	10602	7094	5157	4645	5360	6109	11268	6283	7723	4648	8401	7039	8350
59	8681	8552	8354	7336	7577	7240	6979	7436	5343	7973	3115	8154	3222	8947	10037	7289	4569	10944	3962	6060	5439	5587
60	7205	5425	5117	4093	3911	10090	10112	10934	6516	7859	6295	4716	6156	5911	8396	10200	7779	10656	1687	5633	4105	9212
61	5135	7257	7322	6590	8052	5514	10733	10451	9872	12297	7256	7627	3125	7399	6449	11264	4432	6453	6884	10206	9117	6856
62	7345	7529	7381	6395	6968	6895	8236	8512	6573	9009	4420	7293	2891	7883	8704	8592	4500	9636	4128	6968	6061	6075
63	11037	11198	10999	9980	10104	6876	4478	4791	4892	8017	1135	10781	3708	11590	12402	4939	4107	12744	6040	6646	6718	3804
64	13815	13736	13496	12465	12300	8633	1710	2766	4615	7669	2206	13185	6268	14160	15180	2191	6158	15450	7899	7051	7775	4666
65	9731	9189	8941	7910	7829	8124	6223	6991	4139	6843	2354	8634	4219	9624	11075	6414	5358	12134	3699	5031	4663	5896
66	9520	9848	9679	8675	9012	6283	5996	6167	5612	8550	2407	9529	2552	10216	10885	6446	3494	11297	5333	6863	6537	4166
67	10038	8914	8614	7589	7180	9355	6697	7770	3414	5782	3071	8194	5400	9389	11345	6721	6602	12790	2765	3847	3413	7100
68	8859	10179	10109	9184	9987	4156	7195	6711	7770	10726	4278	10148	648	10453	10191	7836	1476	9866	6992	9003	8534	3263
69	631	4802	5206	5345	7520	10398	16112	16041	14049	15681	12372	6034	8773	4486	797	16531	10026	3925	9494	13456	11886	12495
70	2816	4484	4957	5541	7549	12822	18058	18154	15452	16699	14229	5842	11006	3982	1725	18403	12344	5609	10550	14501	12820	14777
71	694	5158	5534	5562	7730	9769	15684	15552	13808	15553	11984	6326	8249	4892	1388	16127	9460	3543	9391	13328	11800	11941
72	8051	10216	10237	9422	10600	2772	8942	8166	9681	12574	6227	10443	1532	10396	9302	9643	1605	8325	8304	10757	10115	4116
73	2176	4715	5179	5632	7726	12098	17609	17630	15212	16599	13812	6065	10417	4258	953	17985	11710	4855	10416	14385	12738	14165
74	11102	10261	9974	8945	8576	9090	5302	6447	2790	5706	1822	9577	5385	10725	12435	5334	6284	13558	4130	4167	4293	6296
75	11214	10070	9757	8737	8199	9771	5749	7045	2330	5058	2520	9303	5987	10552	12527	5676	6968	13864	3684	3434	3583	7038
76	11034	9726	9402	8387	7778	10045	6212	7526	2398	4873	2984	8922	6189	10217	12332	6113	7253	13807	3250	3105	3121	7439
77	13842	13162	12871	11843	11374	10000	2727	4479	2819	5814	2271	12453	7053	13627	15193	2509	7336	15951	6854	5340	6282	6275
78	13185	12853	12595	11563	11305	8862	2579	3841	3647	6772	1424	12248	6041	13293	14546	2762	6221	15075	6865	6015	6698	5137
79	13008	11888	11565	10550	9898	10528	4413	6093	1327	4500	2557	11082	7098	12377	14332	4131	7747	15498	5367	3697	4601	7202
80	13610	13384	13133	12101	11874	8847	2029	3288	4096	7169	1882	12799	6259	13818	14973	2315	6289	15380	7443	6524	7259	4978
81	18925	18299	17993	16970	16349	13453	3750	5225	6893	8499	7168	17534	11526	18772	20284	3074	11259	20715	11823	9267	10711	9294
82	13149	11826	11486	10483	9713	11052	4883	6635	737	3913	3114	10965	7543	12326	14458	4524	8261	15770	5206	3163	4200	7782
83	12524	11159	10820	9816	9061	10820	5336	6967	994	3994	3036	10301	7184	11659	13826	5055	8015	15217	4546	2861	3674	7740
84	12329	10797	10446	9452	8618	11085	5878	7500	1092	3709	3449	9901	7355	11305	13615	5586	8278	15145	4131	2367	3135	8136
85	14104	12257	11873	10918	9815	12772	6162	8101	1036	2187	4866	11249	9164	12782	15365	5605	9972	17017	5553	2211	3801	9532
86	10324	8814	8479	7472	6822	10207	7145	8383	3127	5107	3741	7982	6230	9312	11597	7066	7463	13286	2294	3066	2551	7943
87	10161	8358	8002	7013	6214	10727	7841	9112	3494	5008	4475	7456	6707	8870	11399	7728	8020	13306	1693	2838	1953	8619
88	3667	2248	2708	3513	5287	13300	17146	17523	13930	14830	13258	3555	10783	1703	3434	17380	12301	7549	8839	12683	10951	14578
89	3165	6354	6553	6084	7964	6906	12914	12632	11707	13881	9369	7086	5285	6341	4390	13427	6443	4478	8030	11709	10410	8930
90	4823	6049	6055	5245	6591	6835	10693	10709	9079	11262	6971	6273	3748	6261	6187	11117	5313	7113	5565	9107	7883	7539
91	10767	11450	11301	10308	10690	5603	4988	4718	6196	9322	2395	11182	2843	11797	12123	5621	2879	12061	6923	7911	7867	2620
92	2176	6363	6672	6471	8556	8148	14695	14379	13376	15414	11146	7368	7022	6198	3033	15210	8073	2925	9402	13214	11816	10582
93	2814	6877	7162	6891	8929	7519	14330	13937	13245	15392	10857	7822	6586	6743	3687	14874	7554	2942	9470	13209	11869	10068

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
94	1966	5988	6418	6647	8816	10827	17185	16996	15336	17028	13509	7273	9660	5613	1127	17643	10783	3078	10846	14802	13243	13286
95	2941	7390	7746	7671	9805	8655	15890	15450	14779	16850	12432	8504	8116	7147	3201	16442	8992	1495	10838	14651	13253	11504
96	10166	10125	9916	8893	9001	7141	5408	5882	4677	7657	1601	9683	3496	10527	11528	5760	4335	12144	4996	6053	5891	4608
97	9969	9656	9425	8397	8398	7689	5775	6433	4298	7161	1885	9150	3890	10076	11324	6033	4898	12178	4312	5459	5213	5302
98	8197	8855	8734	7765	8385	5758	7338	7351	6682	9441	3766	8684	1714	9182	9560	7813	3181	9937	5293	7570	6939	4661
99	15987	15342	15045	14019	13476	11284	1902	4047	4287	6629	4264	14607	8845	15811	17343	1029	8826	17933	8943	6827	8071	7242
100	14874	13906	13586	12570	11904	11271	3103	5155	2589	5114	3522	13104	8318	14391	16213	2499	8618	17133	7378	5136	6383	7481
101	14126	13558	13275	12245	11819	9913	2239	4031	3281	6218	2429	12872	7133	14017	15481	2053	7304	16129	7306	5817	6769	6084
102	12004	10908	10593	9574	8999	9992	5041	6486	1787	4816	2269	10131	6373	11391	13325	4901	7187	14554	4470	3531	4052	6958
103	21258	20740	20438	19414	18799	15155	5824	6748	9311	10663	9503	19984	13644	21211	22620	5334	13195	22867	14274	11621	13116	11023
104	21034	20450	20143	19121	18476	15104	5660	6705	8964	10269	9274	19679	13490	20924	22395	5119	13088	22708	13956	11253	12762	10959
105	20020	19228	18906	17891	17162	14699	4989	6446	7601	8797	8290	18412	12733	19713	21375	4277	12497	21902	12661	9827	11369	10541
106	20433	19703	19385	18368	17661	14908	5265	6584	8110	9321	8685	18899	13059	20185	21791	4609	12767	22250	13154	10350	11886	10748
107	20808	20169	19859	18838	18170	15026	5498	6646	8643	9914	9047	19386	13324	20647	22168	4914	12962	22534	13654	10914	12433	10873
108	12469	10569	10189	9229	8180	11950	6806	8496	1495	2947	4459	9578	8124	11093	13714	6444	9148	15505	3862	1341	2329	9126
109	6247	1843	1635	2421	2665	14445	16264	17035	12210	12500	12440	1479	11193	2044	6497	16326	12844	10449	7089	10506	8754	14797
110	6845	2490	2297	3054	2963	15100	16737	17560	12553	12690	12938	2069	11818	2641	7024	16772	13474	11024	7475	10752	9010	15400
111	7242	2953	2787	3559	3353	15601	17182	18029	12930	12972	13396	2570	12322	3058	7355	17204	13978	11392	7884	11073	9341	15899
112	4533	1213	1580	2556	4040	13571	16602	17134	13058	13753	12716	2325	10714	767	4597	16771	12303	8638	7913	11648	9898	14461
113	4891	1704	2017	3027	4334	14082	17114	17662	13507	14123	13231	2668	11249	1299	4824	17274	12836	8916	8354	12040	10286	14997
114	5664	2374	2586	3618	4586	14904	17748	18354	13982	14436	13875	3059	12032	2060	5497	17879	13629	9614	8827	12401	10645	15766
115	6314	2943	3093	4114	4824	15557	18227	18882	14335	14657	14367	3438	12645	2683	6096	18335	14251	10220	9193	12666	10913	16364
116	2929	7159	7581	7757	9932	10533	17516	17183	16009	17849	13943	8425	9827	6797	2322	18025	10799	2018	11704	15627	14118	13314
117	3216	7604	8007	8098	10271	9906	17176	16761	15899	17853	13676	8827	9421	7278	2890	17715	10309	1282	11758	15639	14177	12820
118	5274	9717	10107	10133	12291	9591	17828	17162	17158	19339	14572	10908	10000	9408	5037	18449	10573	1076	13380	17154	15790	13018
119	5536	9966	10306	10162	12255	7947	16460	15686	16172	18531	13360	11038	8669	9738	5707	17119	9090	1768	12764	16389	15136	11489
120	4914	9342	9684	9546	11645	7981	16225	15526	15758	18062	13038	10417	8405	9115	5116	16861	8934	1349	12240	15906	14623	11373
121	3608	7734	8019	7736	9756	7074	14434	13914	13664	15924	11086	8674	6619	7597	4346	15020	7414	2622	10102	13763	12481	9921
122	7174	9903	9990	9278	10710	2915	10398	9585	10926	13719	7604	10316	2812	10010	8338	11097	2990	6963	9004	11807	11005	5444
123	6540	9290	9386	8693	10177	3554	10683	9978	10892	13603	7712	9732	2930	9387	7717	11349	3417	6508	8676	11636	10752	5916
124	8286	11019	11096	10361	11725	1779	10061	9040	11167	14082	7634	11397	3041	11135	9426	10819	2558	7775	9735	12270	11605	4782
125	7741	10455	10534	9807	11197	2344	10172	9259	10990	13849	7554	10844	2830	10569	8896	10900	2681	7391	9327	11987	11259	5055
126	9297	12111	12189	11452	12794	759	10093	8862	11718	14716	8050	12488	3778	12224	10399	10902	2813	8463	10652	12989	12428	4574
127	8901	11638	11710	10966	12298	1152	9935	8796	11355	14326	7732	12001	3338	11759	10028	10723	2524	8251	10176	12570	11977	4508
128	16090	15219	14902	13884	13221	11864	2698	4847	3808	5913	4508	14424	9226	15701	17437	1837	9331	18208	8697	6281	7630	7884
129	18929	18689	18416	17385	16959	12636	3415	4232	7794	9786	7246	18025	11172	19138	20293	3120	10675	20395	12433	10293	11598	8497
130	19375	19236	18970	17939	17552	12795	3877	4399	8439	10444	7752	18595	11524	19679	20739	3686	10944	20735	13032	10946	12238	8690
131	9028	4612	4334	4851	3753	16865	17469	18515	12820	12405	13818	3815	13360	4821	9210	17392	15030	13215	8056	10708	9059	16771
132	8753	4371	4119	4700	3770	16751	17568	18575	12987	12650	13886	3661	13297	4549	8900	17510	14965	12925	8159	10916	9249	16749
133	11226	6788	6478	6877	5365	18704	18389	19627	13392	12446	14928	5867	15040	7022	11417	18207	16706	15422	9099	11050	9569	18272
134	11710	7265	6946	7314	5730	19076	18539	19821	13476	12413	15130	6314	15377	7509	11914	18334	17039	15912	9311	11093	9659	18561
135	12108	7663	7345	7709	6103	19448	18791	20100	13687	12541	15415	6712	15734	7905	12305	18571	17394	16307	9605	11277	9877	18893
136	12633	8172	7831	8125	6394	19704	18684	20055	13498	12201	15393	7152	15930	8444	12880	18430	17580	16849	9621	11042	9715	19001
137	13439	8975	8622	8870	7059	20304	18913	20352	13644	12157	15724	7917	16480	9261	13712	18620	18119	17662	10015	11140	9911	19461
138	13750	9289	8913	9083	7170	20290	18547	20038	13223	11614	15447	8167	16415	9608	14086	18224	18039	17984	9814	10694	9542	19296
139	14140	9678	9303	9472	7553	20648	18790	20305	13442	11758	15730	8557	16763	9996	14472	18452	18383	18373	10128	10901	9791	19617
140	13695	9345	9085	9576	8139	21473	20897	22227	15741	14429	17547	8549	17812	9507	13734	20658	19476	17818	11740	13290	11949	21014
141	14181	9849	9596	10100	8673	22006	21390	22735	16211	14844	18059	9071	18346	10001	14196	21142	20010	18289	12257	13747	12429	21543
142	14470	10118	9855	10335	8858	22201	21434	22806	16222	14789	18139	9311	18515	10281	14503	21172	20177	18591	12353	13741	12455	21678
143	14723	10395	10141	10642	9197	22535	21810	23180	16598	15155	18512	9614	18862	10544	14730	21548	20525	18826	12723	14115	12832	22039
144	15149	10835	10586	11097	9660	22998	22242	23623	17014	15528	18959	10068	19326	10977	15137	21972	20988	19239	13175	14522	13257	22499
145	17297	12965	12704	13179	11645	24989	23730	25213	18391	16620	20600	12157	21250	13119	17290	23400	22904	21393	14893	15847	14726	24318
146	17918	13578	13313	13775	12213	25552	24143	25655	18778	16930	21060	12756	21794	13737	17916	23795	23444	22018	15383	16224	15146	24828
147	18266	13939	13679	14151	12603	25944	24539	26054	19170	17307	21461	13130	22191	14091	18248	24189	23841	22354	15784	16615	15544	25229
148	9063	6906	7126	8157	8793	18961	22285	22889	18367	18506	18416	7505	16410	6532	8288	22403	17958	12129	13242	16598	14857	20185
149	9032	6641	6836	7862	8408	18858	21979	22620	17993	18081	18119	7171	16223	6294	8322	22081	17787	12233	12881	16190	14454	19985
150	8685	6068	6241	7262	7754	18418	21364	22030	17342	17418	17510	6545	15702	5745	8058	21455	17282	12043	12237	15530	13795	19452
151	9088	6322	6467	7479	7850	18769	21543	22248	17439	17432	17702	6718	15997	6026	8487	21616	17587	12486	12359	15577	13852	19733
152	9422	6717	6865	7877	8235	19139	21940	22646	17822	17790	18099	7115	16387	6418	8789	22011	17974	12760	12748	15947	14225	20126
153	10316	7634	7771	8777	9049	20063	22810	23541	18621	18495	18979	7992	17313	7342	9644	22867	18901	13571	13576	16695	14986	21048
154	10399	7580	7697	8693	8886	20086	22683	23443	18442	18268	18863	7881	17281	7309	9766	22727	18879	13727	13418	16488	14787	21003
155	10688	7709	7799	8777	8854	20299	22693	23494	18374	18120	18891	7931	17426	7468	10098	22718	19036	14089	13386	16376	14688	21129
156	10925	6699	6504	7150	6143	19211	19734	20845	14918	14183	16141	6113	15750	6789	10890	19615	17420	14994	10338	12670	11106	19167
157	11337	7064	6847	7450	6324	19489	19782	20937	14894	14056	16231	6412	15978	7178	11331	19641	17648	15428	10411	12603	11074	19352
158	11666	7424	7218	7837	6729	19883	20173	21336	15267	14387	16630	6799	16380	7524	11630	20027	18050	15735	10808	12961	11445	19757
159	11955	7683	7463	8053	6870	20079	20210	21403	15257	14306	16697	7015	16543	7798	11940	20048	18213	16040	10870	12923	11433	19888
160	12270	8190	8034	8736	7793	20807	21340	22478	16455	15568	17772	7704	17383	8225	12113	21203	19052	16237	11959	14152	12634	20815
161	10111	6025	5887	6633	5924	18696	19718	20734	15065	14541	16044	5614	15352	6052	10001	19647	17016	14119	10305	12914	11289	18858
162	9798	5651	5495	6221	5485	18289	19283	20296	14647	14160	15607	5197	14927	5700	9733	19216	16592	13842	9871	12511	10877	18425

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
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164	14995	10547	10156	10259	8263	21165	18827	20421	13416	11517	15916	9380	17228	10888	15376	18442	18825	19232	10458	10851	9882	19947
165	16001	11546	11161	11281	9294	22174	19632	21269	14193	12147	16807	10394	18226	11876	16359	19218	19815	20237	11421	11621	10740	20898
166	16418	11968	11578	11678	9669	22470	19741	21408	14288	12158	16982	10803	18506	12305	16791	19308	20084	20654	11665	11717	10897	21124
167	12976	8603	8333	8809	7362	20696	20203	21508	15087	13871	16821	7784	17038	8779	13049	19981	18703	17119	11005	12662	11282	20251
168	12235	7936	7704	8268	7017	20268	20247	21468	15250	14231	16765	7231	16702	8067	12239	20070	18371	16334	10935	12892	11427	20017
169	17327	12874	12487	12594	10586	23351	20432	22136	14968	12723	17755	11716	19377	13205	17688	19974	20947	21563	12510	12401	11658	21948
170	12054	8045	7912	8649	7806	20717	21442	22546	16610	15794	17843	7624	17341	8054	11858	21322	19008	15983	12045	14336	12793	20807
171	11854	7911	7797	8563	7807	20620	21509	22583	16725	15970	17884	7547	17286	7898	11626	21404	18950	15750	12102	14477	12914	20780
172	11181	7182	7059	7817	7070	19877	20804	21859	16063	15388	17162	6799	16536	7184	10997	20710	18201	15123	11393	13847	12262	20033
173	10448	6401	6270	7025	6313	19085	20093	21119	15414	14844	16428	6008	15748	6415	10307	20016	17412	14430	10680	13243	11630	19254
174	10897	6862	6731	7479	6724	19543	20467	21516	15741	15098	16820	6460	16194	6875	10740	20377	17859	14864	11055	13538	11944	19688
175	12877	8571	8333	8879	7570	20856	20648	21909	15587	14452	17212	7844	17260	8706	12879	20448	18928	16975	11385	13190	11772	20539
176	9760	6139	6125	7025	6800	18904	20677	21566	16235	15917	16919	6087	15789	6019	9436	20666	17431	13550	11311	14194	12519	19413
177	8366	4640	4631	5546	5498	17406	19338	20169	15045	14937	15547	4634	14300	4529	8139	19360	15939	12264	10031	13113	11401	17939
178	7993	4219	4209	5127	5134	16986	18953	19768	14701	14654	15153	4222	13878	4115	7805	18983	15517	11929	9665	12802	11082	17520
179	10251	5817	5516	5950	4566	17859	17918	19078	13058	12339	14372	4930	14255	6046	10444	17781	15924	14445	8549	10805	9243	17561
180	9867	5431	5129	5569	4228	17497	17684	18814	12878	12249	14108	4547	13912	5663	10070	17562	15581	14065	8295	10664	9074	17242
181	15644	11190	10804	10925	8941	21844	19397	21016	13968	11978	16535	10037	17903	11521	16004	18995	19496	19880	11116	11398	10481	20600
182	13365	8995	8726	9200	7739	21077	20497	21822	15352	14073	17141	8176	17408	9169	13429	20263	19072	17503	11332	12909	11556	20605
183	17036	12636	12343	12740	11082	24391	22802	24328	17429	15579	19747	11737	20591	12833	17117	22449	22233	21187	14101	14874	13810	23567
184	17305	12890	12587	12958	11258	24540	22784	24336	17391	15477	19777	11963	20716	13100	17410	22415	22352	21470	14168	14829	13806	23649
185	17668	13258	12959	13337	11646	24930	23151	24711	17752	15811	20157	12341	21107	13463	17760	22776	22743	21826	14555	15187	14179	24037
186	18073	13667	13369	13750	12058	25339	23505	25078	18097	16119	20534	12753	21512	13869	18158	23123	23147	22228	14946	15530	14542	24431
187	18421	14009	13707	14076	12364	25629	23684	25276	18264	16237	20749	13083	21788	14216	18515	23290	23419	22580	15189	15694	14738	24679
188	18658	14235	13926	14275	12531	25766	23685	25297	18252	16174	20791	13288	21907	14452	18771	23278	23533	22828	15268	15681	14759	24762
189	8289	5712	5899	6925	7490	18025	21040	21686	17069	17202	17180	6233	15325	5376	7670	21141	16900	11666	11951	15291	13550	19080
190	9802	7067	7205	8211	8511	19515	22252	22977	18091	18007	18418	7432	16748	6777	9164	22314	18339	13126	13033	16187	14472	20482
191	9515	5073	4768	5207	3902	17147	17440	18545	12686	12139	13840	4184	13576	5313	9733	17334	15246	13717	8039	10508	8895	16926
192	17579	13231	12964	13420	11852	25191	23802	25307	18444	16620	20708	12402	21432	13394	17588	23459	23082	21686	15025	15893	14803	24468
193	13298	8833	8469	8685	6835	20046	18589	20033	13315	11830	15410	7746	16208	9135	13600	18293	17844	17527	9712	10811	9586	19167
194	13024	8562	8218	8497	6736	20024	18848	20249	13624	12239	15601	7531	16230	8838	13277	18577	17876	17242	9854	11145	9861	19264
195	15381	10936	10542	10633	8623	21467	18977	20597	13549	11571	16119	9762	17518	11280	15770	18575	19107	19618	10715	10979	10063	20195
196	17048	12599	12208	12301	10282	23021	20105	21805	14642	12415	17420	11431	19044	12938	17424	19650	20613	21285	12174	12075	11323	21611
197	16787	12345	11950	12025	9992	22696	19772	21469	14310	12099	17082	11164	18716	12691	17181	19320	20283	21024	11842	11742	10986	21275
198	7753	3846	3808	4706	4682	16615	18500	19321	14253	14230	14703	3785	13468	3781	7634	18529	15111	11750	9213	12366	10642	17097
199	9434	5792	5780	6683	6493	18558	20367	21244	15957	15686	16602	5750	15445	5674	9129	20363	17087	13248	11012	13939	12256	19073
200	9127	5457	5444	6349	6189	18223	20058	20923	15677	15449	16286	5419	15109	5342	8845	20060	16750	12967	10713	13681	11990	18739
201	8785	5111	5105	6018	5919	17875	19776	20623	15439	15268	15994	5099	14773	4992	8518	19789	16412	12642	10450	13474	11772	18410
202	10672	6413	6207	6837	5810	18893	19406	20513	14605	13901	15809	5799	15421	6518	10666	19291	17091	14762	10008	12368	10796	18834
203	10402	6115	5899	6514	5475	18566	19087	20186	14305	13642	15482	5476	15088	6234	10424	18977	16758	14509	9686	12085	10501	18500
204	10021	5728	5512	6134	5139	18191	18811	19885	14077	13488	15184	5096	14728	5850	10056	18714	16397	14136	9402	11889	10283	18155
205	13635	9188	8866	9203	7510	20827	19688	21096	14446	12997	16450	8216	17052	9433	13825	19409	18701	17834	10703	11955	10695	20107
206	11611	7626	7502	8256	7479	20318	21178	22252	16399	15661	17553	7237	16970	7625	11411	21074	18635	15537	11771	14157	12590	20458
207	12552	8238	7998	8542	7241	20520	20367	21614	15330	14244	16914	7507	16930	8377	12566	20175	18599	16658	11085	12949	11511	20218
208	13208	8908	8671	9217	7896	21189	20919	22196	15834	14650	17502	8182	17586	9040	13202	20710	19254	17301	11677	13422	12023	20855

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
1	6812	8954	5590	9227	14393	12323	10669	2835	2820	4312	18171	17936	17655	16822	6821	6270	9202
2	2356	13440	10098	5140	16139	13918	12411	5275	5910	8096	20528	20279	20101	18834	11098	9417	12857
3	2885	12689	9395	6270	14946	12725	11216	5390	5909	7974	19335	19086	18910	17639	10788	9529	11801
4	3428	12147	8847	6655	14750	12539	11001	4959	5441	7468	19076	18827	18638	17419	10249	9074	11356
5	8752	7129	3765	11015	14246	12318	10663	3314	2808	3140	17634	17409	17079	16485	5029	5350	8106
6	8100	8299	4982	9939	15436	13450	11789	1931	1490	2644	18944	18716	18397	17741	5354	4629	9487
7	9441	6625	3304	11564	14541	12670	11025	3506	2871	2652	17771	17551	17203	16703	4291	4885	8057
8	7905	7697	4370	10579	13341	11339	9678	3861	3585	4389	16953	16721	16422	15685	6270	6560	7813
9	8308	7292	4102	11267	12351	10366	8707	4866	4571	5164	15949	15717	15419	14682	6629	7378	6908
10	4938	11029	7662	7155	15518	13359	11745	2990	3484	5577	19577	19334	19094	18078	8511	7108	11061
11	5430	10495	7128	7681	15258	13119	11491	2753	3150	5162	19247	19006	18754	17787	8030	6793	10602
12	5929	10146	6777	7998	15422	13306	11667	2270	2622	4625	19324	19086	18821	17913	7521	6265	10490
13	10133	5759	3084	13263	11011	9199	7578	6614	6173	6141	14265	14041	13709	13156	6601	8354	4907
14	3920	12111	8966	7809	13245	11020	9534	6334	6688	8506	17688	17438	17278	15954	10975	10319	10598
15	10072	5537	2461	12941	12017	10215	8593	5814	5311	5139	15192	14972	14627	14132	5667	7344	5605
16	12222	4369	3084	15431	10033	8528	7053	8547	8013	7518	12720	12511	12130	11863	7033	9609	2875
17	12644	4059	3122	15838	10027	8599	7166	8862	8308	7718	12563	12359	11965	11774	7053	9772	2603
18	11046	5271	3206	14288	10216	8516	6943	7672	7204	6997	13283	13064	12716	12254	7037	9173	3821

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
19	12100	6768	5741	15794	7467	5840	4345	10139	9758	9733	10670	10442	10129	9532	9675	11920	2682
20	6698	10344	7586	10629	10572	8368	6816	7428	7489	8729	14909	14659	14484	13233	10466	10843	8022
21	2929	12754	9419	5826	15596	13381	11851	4886	5467	7605	19935	19686	19498	18271	10537	9041	12160
22	7482	8279	5201	10743	11876	9803	8149	5334	5200	6138	15728	15489	15227	14327	7800	8309	7242
23	2591	15320	11951	2882	18438	16213	14728	6143	6907	9149	22864	22614	22441	21149	12356	10003	15114
24	5016	11506	8503	8980	12073	9851	8357	6867	7103	8706	16510	16260	16102	14778	10896	10663	9616
25	4378	11539	8389	8129	13065	10849	9326	5960	6266	8017	17437	17188	17012	15748	10429	9878	10119
26	3501	12225	9004	7201	13938	11716	10213	5806	6220	8140	18344	18094	17925	16635	10756	9863	11008
27	8336	7436	4067	10714	14021	12058	10399	3331	2926	3537	17505	17278	16960	16307	5508	5720	8116
28	10170	5892	2606	12318	14407	12606	10979	4162	3474	2768	17469	17255	16890	16483	3755	4954	7620
29	9370	6790	4155	12710	10541	8613	6962	6728	6403	6723	14084	13852	13555	12830	7539	8956	5275
30	5226	10348	7062	8288	13776	11611	10002	4249	4493	6224	17888	17644	17416	16354	8729	8088	9697
31	4758	10817	7536	7906	13917	11734	10145	4475	4785	6601	18100	17854	17639	16526	9170	8409	10074
32	4304	11271	7985	7495	14159	11964	10392	4635	5009	6905	18397	18150	17945	16791	9549	8649	10492
33	3785	11857	8525	6655	15058	12858	11293	4345	4844	6904	19308	19061	18856	17697	9746	8471	11326
34	5897	16503	13207	3260	21409	19200	17652	6538	7317	9318	25666	25420	25206	24062	12579	9398	17230
35	5226	16448	13123	2691	20935	18719	17188	6559	7351	9429	25243	24996	24794	23606	12705	9667	16971
36	5320	17093	13762	2226	21338	19117	17605	7220	8013	10094	25694	25446	25254	24027	13370	10314	17539
37	6166	14890	11631	4655	20551	18371	16778	4894	5656	7604	24651	24408	24166	23139	10857	7681	15891
38	6285	14233	10986	5193	20148	17981	16374	4236	4992	6931	24186	23945	23693	22710	10185	7044	15320
39	8515	10282	7218	9059	18248	16237	14577	1228	1341	2741	21766	21539	21215	20569	5984	3213	12191
40	7924	10206	7040	8709	17698	15665	14006	556	975	2927	21293	21064	20751	20054	6205	3780	11832
41	7061	14297	11111	5765	20696	18544	16925	4348	5051	6825	24662	24423	24158	23228	10028	6696	15636
42	8786	14089	11088	7418	21608	19506	17862	4602	5122	6402	25374	25141	24845	24054	9389	5719	16001
43	11458	7195	5861	15194	7578	5804	4225	9789	9452	9575	11030	10796	10509	9781	9747	11786	3352
44	10732	7681	6039	14511	7813	5902	4263	9401	9115	9409	11502	11263	11002	10146	9838	11637	4098
45	10489	8325	6631	14360	7533	5532	3874	9639	9401	9822	11421	11179	10946	9965	10388	12054	4617
46	10111	8762	6949	14032	7603	5533	3875	9597	9398	9932	11635	11389	11177	10107	10644	12164	5112
47	17392	10787	11335	21416	3182	3973	4531	16402	16016	15841	4410	4187	3866	3652	15203	17964	5860
48	16415	9128	9665	20330	4378	4347	4258	14912	14492	14227	6000	5791	5417	5330	13521	16330	4173
49	17153	8738	9639	20994	5224	5382	5289	15233	14769	14346	6035	5853	5410	5748	13399	16392	4076
50	17317	10197	10840	21293	3764	4331	4679	16061	15652	15408	4819	4609	4239	4242	14683	17511	5326
51	11720	7825	6636	15561	6817	5017	3439	10469	10159	10342	10401	10163	9898	9077	10531	12558	3584
52	15475	10081	10105	19508	3146	2708	2739	14724	14383	14375	6135	5895	5652	4878	14040	16546	4954
53	15244	10487	10367	19316	2774	2153	2311	14768	14455	14531	6213	5967	5772	4777	14313	16718	5354
54	14814	10586	10308	18903	2815	1790	1821	14511	14219	14366	6590	6341	6173	5046	14257	16566	5464
55	11058	11512	9994	15255	5680	3456	2243	12244	12153	12900	10345	10092	10021	8445	13720	15125	7093
56	15450	7917	8308	19273	5354	4781	4192	13605	13168	12869	7361	7153	6774	6635	12177	14967	2860
57	16634	8722	9427	20499	4923	4908	4744	14865	14419	14068	6206	6010	5599	5715	13240	16142	3881
58	6214	9604	6238	8576	14731	12628	10983	2710	2878	4639	18605	18367	18099	17206	7324	6465	9779
59	8535	7513	4688	11900	10916	8906	7245	6260	6018	6611	14638	14401	14125	13297	7790	8834	6080
60	4870	10978	7827	8500	12872	10669	9113	5663	5912	7579	17169	16921	16731	15525	9916	9493	9638
61	8847	7584	4304	10702	15323	13393	11738	2477	1845	2188	18680	18456	18120	17553	4626	4340	9053
62	7910	7718	4552	10959	12264	10241	8581	4910	4686	5455	15966	15732	15447	14646	7050	7649	7120
63	11062	6059	4327	14539	9123	7384	5803	8469	8067	8042	12359	12133	11810	11235	8179	10240	3451
64	13240	6855	6402	16970	6719	5359	4070	11252	10841	10684	9595	9372	9037	8581	10349	12837	2052
65	8783	8008	5513	12417	9793	7744	6085	7388	7188	7815	13660	13420	13169	12237	8867	10040	5724
66	9969	6178	3661	13247	10497	8646	7015	6952	6562	6669	13866	13638	13321	12696	7211	8892	4776
67	8112	9245	6752	11968	9533	7381	5760	7891	7807	8702	13696	13449	13246	12114	10003	10899	6602
68	10916	4666	1580	13672	12245	10547	8962	6189	5601	5055	15172	14959	14588	14232	5069	7186	5327
69	7773	12980	9871	7100	20133	18030	16386	3216	3819	5403	23924	23690	23399	22587	8568	5207	14633
70	7496	15366	12201	5524	21715	19552	17942	5446	6136	7831	25726	25486	25228	24268	10989	7513	16742
71	8053	12377	9299	7645	19820	17739	16089	2746	3280	4772	23534	23302	23002	22238	7925	4585	14147
72	11474	4542	1404	13693	14144	12486	10909	5462	4732	3518	16881	16677	16282	16050	3143	5466	6858
73	7769	14685	11559	6162	21417	19274	17649	4843	5494	7100	25343	25105	24833	23933	10230	6725	16219
74	9506	8543	6471	13355	8405	6330	4674	8800	8611	9202	12402	12158	11934	10900	10056	11432	5348
75	9109	9283	7148	13059	8339	6193	4567	9016	8890	9634	12526	12278	12086	10923	10656	11854	6005
76	8680	9665	7423	12665	8597	6420	4825	8908	8824	9677	12870	12621	12443	11222	10841	11884	6483
77	12282	8539	7569	16221	5828	4038	2497	11417	11125	11334	9527	9285	9045	8130	11485	13550	3911
78	12239	7412	6458	16033	6781	5125	3632	10684	10334	10389	10128	9895	9604	8910	10389	12587	3002
79	10781	9504	7959	14814	6511	4397	2749	10740	10556	11094	10707	10458	10280	9083	11726	13327	5348

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
80	12810	7211	6530	16585	6603	5100	3718	11078	10699	10650	9729	9501	9190	8604	10478	12828	2551
81	17221	11069	11503	21273	2742	3586	4253	16426	16059	15946	4386	4152	3883	3410	15394	18085	6082
82	10575	10083	8468	14665	6453	4275	2686	10950	10806	11445	10812	10561	10412	9101	12193	13675	5926
83	9929	10033	8212	14006	7115	4927	3351	10361	10242	10961	11474	11223	11070	9768	11853	13186	6146
84	9473	10418	8467	13581	7447	5235	3719	10240	10162	10989	11893	11641	11504	10139	12026	13203	6655
85	10592	11834	10174	14806	6152	3942	2812	12088	12033	12877	10864	10611	10553	8931	13833	15092	7541
86	7723	10103	7610	11716	9457	7257	5698	8322	8311	9357	13797	13548	13378	12115	10800	11527	7280
87	7096	10750	8155	11152	9886	7666	6164	8305	8363	9568	14325	14074	13924	12585	11199	11697	8013
88	5117	15520	12200	3393	20298	18092	16538	5624	6416	8504	24540	24295	24079	22944	11781	8801	16125
89	8593	9389	6280	9564	17388	15403	13743	1008	514	2061	20846	20621	20292	19677	5336	3194	11238
90	7408	8604	5239	9540	14872	12842	11182	2303	2130	3518	18521	18289	17989	17242	6107	5487	9297
91	11647	4809	3110	14877	10084	8480	6953	8124	7621	7264	12966	12751	12387	12021	7032	9400	3306
92	9029	10845	7892	9171	19146	17140	15480	2104	2226	3159	22630	22405	22075	21454	6244	2965	12992
93	9449	10254	7365	9772	18900	16929	15269	2165	2041	2550	22287	22065	21724	21161	5590	2371	12560
94	9013	13567	10607	7880	21359	19277	17627	4251	4710	5868	25055	24824	24519	23772	8815	5125	15597
95	10208	11520	8791	9875	20473	18495	16835	3540	3580	3882	23852	23631	23287	22735	6532	2739	14083
96	9959	6764	4520	13447	9633	7739	6098	7662	7331	7573	13152	12919	12624	11900	8149	9801	4554
97	9354	7441	5067	12928	9640	7657	5999	7545	7283	7731	13356	13119	12849	12008	8561	9964	5144
98	9328	6326	3267	12314	11843	9952	8307	5601	5192	5366	15233	15006	14685	14066	6283	7598	5941
99	14367	9325	9070	18363	4050	2916	2208	13520	13188	13227	7344	7105	6856	6050	13017	15411	4213
100	12777	9717	8852	16833	4661	2765	1224	12514	12261	12563	8688	8439	8257	7116	12768	14785	4874
101	12732	8319	7541	16646	5692	4043	2612	11666	11346	11466	9201	8963	8703	7885	11479	13670	3548
102	9900	9244	7384	13880	7521	5397	3756	9758	9596	10222	11687	11439	11249	10089	11038	12452	5554
103	19668	12523	13437	23725	4008	5674	6626	18720	18316	18058	2201	2020	1588	2551	17229	20147	7882
104	19339	12518	13330	23411	3600	5281	6268	18511	18121	17909	2318	2107	1756	2290	17150	20013	7792
105	18010	12298	12742	22120	2213	3812	4881	17551	17206	17148	3366	3118	2962	2163	16638	19299	7328
106	18513	12440	13011	22614	2663	4338	5395	17947	17587	17479	2901	2657	2462	2009	16885	19616	7543
107	19030	12482	13206	23113	3248	4927	5939	18298	17919	17745	2507	2280	1995	2137	17047	19862	7687
108	8984	11399	9327	13171	7763	5536	4191	10534	10531	11533	12379	12127	12030	10519	12777	13720	7677
109	2076	16167	12805	2372	18582	16354	14924	7182	7937	10182	23105	22853	22705	21325	13368	11072	15703
110	2201	16798	13438	2055	18900	16674	15275	7842	8598	10843	23469	23217	23081	21656	14030	11714	16239
111	2522	17302	13943	1806	19258	17035	15655	8318	9079	11322	23853	23600	23472	22021	14518	12158	16714
112	3789	15588	12228	2648	19451	17231	15716	5987	6780	8978	23806	23558	23368	22138	12241	9567	15756
113	3975	16118	12759	2178	19902	17680	16176	6474	7270	9452	24284	24035	23850	22599	12722	9973	16285
114	4065	16919	13557	1365	20375	18148	16674	7301	8096	10277	24816	24566	24395	23093	13548	10769	16985
115	4191	17547	14183	712	20718	18490	17041	7963	8758	10942	25206	24955	24795	23451	14212	11426	17522
116	10166	13391	10605	9054	21902	19864	18206	4734	5023	5722	25446	25220	24893	24246	8394	4547	15801
117	10564	12804	10107	9682	21688	19683	18023	4595	4767	5195	25130	24907	24569	23984	7729	3852	15392
118	12636	12617	10347	11818	22660	20750	19095	6061	5982	5578	25804	25592	25219	24815	7273	3557	15848
119	12717	10984	8857	12457	21447	19605	17962	5533	5242	4297	24421	24214	23825	23514	5619	2098	14401
120	12099	10994	8707	11848	21130	19256	17607	4971	4725	3991	24197	23987	23608	23242	5680	1912	14218
121	10293	9918	7208	10604	19167	17244	15588	2888	2582	2292	22409	22192	21835	21358	5012	1530	12560
122	11524	5448	2762	13307	15577	13883	12289	4762	3973	2265	18334	18130	17733	17504	2116	4038	8296
123	10974	6053	3206	12682	15751	13998	12383	4123	3333	1716	18646	18438	18053	17750	2525	3683	8658
124	12560	4444	2313	14435	15419	13842	12295	5898	5109	3291	17909	17714	17295	17205	1677	4752	7827
125	12024	4916	2441	13868	15443	13806	12234	5334	4546	2789	18071	17872	17464	17302	1862	4409	8003
126	13636	3734	2591	15523	15588	14130	12634	6964	6170	4245	17798	17614	17173	17227	1688	5408	7753
127	13142	3926	2289	15059	15377	13869	12352	6525	5735	3881	17709	17521	17089	17079	1723	5205	7638
128	14091	10016	9572	18152	3596	2165	1448	13683	13393	13560	7378	7130	6940	5874	13520	15765	4940
129	17862	10048	10916	21799	4377	5046	5365	16353	15917	15575	4729	4543	4111	4492	14701	17645	5357
130	18461	10119	11182	22373	4881	5681	6024	16781	16324	15907	4577	4417	3938	4657	14909	17946	5624
131	2797	18340	15021	3246	18993	16797	15532	9865	10593	12834	23708	23455	23370	21780	15956	13829	17259
132	2811	18281	14950	2870	19194	16992	15705	9669	10407	12652	23891	23638	23545	21979	15796	13599	17306
133	4503	19979	16718	5183	19280	17145	16033	11946	12650	14877	24089	23837	23803	22065	17934	15969	18444
134	4897	20299	17057	5678	19283	17167	16093	12389	13085	15307	24107	23856	23833	22064	18343	16428	18656
135	5281	20647	17414	6025	19434	17332	16285	12785	13480	15700	24266	24016	24001	22210	18730	16826	18946
136	5632	20807	17611	6703	19123	17049	16055	13198	13875	16080	23968	23719	23719	21889	19062	17274	18932
137	6346	21316	18159	7559	19099	17066	16142	13933	14595	16786	23954	23706	23727	21847	19728	18029	19265
138	6530	21199	18088	8102	18558	16553	15676	14111	14750	16916	23415	23168	23201	21294	19798	18234	18983
139	6918	21533	18434	8454	18698	16713	15867	14497	15135	17297	23555	23309	23351	21424	20171	18622	19263
140	7268	22744	19490	7077	21359	19293	18303	14615	15338	17576	26207	25958	25963	24121	20668	18573	21079

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
141	7801	23277	20024	7501	21781	19728	18759	15133	15858	18097	26633	26384	26395	24536	21195	19079	21593
142	8002	23434	20195	7828	21731	19694	18750	15381	16101	18337	26586	26338	26357	24480	21420	19346	21677
143	8332	23787	20541	8020	22097	20064	19124	15677	16402	18641	26953	26705	26725	24844	21735	19624	22049
144	8794	24249	21005	8405	22473	20450	19527	16127	16854	19093	27329	27082	27108	25213	22192	20064	22497
145	10813	26134	22931	10549	23536	21599	20799	18230	18948	21182	28385	28142	28205	26228	24251	22193	24140
146	11393	26663	23474	11177	23826	21917	21153	18832	19546	21778	28668	28426	28500	26501	24837	22805	24598
147	11778	27063	23871	11495	24196	22294	21538	19204	19921	22155	29036	28794	28871	26865	25220	23167	24999
148	8041	21195	17864	3801	24734	22507	21081	11288	12075	14093	29259	29008	28855	27481	17351	14074	21515
149	7634	21042	17700	3423	24349	22123	20711	11182	11973	14027	28896	28645	28498	27102	17295	14087	21253
150	6974	20551	17200	2778	23695	21469	20062	10747	11542	13631	28250	27998	27853	26449	16906	13781	20668
151	7037	20866	17510	2932	23773	21550	20162	11104	11901	14007	28357	28105	27969	26535	17284	14194	20893
152	7415	21251	17895	3329	24152	21929	20546	11471	12266	14362	28742	28490	28356	26916	17638	14517	21291
153	8202	22178	18823	4213	24928	22709	21347	12392	13188	15276	29547	29294	29169	27699	18550	15395	22191
154	8024	22165	18805	4122	24734	22518	21168	12424	13220	15328	29368	29116	28996	27508	18604	15495	22098
155	7970	22332	18968	4220	24639	22428	21100	12652	13449	15578	29298	29045	28934	27418	18856	15800	22159
156	5191	20732	17407	4189	20945	18782	17601	12055	12808	15053	25722	25469	25413	23735	18225	15898	19607
157	5384	20954	17641	4661	20860	18710	17561	12403	13148	15393	25654	25402	25356	23648	18546	16282	19715
158	5789	21357	18043	4912	21208	19065	17927	12772	13521	15767	26009	25757	25715	23996	18927	16632	20116
159	5940	21514	18210	5242	21151	19019	17904	13018	13761	16006	25962	25711	25676	23936	19154	16901	20195
160	6840	22368	19036	5314	22397	20255	19118	13560	14325	16567	27200	26948	26906	25184	19767	17315	21246
161	4966	20339	16990	3234	21204	19016	17773	11394	12163	14403	25938	25685	25607	23993	17612	15144	19463
162	4528	19914	16568	3024	20801	18610	17357	11020	11785	14027	25528	25275	25193	23589	17227	14805	19025
163	7291	21563	18516	9099	18259	16312	15525	14827	15442	17577	23112	22868	22924	20965	20388	18969	19123
164	7699	21921	18888	9464	18425	16501	15747	15234	15848	17980	23273	23030	23096	21117	20784	19376	19429
165	8722	22892	19882	10332	19004	17135	16452	16264	16879	19011	23837	23596	23682	21662	21810	20405	20306
166	9119	23138	20155	10793	18979	17142	16501	16642	17248	19369	23800	23561	23657	21616	22142	20788	20467
167	6492	21973	18716	6459	20784	18698	17674	13855	14574	16811	25625	25375	25369	23554	19896	17827	20349
168	6099	21666	18372	5561	21097	18976	17884	13256	13995	16239	25917	25666	25639	23879	19372	17162	20272
169	10035	23981	21022	11624	19473	17689	17112	17559	18164	20282	24269	24033	24147	22073	23045	21705	21222
170	6848	22328	18986	5062	22597	20445	19285	13411	14183	16421	27388	27136	27087	25386	19635	17121	21302
171	6848	22272	18924	4842	22749	20589	19409	13268	14044	16278	27529	27277	27221	25539	19503	16938	21329
172	6110	21523	18175	4199	22130	19959	18756	12546	13319	15556	26895	26642	26579	24920	18775	16248	20599
173	5355	20734	17385	3518	21532	19350	18118	11767	12538	14777	26277	26024	25950	24322	17991	15496	19851
174	5765	21180	17833	3943	21823	19649	18438	12229	12999	15238	26582	26330	26263	24614	18452	15952	20255
175	6666	22215	18933	6188	21350	19249	18196	13882	14617	16860	26184	25933	25918	24126	19984	17798	20730
176	5881	20750	17382	2762	22468	20262	18958	11384	12174	14379	27150	26898	26797	25251	17640	14883	20256
177	4627	19257	15888	1346	21343	19125	17771	9903	10691	12903	25971	25718	25598	24115	16158	13467	18846
178	4283	18835	15466	1012	21015	18795	17427	9493	10280	12495	25626	25374	25249	23783	15747	13083	18441
179	3660	19214	15927	4314	19082	16917	15737	11007	11720	13953	23857	23604	23548	21872	17035	15011	17862
180	3310	18877	15582	4026	18950	16774	15569	10623	11337	13572	23708	23456	23391	21740	16659	14624	17588
181	8365	22584	19561	9999	18857	16967	16256	15910	16527	18662	23697	23455	23533	21528	21468	20051	20041
182	6874	22338	19087	6818	20997	18924	17923	14248	14966	17202	25843	25593	25594	23762	20285	18220	20672
183	10298	25432	22270	10473	22480	20565	19799	17813	18510	20730	27324	27082	27153	25160	23743	21838	23283
184	10493	25535	22393	10798	22359	20466	19730	18034	18723	20936	27197	26956	27035	25026	23928	22076	23308
185	10877	25925	22784	11126	22681	20800	20078	18413	19105	21319	27515	27275	27359	25340	24315	22450	23687
186	11290	26325	23189	11511	22974	21108	20406	18826	19517	21732	27802	27563	27652	25622	24727	22861	24061
187	11607	26587	23464	11876	23070	21224	20547	19153	19841	22052	27891	27652	27749	25705	25036	23196	24271
188	11790	26687	23581	12157	22984	21158	20507	19351	20032	22238	27796	27558	27662	25605	25203	23407	24307
189	6734	20166	16817	2498	23431	21204	19785	10352	11147	13234	27967	27716	27566	26180	16509	13387	20321
190	7675	21618	18262	3650	24408	22187	20816	11848	12644	14742	29014	28762	28633	27176	18018	14895	21625
191	2973	18545	15245	3801	18798	16614	15386	10260	10975	13209	23541	23288	23216	21588	16300	14263	17309
192	11033	26302	23112	10860	23523	21604	20829	18479	19192	21423	28368	28126	28196	26205	24478	22457	24247
193	6147	21032	17886	7542	18772	16738	15813	13737	14391	16573	23627	23379	23399	21522	19496	17844	18950
194	5992	21091	17910	7092	19173	17118	16155	13568	14240	16439	24024	23775	23785	21932	19408	17650	19142
195	8074	22185	19173	9862	18457	16559	15841	15596	16204	18328	23299	23057	23132	21133	21114	19741	19623
196	9743	23645	20688	11413	19181	17386	16797	17254	17856	19969	23983	23747	23857	21790	22722	21402	20888
197	9468	23311	20359	11229	18878	17073	16474	16963	17560	19666	23685	23448	23555	21495	22408	21113	20551
198	3836	18431	15063	976	20572	18350	16979	9161	9944	12168	25177	24925	24799	23338	15410	12814	17996
199	5582	20406	17038	2425	22206	19997	18681	11041	11831	14037	26877	26624	26519	24987	17297	14553	19930
200	5286	20069	16701	2108	21941	19729	18403	10712	11501	13709	26600	26347	26238	24719	16967	14241	19607
201	5031	19730	16362	1762	21721	19506	18165	10362	11151	13359	26365	26112	25998	24496	16617	13896	19302

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-4.0/4.2

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
202	4858	20403	17079	4017	20648	18481	17291	11761	12511	14756	25419	25166	25107	23438	17920	15624	19274
203	4524	20070	16747	3837	20368	18197	16996	11454	12201	14446	25132	24880	24817	23159	17604	15334	18945
204	4184	19711	16384	3520	20178	17997	16775	11068	11815	14060	24927	24674	24604	22968	17220	14948	18635
205	6733	21924	18732	7453	19938	17900	16961	14279	14965	17176	24792	24544	24562	22689	20174	18337	19991
206	6520	21956	18610	4616	22432	20269	19085	12988	13762	15998	27209	26956	26899	25222	19218	16684	20998
207	6333	21888	18603	5896	21129	19019	17950	13546	14281	16523	25957	25706	25686	23907	19647	17466	20429
208	6996	22539	19260	6494	21559	19467	18432	14220	14955	17198	26397	26147	26138	24331	20322	18134	21023

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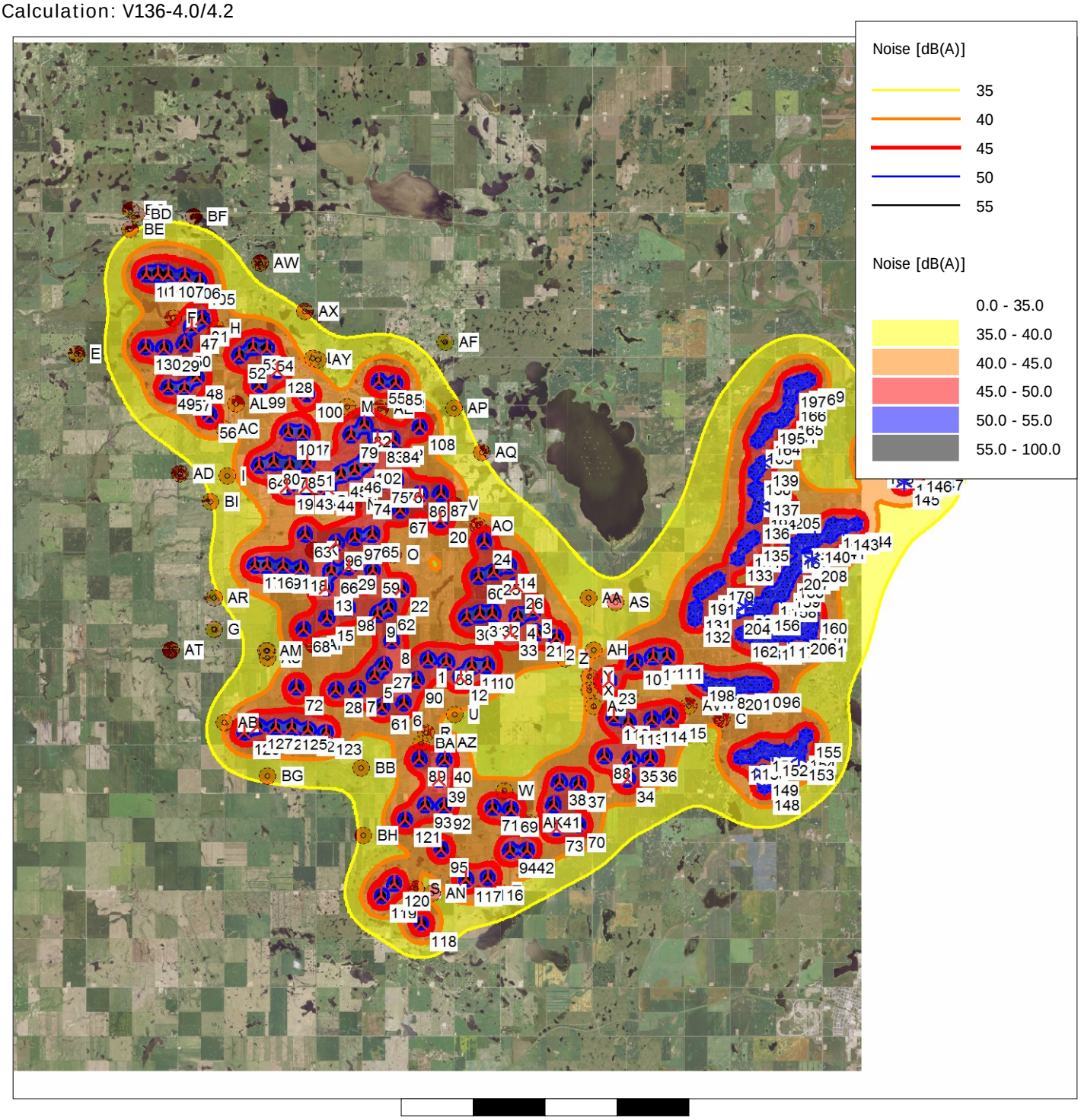
Calculated:
9/15/2018 12:04 AM/3.0.654

DECIBEL - Map 95% rated power

Calculation: V136-4.0/4.2



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 641,190 North: 5,375,412

New WTG Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 95% rated power
Height above sea level from active line object

Project: Description:

Aurora

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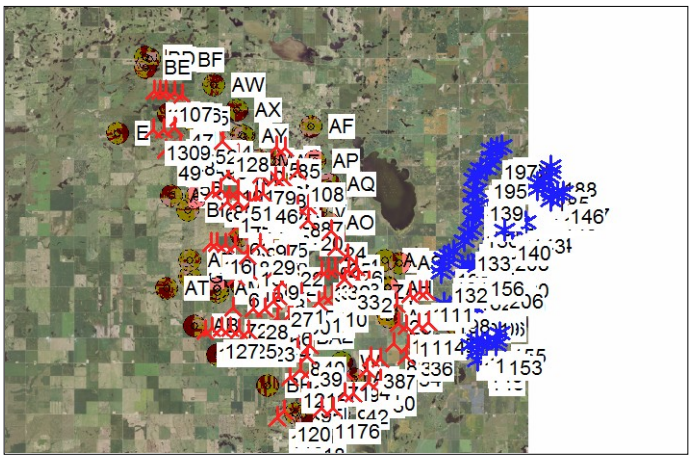
Calculated:
9/14/2018 11:15 PM/3.0.654

DECIBEL - Main Result

Calculation: V136-3.45/3.6

Noise calculation model:
ISO 9613-2 General
Wind speed:
95% rated power
Ground attenuation:
General, fixed, Ground factor: 0.5
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
1.5 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:500,000

New WTG
Existing WTG
Noise sensitive area

WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
1	637,619	5,373,512	727.5	T-43	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
2	642,085	5,374,363	728.5	T-41	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
3	641,252	5,375,220	737.7	T-63	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
4	640,729	5,375,038	740.7	T-62	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
5	635,764	5,372,945	724.6	T-45	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
6	636,817	5,372,047	728.5	T-35	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
7	635,193	5,372,473	710.2	T-47	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
8	636,346	5,374,109	734.6	T-56	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
9	635,830	5,374,972	728.5	T-55	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
10	639,692	5,373,363	740.7	T-39	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
11	639,157	5,373,344	739.4	T-38	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
12	638,790	5,372,951	734.6	T-37	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
13	633,988	5,375,810	737.6	T-70	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
14	640,372	5,376,713	738.1	T-77	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
15	634,074	5,374,798	721.2	T-53	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
16	631,934	5,376,511	729.8	T-67	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
17	631,510	5,376,507	731.5	T-66	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
18	633,108	5,376,447	723.9	T-69	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
19	632,563	5,379,145	737.6	T-93	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
20	637,951	5,378,169	715.2	T-80	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
21	641,389	5,374,486	743.7	T-58	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
22	636,640	5,375,835	734.6	T-73	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
23	643,972	5,372,967	712.3	T-28	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
24	639,495	5,377,499	738.7	T-78	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
25	639,840	5,376,489	737.6	T-76	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
26	640,649	5,376,031	731.5	T-79	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
27	636,095	5,373,292	733.9	T-46	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
28	634,438	5,372,432	701.0	T-57	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
29	634,798	5,376,526	725.4	T-71	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
30	638,928	5,374,941	737.6	T-59	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
31	639,384	5,375,074	737.6	T-60	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
32	639,838	5,375,100	737.6	T-61	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
33	640,492	5,374,466	743.6	T-40	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
34	644,695	5,369,685	736.0	T-15	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
35	644,792	5,370,371	743.7	T-16	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
36	645,456	5,370,405	735.1	T-17	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
37	642,975	5,369,494	737.6	T-12	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
38	642,303	5,369,536	734.9	T-13	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
39	638,102	5,369,527	710.5	T-26	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
40	638,282	5,370,192	712.5	T-25	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
41	642,122	5,368,780	734.6	T-10	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
42	641,239	5,367,252	719.1	T-8	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No

To be continued on next page...

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9/14/2018 11:15 PM/3.0.654

DECIBEL - Main Result

Calculation: V136-3.45/3.6

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					WTG type							Noise data			
	X(East)	Y(North)	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
43	633,243	5,379,162	737.6	T-94	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
44	634,001	5,379,136	737.6	T-95	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
45	634,443	5,379,605	731.5	T-96	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
46	634,918	5,379,749	728.5	T-121	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
47	629,136	5,384,387	713.2	T-142	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
48	629,347	5,382,713	710.2	T-131	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
49	628,366	5,382,343	707.1	T-129	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
50	628,893	5,383,804	717.2	T-141	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
51	633,253	5,379,950	729.4	T-123	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
52	630,815	5,383,459	711.9	T-144	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
53	631,275	5,383,767	710.7	T-145	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
54	631,767	5,383,732	713.2	T-146	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
55	635,699	5,382,724	710.2	T-122	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
56	629,834	5,381,441	713.0	T-117	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
57	628,926	5,382,328	703.0	T-130	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
58	638,268	5,373,457	731.5	T-44	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
59	635,628	5,376,434	728.5	T-72	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
60	639,307	5,376,310	731.5	T-75	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
61	636,056	5,371,908	719.3	T-34	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
62	636,215	5,375,218	731.5	T-74	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
63	633,243	5,377,581	731.5	T-81	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
64	631,582	5,379,814	726.8	T-98	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
65	635,586	5,377,640	725.5	T-85	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
66	634,183	5,376,389	733.5	T-86	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
67	636,542	5,378,452	715.1	T-87	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
68	633,261	5,374,418	716.3	T-51	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
69	640,641	5,368,602	728.5	T-23	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
70	643,024	5,368,138	728.5	T-11	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
71	639,998	5,368,634	725.4	T-22	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
72	633,064	5,372,478	698.0	T-5	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
73	642,243	5,368,015	730.6	T-9	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
74	635,270	5,379,029	725.4	T-90	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
75	635,883	5,379,448	720.6	T-91	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
76	636,364	5,379,455	716.0	T-92	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
77	633,072	5,380,925	729.9	T-106	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
78	632,659	5,379,855	737.2	T-100	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
79	634,758	5,380,905	718.9	T-107	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
80	632,089	5,379,958	731.5	T-99	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
81	629,494	5,384,648	709.6	T-143	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
82	635,222	5,381,271	716.3	T-108	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
83	635,678	5,380,785	716.0	T-109	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
84	636,220	5,380,785	716.3	T-110	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
85	636,276	5,382,673	710.2	T-124	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
86	637,208	5,379,005	710.9	T-88	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
87	637,941	5,379,046	713.2	T-89	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
88	643,859	5,370,443	732.3	T-14	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
89	637,408	5,370,185	701.0	T-24	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
90	637,234	5,372,817	719.9	T-42	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
91	632,509	5,376,501	722.8	T-68	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
92	638,306	5,368,644	716.3	T-21	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
93	637,648	5,368,666	713.2	T-20	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
94	640,643	5,367,238	719.3	T-19	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
95	638,242	5,367,207	710.2	T-18	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
96	634,318	5,377,326	731.6	T-83	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
97	634,979	5,377,549	725.3	T-84	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
98	634,798	5,375,163	713.2	T-54	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
99	631,532	5,382,484	707.7	T-118	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
100	633,206	5,382,201	722.4	T-120	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
101	632,585	5,380,949	731.5	T-105	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
102	635,298	5,380,049	728.5	T-97	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
103	627,504	5,386,079	711.3	T-147	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
104	627,911	5,386,105	710.2	T-148	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
105	629,368	5,385,888	704.0	T-149	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
106	628,867	5,386,049	710.2	T-150	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
107	628,269	5,386,086	711.9	T-151	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
108	637,149	5,381,224	704.1	T-152	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
109	644,833	5,373,605	713.9	T-153	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
110	645,462	5,373,811	728.5	T-154	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

					WTG type							Noise data				
	X(East)	Y(North)	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
111	645,966	5,373,838	730.1	T-155	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
112	644,144	5,371,765	710.2	T-156	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
113	644,660	5,371,616	715.4	T-157	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
114	645,479	5,371,724	719.3	T-158	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
115	646,127	5,371,875	717.1	T-159	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
116	639,890	5,366,309	710.2	T-160	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
117	639,135	5,366,239	709.0	T-161	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
118	637,617	5,364,719	707.6	T-162	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
119	636,191	5,365,609	711.4	T-163	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
120	636,640	5,366,042	710.2	T-164	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
121	636,954	5,368,164	711.3	T-165	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
122	633,495	5,371,087	689.0	T-166	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
123	634,130	5,371,006	696.6	T-167	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
124	632,359	5,371,139	688.8	T-168	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
125	632,926	5,371,158	686.0	T-169	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
126	631,283	5,370,947	682.8	T-170	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
127	631,732	5,371,159	684.7	T-171	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
128	632,154	5,382,999	713.2	T-172	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
129	628,195	5,383,647	711.6	T-173	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
130	627,535	5,383,666	710.2	T-174	Yes	VESTAS	V136-3.6-3,600	3,600	136.0	82.0	USER	Standard +2 (110.2 dB)	(95%)	110.2	No
131	646,913	5,375,455	745.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
132	646,888	5,375,080	743.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
133	648,328	5,377,151	749.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
134	648,570	5,377,592	749.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
135	648,872	5,377,853	752.9	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
136	648,872	5,378,572	753.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
137	649,189	5,379,368	749.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
138	648,868	5,380,034	743.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
139	649,124	5,380,328	729.4	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
140	651,007	5,377,868	748.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
141	651,525	5,378,000	750.5	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
142	651,616	5,378,348	758.5	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
143	651,987	5,378,290	755.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
144	652,436	5,378,405	749.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
145	654,047	5,379,834	743.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
146	654,478	5,380,290	740.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
147	654,876	5,380,346	731.4	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
148	649,468	5,369,552	735.9	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
149	649,403	5,370,046	745.1	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
150	648,989	5,370,563	740.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
151	649,348	5,370,846	749.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
152	649,714	5,370,690	746.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
153	650,635	5,370,574	746.1	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
154	650,667	5,370,918	744.2	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
155	650,882	5,371,340	743.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
156	649,309	5,375,532	733.1	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
157	649,484	5,375,990	732.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
158	649,889	5,375,994	741.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
159	650,008	5,376,322	740.0	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
160	650,956	5,375,465	750.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
161	648,982	5,374,557	737.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
162	648,553	5,374,643	733.0	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
163	648,903	5,381,054	722.4	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
164	649,170	5,381,363	721.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
165	649,950	5,382,038	713.3	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
166	650,030	5,382,496	712.9	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
167	650,267	5,377,632	746.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
168	650,119	5,376,640	740.5	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
169	650,663	5,383,159	707.1	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
170	650,947	5,375,049	753.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
171	650,911	5,374,694	758.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
172	650,163	5,374,664	746.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
173	649,378	5,374,555	741.2	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
174	649,818	5,374,694	743.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
175	650,613	5,377,049	737.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
176	649,406	5,372,982	725.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
177	647,909	5,372,903	716.3	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
178	647,487	5,372,910	715.5	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

To be continued on next page...

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9/14/2018 11:15 PM/3.0.654

DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

					WTG type							Noise data				
	X(East)	Y(North)	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
179	647,672	5,376,428	744.3	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
180	647,365	5,376,192	740.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
181	649,728	5,381,758	721.2	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
182	650,599	5,377,842	746.4	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
183	653,143	5,380,511	713.2	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
184	653,130	5,380,927	710.2	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
185	653,497	5,381,062	704.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
186	653,850	5,381,276	700.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
187	654,022	5,381,604	696.2	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
188	654,011	5,381,966	694.9	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
189	648,594	5,370,523	731.5	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
190	650,092	5,370,737	743.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
191	647,056	5,376,002	741.1	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
192	654,134	5,380,179	733.9	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
193	648,870	5,379,452	759.0	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
194	649,079	5,378,913	759.0	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
195	649,308	5,381,738	716.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
196	650,346	5,383,045	709.6	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
197	650,021	5,382,956	710.0	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
198	647,090	5,373,129	713.2	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
199	649,061	5,372,960	722.4	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
200	648,724	5,372,961	720.7	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
201	648,383	5,372,886	719.3	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
202	648,975	5,375,560	735.2	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
203	648,641	5,375,554	726.1	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
204	648,297	5,375,376	728.5	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
205	649,928	5,378,956	741.8	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
206	650,591	5,374,779	748.5	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
207	650,301	5,376,922	735.1	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
208	650,917	5,377,197	740.0	VESTAS V100 2000 100....	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

Calculation Results

Sound Level

Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	X(East)	Y(North)	Z	Imission height	Noise	From WTGs	Distance to noise demand	Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
A	1 - Non-Participating	644,116	5,375,554	701.3	1.5	50.0	36.8	1,797	Yes
B	39 - Participating	643,400	5,373,971	711.5	1.5	50.0	40.2	889	Yes
C	2 - Non-Participating	647,930	5,371,801	718.0	1.5	50.0	41.1	888	Yes
D	40 - Participating	643,453	5,372,099	716.3	1.5	50.0	42.8	490	Yes
E	41 - Participating	625,162	5,383,364	711.9	1.5	50.0	31.7	2,125	Yes
F	42 - Participating	628,500	5,384,644	704.1	1.5	50.0	45.0	381	Yes
G	43 - Participating	630,148	5,374,327	691.9	1.5	50.0	33.7	2,291	Yes
H	44 - Participating	629,997	5,384,325	711.4	1.5	50.0	45.1	305	Yes
I	3 - Non-Participating	630,488	5,379,437	722.7	1.5	50.0	39.0	882	Yes
J	4 - Non-Participating	632,031	5,373,676	696.3	1.5	50.0	38.3	1,172	Yes
K	45 - Participating	633,554	5,377,057	735.4	1.5	50.0	46.8	318	Yes
L	46 - Participating	633,395	5,383,413	715.7	1.5	50.0	39.7	958	Yes
M	47 - Participating	634,615	5,381,825	716.9	1.5	50.0	43.5	522	Yes
N	48 - Participating	634,891	5,378,584	728.5	1.5	50.0	46.4	280	Yes
O	5 - Non-Participating	636,328	5,376,974	731.5	1.5	50.0	43.7	597	Yes
P	49 - Participating	636,455	5,380,259	709.9	1.5	50.0	46.6	276	Yes
Q	50 - Participating	636,416	5,382,006	707.4	1.5	50.0	44.1	406	Yes
R	51 - Participating	637,621	5,371,070	716.6	1.5	50.0	42.3	636	Yes
S	6 - Non-Participating	637,411	5,365,868	713.2	1.5	50.0	41.9	522	Yes
T	52 - Participating	640,276	5,365,862	710.2	1.5	50.0	43.4	323	Yes
U	7 - Non-Participating	638,615	5,371,717	720.3	1.5	50.0	40.7	959	Yes
V	8 - Non-Participating	638,435	5,378,666	709.4	1.5	50.0	44.9	343	Yes
W	9 - Non-Participating	640,413	5,369,191	728.5	1.5	50.0	44.6	344	Yes
X	10 - Non-Participating	643,279	5,372,615	722.4	1.5	50.0	42.1	506	Yes
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.5	50.0	42.4	432	Yes

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	X(East)	Y(North)	Z [m]	Imission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]	Noise
Z	53 - Participating	642,413	5,373,644	734.1	1.5	50.0	41.8	517	Yes
AA	54 - Participating	643,167	5,375,685	714.9	1.5	50.0	37.4	1,438	Yes
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.5	50.0	41.1	486	Yes
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.5	50.0	42.4	416	Yes
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.5	50.0	34.4	1,950	Yes
AE	55 - Participating	635,760	5,381,775	711.0	1.5	50.0	44.9	441	Yes
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.5	50.0	32.9	1,918	Yes
AG	57 - Participating	633,480	5,378,691	739.8	1.5	50.0	47.1	215	Yes
AH	59 - Participating	643,400	5,373,968	711.4	1.5	50.0	40.2	886	Yes
AI	61 - Participating	633,645	5,373,895	713.7	1.5	50.0	43.9	376	Yes
AJ	62 - Participating	643,453	5,372,097	716.3	1.5	50.0	42.8	489	Yes
AK	63 - Participating	641,300	5,368,154	725.4	1.5	50.0	44.5	520	Yes
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.5	50.0	42.1	717	Yes
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.5	50.0	38.1	1,210	Yes
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.5	50.0	40.4	814	Yes
AO	64 - Participating	639,268	5,377,996	720.6	1.5	50.0	44.3	282	Yes
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.5	50.0	36.9	1,076	Yes
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.5	50.0	35.7	1,682	Yes
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.5	50.0	35.1	1,498	Yes
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.5	50.0	36.8	1,796	Yes
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.5	50.0	30.5	3,456	Yes
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.5	50.0	38.4	1,139	Yes
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.5	50.0	43.5	438	Yes
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.5	50.0	34.1	1,938	Yes
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.5	50.0	35.7	1,509	Yes
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.5	50.0	39.3	958	Yes
AZ	66 - Participating	638,244	5,370,747	710.8	1.5	50.0	44.6	281	Yes
BA	67 - Participating	637,448	5,370,698	712.2	1.5	50.0	45.2	241	Yes
BB	68 - Participating	635,378	5,369,828	692.6	1.5	50.0	37.7	1,447	Yes
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.5	50.0	32.4	1,904	Yes
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.5	50.0	33.4	1,718	Yes
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.5	50.0	35.3	1,296	Yes
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.5	50.0	34.3	1,708	Yes
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.5	50.0	37.0	1,376	Yes
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.5	50.0	36.6	1,267	Yes
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.5	50.0	35.7	1,775	Yes

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	6810	5799	10452	6003	15882	14390	7516	13229	9271	5591	5393	10764	8839	5759	3695	6847	8579	2442	7647	8099	2053	5218
2	2355	1372	6382	2645	19168	17037	11937	15664	12659	10077	8946	12547	10558	8341	6322	8153	9516	5546	9696	8691	4363	5643
3	2883	2484	7503	3819	18034	15857	11140	14477	11561	9350	7914	11352	9363	7196	5227	6957	8333	5514	10110	9409	4385	4451
4	3426	2876	7896	4008	17654	15551	10605	14192	11146	8804	7453	11132	9134	6830	4808	6747	8195	5040	9752	9188	3937	4293
5	8751	7705	12221	7736	14865	13771	5783	12758	8366	3804	4668	10733	8954	5707	4069	7347	9085	2639	7266	8398	3105	6315
6	8098	6859	11117	6637	16245	15095	7047	14045	9729	5055	5978	11870	10022	6815	4951	8220	9967	1266	6207	7087	1829	6814
7	9440	8343	12755	8269	14807	13890	5375	12941	8404	3383	4868	11086	9369	6119	4642	7888	9611	2805	6968	8340	3505	6990
8	7903	7055	11812	7386	14517	13136	6202	12028	7919	4337	4060	9760	7907	4706	2865	6151	7897	3296	8310	9136	3297	5013
9	8306	7636	12509	8146	13573	12136	5719	11023	6962	4014	3086	8785	6960	3732	2063	5324	7059	4294	9240	10137	4284	4520
10	4937	3758	8385	3968	17639	15891	9592	14634	11028	7667	7164	11860	9868	7093	4935	7618	9243	3089	7834	7524	1967	5450
11	5429	4289	8908	4473	17213	15533	9063	14300	10596	7134	6722	11601	9620	6757	4602	7424	9085	2744	7677	7566	1715	5371
12	5928	4721	9212	4740	17151	15577	8751	14377	10536	6798	6654	11771	9807	6851	4717	7673	9362	2214	7216	7243	1246	5726
13	10131	9590	14507	10166	11618	10400	4117	9404	5041	2896	1320	7626	6047	2917	2613	5087	6655	5972	10515	11769	6178	5285
14	3919	4084	9014	5548	16601	14278	10499	12869	10253	8877	6827	9673	7699	5792	4053	5284	6609	6278	11242	10852	5296	2752
15	10070	9362	14177	9760	12361	11314	3955	10362	5863	2331	2318	8641	7047	3873	3132	5957	7579	5146	9533	10878	5488	5829
16	12220	11744	16676	12335	9635	8829	2821	8051	3264	2836	1710	7055	5953	3612	4418	5873	7092	7871	11969	13528	8224	6849
17	12642	12158	17082	12731	9344	8676	2570	7963	3104	2878	2118	7159	6159	3969	4841	6208	7370	8180	12166	13790	8569	7254
18	11044	10585	15533	11221	10535	9404	3641	8470	3976	2973	756	6972	5585	2783	3262	5073	6469	7020	11420	12784	7260	5770
19	12098	12009	17033	12971	8519	6837	5389	5781	2095	5495	2311	4349	3376	2395	4346	4049	4800	9529	14134	15360	9582	5892
20	6696	6878	11838	8193	13804	11457	8699	10058	7570	7433	4536	6946	4949	3088	2016	2570	4133	7107	12313	12526	6487	693
21	2928	2075	7071	3156	18497	16411	11243	15053	11973	9394	8246	11983	9987	7683	5640	7595	9016	5086	9492	8696	3920	5119

To be continued on next page...

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9/14/2018 11:15 PM/3.0.654

DECIBEL - Main Result

Calculation: V136-3.45/3.6

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WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
22	7481	7012	11989	7770	13728	11995	6665	10781	7129	5090	3319	8244	6323	3259	1181	4429	6176	4865	9996	10615	4567	3352
23	2591	1156	4127	1011	21493	19385	13891	18009	14956	11962	11192	14866	12885	10678	8631	10473	11782	6628	9666	8009	5501	7947
24	5014	5263	10180	6696	15486	13113	9871	11696	9213	8386	5957	8496	6521	4730	3210	4106	5458	6697	11816	11664	5849	1577
25	4376	4360	9350	5685	16209	13969	9931	12582	9806	8301	6312	9460	7468	5375	3546	5067	6494	5856	10895	10636	4927	2592
26	3500	3437	8421	4830	17135	14892	10639	13500	10716	8934	7168	10349	8365	6298	4423	5955	7322	5812	10667	10177	4770	3442
27	8334	7337	11929	7454	14865	13659	6036	12606	8319	4082	4542	10475	8660	5428	3690	6977	8720	2696	7539	8526	2972	5862
28	10169	9093	13507	9021	14338	13579	4690	12695	8042	2710	4709	11030	9394	6169	4919	8083	9776	3462	7206	8789	4238	7405
29	9368	8973	13956	9721	11816	10275	5144	9158	5201	3973	1353	7028	5302	2060	1594	4084	5714	6143	10973	11989	6140	4219
30	5224	4576	9535	5344	16138	14244	8801	12955	9563	7012	5775	10119	8123	5438	3300	5865	7499	4085	9198	9179	3239	3758
31	4756	4165	9152	5041	16461	14493	9266	13179	9908	7484	6157	10266	8265	5701	3598	5955	7540	4375	9415	9256	3444	3715
32	4302	3737	8739	4699	16843	14820	9721	13489	10307	7936	6581	10517	8515	6050	3979	6169	7707	4599	9546	9249	3597	3832
33	3784	2950	7902	3791	17725	15729	10345	14400	11171	8498	7406	11420	9417	6952	4861	7061	8571	4447	9133	8607	3329	4677
34	5898	4478	3866	2715	23847	22047	15270	20745	17232	13278	13359	17781	15779	13241	11097	13406	14845	7208	8224	5844	6410	10948
35	5227	3860	3449	2186	23540	21660	15169	20337	16935	13182	13076	17320	15322	12864	10735	12933	14336	7204	8647	6382	6322	10451
36	5321	4117	2841	2623	24079	22142	15802	20803	17482	13818	13635	17739	15746	13361	11246	13346	14708	7863	9236	6890	6965	10842
37	6166	4497	5466	2648	22576	20954	13707	19708	15962	11716	12081	16897	14898	12165	10007	12586	14127	5581	6642	4526	4894	10234
38	6285	4569	6066	2809	22024	20465	13066	19240	15416	11075	11538	16490	14496	11697	9541	12214	13790	4927	6115	4197	4285	9916
39	8514	6915	10088	5936	18945	17909	9290	16872	12498	7354	8797	14662	12783	9610	7655	10858	12593	1616	3724	4261	2249	9145
40	7923	6362	9781	5511	18592	17452	9125	16383	12092	7157	8336	14095	12197	9051	7058	10232	11961	1099	4411	4767	1560	8476
41	7061	5346	6547	3576	22368	20910	13196	19714	15777	11216	11913	17037	15050	12182	10035	12802	14404	5049	5539	3453	4574	10551
42	8786	7058	8091	5328	22761	21559	13155	20442	16250	11227	12458	17964	16007	12989	10892	13859	15522	5260	4071	1691	5178	11754
43	11456	11407	16429	12415	9108	7249	5741	6098	2768	5618	2128	4253	2996	1747	3782	3395	4261	9201	13932	15046	9182	5216
44	10730	10724	15743	11784	9798	7785	6163	6554	3526	5805	2127	4319	2758	1047	3176	2699	3751	8841	13699	14683	8737	4458
45	10487	10582	15583	11727	10013	7792	6805	6484	3958	6401	2698	3949	2227	1115	3237	2116	3108	9108	14054	14930	8924	4101
46	10109	10263	15248	11462	10404	8072	7222	6720	4441	6724	3018	3968	2098	1165	3113	1620	2709	9090	14103	14885	8842	3680
47	17391	17662	22620	18868	4103	686	10112	863	5132	11096	8559	4369	6049	8173	10329	8403	7660	15791	20284	21617	15824	10918
48	16413	16551	21551	17654	4235	2108	8425	1738	3469	9428	7050	4108	5343	6913	9038	7520	7105	14284	18676	20086	14382	9949
49	17151	17208	22225	18237	3362	2305	8212	2567	3598	9410	7407	5142	6271	7531	9603	8354	8058	14586	18795	20335	14764	10720
50	17315	17526	22506	18682	3757	927	9561	1220	4650	10604	8201	4519	6055	7952	10096	8352	7735	15439	19856	21249	15513	10837
51	11718	11777	16788	12871	8782	6681	6424	5454	2812	6392	2908	3466	2317	2132	4279	3217	3772	9896	14683	15741	9825	5338
52	15473	15761	20709	16994	5653	2601	9157	1191	4035	9859	6964	2581	4137	6355	8512	6485	5787	14136	18787	19980	14098	9002
53	15243	15588	20509	16866	6127	2911	9508	1395	4401	10120	7087	2149	3864	6320	8467	6256	5434	14195	18922	20041	14110	8791
54	14812	15186	20091	16490	6615	3392	9544	1866	4481	10060	6911	1659	3428	6022	8154	5835	4960	13951	18735	19793	13831	8374
55	11057	11658	16399	13154	10556	7451	10066	5923	6161	9763	6059	2405	1408	4218	5784	2578	1015	11811	16943	17473	11387	4894
56	15448	15487	20504	16515	5052	3470	7121	2889	2108	8070	5750	4071	4797	5809	7882	6726	6607	12969	17318	18755	13103	9037
57	16633	16714	21726	17768	3903	2354	8095	2265	3287	9193	7015	4599	5712	7043	9136	7809	7497	14226	18519	20000	14370	10190
58	6212	5157	9803	5360	16430	14852	8167	13658	9813	6241	5932	11085	9131	6140	4017	7040	8748	2473	7637	7856	1774	5212
59	8534	8153	13146	8946	12552	10873	5871	9694	5953	4532	2165	7327	5485	2273	884	3914	5628	5722	10715	11549	5584	3586
60	4868	4714	9731	5909	15807	13648	9371	12285	9357	7738	5801	9242	7241	4967	3052	4872	6388	5504	10612	10493	4645	2513
61	8846	7628	11875	7399	15809	14809	6384	13817	9365	4397	5725	11809	10021	6777	5073	8361	10105	1775	6190	7373	2566	7165
62	7908	7292	12204	7882	13731	12181	6132	11027	7113	4459	3234	8666	6798	3617	1760	5047	6791	4380	9426	10200	4245	4101
63	11060	10780	15784	11589	9937	8508	4491	7484	3322	4089	610	5834	4460	1930	3144	4182	5445	7847	12433	13668	7953	5304
64	13238	13184	18207	14158	7336	5729	5672	4781	1157	6155	3390	4029	3639	3531	5531	4894	5308	10627	15115	16440	10726	6949
65	8781	8632	13656	9622	11892	9964	6369	8714	5406	5325	2114	6174	4296	1172	997	2759	4444	6878	11913	12678	6653	3027
66	9968	9529	14493	10215	11403	10022	4532	8972	4790	3463	917	7068	5453	2306	2223	4488	6044	6334	11005	12164	6440	4823
67	8110	8192	13189	9388	12395	10150	7609	8794	6133	6569	3297	5875	3884	1656	1493	1810	3557	7460	12614	13132	7047	1905
68	10914	10149	14901	10452	12068	11280	3115	10431	5734	1437	2655	8996	7530	4474	3992	6658	8218	5497	9504	11064	5997	6694
69	7773	6037	7961	4488	21390	20119	11953	18987	14849	9994	11032	16488	14531	11520	9418	12386	14055	3900	4231	2764	3715	10303
70	7496	5846	6123	3984	23472	21987	14287	20779	16877	12310	13009	18057	16064	13239	11087	13787	15363	6148	6055	3569	5679	11486
71	8053	6329	8541	4893	20907	19711	11377	18607	14393	9428	10605	16187	14247	11184	9112	12153	13844	3403	3787	2786	3378	10153
72	11472	10444	14882	10396	13452	12994	3453	12238	7421	1582	4606	10940	9475	6374	5556	8489	10101	4770	7911	9787	5603	8194
73	7769	6068	6832	4260	22965	21574	13643	20396	16391	11677	12541	17760	15777	12875	10736	13544	15157	5540	5288	2916	5183	11312
74	9504	9575	14579	10723	10998	8796	6953	7474	4799	6257	2614	4768	2871	584	2311	1708	3190	8299	13334	14087	8041	3185
75	9107	9301	14270	10551	11414	9028	7689	7644	5395	6940	3338	4681	2694	1315	2514	992	2613	8557	13666	14279	8200	2669
76	8678	8920	13870	10216	11865	9422	8059	8016	5876	7223	3694	4948	2946	1711	2481	810	2552	8478	13627	14145	8059	2216
77	12281	12451	17436	13626	8278	5894	7218	4584	2982	7324	3898	2508	1786	2965	5120	3448	3514	10855	15670	16698	10748	5819
78	12237	12247	17265	13291	8278	6343	6072	5203	2211	6211	2938	3633	2776	2568	4665	3817	4329	10089	14772	15932	10085	5897
79	10779	11079	16012	12375	9906	7291	8033	5863	4515	7727	4032	2854	931	2325	4233	1816	1990	10243	15269	16023	9965	4304
80	12808	12798	17818	13817	7719	5903	5956	4843	1683	6282	3250	3694	3141	3121	5184	4377	4787	10469	15061	16301	10512	6476
81	17219	17532	22471	18771	4518	995	10343	598	5305	11262	8609	4092	5848	8118	10276	8229	7409	15825	20381	21661	15825	10757
82	10573	10962	15849	12324	10275	7521	8601	6052	5077	8239	4532	2815	821	2707	4438	1595	1402	10480	15558	16217	10140	4136
83	9928	10298	15193	11658	10828	8150	8503	6694	5362	7990	4291	3481	1487	2337	3866	938	1426	9908	15017	15616	9532	3477
84	9471	9898	14760	11303	11355	8631	8865	7160	5888	8251	4583	3859	1912	2571	3812	576	1237	9815	14964	15465	9379	3065
85	10590	11246	15939	12780	11135	8022	10355	6493	6631	9949	6241	2974	1865	4317	5700	2421	682	11681	16844	17281	11204	4552
86	7722	7980	12918	9311	12811	10375	8470	8962	6734	7430	4141	5829	3831	2355	2213	1463	3104	7945	13138	13496	7423	1272
87	7094	7454	12341	8869	13488	10976	9110	9538	7463	7985	4816	6303	4333	3084	2626	1918	3330	7982	13189	13390	7360	623
88	5118	3558	4291	1705	22728	20919	14251	19619	16115	12263	12245	16665	14663	12113	9969	12296	13752	6270	7907	5817	5397	9852
89	8592	7088	10646	6341	17991	16983	8358	15965	11554	6411	7879	13823	11970	8768	6875	10120	11863	911	4317	5188	1951	8543
90	7407	6274	10745	6261	16030	14703	7245	13595	9452	5273	5614	11270	9381	6225	4255	7483	9226	1789	6951	7591	1766	5972

To be continued on next page...

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Calculated:
9/14/2018 11:15 PM/3.0.654

DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
91	11646	11181	16122	11796	10054	9076	3210	8217	3564	2866	1184	6968	5725	3165	3848	5449	6750	7459	11709	13173	7758	6309
92	9028	7371	10129	6199	19735	18767	9943	17747	13328	8044	9663	15564	13688	10511	8562	11762	13496	2521	2917	3409	3088	10023
93	9448	7825	10749	6744	19286	18412	9397	17428	12934	7527	9336	15348	13504	10294	8412	11654	13397	2404	2808	3843	3200	10031
94	9012	7276	8598	5615	22355	21224	12665	20133	15873	10753	12111	17725	15784	12722	10650	13679	15362	4881	3511	1424	4917	11640
95	10207	8507	10723	7148	20788	19974	10779	19000	14481	8968	10909	16915	15061	11861	9953	13174	14912	3913	1576	2439	4525	11461
96	9957	9682	14692	10525	10967	9349	5137	8225	4373	4307	809	6156	4509	1383	2041	3630	5129	7075	11868	12920	7067	4330
97	9352	9149	14170	10075	11410	9609	5807	8411	4872	4867	1507	6074	4292	1039	1466	3086	4683	6997	11931	12831	6873	3632
98	9326	8684	13556	9181	12654	11383	4725	10344	6070	3141	2266	8369	6665	3423	2371	5359	7032	4972	9655	10794	5143	5050
99	14366	14605	19571	15810	6431	3723	8274	2397	3220	8822	5791	2082	3153	5147	7305	5402	4907	12936	17625	18782	12888	7888
100	12776	13102	18028	14390	8127	5302	8448	3848	3876	8606	5156	1226	1459	3991	6089	3786	3216	11975	16866	17804	11798	6312
101	12730	12870	17865	14015	7806	5509	7057	4254	2585	7294	4011	2594	2211	3303	5460	3931	3974	11089	15834	16934	11027	6279
102	9898	10129	15088	11390	10664	8205	7699	6810	4848	7162	3463	3864	1902	1521	3244	1176	2254	9275	14338	15036	8969	3429
103	19666	19982	24923	21209	3585	1747	12047	3048	7282	13204	10863	6467	8287	10524	12680	10677	9799	18101	22509	23914	18159	13208
104	19338	19676	24606	20923	3882	1576	11990	2743	7149	13095	10664	6110	7955	10262	12419	10353	9442	17899	22356	23722	17934	12888
105	18008	18410	23303	19712	4905	1518	11588	1685	6548	12500	9773	4727	6637	9157	11310	9051	8046	16962	21576	22805	16922	11592
106	18512	18897	23800	20183	4575	1452	11792	2061	6808	12771	10140	5240	7134	9592	11748	9545	8563	17350	21915	23188	17333	12085
107	19028	19384	24304	20645	4131	1461	11909	2468	7010	12968	10463	5782	7645	10007	12165	10049	9112	17691	22189	23521	17707	12586
108	8983	9575	14319	11091	12177	9301	9828	7796	6896	9120	5503	4345	2604	3474	4329	1188	1072	10165	15358	15678	9620	2863
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110	2202	2069	3183	2640	22436	20127	15323	18701	15996	13432	12343	15421	13486	11599	9667	11077	12206	8306	11310	9492	7160	8542
111	2524	2570	2830	3057	22882	20539	15826	19105	16460	13936	12823	15802	13879	12049	10136	11476	12567	8792	11693	9798	7651	8946
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113	3976	2672	3276	1300	22764	20758	14763	19405	16187	12796	12367	16312	14322	12000	9906	11918	13264	7060	9251	7234	6045	9406
114	4066	3062	2453	2061	23416	21336	15551	19962	16859	13589	13063	16813	14834	12616	10550	12421	13707	7885	9969	7838	6864	9891
115	4193	3440	1805	2684	23907	21766	16166	20376	17371	14211	13599	17182	15216	13087	11046	12800	14034	8544	10586	8391	7514	10261
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143	8334	9612	7653	10544	27301	24333	22196	22804	21530	20483	18475	19286	17728	17099	15715	15657	16009	16078	19152	17077	14900	13558
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145	10815	12155	10097	13118	29101	25997	24526	24467	23563	22862	20681	20961	19534	19197	17949	17598	17765	18618	21722	19619	17437	15657
146	11394	12754	10722	13736	29478	26342	25051	24813	24006	23402	21173	21314	19923	19662	18452	18024	18144	19214	22346	20246	18032	16126
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148	8042	7507	2724	6533	27957	25836	19902	24442	21401	17919	17595	21225	19268	17149	15092	16852	18041	11944	12608	9906	11067	14312
149	7635	7173	2291	6295	27659	25497	19726	24094	21119	17748	17331	20855	18906	16838	14798	16492	17656	11827	12700	10041	10917	13951
150	6976	6547	1629	5745	27048	24862	19214	23455	20519	17242	16746	20207	18261	16220	14192	15847	17001	11379	12494	9901	10438	13307
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153	8204	7993	2970	7343	28504	26229	20828	24800	22011	18861	18270	21496	19576	17665	15674	17172	18245	13023	14037	11381	12074	14640
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To be continued on next page...

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Calculated:
9/14/2018 11:15 PM/3.0.654

DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
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162	4529	5197	2910	5700	24964	22409	18408	20930	18690	16550	15192	17512	15679	14219	12445	13338	14196	11501	14183	12068	10360	10889
163	7291	8969	9304	10483	23853	20717	19925	19187	18486	18415	15861	15686	14309	14228	13221	12473	12523	15065	19044	17471	13893	10737
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166	9120	10800	10900	12303	24883	21637	21495	20117	19780	20044	17350	16660	15429	15636	14773	13758	13623	16868	20874	19284	15700	12212
167	6493	7782	6283	8778	25751	22869	20389	21347	19861	18661	16723	17835	16204	15405	13955	14060	14525	14247	17427	15440	13068	11878
168	6101	7229	5311	8066	25847	23054	20105	21540	19829	18329	16570	18044	16348	15351	13795	14135	14717	13682	16659	14596	12513	11859
169	10036	11712	11683	13204	25502	22214	22336	20700	20516	20907	18165	17270	16104	16422	15613	14501	14294	17783	21786	20177	16616	13028
170	6850	7624	4433	8054	27093	24412	20812	22912	20924	18966	17508	19443	17682	16440	14745	15400	16111	13907	16356	14081	12774	13025
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173	5357	6007	3112	6415	25769	23189	19232	21705	19511	17370	16021	18274	16456	15037	13273	14126	14952	12263	14788	12587	11131	11691
174	5767	6459	3455	6874	26136	23526	19674	22038	19904	17817	16435	18594	16792	15426	13682	14476	15267	12724	15227	13003	11592	12057
175	6667	7843	5895	8705	26223	23382	20646	21863	20266	18886	17059	18357	16696	15797	14286	14518	15038	14302	17301	15232	13130	12286
176	5883	6088	1890	6019	26374	23940	19306	22482	19990	17390	16368	19110	17233	15559	13675	14856	15818	11939	13946	11579	10865	12357
177	4628	4634	1102	4529	25038	22685	17819	21245	18607	15897	14944	17920	16011	14204	12276	13613	14662	10450	12638	10385	9370	11090
178	4284	4223	1195	4115	24652	22321	17397	20886	18209	15475	14537	17576	15658	13815	11877	13256	14329	10036	12294	10084	8952	10728
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180	3311	4545	4428	5662	23333	20672	17318	19178	17186	15539	13838	15726	13938	12701	11065	11643	12397	11008	14341	12529	9828	9267
181	8366	10034	10119	11519	24619	21424	20943	19898	19380	19456	16843	16417	15113	15173	14229	13357	13315	16150	20105	18495	14978	11709
182	6875	8174	6605	9168	26030	23123	20752	21599	20175	19030	17063	18084	16473	15726	14298	14349	14782	14639	17813	15815	13459	12193
183	10299	11735	10151	12832	28126	24988	23813	23459	22681	22191	19891	19960	18575	18353	17184	16690	16794	18168	21493	19498	16983	14824
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185	10879	12338	10806	13462	28428	25253	24301	23726	23066	22701	20341	20239	18897	18770	17649	17061	17107	18758	22128	20146	17573	15252
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191	2974	4182	4291	5312	23099	20470	16991	18982	16921	15204	13543	15542	13736	12436	10772	11424	12218	10646	13990	12198	9466	9024
192	11035	12400	10425	13394	29147	26021	24690	24491	23658	23040	20816	20990	19588	19309	18093	17679	17812	18859	22011	19926	17676	15772
193	6148	7744	7709	9133	24029	21022	19412	19493	18383	17803	15503	15975	14452	14006	12785	12442	12714	14028	17772	16080	12845	10465
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200	5288	5420	1406	5342	25757	23357	18627	21906	19352	16709	15714	18554	16663	14933	13030	14276	15275	11263	13354	11036	10186	11766
201	5033	5100	1175	4992	25476	23100	18292	21654	19056	16371	15404	18316	16415	14646	12730	14023	15046	10913	13024	10726	9837	11506
202	4860	5798	3902	6518	25060	22401	18868	20905	18890	17049	15494	17448	15668	14406	12727	13373	14118	12210	15089	13028	11050	10989
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204	4185	5095	3594	5849	24476	21860	18180	20372	18267	16355	14839	16932	15126	13785	12076	12810	13606	11512	14454	12445	10351	10397
205	6735	8214	7429	9431	25155	22170	20315	20642	19446	18660	16483	17123	15579	15041	13744	13536	13852	14616	18110	16268	13431	11497
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WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
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2	5436	2117	1749	790	1709	11918	13483	14196	9745	10528	9632	1373	8453	2647	6259	13590	10119	9561	4598	8383	6649	11986
3	6088	3301	2944	1957	1971	11387	12341	13120	8552	9424	8512	2486	7722	3821	7067	12426	9392	10037	3412	7252	5538	11111
4	5856	3518	3213	2186	2523	10833	11971	12688	8372	9428	8117	2877	7176	4009	6908	12087	8846	9703	3299	7229	5555	10592
5	5976	7523	7520	6686	7895	5453	9705	9512	8831	11327	6183	7704	2323	7736	7322	10215	3843	7530	6149	9275	8280	6125
6	4593	6487	6549	5820	7319	6285	11043	10894	9786	12063	7434	6858	3671	6637	5938	11524	5093	6409	6435	9927	8738	7459
7	6167	8087	8113	7315	8597	4772	9805	9448	9320	11910	6449	8342	2102	8269	7480	10369	3420	7278	6864	9895	8956	5826
8	6382	7092	7011	6085	7001	6438	9134	9223	7689	10077	5404	7055	2710	7386	7747	9549	4379	8522	4863	7998	6978	6332
9	7378	7813	7687	6716	7372	6439	8146	8311	6804	9332	4399	7636	2436	8147	8741	8548	4056	9473	4579	7325	6473	5702
10	4234	3664	3601	2736	4180	9353	12067	12452	9286	10829	8184	3757	6071	3969	5452	12330	7709	7818	4653	8603	7062	9760
11	4339	4186	4133	3270	4643	8828	11670	11998	9090	10776	7799	4288	5540	4473	5616	11960	7175	7699	4653	8553	7073	9241
12	4096	4501	4494	3688	5161	8383	11663	11895	9331	11134	7820	4720	5232	4740	5414	11993	6839	7259	5068	8919	7484	8982
13	9225	9825	9684	8699	9180	5699	6337	6315	6223	9156	2925	9590	1946	10167	10587	6848	2929	10823	5715	7445	7055	3870
14	7523	5024	4648	3685	2978	11215	10903	11859	6849	7724	7171	4087	7294	5550	8609	10915	8919	11236	1693	5535	3845	10317
15	8463	9460	9365	8418	9136	4985	7233	7014	7178	10043	3937	9362	1000	9760	9817	7789	2371	9855	6100	8243	7694	3974
16	11202	11996	11853	10864	11264	5441	4758	4279	6508	9663	2673	11745	3125	12336	12553	5458	2842	12339	7484	8337	8367	2120
17	11524	12396	12259	11273	11687	5348	4638	3986	6770	9937	2942	12158	3373	12732	12870	5385	2877	12548	7901	8669	8746	1774
18	10296	10869	10714	9718	10088	5787	5322	5229	5952	9030	2274	10586	2607	11222	11657	5888	2994	11753	6352	7520	7382	3153

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9/14/2018 11:15 PM/3.0.654

DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
19	12677	12549	12312	11282	11155	8149	2888	3739	4141	7306	1024	12010	5360	12972	14041	3253	5505	14448	6803	6374	6889	4479
20	9310	7697	7365	6355	5778	10115	8113	9205	4220	5885	4502	6880	6068	8194	10561	8095	7470	12430	1328	3707	2637	8294
21	5385	2660	2353	1325	2144	11283	12819	13503	9210	10160	8958	2076	7768	3157	6333	12944	9436	9397	4101	7981	6275	11283
22	7641	7378	7187	6174	6529	7603	8140	8606	6006	8327	4260	7012	3569	7771	8984	8420	5130	10180	3403	6255	5313	6514
23	5189	777	701	1700	2835	13500	15816	16470	12043	12607	11952	1153	10369	1013	5505	15934	12003	9404	6886	10530	8775	14038
24	8360	6179	5814	4835	4096	10890	9794	10837	5678	6730	6132	5265	6872	6697	9519	9775	8426	11860	546	4511	2920	9591
25	7321	5180	4838	3835	3423	10642	10510	11398	6678	7793	6731	4362	6717	5687	8462	10560	8342	10913	1612	5577	3959	9762
26	6845	4312	3949	2968	2542	11148	11437	12300	7543	8458	7646	3439	7323	4832	7905	11489	8976	10639	2401	6270	4577	10527
27	5956	7216	7190	6328	7467	5881	9613	9527	8490	10925	5999	7336	2523	7455	7314	10086	4123	7777	5675	8853	7825	6307
28	6797	8843	8868	8066	9315	4035	9492	8990	9436	12148	6332	9092	1665	9021	8086	10106	2744	7560	7368	10197	9364	5208
29	9238	9339	9154	8142	8411	6761	6309	6646	5337	8170	2535	8974	2873	9722	10600	6686	4006	11238	4706	6395	5974	4796
30	5939	4934	4732	3719	4305	9128	10503	11058	7533	9164	6614	4577	5386	5345	7190	10709	7054	9252	3075	6943	5490	8796
31	5973	4607	4375	3350	3833	9599	10805	11423	7618	9090	6923	4166	5859	5042	7181	10979	7527	9443	2924	6864	5341	9246
32	5938	4245	3989	2958	3381	10027	11174	11834	7823	9147	7302	3738	6309	4700	7099	11324	7978	9548	2952	6924	5339	9699
33	5276	3346	3112	2089	2940	10421	12066	12681	8708	9914	8186	2950	6871	3792	6364	12228	8540	9088	3736	7701	6061	10390
34	4311	3254	3685	4570	6191	14197	18271	18631	15034	15864	14384	4474	11826	2713	3725	18508	13316	7811	9926	13736	11995	15626
35	4536	2706	3108	4046	5556	14235	17932	18364	14548	15288	14042	3856	11691	2184	4137	18140	13221	8259	9415	13179	11431	15481
36	5187	3102	3453	4445	5755	14896	18452	18927	14944	15567	14563	4114	12316	2622	4726	18638	13857	8834	9794	13488	11734	16100
37	2580	3135	3607	4188	6194	12514	17082	17300	14244	15396	13219	4494	10317	2646	2146	17383	11753	6269	9275	13207	11512	14117
38	1922	3229	3685	4110	6209	11843	16562	16730	13879	15151	12715	4565	9694	2807	1708	16886	11112	5773	8988	12946	11277	13491
39	2335	6027	6286	5961	7973	7712	13846	13586	12470	14528	10264	6912	6241	5936	3480	14345	7385	3790	8549	12333	10957	9878
40	2354	5553	5778	5383	7351	7770	13406	13236	11855	13866	9762	6359	5935	5511	3642	13876	7190	4464	7866	11665	10277	9651
41	1758	4005	4461	4873	6983	11798	16968	17048	14469	15828	13149	5342	9901	3574	1034	17324	11251	5159	9648	13616	11964	13676
42	2107	5737	6183	6499	8650	11377	17537	17405	15523	17117	13822	7055	10090	5327	903	17973	11258	3616	10923	14892	13300	13753
43	12282	11983	11734	10703	10516	8357	3428	4415	3629	6805	528	11408	5282	12417	13642	3666	5634	14225	6138	5758	6218	4893
44	11833	11341	11078	10046	9794	8604	4101	5174	3172	6321	686	10726	5253	11785	13187	4238	5825	13967	5389	5114	5483	5388
45	12005	11267	10982	9953	9565	9212	4326	5607	2539	5680	1328	10584	5765	11729	13348	4328	6422	14303	5087	4493	4957	6031
46	11903	10991	10692	9667	9196	9549	4739	6087	2195	5279	1785	10265	5991	11463	13236	4675	6748	14334	4690	4012	4465	6475
47	18924	18402	18105	17079	16511	13227	3601	4932	7120	8843	7164	17665	11420	18869	20286	3011	11091	20628	11980	9537	10944	9067
48	17474	17208	16937	15905	15505	11540	1987	3288	6482	8729	5768	16552	9810	17655	18838	1642	9422	19031	10986	9025	10248	7380
49	17836	17806	17555	16523	16231	11322	2395	2917	7416	9758	6285	17210	9962	18238	19200	2422	9400	19173	11738	9977	11136	7189
50	18609	18226	17941	16912	16422	12678	3162	4340	7160	9083	6870	17528	10990	18683	19972	2696	10597	20210	11891	9636	10977	8520
51	12924	12423	12152	11120	10792	9110	3090	4442	3101	6254	1279	11779	6067	12873	14279	3147	6406	14967	6324	5424	6098	5531
52	17197	16522	16217	15194	14596	12222	2507	4457	5224	7182	5463	15763	9974	16995	18553	1626	9860	19104	10065	7685	9046	8111
53	17204	16385	16069	15051	14379	12547	2923	4945	4907	6703	5535	15590	10153	16867	18555	2007	10123	19225	9859	7309	8728	8467
54	16918	16005	15682	14667	13955	12548	3083	5176	4447	6214	5325	15188	10015	16491	18264	2160	10065	19027	9444	6827	8262	8512
55	14331	12636	12262	11293	10263	12572	5624	7596	950	2634	4603	11661	9065	13155	15610	5044	9785	17133	5924	2771	4306	9212
56	16186	16084	15831	14799	14523	10228	678	2213	5936	8548	4567	15488	8453	16517	17551	983	8065	17677	10044	8507	9555	6072
57	17452	17332	17073	16042	15715	11212	1948	2865	6857	9210	5829	16716	9664	17769	18816	1874	9185	18887	11214	9417	10582	7058
58	4775	5081	5027	4149	5382	7998	10936	11182	8689	10602	7094	5157	4645	5360	6109	11268	6283	7723	4648	8401	7039	8350
59	8681	8552	8354	7336	7577	7240	6979	7436	5343	7973	3115	8154	3222	8947	10037	7289	4569	10944	3962	6060	5439	5587
60	7205	5425	5117	4093	3911	10090	10112	10934	6516	7859	6295	4716	6156	5911	8396	10200	7779	10656	1687	5633	4105	9212
61	5135	7257	7322	6590	8052	5514	10733	10451	9872	12297	7256	7627	3125	7399	6449	11264	4432	6453	6884	10206	9117	6856
62	7345	7529	7381	6395	6968	6895	8236	8512	6573	9009	4420	7293	2891	7883	8704	8592	4500	9636	4128	6968	6061	6075
63	11037	11198	10999	9980	10104	6876	4478	4791	4892	8017	1135	10781	3708	11590	12402	4939	4107	12744	6040	6646	6718	3804
64	13815	13736	13496	12465	12300	8633	1710	2766	4615	7669	2206	13185	6268	14160	15180	2191	6158	15450	7899	7051	7775	4666
65	9731	9189	8941	7910	7829	8124	6223	6991	4139	6843	2354	8634	4219	9624	11075	6414	5358	12134	3699	5031	4663	5896
66	9520	9848	9679	8675	9012	6283	5996	6167	5612	8550	2407	9529	2552	10216	10885	6446	3494	11297	5333	6863	6537	4166
67	10038	8914	8614	7589	7180	9355	6697	7770	3414	5782	3071	8194	5400	9389	11345	6721	6602	12790	2765	3847	3413	7100
68	8859	10179	10109	9184	9987	4156	7195	6711	7770	10726	4278	10148	648	10453	10191	7836	1476	9866	6992	9003	8534	3263
69	631	4802	5206	5345	7520	10398	16112	16041	14049	15681	12372	6034	8773	4486	797	16531	10026	3925	9494	13456	11886	12495
70	2816	4484	4957	5541	7549	12822	18058	18154	15452	16699	14229	5842	11006	3982	1725	18403	12344	5609	10550	14501	12820	14777
71	694	5158	5534	5562	7730	9769	15684	15552	13808	15553	11984	6326	8249	4892	1388	16127	9460	3543	9391	13328	11800	11941
72	8051	10216	10237	9422	10600	2772	8942	8166	9681	12574	6227	10443	1532	10396	9302	9643	1605	8325	8304	10757	10115	4116
73	2176	4715	5179	5632	7726	12098	17609	17630	15212	16599	13812	6065	10417	4258	953	17985	11710	4855	10416	14385	12738	14165
74	11102	10261	9974	8945	8576	9090	5302	6447	2790	5706	1822	9577	5385	10725	12435	5334	6284	13558	4130	4167	4293	6296
75	11214	10070	9757	8737	8199	9771	5749	7045	2330	5058	2520	9303	5987	10552	12527	5676	6968	13864	3684	3434	3583	7038
76	11034	9726	9402	8387	7778	10045	6212	7526	2398	4873	2984	8922	6189	10217	12332	6113	7253	13807	3250	3105	3121	7439
77	13842	13162	12871	11843	11374	10000	2727	4479	2819	5814	2271	12453	7053	13627	15193	2509	7336	15951	6854	5340	6282	6275
78	13185	12853	12595	11563	11305	8862	2579	3841	3647	6772	1424	12248	6041	13293	14546	2762	6221	15075	6865	6015	6698	5137
79	13008	11888	11565	10550	9898	10528	4413	6093	1327	4500	2557	11082	7098	12377	14332	4131	7747	15498	5367	3697	4601	7202
80	13610	13384	13133	12101	11874	8847	2029	3288	4096	7169	1882	12799	6259	13818	14973	2315	6289	15380	7443	6524	7259	4978
81	18925	18299	17993	16970	16349	13453	3750	5225	6893	8499	7168	17534	11526	18772	20284	3074	11259	20715	11823	9267	10711	9294
82	13149	11826	11486	10483	9713	11052	4883	6635	737	3913	3114	10965	7543	12326	14458	4524	8261	15770	5206	3163	4200	7782
83	12524	11159	10820	9816	9061	10820	5336	6967	994	3994	3036	10301	7184	11659	13826	5055	8015	15217	4546	2861	3674	7740
84	12329	10797	10446	9452	8618	11085	5878	7500	1092	3709	3449	9901	7355	11305	13615	5586	8278	15145	4131	2367	3135	8136
85	14104	12257	11873	10918	9815	12772	6162	8101	1036	2187	4866	11249	9164	12782	15365	5605	9972	17017	5553	2211	3801	9532
86	10324	8814	8479	7472	6822	10207	7145	8383	3127	5107	3741	7982	6230	9312	11597	7066	7463	13286	2294	3066	2551	7943
87	10161	8358	8002	7013	6214	10727	7841	9112	3494	5008	4475	7456	6707	8870	11399	7728	8020	13306	1693	2838	1953	8619

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DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
88	3667	2248	2708	3513	5287	13300	17146	17523	13930	14830	13258	3555	10783	1703	3434	17380	12301	7549	8839	12683	10951	14578
89	3165	6354	6553	6084	7964	6906	12914	12632	11707	13881	9369	7086	5285	6341	4390	13427	6443	4478	8030	11709	10410	8930
90	4823	6049	6055	5245	6591	6835	10693	10709	9079	11262	6971	6273	3748	6261	6187	11117	5313	7113	5565	9107	7883	7539
91	10767	11450	11301	10308	10690	5603	4988	4718	6196	9322	2395	11182	2843	11797	12123	5621	2879	12061	6923	7911	7867	2620
92	2176	6363	6672	6471	8556	8148	14695	14379	13376	15414	11146	7368	7022	6198	3033	15210	8073	2925	9402	13214	11816	10582
93	2814	6877	7162	6891	8929	7519	14330	13937	13245	15392	10857	7822	6586	6743	3687	14874	7554	2942	9470	13209	11869	10068
94	1966	5988	6418	6647	8816	10827	17185	16996	15336	17028	13509	7273	9660	5613	1127	17643	10783	3078	10846	14802	13243	13286
95	2941	7390	7746	7671	9805	8655	15890	15450	14779	16850	12432	8504	8116	7147	3201	16442	8992	1495	10838	14651	13253	11504
96	10166	10125	9916	8893	9001	7141	5408	5882	4677	7657	1601	9683	3496	10527	11528	5760	4335	12144	4996	6053	5891	4608
97	9969	9656	9425	8397	8398	7689	5775	6433	4298	7161	1885	9150	3890	10076	11324	6033	4898	12178	4312	5459	5213	5302
98	8197	8855	8734	7765	8385	5758	7338	7351	6682	9441	3766	8684	1714	9182	9560	7813	3181	9937	5293	7570	6939	4661
99	15987	15342	15045	14019	13476	11284	1902	4047	4287	6629	4264	14607	8845	15811	17343	1029	8826	17933	8943	6827	8071	7242
100	14874	13906	13586	12570	11904	11271	3103	5155	2589	5114	3522	13104	8318	14391	16213	2499	8618	17133	7378	5136	6383	7481
101	14126	13558	13275	12245	11819	9913	2239	4031	3281	6218	2429	12872	7133	14017	15481	2053	7304	16129	7306	5817	6769	6084
102	12004	10908	10593	9574	8999	9992	5041	6486	1787	4816	2269	10131	6373	11391	13325	4901	7187	14554	4470	3531	4052	6958
103	21258	20740	20438	19414	18799	15155	5824	6748	9311	10663	9503	19984	13644	21211	22620	5334	13195	22867	14274	11621	13116	11023
104	21034	20450	20143	19121	18476	15104	5660	6705	8964	10269	9274	19679	13490	20924	22395	5119	13088	22708	13956	11253	12762	10959
105	20020	19228	18906	17891	17162	14699	4989	6446	7601	8797	8290	18412	12733	19713	21375	4277	12497	21902	12661	9827	11369	10541
106	20433	19703	19385	18368	17661	14908	5265	6584	8110	9321	8685	18899	13059	20185	21791	4609	12767	22250	13154	10350	11886	10748
107	20808	20169	19859	18838	18170	15026	5498	6646	8643	9914	9047	19386	13324	20647	22168	4914	12962	22534	13654	10914	12433	10873
108	12469	10569	10189	9229	8180	11950	6806	8496	1495	2947	4459	9578	8124	11093	13714	6444	9148	15505	3862	1341	2329	9126
109	6247	1843	1635	2421	2665	14445	16264	17035	12210	12500	12440	1479	11193	2044	6497	16326	12844	10449	7089	10506	8754	14797
110	6845	2490	2297	3054	2963	15100	16737	17560	12553	12690	12938	2069	11818	2641	7024	16772	13474	11024	7475	10752	9010	15400
111	7242	2953	2787	3559	3353	15601	17182	18029	12930	12972	13396	2570	12322	3058	7355	17204	13978	11392	7884	11073	9341	15899
112	4533	1213	1580	2556	4040	13571	16602	17134	13058	13753	12716	2325	10714	767	4597	16771	12303	8638	7913	11648	9898	14461
113	4891	1704	2017	3027	4334	14082	17114	17662	13507	14123	13231	2668	11249	1299	4824	17274	12836	8916	8354	12040	10286	14997
114	5664	2374	2586	3618	4586	14904	17748	18354	13982	14436	13875	3059	12032	2060	5497	17879	13629	9614	8827	12401	10645	15766
115	6314	2943	3093	4114	4824	15557	18227	18882	14335	14657	14367	3438	12645	2683	6096	18335	14251	10220	9193	12666	10913	16364
116	2929	7159	7581	7757	9932	10533	17516	17183	16009	17849	13943	8425	9827	6797	2322	18025	10799	2018	11704	15627	14118	13314
117	3216	7604	8007	8098	10271	9906	17176	16761	15899	17853	13676	8827	9421	7278	2890	17715	10309	1282	11758	15639	14177	12820
118	5274	9717	10107	10133	12291	9591	17828	17162	17158	19339	14572	10908	10000	9408	5037	18449	10573	1076	13380	17154	15790	13018
119	5536	9966	10306	10162	12255	7947	16460	15686	16172	18531	13360	11038	8669	9738	5707	17119	9090	1768	12764	16389	15136	11489
120	4914	9342	9684	9546	11645	7981	16225	15526	15758	18062	13038	10417	8405	9115	5116	16861	8934	1349	12240	15906	14623	11373
121	3608	7734	8019	7736	9756	7074	14434	13914	13664	15924	11086	8674	6619	7597	4346	15020	7414	2622	10102	13763	12481	9921
122	7174	9903	9990	9278	10710	2915	10398	9585	10926	13719	7604	10316	2812	10010	8338	11097	2990	6963	9004	11807	11005	5444
123	6540	9290	9386	8693	10177	3554	10683	9978	10892	13603	7712	9732	2930	9387	7717	11349	3417	6508	8676	11636	10752	5916
124	8286	11019	11096	10361	11725	1779	10061	9040	11167	14082	7634	11397	3041	11135	9426	10819	2558	7775	9735	12270	11605	4782
125	7741	10455	10534	9807	11197	2344	10172	9259	10990	13849	7554	10844	2830	10569	8896	10900	2681	7391	9327	11987	11259	5055
126	9297	12111	12189	11452	12794	759	10093	8862	11718	14716	8050	12488	3778	12224	10399	10902	2813	8463	10652	12989	12428	4574
127	8901	11638	11710	10966	12298	1152	9935	8796	11355	14326	7732	12001	3338	11759	10028	10723	2524	8251	10176	12570	11977	4508
128	16090	15219	14902	13884	13221	11864	2698	4847	3808	5913	4508	14424	9226	15701	17437	1837	9331	18208	8697	6281	7630	7884
129	18929	18689	18416	17385	16959	12636	3415	4232	7794	9786	7246	18025	11172	19138	20293	3120	10675	20395	12433	10293	11598	8497
130	19375	19236	18970	17939	17552	12795	3877	4399	8439	10444	7752	18595	11524	19679	20739	3686	10944	20735	13032	10946	12238	8690
131	9028	4612	4334	4851	3753	16865	17469	18515	12820	12405	13818	3815	13360	4821	9210	17392	15030	13215	8056	10708	9059	16771
132	8753	4371	4119	4700	3770	16751	17568	18575	12987	12650	13886	3661	13297	4549	8900	17510	14965	12925	8159	10916	9249	16749
133	11226	6788	6478	6877	5365	18704	18389	19627	13392	12446	14928	5867	15040	7022	11417	18207	16706	15422	9099	11050	9569	18272
134	11710	7265	6946	7314	5730	19076	18539	19821	13476	12413	15130	6314	15377	7509	11914	18334	17039	15912	9311	11093	9659	18561
135	12108	7663	7345	7709	6103	19448	18791	20100	13687	12541	15415	6712	15734	7905	12305	18571	17394	16307	9605	11277	9877	18893
136	12633	8172	7831	8125	6394	19704	18684	20055	13498	12201	15393	7152	15930	8444	12880	18430	17580	16849	9621	11042	9715	19001
137	13439	8975	8622	8870	7059	20304	18913	20352	13644	12157	15724	7917	16480	9261	13712	18620	18119	17662	10015	11140	9911	19461
138	13750	9289	8913	9083	7170	20290	18547	20038	13223	11614	15447	8167	16415	9608	14086	18224	18039	17984	9814	10694	9542	19296
139	14140	9678	9303	9472	7553	20648	18790	20305	13442	11758	15730	8557	16763	9996	14472	18452	18383	18373	10128	10901	9791	19617
140	13695	9345	9085	9576	8139	21473	20897	22227	15741	14429	17547	8549	17812	9507	13734	20658	19476	17818	11740	13290	11949	21014
141	14181	9849	9596	10100	8673	22006	21390	22735	16211	14844	18059	9071	18346	10001	14196	21142	20010	18289	12257	13747	12429	21543
142	14470	10118	9855	10335	8858	22201	21434	22806	16222	14789	18139	9311	18515	10281	14503	21172	20177	18591	12353	13741	12455	21678
143	14723	10395	10141	10642	9197	22535	21810	23180	16598	15155	18512	9614	18862	10544	14730	21548	20525	18826	12723	14115	12832	22039
144	15149	10835	10586	11097	9660	22998	22242	23623	17014	15528	18959	10068	19326	10977	15137	21972	20988	19239	13175	14522	13257	22499
145	17297	12965	12704	13179	11645	24989	23730	25213	18391	16620	20600	12157	21250	13119	17290	23400	22904	21393	14893	15847	14726	24318
146	17918	13578	13313	13775	12213	25552	24143	25655	18778	16930	21060	12756	21794	13737	17916	23795	23444	22018	15383	16224	15146	24828
147	18266	13939	13679	14151	12603	25944	24539	26054	19170	17307	21461	13130	22191	14091	18248	24189	23841	22354	15784	16615	15544	25229
148	9063	6906	7126	8157	8793	18961	22285	22889	18367	18506	18416	7505	16410	6532	8288	22403	17958	12129	13242	16598	14857	20185
149	9032	6641	6836	7862	8408	18858	21979	22620	17993	18081	18119	7171	16223	6294	8322	22081	17787	12233	12881	16190	14454	19985
150	8685	6068	6241	7262	7754	18418	21364	22030	17342	17418	17510	6545	15702	5745	8058	21455	17282	12043	12237	15530	13795	19452
151	9088	6322	6467	7479	7850	18769	21543	22248	17439	17432	17702	6718	15997	6026	8487	21616	17587	12486	12359	15577	13852	19733
152	9422	6717	6865	7877	8235	19139	21940	22646	17822	17790	18099	7115	16387	6418	8789	22011	17974	12760	12748	15947	14225	20126
153	10316	7634	7771	8777	9049	20063	22810	23541	18621	18495	18979	7992	17313	7342	9644	22867	18901	13571	13576	16695	14986	21048
154	10399	7580	7697	8693	8886	20086	22683	23443	18442	18268	18863	7881	17281	7309	9766	22727	18879	13727	13418	16488	14787	21003
155	10688	7709	7799	8777	8854	20299	22693	23494	18374	18120	18891	7931	17426	7468	10098	22718	19036	14089	13386	16376	14688	21129
156	10925	6699	6504	7150	6143	19211	19734	20845	14918	14183	16141	6113	15750	6789	10890	19615	17420	14994	10338	12670	11106	19167

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
157	11337	7064	6847	7450	6324	19489	19782	20937	14894	14056	16231	6412	15978	7178	11331	19641	17648	15428	10411	12603	11074	19352
158	11666	7424	7218	7837	6729	19883	20173	21336	15267	14387	16630	6799	16380	7524	11630	20027	18050	15735	10808	12961	11445	19757
159	11955	7683	7463	8053	6870	20079	20210	21403	15257	14306	16697	7015	16543	7798	11940	20048	18213	16040	10870	12923	11433	19888
160	12270	8190	8034	8736	7793	20807	21340	22478	16455	15568	17772	7704	17383	8225	12113	21203	19052	16237	11959	14152	12634	20815
161	10111	6025	5887	6633	5924	18696	19718	20734	15065	14541	16044	5614	15352	6052	10001	19647	17016	14119	10305	12914	11289	18858
162	9798	5651	5495	6221	5485	18289	19283	20296	14647	14160	15607	5197	14927	5700	9733	19216	16592	13842	9871	12511	10877	18425
163	14589	10142	9749	9850	7857	20783	18557	20128	13163	11335	15603	8972	16854	10485	14974	18186	18455	18825	10108	10603	9591	19601
164	14995	10547	10156	10259	8263	21165	18827	20421	13416	11517	15916	9380	17228	10888	15376	18442	18825	19232	10458	10851	9882	19947
165	16001	11546	11161	11281	9294	22174	19632	21269	14193	12147	16807	10394	18226	11876	16359	19218	19815	20237	11421	11621	10740	20898
166	16418	11968	11578	11678	9669	22470	19741	21408	14288	12158	16982	10803	18506	12305	16791	19308	20084	20654	11665	11717	10897	21124
167	12976	8603	8333	8809	7362	20696	20203	21508	15087	13871	16821	7784	17038	8779	13049	19981	18703	17119	11005	12662	11282	20251
168	12235	7936	7704	8268	7017	20268	20247	21468	15250	14231	16765	7231	16702	8067	12239	20070	18371	16334	10935	12892	11427	20017
169	17327	12874	12487	12594	10586	23351	20432	22136	14968	12723	17755	11716	19377	13205	17688	19974	20947	21563	12510	12401	11658	21948
170	12054	8045	7912	8649	7806	20717	21442	22546	16610	15794	17843	7624	17341	8054	11858	21322	19008	15983	12045	14336	12793	20807
171	11854	7911	7797	8563	7807	20620	21509	22583	16725	15970	17884	7547	17286	7898	11626	21404	18950	15750	12102	14477	12914	20780
172	11181	7182	7059	7817	7070	19877	20804	21859	16063	15388	17162	6799	16536	7184	10997	20710	18201	15123	11393	13847	12262	20033
173	10448	6401	6270	7025	6313	19085	20093	21119	15414	14844	16428	6008	15748	6415	10307	20016	17412	14430	10680	13243	11630	19254
174	10897	6862	6731	7479	6724	19543	20467	21516	15741	15098	16820	6460	16194	6875	10740	20377	17859	14864	11055	13538	11944	19688
175	12877	8571	8333	8879	7570	20856	20648	21909	15587	14452	17212	7844	17260	8706	12879	20448	18928	16975	11385	13190	11772	20539
176	9760	6139	6125	7025	6800	18904	20677	21566	16235	15917	16919	6087	15789	6019	9436	20666	17431	13550	11311	14194	12519	19413
177	8366	4640	4631	5546	5498	17406	19338	20169	15045	14937	15547	4634	14300	4529	8139	19360	15939	12264	10031	13113	11401	17939
178	7993	4219	4209	5127	5134	16986	18953	19768	14701	14654	15153	4222	13878	4115	7805	18983	15517	11929	9665	12802	11082	17520
179	10251	5817	5516	5950	4566	17859	17918	19078	13058	12339	14372	4930	14255	6046	10444	17781	15924	14445	8549	10805	9243	17561
180	9867	5431	5129	5569	4228	17497	17684	18814	12878	12249	14108	4547	13912	5663	10070	17562	15581	14065	8295	10664	9074	17242
181	15644	11190	10804	10925	8941	21844	19397	21016	13968	11978	16535	10037	17903	11521	16004	18995	19496	19880	11116	11398	10481	20600
182	13365	8995	8726	9200	7739	21077	20497	21822	15352	14073	17141	8176	17408	9169	13429	20263	19072	17503	11332	12909	11556	20605
183	17036	12636	12343	12740	11082	24391	22802	24328	17429	15579	19747	11737	20591	12833	17117	22449	22233	21187	14101	14874	13810	23567
184	17305	12890	12587	12958	11258	24540	22784	24336	17391	15477	19777	11963	20716	13100	17410	22415	22352	21470	14168	14829	13806	23649
185	17668	13258	12959	13337	11646	24930	23151	24711	17752	15811	20157	12341	21107	13463	17760	22776	22743	21826	14555	15187	14179	24037
186	18073	13667	13369	13750	12058	25339	23505	25078	18097	16119	20534	12753	21512	13869	18158	23123	23147	22228	14946	15530	14542	24431
187	18421	14009	13707	14076	12364	25629	23684	25276	18264	16237	20749	13083	21788	14216	18515	23290	23419	22580	15189	15694	14738	24679
188	18658	14235	13926	14275	12531	25766	23685	25297	18252	16174	20791	13288	21907	14452	18771	23278	23533	22828	15268	15681	14759	24762
189	8289	5712	5899	6925	7490	18025	21040	21686	17069	17202	17180	6233	15325	5376	7670	21141	16900	11666	11951	15291	13550	19080
190	9802	7067	7205	8211	8511	19515	22252	22977	18091	18007	18418	7432	16748	6777	9164	22314	18339	13126	13033	16187	14472	20482
191	9515	5073	4768	5207	3902	17147	17440	18545	12686	12139	13840	4184	13576	5313	9733	17334	15246	13717	8039	10508	8895	16926
192	17579	13231	12964	13420	11852	25191	23802	25307	18444	16620	20708	12402	21432	13394	17588	23459	23082	21686	15025	15893	14803	24468
193	13298	8833	8469	8685	6835	20046	18589	20033	13315	11830	15410	7746	16208	9135	13600	18293	17844	17527	9712	10811	9586	19167
194	13024	8562	8218	8497	6736	20024	18848	20249	13624	12239	15601	7531	16230	8838	13277	18577	17876	17242	9854	11145	9861	19264
195	15381	10936	10542	10633	8623	21467	18977	20597	13549	11571	16119	9762	17518	11280	15770	18575	19107	19618	10715	10979	10063	20195
196	17048	12599	12208	12301	10282	23021	20105	21805	14642	12415	17420	11431	19044	12938	17424	19650	20613	21285	12174	12075	11323	21611
197	16787	12345	11950	12025	9992	22696	19772	21469	14310	12099	17082	11164	18716	12691	17181	19320	20283	21024	11842	11742	10986	21275
198	7753	3846	3808	4706	4682	16615	18500	19321	14253	14230	14703	3785	13468	3781	7634	18529	15111	11750	9213	12366	10642	17097
199	9434	5792	5780	6683	6493	18558	20367	21244	15957	15686	16602	5750	15445	5674	9129	20363	17087	13248	11012	13939	12256	19073
200	9127	5457	5444	6349	6189	18223	20058	20923	15677	15449	16286	5419	15109	5342	8845	20060	16750	12967	10713	13681	11990	18739
201	8785	5111	5105	6018	5919	17875	19776	20623	15439	15268	15994	5099	14773	4992	8518	19789	16412	12642	10450	13474	11772	18410
202	10672	6413	6207	6837	5810	18893	19406	20513	14605	13901	15809	5799	15421	6518	10666	19291	17091	14762	10008	12368	10796	18834
203	10402	6115	5899	6514	5475	18566	19087	20186	14305	13642	15482	5476	15088	6234	10424	18977	16758	14509	9686	12085	10501	18500
204	10021	5728	5512	6134	5139	18191	18811	19885	14077	13488	15184	5096	14728	5850	10056	18714	16397	14136	9402	11889	10283	18155
205	13635	9188	8866	9203	7510	20827	19688	21096	14446	12997	16450	8216	17052	9433	13825	19409	18701	17834	10703	11955	10695	20107
206	11611	7626	7502	8256	7479	20318	21178	22252	16399	15661	17553	7237	16970	7625	11411	21074	18635	15537	11771	14157	12590	20458
207	12552	8238	7998	8542	7241	20520	20367	21614	15330	14244	16914	7507	16930	8377	12566	20175	18599	16658	11085	12949	11511	20218
208	13208	8908	8671	9217	7896	21189	20919	22196	15834	14650	17502	8182	17586	9040	13202	20710	19254	17301	11677	13422	12023	20855

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
1	6812	8954	5590	9227	14393	12323	10669	2835	2820	4312	18171	17936	17655	16822	6821	6270	9202
2	2356	13440	10098	5140	16139	13918	12411	5275	5910	8096	20528	20279	20101	18834	11098	9417	12857
3	2885	12689	9395	6270	14946	12725	11216	5390	5909	7974	19335	19086	18910	17639	10788	9529	11801
4	3428	12147	8847	6655	14750	12539	11001	4959	5441	7468	19076	18827	18638	17419	10249	9074	11356
5	8752	7129	3765	11015	14246	12318	10663	3314	2808	3140	17634	17409	17079	16485	5029	5350	8106
6	8100	8299	4982	9939	15436	13450	11789	1931	1490	2644	18944	18716	18397	17741	5354	4629	9487
7	9441	6625	3304	11564	14541	12670	11025	3506	2871	2652	17771	17551	17203	16703	4291	4885	8057
8	7905	7697	4370	10579	13341	11339	9678	3861	3585	4389	16953	16721	16422	15685	6270	6560	7813
9	8308	7292	4102	11267	12351	10366	8707	4866	4571	5164	15949	15717	15419	14682	6629	7378	6908
10	4938	11029	7662	7155	15518	13359	11745	2990	3484	5577	19577	19334	19094	18078	8511	7108	11061
11	5430	10495	7128	7681	15258	13119	11491	2753	3150	5162	19247	19006	18754	17787	8030	6793	10602
12	5929	10146	6777	7998	15422	13306	11667	2270	2622	4625	19324	19086	18821	17913	7521	6265	10490
13	10133	5759	3084	13263	11011	9199	7578	6614	6173	6141	14265	14041	13709	13156	6601	8354	4907

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
14	3920	12111	8966	7809	13245	11020	9534	6334	6688	8506	17688	17438	17278	15954	10975	10319	10598
15	10072	5537	2461	12941	12017	10215	8593	5814	5311	5139	15192	14972	14627	14132	5667	7344	5605
16	12222	4369	3084	15431	10033	8528	7053	8547	8013	7518	12720	12511	12130	11863	7033	9609	2875
17	12644	4059	3122	15838	10027	8599	7166	8862	8308	7718	12563	12359	11965	11774	7053	9772	2603
18	11046	5271	3206	14288	10216	8516	6943	7672	7204	6997	13283	13064	12716	12254	7037	9173	3821
19	12100	6768	5741	15794	7467	5840	4345	10139	9758	9733	10670	10442	10129	9532	9675	11920	2682
20	6698	10344	7586	10629	10572	8368	6816	7428	7489	8729	14909	14659	14484	13233	10466	10843	8022
21	2929	12754	9419	5826	15596	13381	11851	4886	5467	7605	19935	19686	19498	18271	10537	9041	12160
22	7482	8279	5201	10743	11876	9803	8149	5334	5200	6138	15728	15489	15227	14327	7800	8309	7242
23	2591	15320	11951	2882	18438	16213	14728	6143	6907	9149	22864	22614	22441	21149	12356	10003	15114
24	5016	11506	8503	8980	12073	9851	8357	6867	7103	8706	16510	16260	16102	14778	10896	10663	9616
25	4378	11539	8389	8129	13065	10849	9326	5960	6266	8017	17437	17188	17012	15748	10429	9878	10119
26	3501	12225	9004	7201	13938	11716	10213	5806	6220	8140	18344	18094	17925	16635	10756	9863	11008
27	8336	7436	4067	10714	14021	12058	10399	3331	2926	3537	17505	17278	16960	16307	5508	5720	8116
28	10170	5892	2606	12318	14407	12606	10979	4162	3474	2768	17469	17255	16890	16483	3755	4954	7620
29	9370	6790	4155	12710	10541	8613	6962	6728	6403	6723	14084	13852	13555	12830	7539	8956	5275
30	5226	10348	7062	8288	13776	11611	10002	4249	4493	6224	17888	17644	17416	16354	8729	8088	9697
31	4758	10817	7536	7906	13917	11734	10145	4475	4785	6601	18100	17854	17639	16526	9170	8409	10074
32	4304	11271	7985	7495	14159	11964	10392	4635	5009	6905	18397	18150	17945	16791	9549	8649	10492
33	3785	11857	8525	6655	15058	12858	11293	4345	4844	6904	19308	19061	18856	17697	9746	8471	11326
34	5897	16503	13207	3260	21409	19200	17652	6538	7317	9318	25666	25420	25206	24062	12579	9398	17230
35	5226	16448	13123	2691	20935	18719	17188	6559	7351	9429	25243	24996	24794	23606	12705	9667	16971
36	5320	17093	13762	2226	21338	19117	17605	7220	8013	10094	25694	25446	25254	24027	13370	10314	17539
37	6166	14890	11631	4655	20551	18371	16778	4894	5656	7604	24651	24408	24166	23139	10857	7681	15891
38	6285	14233	10986	5193	20148	17981	16374	4236	4992	6931	24186	23945	23693	22710	10185	7044	15320
39	8515	10282	7218	9059	18248	16237	14577	1228	1341	2741	21766	21539	21215	20569	5984	3213	12191
40	7924	10206	7040	8709	17698	15665	14006	556	975	2927	21293	21064	20751	20054	6205	3780	11832
41	7061	14297	11111	5765	20696	18544	16925	4348	5051	6825	24662	24423	24158	23228	10028	6696	15636
42	8786	14089	11088	7418	21608	19506	17862	4602	5122	6402	25374	25141	24845	24054	9389	5719	16001
43	11458	7195	5861	15194	7578	5804	4225	9789	9452	9575	11030	10796	10509	9781	9747	11786	3352
44	10732	7681	6039	14511	7813	5902	4263	9401	9115	9409	11502	11263	11002	10146	9838	11637	4098
45	10489	8325	6631	14360	7533	5532	3874	9639	9401	9822	11421	11179	10946	9965	10388	12054	4617
46	10111	8762	6949	14032	7603	5533	3875	9597	9398	9932	11635	11389	11177	10107	10644	12164	5112
47	17392	10787	11335	21416	3182	3973	4531	16402	16016	15841	4410	4187	3866	3652	15203	17964	5860
48	16415	9128	9665	20330	4378	4347	4258	14912	14492	14227	6000	5791	5417	5330	13521	16330	4173
49	17153	8738	9639	20994	5224	5382	5289	15233	14769	14346	6035	5853	5410	5748	13399	16392	4076
50	17317	10197	10840	21293	3764	4331	4679	16061	15652	15408	4819	4609	4239	4242	14683	17511	5326
51	11720	7825	6636	15561	6817	5017	3439	10469	10159	10342	10401	10163	9898	9077	10531	12558	3584
52	15475	10081	10105	19508	3146	2708	2739	14724	14383	14375	6135	5895	5652	4878	14040	16546	4954
53	15244	10487	10367	19316	2774	2153	2311	14768	14455	14531	6213	5967	5772	4777	14313	16718	5354
54	14814	10586	10308	18903	2815	1790	1821	14511	14219	14366	6590	6341	6173	5046	14257	16566	5464
55	11058	11512	9994	15255	5680	3456	2243	12244	12153	12900	10345	10092	10021	8445	13720	15125	7093
56	15450	7917	8308	19273	5354	4781	4192	13605	13168	12869	7361	7153	6774	6635	12177	14967	2860
57	16634	8722	9427	20499	4923	4908	4744	14865	14419	14068	6206	6010	5599	5715	13240	16142	3881
58	6214	9604	6238	8576	14731	12628	10983	2710	2878	4639	18605	18367	18099	17206	7324	6465	9779
59	8535	7513	4688	11900	10916	8906	7245	6260	6018	6611	14638	14401	14125	13297	7790	8834	6080
60	4870	10978	7827	8500	12872	10669	9113	5663	5912	7579	17169	16921	16731	15525	9916	9493	9638
61	8847	7584	4304	10702	15323	13393	11738	2477	1845	2188	18680	18456	18120	17553	4626	4340	9053
62	7910	7718	4552	10959	12264	10241	8581	4910	4686	5455	15966	15732	15447	14646	7050	7649	7120
63	11062	6059	4327	14539	9123	7384	5803	8469	8067	8042	12359	12133	11810	11235	8179	10240	3451
64	13240	6855	6402	16970	6719	5359	4070	11252	10841	10684	9595	9372	9037	8581	10349	12837	2052
65	8783	8008	5513	12417	9793	7744	6085	7388	7188	7815	13660	13420	13169	12237	8867	10040	5724
66	9969	6178	3661	13247	10497	8646	7015	6952	6562	6669	13866	13638	13321	12696	7211	8892	4776
67	8112	9245	6752	11968	9533	7381	5760	7891	7807	8702	13696	13449	13246	12114	10003	10899	6602
68	10916	4666	1580	13672	12245	10547	8962	6189	5601	5055	15172	14959	14588	14232	5069	7186	5327
69	7773	12980	9871	7100	20133	18030	16386	3216	3819	5403	23924	23690	23399	22587	8568	5207	14633
70	7496	15366	12201	5524	21715	19552	17942	5446	6136	7831	25726	25486	25228	24268	10989	7513	16742
71	8053	12377	9299	7645	19820	17739	16089	2746	3280	4772	23534	23302	23002	22238	7925	4585	14147
72	11474	4542	1404	13693	14144	12486	10909	5462	4732	3518	16881	16677	16282	16050	3143	5466	6858
73	7769	14685	11559	6162	21417	19274	17649	4843	5494	7100	25343	25105	24833	23933	10230	6725	16219
74	9506	8543	6471	13355	8405	6330	4674	8800	8611	9202	12402	12158	11934	10900	10056	11432	5348

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DECIBEL - Main Result

Calculation: V136-3.45/3.6

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WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
75	9109	9283	7148	13059	8339	6193	4567	9016	8890	9634	12526	12278	12086	10923	10656	11854	6005
76	8680	9665	7423	12665	8597	6420	4825	8908	8824	9677	12870	12621	12443	11222	10841	11884	6483
77	12282	8539	7569	16221	5828	4038	2497	11417	11125	11334	9527	9285	9045	8130	11485	13550	3911
78	12239	7412	6458	16033	6781	5125	3632	10684	10334	10389	10128	9895	9604	8910	10389	12587	3002
79	10781	9504	7959	14814	6511	4397	2749	10740	10556	11094	10707	10458	10280	9083	11726	13327	5348
80	12810	7211	6530	16585	6603	5100	3718	11078	10699	10650	9729	9501	9190	8604	10478	12828	2551
81	17221	11069	11503	21273	2742	3586	4253	16426	16059	15946	4386	4152	3883	3410	15394	18085	6082
82	10575	10083	8468	14665	6453	4275	2686	10950	10806	11445	10812	10561	10412	9101	12193	13675	5926
83	9929	10033	8212	14006	7115	4927	3351	10361	10242	10961	11474	11223	11070	9768	11853	13186	6146
84	9473	10418	8467	13581	7447	5235	3719	10240	10162	10989	11893	11641	11504	10139	12026	13203	6655
85	10592	11834	10174	14806	6152	3942	2812	12088	12033	12877	10864	10611	10553	8931	13833	15092	7541
86	7723	10103	7610	11716	9457	7257	5698	8322	8311	9357	13797	13548	13378	12115	10800	11527	7280
87	7096	10750	8155	11152	9886	7666	6164	8305	8363	9568	14325	14074	13924	12585	11199	11697	8013
88	5117	15520	12200	3393	20298	18092	16538	5624	6416	8504	24540	24295	24079	22944	11781	8801	16125
89	8593	9389	6280	9564	17388	15403	13743	1008	514	2061	20846	20621	20292	19677	5336	3194	11238
90	7408	8604	5239	9540	14872	12842	11182	2303	2130	3518	18521	18289	17989	17242	6107	5487	9297
91	11647	4809	3110	14877	10084	8480	6953	8124	7621	7264	12966	12751	12387	12021	7032	9400	3306
92	9029	10845	7892	9171	19146	17140	15480	2104	2226	3159	22630	22405	22075	21454	6244	2965	12992
93	9449	10254	7365	9772	18900	16929	15269	2165	2041	2550	22287	22065	21724	21161	5590	2371	12560
94	9013	13567	10607	7880	21359	19277	17627	4251	4710	5868	25055	24824	24519	23772	8815	5125	15597
95	10208	11520	8791	9875	20473	18495	16835	3540	3580	3882	23852	23631	23287	22735	6532	2739	14083
96	9959	6764	4520	13447	9633	7739	6098	7662	7331	7573	13152	12919	12624	11900	8149	9801	4554
97	9354	7441	5067	12928	9640	7657	5999	7545	7283	7731	13356	13119	12849	12008	8561	9964	5144
98	9328	6326	3267	12314	11843	9952	8307	5601	5192	5366	15233	15006	14685	14066	6283	7598	5941
99	14367	9325	9070	18363	4050	2916	2208	13520	13188	13227	7344	7105	6856	6050	13017	15411	4213
100	12777	9717	8852	16833	4661	2765	1224	12514	12261	12563	8688	8439	8257	7116	12768	14785	4874
101	12732	8319	7541	16646	5692	4043	2612	11666	11346	11466	9201	8963	8703	7885	11479	13670	3548
102	9900	9244	7384	13880	7521	5397	3756	9758	9596	10222	11687	11439	11249	10089	11038	12452	5554
103	19668	12523	13437	23725	4008	5674	6626	18720	18316	18058	2201	2020	1588	2551	17229	20147	7882
104	19339	12518	13330	23411	3600	5281	6268	18511	18121	17909	2318	2107	1756	2290	17150	20013	7792
105	18010	12298	12742	22120	2213	3812	4881	17551	17206	17148	3366	3118	2962	2163	16638	19299	7328
106	18513	12440	13011	22614	2663	4338	5395	17947	17587	17479	2901	2657	2462	2009	16885	19616	7543
107	19030	12482	13206	23113	3248	4927	5939	18298	17919	17745	2507	2280	1995	2137	17047	19862	7687
108	8984	11399	9327	13171	7763	5536	4191	10534	10531	11533	12379	12127	12030	10519	12777	13720	7677
109	2076	16167	12805	2372	18582	16354	14924	7182	7937	10182	23105	22853	22705	21325	13368	11072	15703
110	2201	16798	13438	2055	18900	16674	15275	7842	8598	10843	23469	23217	23081	21656	14030	11714	16239
111	2522	17302	13943	1806	19258	17035	15655	8318	9079	11322	23853	23600	23472	22021	14518	12158	16714
112	3789	15588	12228	2648	19451	17231	15716	5987	6780	8978	23806	23558	23368	22138	12241	9567	15756
113	3975	16118	12759	2178	19902	17680	16176	6474	7270	9452	24284	24035	23850	22599	12722	9973	16285
114	4065	16919	13557	1365	20375	18148	16674	7301	8096	10277	24816	24566	24395	23093	13548	10769	16985
115	4191	17547	14183	712	20718	18490	17041	7963	8758	10942	25206	24955	24795	23451	14212	11426	17522
116	10166	13391	10605	9054	21902	19864	18206	4734	5023	5722	25446	25220	24893	24246	8394	4547	15801
117	10564	12804	10107	9682	21688	19683	18023	4595	4767	5195	25130	24907	24569	23984	7729	3852	15392
118	12636	12617	10347	11818	22660	20750	19095	6061	5982	5578	25804	25592	25219	24815	7273	3557	15848
119	12717	10984	8857	12457	21447	19605	17962	5533	5242	4297	24421	24214	23825	23514	5619	2098	14401
120	12099	10994	8707	11848	21130	19256	17607	4971	4725	3991	24197	23987	23608	23242	5680	1912	14218
121	10293	9918	7208	10604	19167	17244	15588	2888	2582	2292	22409	22192	21835	21358	5012	1530	12560
122	11524	5448	2762	13307	15577	13883	12289	4762	3973	2265	18334	18130	17733	17504	2116	4038	8296
123	10974	6053	3206	12682	15751	13998	12383	4123	3333	1716	18646	18438	18053	17750	2525	3683	8658
124	12560	4444	2313	14435	15419	13842	12295	5898	5109	3291	17909	17714	17295	17205	1677	4752	7827
125	12024	4916	2441	13868	15443	13806	12234	5334	4546	2789	18071	17872	17464	17302	1862	4409	8003
126	13636	3734	2591	15523	15588	14130	12634	6964	6170	4245	17798	17614	17173	17227	1688	5408	7753
127	13142	3926	2289	15059	15377	13869	12352	6525	5735	3881	17709	17521	17089	17079	1723	5205	7638
128	14091	10016	9572	18152	3596	2165	1448	13683	13393	13560	7378	7130	6940	5874	13520	15765	4940
129	17862	10048	10916	21799	4377	5046	5365	16353	15917	15575	4729	4543	4111	4492	14701	17645	5357
130	18461	10119	11182	22373	4881	5681	6024	16781	16324	15907	4577	4417	3938	4657	14909	17946	5624
131	2797	18340	15021	3246	18993	16797	15532	9865	10593	12834	23708	23455	23370	21780	15956	13829	17259
132	2811	18281	14950	2870	19194	16992	15705	9669	10407	12652	23891	23638	23545	21979	15796	13599	17306
133	4503	19979	16718	5183	19280	17145	16033	11946	12650	14877	24089	23837	23803	22065	17934	15969	18444
134	4897	20299	17057	5678	19283	17167	16093	12389	13085	15307	24107	23856	23833	22064	18343	16428	18656
135	5281	20647	17414	6025	19434	17332	16285	12785	13480	15700	24266	24016	24001	22210	18730	16826	18946

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DECIBEL - Main Result

Calculation: V136-3.45/3.6

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WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
136	5632	20807	17611	6703	19123	17049	16055	13198	13875	16080	23968	23719	23719	21889	19062	17274	18932
137	6346	21316	18159	7559	19099	17066	16142	13933	14595	16786	23954	23706	23727	21847	19728	18029	19265
138	6530	21199	18088	8102	18558	16553	15676	14111	14750	16916	23415	23168	23201	21294	19798	18234	18983
139	6918	21533	18434	8454	18698	16713	15867	14497	15135	17297	23555	23309	23351	21424	20171	18622	19263
140	7268	22744	19490	7077	21359	19293	18303	14615	15338	17576	26207	25958	25963	24121	20668	18573	21079
141	7801	23277	20024	7501	21781	19728	18759	15133	15858	18097	26633	26384	26395	24536	21195	19079	21593
142	8002	23434	20195	7828	21731	19694	18750	15381	16101	18337	26586	26338	26357	24480	21420	19346	21677
143	8332	23787	20541	8020	22097	20064	19124	15677	16402	18641	26953	26705	26725	24844	21735	19624	22049
144	8794	24249	21005	8405	22473	20450	19527	16127	16854	19093	27329	27082	27108	25213	22192	20064	22497
145	10813	26134	22931	10549	23536	21599	20799	18230	18948	21182	28385	28142	28205	26228	24251	22193	24140
146	11393	26663	23474	11177	23826	21917	21153	18832	19546	21778	28668	28426	28500	26501	24837	22805	24598
147	11778	27063	23871	11495	24196	22294	21538	19204	19921	22155	29036	28794	28871	26865	25220	23167	24999
148	8041	21195	17864	3801	24734	22507	21081	11288	12075	14093	29259	29008	28855	27481	17351	14074	21515
149	7634	21042	17700	3423	24349	22123	20711	11182	11973	14027	28896	28645	28498	27102	17295	14087	21253
150	6974	20551	17200	2778	23695	21469	20062	10747	11542	13631	28250	27998	27853	26449	16906	13781	20668
151	7037	20866	17510	2932	23773	21550	20162	11104	11901	14007	28357	28105	27969	26535	17284	14194	20893
152	7415	21251	17895	3329	24152	21929	20546	11471	12266	14362	28742	28490	28356	26916	17638	14517	21291
153	8202	22178	18823	4213	24928	22709	21347	12392	13188	15276	29547	29294	29169	27699	18550	15395	22191
154	8024	22165	18805	4122	24734	22518	21168	12424	13220	15328	29368	29116	28996	27508	18604	15495	22098
155	7970	22332	18968	4220	24639	22428	21100	12652	13449	15578	29298	29045	28934	27418	18856	15800	22159
156	5191	20732	17407	4189	20945	18782	17601	12055	12808	15053	25722	25469	25413	23735	18225	15898	19607
157	5384	20954	17641	4661	20860	18710	17561	12403	13148	15393	25654	25402	25356	23648	18546	16282	19715
158	5789	21357	18043	4912	21208	19065	17927	12772	13521	15767	26009	25757	25715	23996	18927	16632	20116
159	5940	21514	18210	5242	21151	19019	17904	13018	13761	16006	25962	25711	25676	23936	19154	16901	20195
160	6840	22368	19036	5314	22397	20255	19118	13560	14325	16567	27200	26948	26906	25184	19767	17315	21246
161	4966	20339	16990	3234	21204	19016	17773	11394	12163	14403	25938	25685	25607	23993	17612	15144	19463
162	4528	19914	16568	3024	20801	18610	17357	11020	11785	14027	25528	25275	25193	23589	17227	14805	19025
163	7291	21563	18516	9099	18259	16312	15525	14827	15442	17577	23112	22868	22924	20965	20388	18969	19123
164	7699	21921	18888	9464	18425	16501	15747	15234	15848	17980	23273	23030	23096	21117	20784	19376	19429
165	8722	22892	19882	10332	19004	17135	16452	16264	16879	19011	23837	23596	23682	21662	21810	20405	20306
166	9119	23138	20155	10793	18979	17142	16501	16642	17248	19369	23800	23561	23657	21616	22142	20788	20467
167	6492	21973	18716	6459	20784	18698	17674	13855	14574	16811	25625	25375	25369	23554	19896	17827	20349
168	6099	21666	18372	5561	21097	18976	17884	13256	13995	16239	25917	25666	25639	23879	19372	17162	20272
169	10035	23981	21022	11624	19473	17689	17112	17559	18164	20282	24269	24033	24147	22073	23045	21705	21222
170	6848	22328	18986	5062	22597	20445	19285	13411	14183	16421	27388	27136	27087	25386	19635	17121	21302
171	6848	22272	18924	4842	22749	20589	19409	13268	14044	16278	27529	27277	27221	25539	19503	16938	21329
172	6110	21523	18175	4199	22130	19959	18756	12546	13319	15556	26895	26642	26579	24920	18775	16248	20599
173	5355	20734	17385	3518	21532	19350	18118	11767	12538	14777	26277	26024	25950	24322	17991	15496	19851
174	5765	21180	17833	3943	21823	19649	18438	12229	12999	15238	26582	26330	26263	24614	18452	15952	20255
175	6666	22215	18933	6188	21350	19249	18196	13882	14617	16860	26184	25933	25918	24126	19984	17798	20730
176	5881	20750	17382	2762	22468	20262	18958	11384	12174	14379	27150	26898	26797	25251	17640	14883	20256
177	4627	19257	15888	1346	21343	19125	17771	9903	10691	12903	25971	25718	25598	24115	16158	13467	18846
178	4283	18835	15466	1012	21015	18795	17427	9493	10280	12495	25626	25374	25249	23783	15747	13083	18441
179	3660	19214	15927	4314	19082	16917	15737	11007	11720	13953	23857	23604	23548	21872	17035	15011	17862
180	3310	18877	15582	4026	18950	16774	15569	10623	11337	13572	23708	23456	23391	21740	16659	14624	17588
181	8365	22584	19561	9999	18857	16967	16256	15910	16527	18662	23697	23455	23533	21528	21468	20051	20041
182	6874	22338	19087	6818	20997	18924	17923	14248	14966	17202	25843	25593	25594	23762	20285	18220	20672
183	10298	25432	22270	10473	22480	20565	19799	17813	18510	20730	27324	27082	27153	25160	23743	21838	23283
184	10493	25535	22393	10798	22359	20466	19730	18034	18723	20936	27197	26956	27035	25026	23928	22076	23308
185	10877	25925	22784	11126	22681	20800	20078	18413	19105	21319	27515	27275	27359	25340	24315	22450	23687
186	11290	26325	23189	11511	22974	21108	20406	18826	19517	21732	27802	27563	27652	25622	24727	22861	24061
187	11607	26587	23464	11876	23070	21224	20547	19153	19841	22052	27891	27652	27749	25705	25036	23196	24271
188	11790	26687	23581	12157	22984	21158	20507	19351	20032	22238	27796	27558	27662	25605	25203	23407	24307
189	6734	20166	16817	2498	23431	21204	19785	10352	11147	13234	27967	27716	27566	26180	16509	13387	20321
190	7675	21618	18262	3650	24408	22187	20816	11848	12644	14742	29014	28762	28633	27176	18018	14895	21625
191	2973	18545	15245	3801	18798	16614	15386	10260	10975	13209	23541	23288	23216	21588	16300	14263	17309
192	11033	26302	23112	10860	23523	21604	20829	18479	19192	21423	28368	28126	28196	26205	24478	22457	24247
193	6147	21032	17886	7542	18772	16738	15813	13737	14391	16573	23627	23379	23399	21522	19496	17844	18950
194	5992	21091	17910	7092	19173	17118	16155	13568	14240	16439	24024	23775	23785	21932	19408	17650	19142
195	8074	22185	19173	9862	18457	16559	15841	15596	16204	18328	23299	23057	23132	21133	21114	19741	19623
196	9743	23645	20688	11413	19181	17386	16797	17254	17856	19969	23983	23747	23857	21790	22722	21402	20888

To be continued on next page...

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DECIBEL - Main Result

Calculation: V136-3.45/3.6

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
197	9468	23311	20359	11229	18878	17073	16474	16963	17560	19666	23685	23448	23555	21495	22408	21113	20551
198	3836	18431	15063	976	20572	18350	16979	9161	9944	12168	25177	24925	24799	23338	15410	12814	17996
199	5582	20406	17038	2425	22206	19997	18681	11041	11831	14037	26877	26624	26519	24987	17297	14553	19930
200	5286	20069	16701	2108	21941	19729	18403	10712	11501	13709	26600	26347	26238	24719	16967	14241	19607
201	5031	19730	16362	1762	21721	19506	18165	10362	11151	13359	26365	26112	25998	24496	16617	13896	19302
202	4858	20403	17079	4017	20648	18481	17291	11761	12511	14756	25419	25166	25107	23438	17920	15624	19274
203	4524	20070	16747	3837	20368	18197	16996	11454	12201	14446	25132	24880	24817	23159	17604	15334	18945
204	4184	19711	16384	3520	20178	17997	16775	11068	11815	14060	24927	24674	24604	22968	17220	14948	18635
205	6733	21924	18732	7453	19938	17900	16961	14279	14965	17176	24792	24544	24562	22689	20174	18337	19991
206	6520	21956	18610	4616	22432	20269	19085	12988	13762	15998	27209	26956	26899	25222	19218	16684	20998
207	6333	21888	18603	5896	21129	19019	17950	13546	14281	16523	25957	25706	25686	23907	19647	17466	20429
208	6996	22539	19260	6494	21559	19467	18432	14220	14955	17198	26397	26147	26138	24331	20322	18134	21023

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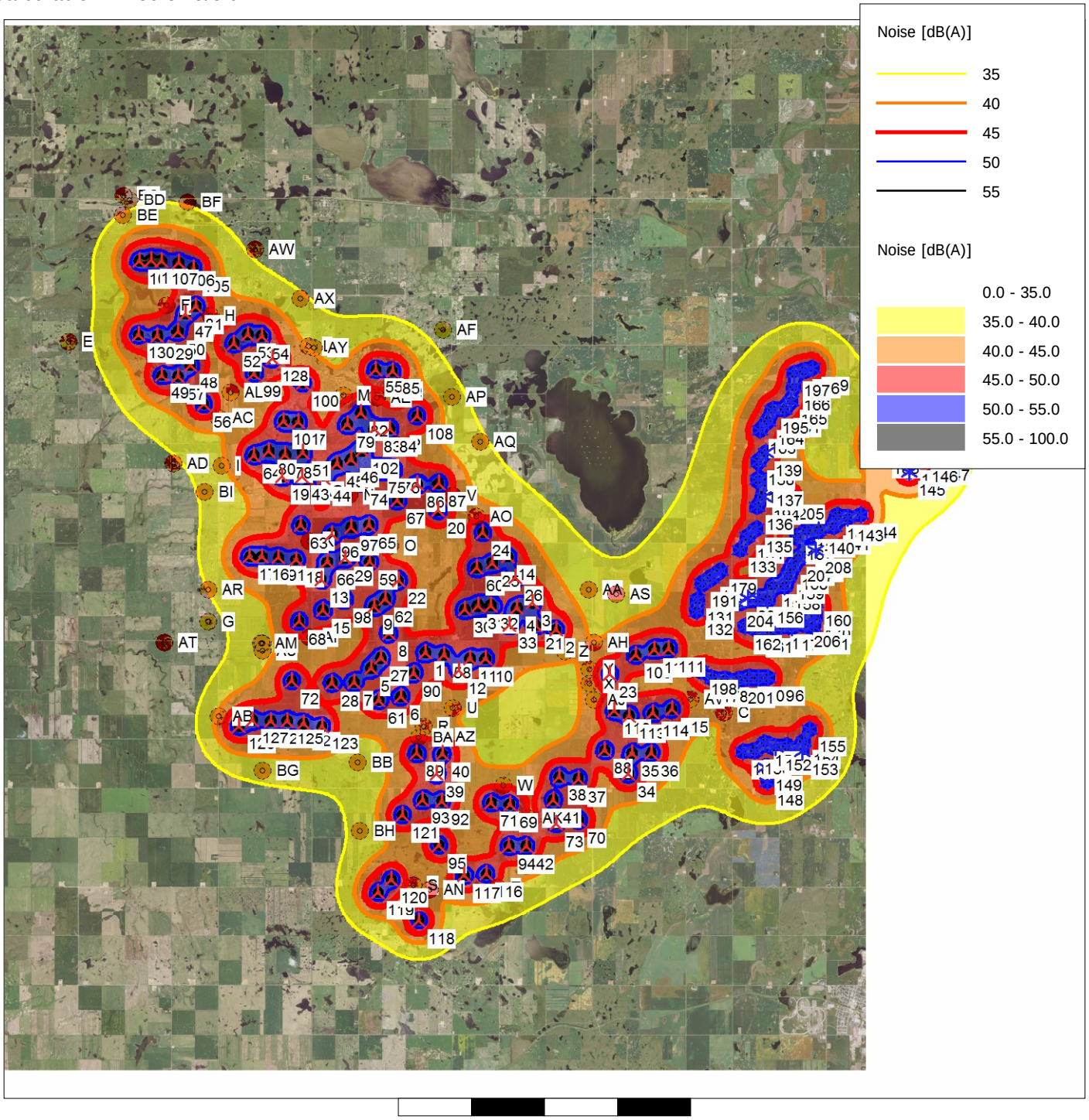
Calculated:
9/14/2018 11:15 PM/3.0.654

DECIBEL - Map 95% rated power

Calculation: V136-3.45/3.6



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 641,190 North: 5,375,412

New WTG Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 95% rated power
Height above sea level from active line object

Project: Description:

Aurora

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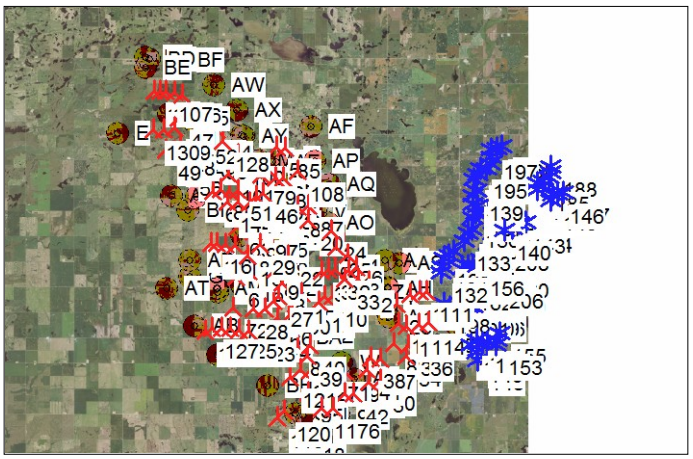
9/14/2018 10:25 PM/3.0.654

DECIBEL - Main Result

Calculation: A031 AW125-3.15

Noise calculation model:
ISO 9613-2 General
Wind speed:
95% rated power
Ground attenuation:
General, fixed, Ground factor: 0.5
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
1.5 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:500,000

New WTG
Existing WTG
Noise sensitive area

WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
1	637,619	5,373,512	727.5	T-43	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
2	642,085	5,374,363	728.5	T-41	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
3	641,252	5,375,220	737.7	T-63	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
4	640,729	5,375,038	740.7	T-62	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
5	635,764	5,372,945	724.6	T-45	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
6	636,817	5,372,047	728.5	T-35	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
7	635,193	5,372,473	710.2	T-47	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
8	636,346	5,374,109	734.6	T-56	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
9	635,830	5,374,972	728.5	T-55	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
10	639,692	5,373,363	740.7	T-39	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
11	639,157	5,373,344	739.4	T-38	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
12	638,790	5,372,951	734.6	T-37	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
13	633,988	5,375,810	737.6	T-70	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
14	640,372	5,376,713	738.1	T-77	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
15	634,074	5,374,798	721.2	T-53	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
16	631,934	5,376,511	729.8	T-67	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
17	631,510	5,376,507	731.5	T-66	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
18	633,108	5,376,447	723.9	T-69	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
19	632,563	5,379,145	737.6	T-93	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
20	637,951	5,378,169	715.2	T-80	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
21	641,389	5,374,486	743.7	T-58	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
22	636,640	5,375,835	734.6	T-73	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
23	643,972	5,372,967	712.3	T-28	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
24	639,495	5,377,499	738.7	T-78	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
25	639,840	5,376,489	737.6	T-76	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
26	640,649	5,376,031	731.5	T-79	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
27	636,095	5,373,292	733.9	T-46	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
28	634,438	5,372,432	701.0	T-57	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
29	634,798	5,376,526	725.4	T-71	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
30	638,928	5,374,941	737.6	T-59	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
31	639,384	5,375,074	737.6	T-60	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
32	639,838	5,375,100	737.6	T-61	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
33	640,492	5,374,466	743.6	T-40	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
34	644,695	5,369,685	736.0	T-15	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
35	644,792	5,370,371	743.7	T-16	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
36	645,456	5,370,405	735.1	T-17	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
37	642,975	5,369,494	737.6	T-12	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
38	642,303	5,369,536	734.9	T-13	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
39	638,102	5,369,527	710.5	T-26	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
40	638,282	5,370,192	712.5	T-25	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
41	642,122	5,368,780	734.6	T-10	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
42	641,239	5,367,252	719.1	T-8	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
43	633,243	5,379,162	737.6	T-94	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
44	634,001	5,379,136	737.6	T-95	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
45	634,443	5,379,605	731.5	T-96	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
46	634,918	5,379,749	728.5	T-121	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
47	629,136	5,384,387	713.2	T-142	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
48	629,347	5,382,713	710.2	T-131	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
49	628,366	5,382,343	707.1	T-129	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
50	628,893	5,383,804	717.2	T-141	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
51	633,253	5,379,950	729.4	T-123	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No

To be continued on next page...

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9/14/2018 10:25 PM/3.0.654

DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
52	630,815	5,383,459	711.9	T-144	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
53	631,275	5,383,767	710.7	T-145	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
54	631,767	5,383,732	713.2	T-146	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
55	635,699	5,382,724	710.2	T-122	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
56	629,834	5,381,441	713.0	T-117	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
57	628,926	5,382,328	703.0	T-130	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
58	638,268	5,373,457	731.5	T-44	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
59	635,628	5,376,434	728.5	T-72	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
60	639,307	5,376,310	731.5	T-75	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
61	636,056	5,371,908	719.3	T-34	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
62	636,215	5,375,218	731.5	T-74	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
63	633,243	5,377,581	731.5	T-81	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
64	631,582	5,379,814	726.8	T-98	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
65	635,586	5,377,640	725.5	T-85	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
66	634,183	5,376,389	733.5	T-86	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
67	636,542	5,378,452	715.1	T-87	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
68	633,261	5,374,418	716.3	T-51	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
69	640,641	5,368,602	728.5	T-23	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
70	643,024	5,368,138	728.5	T-11	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
71	639,998	5,368,634	725.4	T-22	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
72	633,064	5,372,478	698.0	T-5	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
73	642,243	5,368,015	730.6	T-9	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
74	635,270	5,379,029	725.4	T-90	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
75	635,883	5,379,448	720.6	T-91	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
76	636,364	5,379,455	716.0	T-92	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
77	633,072	5,380,925	729.9	T-106	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
78	632,659	5,379,855	737.2	T-100	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
79	634,758	5,380,905	718.9	T-107	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
80	632,089	5,379,958	731.5	T-99	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
81	629,494	5,384,648	709.6	T-143	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
82	635,222	5,381,271	716.3	T-108	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
83	635,678	5,380,785	716.0	T-109	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
84	636,220	5,380,785	716.3	T-110	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
85	636,276	5,382,673	710.2	T-124	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
86	637,208	5,379,005	710.9	T-88	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
87	637,941	5,379,046	713.2	T-89	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
88	643,859	5,370,443	732.3	T-14	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
89	637,408	5,370,185	701.0	T-24	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
90	637,234	5,372,817	719.9	T-42	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
91	632,509	5,376,501	722.8	T-68	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
92	638,306	5,368,644	716.3	T-21	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
93	637,648	5,368,666	713.2	T-20	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
94	640,643	5,367,238	719.3	T-19	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
95	638,242	5,367,207	710.2	T-18	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
96	634,318	5,377,326	731.6	T-83	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
97	634,979	5,377,549	725.3	T-84	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
98	634,798	5,375,163	713.2	T-54	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
99	631,532	5,382,484	707.7	T-118	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
100	633,206	5,382,201	722.4	T-120	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
101	632,585	5,380,949	731.5	T-105	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
102	635,298	5,380,049	728.5	T-97	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
103	627,504	5,386,079	711.3	T-147	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
104	627,911	5,386,105	710.2	T-148	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
105	629,368	5,385,888	704.0	T-149	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
106	628,867	5,386,049	710.2	T-150	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
107	628,269	5,386,086	711.9	T-151	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
108	637,149	5,381,224	704.1	T-152	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
109	644,833	5,373,605	713.9	T-153	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
110	645,462	5,373,811	728.5	T-154	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
111	645,966	5,373,838	730.1	T-155	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
112	644,144	5,371,765	710.2	T-156	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
113	644,660	5,371,616	715.4	T-157	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
114	645,479	5,371,724	719.3	T-158	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
115	646,127	5,371,875	717.1	T-159	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
116	639,890	5,366,309	710.2	T-160	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
117	639,135	5,366,239	709.0	T-161	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
118	637,617	5,364,719	707.6	T-162	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
119	636,191	5,365,609	711.4	T-163	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
120	636,640	5,366,042	710.2	T-164	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
121	636,954	5,368,164	711.3	T-165	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
122	633,495	5,371,087	689.0	T-166	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
123	634,130	5,371,006	696.6	T-167	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
124	632,359	5,371,139	688.8	T-168	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
125	632,926	5,371,158	686.0	T-169	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
126	631,283	5,370,947	682.8	T-170	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
127	631,732	5,371,159	684.7	T-171	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
128	632,154	5,382,999	713.2	T-172	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
129	628,195	5,383,647	711.6	T-173	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
130	627,535	5,383,666	710.2	T-174	Yes	Acciona	AW3150/125-3,150	3,150	125.0	87.5	USER	AW Sound 110.4dB provided octave (108.4+2dB)	(95%)	110.4	No
131	646,913	5,375,455	745.7	VESTAS V100 2000 100.0 !O! ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
132	646,888	5,375,080	743.7	VESTAS V100 2000 100.0 !O! ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
133	648,328	5,377,151	749.8	VESTAS V100 2000 100.0 !O! ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
134	648,570	5,377,592	749.8	VESTAS V100 2000 100.0 !O! ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

To be continued on next page...

Licensed user:
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Calculated:
9/14/2018 10:25 PM/3.0.654

DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

					WTG type							Noise data					
	X(East)	Y(North)	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
135	648,872	5,377,853	752.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
136	648,872	5,378,572	753.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
137	649,189	5,379,368	749.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
138	648,868	5,380,034	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
139	649,124	5,380,328	729.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
140	651,007	5,377,868	748.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
141	651,525	5,378,000	750.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
142	651,616	5,378,348	758.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
143	651,987	5,378,290	755.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
144	652,436	5,378,405	749.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
145	654,047	5,379,834	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
146	654,478	5,380,290	740.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
147	654,876	5,380,346	731.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
148	649,468	5,369,552	735.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
149	649,403	5,370,046	745.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
150	648,989	5,370,563	740.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
151	649,348	5,370,846	749.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
152	649,714	5,370,690	746.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
153	650,635	5,370,574	746.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
154	650,667	5,370,918	744.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
155	650,882	5,371,340	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
156	649,309	5,375,532	733.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
157	649,484	5,375,990	732.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
158	649,889	5,375,994	741.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
159	650,008	5,376,322	740.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
160	650,956	5,375,465	750.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
161	648,982	5,374,557	737.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
162	648,553	5,374,643	733.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
163	648,903	5,381,054	722.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
164	649,170	5,381,363	721.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
165	649,950	5,382,038	713.3	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
166	650,030	5,382,496	712.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
167	650,267	5,377,632	746.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
168	650,119	5,376,640	740.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
169	650,663	5,383,159	707.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
170	650,947	5,375,049	753.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
171	650,911	5,374,694	758.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
172	650,163	5,374,664	746.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
173	649,378	5,374,555	741.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
174	649,818	5,374,694	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
175	650,613	5,377,049	737.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
176	649,406	5,372,982	725.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
177	647,909	5,372,903	716.3	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
178	647,487	5,372,910	715.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
179	647,672	5,376,428	744.3	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
180	647,365	5,376,192	740.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
181	649,728	5,381,758	721.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
182	650,599	5,377,842	746.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
183	653,143	5,380,511	713.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
184	653,130	5,380,927	710.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
185	653,497	5,381,062	704.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
186	653,850	5,381,276	700.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
187	654,022	5,381,604	696.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
188	654,011	5,381,966	694.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
189	648,594	5,370,523	731.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
190	650,092	5,370,737	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
191	647,056	5,376,002	741.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
192	654,134	5,380,179	733.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
193	648,870	5,379,452	759.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
194	649,079	5,378,913	759.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
195	649,308	5,381,738	716.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
196	650,346	5,383,045	709.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
197	650,021	5,382,956	710.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
198	647,090	5,373,129	713.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
199	649,061	5,372,960	722.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
200	648,724	5,372,961	720.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
201	648,383	5,372,886	719.3	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
202	648,975	5,375,560	735.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
203	648,641	5,375,554	726.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
204	648,297	5,375,376	728.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
205	649,928	5,378,956	741.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
206	650,591	5,374,779	748.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
207	650,301	5,376,922	735.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
208	650,917	5,377,197	740.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

Calculation Results

Licensed user:
TradeWind Energy, Inc
16105 W. 113th Street, Suite 105
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Kevin Walter / kwalter@tradewindenergy.com
Calculated:
9/14/2018 10:25 PM/3.0.654

DECIBEL - Main Result

Calculation: A031 AW125-3.15

Sound Level

Noise sensitive area					Demands	Sound Level		Demands fulfilled ?
No.	Name	X(East)	Y(North)	Z [m]	Imission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]	Noise
A	1 - Non-Participating	644,116	5,375,554	701.3	1.5	50.0	37.7	1,794	Yes
B	39 - Participating	643,400	5,373,971	711.5	1.5	50.0	41.0	886	Yes
C	2 - Non-Participating	647,930	5,371,801	718.0	1.5	50.0	41.3	887	Yes
D	40 - Participating	643,453	5,372,099	716.3	1.5	50.0	43.5	486	Yes
E	41 - Participating	625,162	5,383,364	711.9	1.5	50.0	32.8	2,123	Yes
F	42 - Participating	628,500	5,384,644	704.1	1.5	50.0	45.6	372	Yes
G	43 - Participating	630,148	5,374,327	691.9	1.5	50.0	34.9	2,287	Yes
H	44 - Participating	629,997	5,384,325	711.4	1.5	50.0	45.6	298	Yes
I	3 - Non-Participating	630,488	5,379,437	722.7	1.5	50.0	40.0	877	Yes
J	4 - Non-Participating	632,031	5,373,676	696.3	1.5	50.0	39.3	1,169	Yes
K	45 - Participating	633,554	5,377,057	735.4	1.5	50.0	47.4	308	Yes
L	46 - Participating	633,395	5,383,413	715.7	1.5	50.0	40.6	955	Yes
M	47 - Participating	634,615	5,381,825	716.9	1.5	50.0	44.3	513	Yes
N	48 - Participating	634,891	5,378,584	728.5	1.5	50.0	47.1	267	Yes
O	5 - Non-Participating	636,328	5,376,974	731.5	1.5	50.0	44.5	588	Yes
P	49 - Participating	636,455	5,380,259	709.9	1.5	50.0	47.1	265	Yes
Q	50 - Participating	636,416	5,382,006	707.4	1.5	50.0	44.7	402	Yes
R	51 - Participating	637,621	5,371,070	716.6	1.5	50.0	43.1	632	Yes
S	6 - Non-Participating	637,411	5,365,868	713.2	1.5	50.0	42.5	520	Yes
T	52 - Participating	640,276	5,365,862	710.2	1.5	50.0	43.8	321	Yes
U	7 - Non-Participating	638,615	5,371,717	720.3	1.5	50.0	41.6	953	Yes
V	8 - Non-Participating	638,435	5,378,666	709.4	1.5	50.0	45.4	339	Yes
W	9 - Non-Participating	640,413	5,369,191	728.5	1.5	50.0	45.1	338	Yes
X	10 - Non-Participating	643,279	5,372,615	722.4	1.5	50.0	42.7	504	Yes
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.5	50.0	43.0	430	Yes
Z	53 - Participating	642,413	5,373,644	734.1	1.5	50.0	42.5	514	Yes
AA	54 - Participating	643,167	5,375,685	714.9	1.5	50.0	38.4	1,435	Yes
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.5	50.0	41.7	484	Yes
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.5	50.0	43.1	414	Yes
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.5	50.0	35.6	1,949	Yes
AE	55 - Participating	635,760	5,381,775	711.0	1.5	50.0	45.5	431	Yes
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.5	50.0	34.0	1,916	Yes
AG	57 - Participating	633,480	5,378,691	739.8	1.5	50.0	47.6	200	Yes
AH	59 - Participating	643,400	5,373,968	711.4	1.5	50.0	41.0	883	Yes
AI	61 - Participating	633,645	5,373,895	713.7	1.5	50.0	44.5	372	Yes
AJ	62 - Participating	643,453	5,372,097	716.3	1.5	50.0	43.5	485	Yes
AK	63 - Participating	641,300	5,368,154	725.4	1.5	50.0	45.1	516	Yes
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.5	50.0	42.9	714	Yes
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.5	50.0	39.2	1,208	Yes
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.5	50.0	41.2	814	Yes
AO	64 - Participating	639,268	5,377,996	720.6	1.5	50.0	44.8	280	Yes
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.5	50.0	37.9	1,074	Yes
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.5	50.0	36.9	1,678	Yes
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.5	50.0	36.2	1,495	Yes
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.5	50.0	37.7	1,793	Yes
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.5	50.0	31.6	3,454	Yes
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.5	50.0	39.4	1,137	Yes
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.5	50.0	43.9	436	Yes
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.5	50.0	35.3	1,935	Yes
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.5	50.0	36.8	1,505	Yes
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.5	50.0	40.3	955	Yes
AZ	66 - Participating	638,244	5,370,747	710.8	1.5	50.0	45.1	277	Yes
BA	67 - Participating	637,448	5,370,698	712.2	1.5	50.0	45.7	237	Yes
BB	68 - Participating	635,378	5,369,828	692.6	1.5	50.0	38.8	1,444	Yes
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.5	50.0	33.5	1,899	Yes
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.5	50.0	34.5	1,713	Yes
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.5	50.0	36.3	1,292	Yes
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.5	50.0	35.4	1,702	Yes

To be continued on next page...

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Calculated:
9/14/2018 10:25 PM/3.0.654

DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	X(East)	Y(North)	Z	Imission height	Noise	From WTGs	Distance to noise demand	Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.5	50.0	38.0	1,368	Yes
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.5	50.0	37.6	1,265	Yes
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.5	50.0	36.9	1,771	Yes

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	6810	5799	10452	6003	15882	14390	7516	13229	9271	5591	5393	10764	8839	5759	3695	6847	8579	2442	7647	8099	2053	5218
2	2355	1372	6382	2645	19168	17037	11937	15664	12659	10077	8946	12547	10558	8341	6322	8153	9516	5546	9696	8691	4363	5643
3	2883	2484	7503	3819	18034	15857	11140	14477	11561	9350	7914	11352	9363	7196	5227	6957	8333	5514	10110	9409	4385	4451
4	3426	2876	7896	4008	17654	15551	10605	14192	11146	8804	7453	11132	9134	6830	4808	6747	8195	5040	9752	9188	3937	4293
5	8751	7705	12221	7736	14865	13771	5783	12758	8366	3804	4668	10733	8954	5707	4069	7347	9085	2639	7266	8398	3105	6315
6	8098	6859	11117	6637	16245	15095	7047	14045	9729	5055	5978	11870	10022	6815	4951	8220	9967	1266	6207	7087	1829	6814
7	9440	8343	12755	8269	14807	13890	5375	12941	8404	3383	4868	11086	9369	6119	4642	7888	9611	2805	6968	8340	3505	6990
8	7903	7055	11812	7386	14517	13136	6202	12028	7919	4337	4060	9760	7907	4706	2865	6151	7897	3296	8310	9136	3297	5013
9	8306	7636	12509	8146	13573	12136	5719	11023	6962	4014	3086	8785	6960	3732	2063	5324	7059	4294	9240	10137	4284	4520
10	4937	3758	8385	3968	17639	15891	9592	14634	11028	7667	7164	11860	9868	7093	4935	7618	9243	3089	7834	7524	1967	5450
11	5429	4289	8908	4473	17213	15533	9063	14300	10596	7134	6722	11601	9620	6757	4602	7424	9085	2744	7677	7566	1715	5371
12	5928	4721	9212	4740	17151	15577	8751	14377	10536	6798	6654	11771	9807	6851	4717	7673	9362	2214	7216	7243	1246	5726
13	10131	9590	14507	10166	11618	10400	4117	9404	5041	2896	1320	7626	6047	2917	2613	5087	6655	5972	10515	11769	6178	5285
14	3919	4084	9014	5548	16601	14278	10499	12869	10253	8877	6827	9673	7699	5792	4053	5284	6609	6278	11242	10852	5296	2752
15	10070	9362	14177	9760	12361	11314	3955	10362	5863	2331	2318	8641	7047	3873	3132	5957	7579	5146	9533	10878	5488	5829
16	12220	11744	16676	12335	9635	8829	2821	8051	3264	2836	1710	7055	5953	3612	4418	5873	7092	7871	11969	13528	8224	6849
17	12642	12158	17082	12731	9344	8676	2570	7963	3104	2878	2118	7159	6159	3969	4841	6208	7370	8180	12166	13790	8569	7254
18	11044	10585	15533	11221	10535	9404	3641	8470	3976	2973	756	6972	5585	2783	3262	5073	6469	7020	11420	12784	7260	5770
19	12098	12009	17033	12971	8519	6837	5389	5781	2095	5495	2311	4349	3376	2395	4346	4049	4800	9529	14134	15360	9582	5892
20	6696	6878	11838	8193	13804	11457	8699	10058	7570	7433	4536	6946	4949	3088	2016	2570	4133	7107	12313	12526	6487	693
21	2928	2075	7071	3156	18497	16411	11243	15053	11973	9394	8246	11983	9987	7683	5640	7595	9016	5086	9492	8696	3920	5119
22	7481	7012	11989	7770	13728	11995	6665	10781	7129	5090	3319	8244	6323	3259	1181	4429	6176	4865	9996	10615	4567	3352
23	2591	1156	4127	1011	21493	19385	13891	18009	14956	11962	11192	14866	12885	10678	8631	10473	11782	6628	9666	8009	5501	7947
24	5014	5263	10180	6696	15486	13113	9871	11696	9213	8386	5957	8496	6521	4730	3210	4106	5458	6697	11816	11664	5849	1577
25	4376	4360	9350	5685	16209	13969	9931	12582	9806	8301	6312	9460	7468	5375	3546	5067	6494	5856	10895	10636	4927	2592
26	3500	3437	8421	4830	17135	14892	10639	13500	10716	8934	7168	10349	8365	6298	4423	5955	7322	5812	10667	10177	4770	3442
27	8334	7337	11929	7454	14865	13659	6036	12606	8319	4082	4542	10475	8660	5428	3690	6977	8720	2696	7539	8526	2972	5862
28	10169	9093	13507	9021	14338	13579	4690	12695	8042	2710	4709	11030	9394	6169	4919	8083	9776	3462	7206	8789	4238	7405
29	9368	8973	13956	9721	11816	10275	5144	9158	5201	3973	1353	7028	5302	2060	1594	4084	5714	6143	10973	11989	6140	4219
30	5224	4576	9535	5344	16138	14244	8801	12955	9563	7012	5775	10119	8123	5438	3300	5865	7499	4085	9198	9179	3239	3758
31	4756	4165	9152	5041	16461	14493	9266	13179	9908	7484	6157	10266	8265	5701	3598	5955	7540	4375	9415	9256	3444	3715
32	4302	3737	8739	4699	16843	14820	9721	13489	10307	7936	6581	10517	8515	6050	3979	6169	7707	4599	9546	9249	3597	3832
33	3784	2950	7902	3791	17725	15729	10345	14400	11171	8498	7406	11420	9417	6952	4861	7061	8571	4447	9133	8607	3329	4677
34	5898	4478	3866	2715	23847	22047	15270	20745	17232	13278	13359	17781	15779	13241	11097	13406	14845	7208	8224	5844	6410	10948
35	5227	3860	3449	2186	23540	21660	15169	20337	16935	13182	13076	17320	15322	12864	10735	12933	14336	7204	8647	6382	6322	10451
36	5321	4117	2841	2623	24079	22142	15802	20803	17482	13818	13635	17739	15746	13361	11246	13346	14708	7863	9236	6890	6965	10842
37	6166	4497	5466	2648	22576	20954	13707	19708	15962	11716	12081	16897	14898	12165	10007	12586	14127	5581	6642	4526	4894	10234
38	6285	4569	6066	2809	22024	20465	13066	19240	15416	11075	11538	16490	14496	11697	9541	12214	13790	4927	6115	4197	4285	9916
39	8514	6915	10088	5936	18945	17909	9290	16872	12498	7354	8797	14662	12783	9610	7655	10858	12593	1616	3724	4261	2249	9145
40	7923	6362	9781	5511	18592	17452	9125	16383	12092	7157	8336	14095	12197	9051	7058	10232	11961	1099	4411	4767	1560	8476
41	7061	5346	6547	3576	22368	20910	13196	19714	15777	11216	11913	17037	15050	12182	10035	12802	14404	5049	5539	3453	4574	10551
42	8786	7058	8091	5328	22761	21559	13155	20442	16250	11227	12458	17964	16007	12989	10892	13859	15522	5260	4071	1691	5178	11754
43	11456	11407	16429	12415	9108	7249	5741	6098	2768	5618	2128	4253	2996	1747	3782	3395	4261	9201	13932	15046	9182	5216
44	10730	10724	15743	11784	9798	7785	6163	6554	3526	5805	2127	4319	2758	1047	3176	2699	3751	8841	13699	14683	8737	4458
45	10487	10582	15583	11727	10013	7792	6805	6484	3958	6401	2698	3949	2227	1115	3237	2116	3108	9108	14054	14930	8924	4101
46	10109	10263	15248	11462	10404	8072	7222	6720	4441	6724	3018	3968	2098	1165	3113	1620	2709	9090	14103	14885	8842	3680
47	17391	17662	22620	18868	4103	686	10112	863	5132	11096	8559	4369	6049	8173	10329	8403	7660	15791	20284	21617	15824	10918
48	16413	16551	21551	17654	4235	2108	8425	1738	3469	9428	7050	4108	5343	6913	9038	7520	7105	14284	18676	20086	14382	9949
49	17151	17208	22225	18237	3362	2305	8212	2567	3598	9410	7407	5142	6271	7531	9603	8354	8058	14586	18795	20335	14764	10720
50	17315	17526	22506	18682	3757	927	9561	1220	4650	10604	8201	4519	6055	7952	10096	8352	7735	15439	19856	21249	15513	10837
51	11718	11777	16788	12871	8782	6681	6424	5454	2812	6392	2908	3466	2317	2132	4279	3217	3772	9896	14683	15741	9825	5338
52	15473	15761	20709	16994	5653	2601	9157	1191	4035	9859	6964	2581	4137	6355	8512	6485	5787	14136	18787	19980	14098	9002
53	15243	15588	20509	16866	6127	2911	9508	1395	4401	10120	7087	2149	3864	6320	8467	6256	5434	14195	18922	20041	14110	8791
54	14812	15186	20091	16490	6615	3392	9544	1866	4481	10060	6911	1659	3428	6022	8154	5835	4960	13951	18735	19793	13831	8374
55	11057	11658	16399	13154	10556	7451	10066	5923	6161	9763	6059	2405	1408	4218	5784	2578	1015	11811	16943	17473	11387	4894
56	15448	15487	20504	16515	5052	3470	7121	2889	2108	8070	5750	4071	4797	5809	7882	6726	6607	12969	17318	18755	13103	9037
57	16633	16714	21726	17768	3903	2354	8095	2265	3287	9193	7015	4599	5712	7043	9136	7809	7497	14226	18519	20000	14370	10190
58	6212	5157	9803	5360	16430	14852	8167	13658	9813	6241	5932	11085	9131	6140	4017	7040	8748	2473	7637	7856	1774	5212

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DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
59	8534	8153	13146	8946	12552	10873	5871	9694	5953	4532	2165	7327	5485	2273	884	3914	5628	5722	10715	11549	5584	3586
60	4868	4714	9731	5909	15807	13648	9371	12285	9357	7738	5801	9242	7241	4967	3052	4872	6388	5504	10612	10493	4645	2513
61	8846	7628	11875	7399	15809	14809	6384	13817	9365	4397	5725	11809	10021	6777	5073	8361	10105	1775	6190	7373	2566	7165
62	7908	7292	12204	7882	13731	12181	6132	11027	7113	4459	3234	8666	6798	3617	1760	5047	6791	4380	9426	10200	4245	4101
63	11060	10780	15784	11589	9937	8508	4491	7484	3322	4089	610	5834	4460	1930	3144	4182	5445	7847	12433	13668	7953	5304
64	13238	13184	18207	14158	7336	5729	5672	4781	1157	6155	3390	4029	3639	3531	5531	4894	5308	10627	15115	16440	10726	6949
65	8781	8632	13656	9622	11892	9964	6369	8714	5406	5325	2114	6174	4296	1172	997	2759	4444	6878	11913	12678	6653	3027
66	9968	9529	14493	10215	11403	10022	4532	8972	4790	3463	917	7068	5453	2306	2223	4488	6044	6334	11005	12164	6440	4823
67	8110	8192	13189	9388	12395	10150	7609	8794	6133	6569	3297	5875	3884	1656	1493	1810	3557	7460	12614	13132	7047	1905
68	10914	10149	14901	10452	12068	11280	3115	10431	5734	1437	2655	8996	7530	4474	3992	6658	8218	5497	9504	11064	5997	6694
69	7773	6037	7961	4488	21390	20119	11953	18987	14849	9994	11032	16488	14531	11520	9418	12386	14055	3900	4231	2764	3715	10303
70	7496	5846	6123	3984	23472	21987	14287	20779	16877	12310	13009	18057	16064	13239	11087	13787	15363	6148	6055	3569	5679	11486
71	8053	6329	8541	4893	20907	19711	11377	18607	14393	9428	10605	16187	14247	11184	9112	12153	13844	3403	3787	2786	3378	10153
72	11472	10444	14882	10396	13452	12994	3453	12238	7421	1582	4606	10940	9475	6374	5556	8489	10101	4770	7911	9787	5603	8194
73	7769	6068	6832	4260	22965	21574	13643	20396	16391	11677	12541	17760	15777	12875	10736	13544	15157	5540	5288	2916	5183	11312
74	9504	9575	14579	10723	10998	8796	6953	7474	4799	6257	2614	4768	2871	584	2311	1708	3190	8299	13334	14087	8041	3185
75	9107	9301	14270	10551	11414	9028	7689	7644	5395	6940	3338	4681	2694	1315	2514	992	2613	8557	13666	14279	8200	2669
76	8678	8920	13870	10216	11865	9422	8059	8016	5876	7223	3694	4948	2946	1711	2481	810	2552	8478	13627	14145	8059	2216
77	12281	12451	17436	13626	8278	5894	7218	4584	2982	7324	3898	2508	1786	2965	5120	3448	3514	10855	15670	16698	10748	5819
78	12237	12247	17265	13291	8278	6343	6072	5203	2211	6211	2938	3633	2776	2568	4665	3817	4329	10089	14772	15932	10085	5897
79	10779	11079	16012	12375	9906	7291	8033	5863	4515	7727	4032	2854	931	2325	4233	1816	1990	10243	15269	16023	9965	4304
80	12808	12798	17818	13817	7719	5903	5956	4843	1683	6282	3250	3694	3141	3121	5184	4377	4787	10469	15061	16301	10512	6476
81	17219	17532	22471	18771	4518	995	10343	598	5305	11262	8609	4092	5848	8118	10276	8229	7409	15825	20381	21661	15825	10757
82	10573	10962	15849	12324	10275	7521	8601	6052	5077	8239	4532	2815	821	2707	4438	1595	1402	10480	15558	16217	10140	4136
83	9928	10298	15193	11658	10828	8150	8503	6694	5362	7990	4291	3481	1487	2337	3866	938	1426	9908	15017	15616	9532	3477
84	9471	9898	14760	11303	11355	8631	8865	7160	5888	8251	4583	3859	1912	2571	3812	576	1237	9815	14964	15465	9379	3065
85	10590	11246	15939	12780	11135	8022	10355	6493	6631	9949	6241	2974	1865	4317	5700	2421	682	11681	16844	17281	11204	4552
86	7722	7980	12918	9311	12811	10375	8470	8962	6734	7430	4141	5829	3831	2355	2213	1463	3104	7945	13138	13496	7423	1272
87	7094	7454	12341	8869	13488	10976	9110	9538	7463	7985	4816	6303	4333	3084	2626	1918	3330	7982	13189	13390	7360	623
88	5118	3558	4291	1705	22728	20919	14251	19619	16115	12263	12245	16665	14663	12113	9969	12296	13752	6270	7907	5817	5397	9852
89	8592	7088	10646	6341	17991	16983	8358	15965	11554	6411	7879	13823	11970	8768	6875	10120	11863	911	4317	5188	1951	8543
90	7407	6274	10745	6261	16030	14703	7245	13595	9452	5273	5614	11270	9381	6225	4255	7483	9226	1789	6951	7591	1766	5972
91	11646	11181	16122	11796	10054	9076	3210	8217	3564	2866	1184	6968	5725	3165	3848	5449	6750	7459	11709	13173	7758	6309
92	9028	7371	10129	6199	19735	18767	9943	17747	13328	8044	9663	15564	13688	10511	8562	11762	13496	2521	2917	3409	3088	10023
93	9448	7825	10749	6744	19286	18412	9397	17428	12934	7527	9336	15348	13504	10294	8412	11654	13397	2404	2808	3843	3200	10031
94	9012	7276	8598	5615	22355	21224	12665	20133	15873	10753	12111	17725	15784	12722	10650	13679	15362	4881	3511	1424	4917	11640
95	10207	8507	10723	7148	20788	19974	10779	19000	14481	8968	10909	16915	15061	11861	9953	13174	14912	3913	1576	2439	4525	11461
96	9957	9682	14692	10525	10967	9349	5137	8225	4373	4307	809	6156	4509	1383	2041	3630	5129	7075	11868	12920	7067	4330
97	9352	9149	14170	10075	11410	9609	5807	8411	4872	4867	1507	6074	4292	1039	1466	3086	4683	6997	11931	12831	6873	3632
98	9326	8684	13556	9181	12654	11383	4725	10344	6070	3141	2266	8369	6665	3423	2371	5359	7032	4972	9655	10794	5143	5050
99	14366	14605	19571	15810	6431	3723	8274	2397	3220	8822	5791	2082	3153	5147	7305	5402	4907	12936	17625	18782	12888	7888
100	12776	13102	18028	14390	8127	5302	8448	3848	3876	8606	5156	1226	1459	3991	6089	3786	3216	11975	16866	17804	11798	6312
101	12730	12870	17865	14015	7806	5509	7057	4254	2585	7294	4011	2594	2211	3303	5460	3931	3974	11089	15834	16934	11027	6279
102	9898	10129	15088	11390	10664	8205	7699	6810	4848	7162	3463	3864	1902	1521	3244	1176	2254	9275	14338	15036	8969	3429
103	19666	19982	24923	21209	3585	1747	12047	3048	7282	13204	10863	6467	8287	10524	12680	10677	9799	18101	22509	23914	18159	13208
104	19338	19676	24606	20923	3882	1576	11990	2743	7149	13095	10664	6110	7955	10262	12419	10353	9442	17899	22356	23722	17934	12888
105	18008	18410	23303	19712	4905	1518	11588	1685	6548	12500	9773	4727	6637	9157	11310	9051	8046	16962	21576	22805	16922	11592
106	18512	18897	23800	20183	4575	1452	11792	2061	6808	12771	10140	5240	7134	9592	11748	9545	8563	17350	21915	23188	17333	12085
107	19028	19384	24304	20645	4131	1461	11909	2468	7010	12968	10463	5782	7645	10007	12165	10049	9112	17691	22189	23521	17707	12586
108	8983	9575	14319	11091	12177	9301	9828	7796	6896	9120	5503	4345	2604	3474	4329	1188	1072	10165	15358	15678	9620	2863
109	2077	1479	3585	2043	21959	19714	14703	18304	15485	12802	11795	15067	13114	11119	9148	10699	11892	7644	10722	8985	6498	8158
110	2202	2069	3183	2640	22436	20127	15323	18701	15996	13432	12343	15421	13486	11599	9667	11077	12206	8306	11310	9492	7160	8542
111	2524	2570	2830	3057	22882	20539	15826	19105	16460	13936	12823	15802	13879	12049	10136	11476	12567	8792	11693	9798	7651	8946
112	3790	2329	3786	768	22246	20264	14229	18919	15664	12263	11839	15850	13857	11495	9393	11458	12830	6560	8950	7058	5529	8957
113	3976	2672	3276	1300	22764	20758	14763	19405	16187	12796	12367	16312	14322	12000	9906	11918	13264	7060	9251	7234	6045	9406
114	4066	3062	2453	2061	23416	21336	15551	19962	16859	13589	13063	16813	14834	12616	10550	12421	13707	7885	9969	7838	6864	9891
115	4193	3440	1805	2684	23907	21766	16166	20376	17371	14211	13599	17182	15216	13087	11046	12800	14034	8544	10586	8391	7514	10261
116	10165	8428	9737	6798	22535	21586	12617	20554	16148	10772	12477	18296	16388	13255	11245	14367	16078	5274	2518	590	5556	12443
117	10563	8831	10407	7279	22102	21257	12090	20263	15778	10284	12173	18108	16228	13054	11096	14274	16000	5062	1763	1202	5502	12447
118	12635	10912	12511	9409	22423	21912	12169	21035	16354	10556	12990	19165	17368	14131	12323	15584	17329	6352	1168	2895	7069	13972
119	12716	11041	13272	9739	20902	20530	10607	19714	14958	9077	11748	18022	16292	13040	11366	14653	16399	5645	1247	4092	6571	13249
120	12099	10420	12675	9116	20780	20305	10525	19452	14740	8917	11439	17671	15912	12664	10936	14219	15966	5123	790	3641	6009	12751
121	10292	8677	11564	7598	19238	18523	9182	17595	12996	7391	9521	15659	13860	10623	8833	12106	13853	2982	2340	4042	3923	10607
122	11523	10317	14454	10010	14838	14448	4658	13692	8875	2974	5971	12326	10796	7627	6533	9639	11304	4127	6525	8561	5159	9047
123	10973	9733	13823	9387	15269	14755	5185	13946	9184	3396	6079	12429	10830	7617	6360	9541	11235	3492	6096	8015	4541	8787
124	12559	11398	15585	11135	14187	14046	3879	13396	8507	2558	6038	12317	10921	7864	7057	9998	11600	5263	7301	9515	6283	9673
125	12022	10845	15018	10569	14467	14194	4214	13489	8631	2673	5933	12264	10800	7682	6738	9762	11396	4696	6935	9059	5716	9313
126	13635	12489	16669	12224	13844	13977	3565	13440	8528	2830	6519	12644	11377	8447	7860	10653	12193	6340	7959	10331	7373	10523
127	13141	12002	16211	11758	13862	13867	3542	13280	8372	2535	6173	12366	11049	8070	7412	10253	11816	5890	7761	10053	6906	10064

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9/14/2018 10:25 PM/3.0.654

DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
128	14090	14421	19347	15700	7002	4008	8902	2532	3933	9325	6105	1308	2727	5195	7330	5100	4376	13123	17920	18965	13002	7630
129	17860	18023	23019	19136	3046	1042	9524	1925	4795	10684	8495	5206	6674	8395	10521	8929	8384	15718	20026	21501	15841	11388
130	18459	18593	23596	19677	2392	1373	9699	2548	5158	10956	8940	5865	7316	8941	11050	9549	9035	16137	20355	21894	16296	11992
131	2799	3814	3793	4820	23145	20579	16803	19101	16901	14988	13455	15687	13850	12423	10694	11509	12374	10274	13498	11665	9101	9066
132	2813	3660	3441	4548	23252	20727	16757	19256	16969	14923	13480	15859	14004	12498	10729	11648	12556	10097	13217	11345	8930	9183
133	4505	5865	5365	7021	23985	21197	18399	19685	17986	16664	14774	16193	14488	13513	12002	12273	12864	12313	15700	13867	11130	10009
134	4899	6312	5827	7508	24109	21274	18710	19756	18176	16997	15026	16253	14583	13715	12258	12405	12931	12744	16186	14367	11560	10192
135	5283	6709	6125	7904	24343	21475	19054	19955	18453	17352	15339	16446	14800	14000	12575	12648	13131	13137	16583	14754	11952	10469
136	5633	7149	6837	8442	24190	21258	19200	19733	18405	17539	15393	16217	14623	13981	12646	12531	12921	13523	17110	15345	12337	10438
137	6347	7915	7672	9260	24357	21352	19698	19822	18701	18078	15805	16304	14780	14320	13083	12765	13043	14236	17916	16183	13052	10777
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140	7270	8548	6803	9506	26424	23506	21158	21981	20579	19434	17472	18465	16863	16132	14707	14748	15167	15013	18135	16104	13835	12598
141	7803	9069	7167	10000	26903	23965	21691	22438	21086	19968	17996	18921	17337	16644	15232	15238	15631	15535	18612	16550	14358	13107
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143	8334	9612	7653	10544	27301	24333	22196	22804	21530	20483	18475	19286	17728	17099	15715	15657	16009	16078	19152	17077	14900	13558
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147	11780	13128	11013	14090	29868	26725	25451	25196	24406	23800	21575	21700	20315	20063	18853	18422	18535	19591	22687	20567	18409	16528
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151	7039	6719	1709	6027	27234	25001	19513	23583	20725	17547	16971	20309	18374	16398	14390	15964	17082	11729	12934	10351	10768	13426
152	7417	7116	2102	6418	27631	25393	19902	23973	21123	17934	17370	20693	18761	16794	14788	16352	17462	12099	13215	10602	11147	13815
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176	5883	6088	1890	6019	26374	23940	19306	22482	19990	17390	16368	19110	17233	15559	13675	14856	15818	11939	13946	11579	10865	12357
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182	6875	8174	6605	9168	26030	23123	20752	21599	20175	19030	17063	18084	16473	15726	14298	14349	14782	14639	17813	15815	13459	12193
183	10299	11735	10151	12832	28126	24988	23813	23459	22681	22191	19891	19960	18575	18353	17184	16690	16794	18168	21493	19498	16983	14824
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186	11292	12750	11173	13869	28764	25573	24700	24048	23434	23105	20730	20566	19243	19149	18043	17425	17449	19171	22532	20540	17986	15635
187	11608	13081	11542	14215	28915	25704	24960	24180	23634	23377	20968	20707	19409	19368	18291	17619	17612	19493	22882	20900	18307	15863
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190	7676	7433	2409	6777	27946	25684	20265	24258	21448	18299	17705	20964	19039	17107	15112	16633	17721	12475	13584	10960	11519	14099
191	2974	4182	4291	5312	23099	20470	16991	18982	16921	15204	13543	15542	13736	12436	10772	11424	12218	10646	13990	12198	9466	9024
192	11035	12400	10425	13394	29147	26021	24690	24491	23658	23040	20816	20990	19588	19309	18093	17679	17812	18859	22011	19926	17676	15772
193	6148	7744	7709	9133	24029	21022	19412	19493	18383	17803	15503	15975	14452	14006	12785	12442	12714	14028	17772	16080	12845	10465
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To be continued on next page...

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9/14/2018 10:25 PM/3.0.654

DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
197	9469	11161	11350	12690	24863	21588	21666	20071	19848	20243	17492	16633	15447	15749	14943	13832	13638	17177	21237	19677	16013	12355
198	3838	3785	1572	3781	24200	21868	16985	20434	17760	15069	14095	17127	15207	13363	11429	12804	13883	9690	12100	9963	8592	10275
199	5584	5751	1620	5674	26065	23649	18962	22195	19670	17045	16039	18833	16949	15245	13351	14567	15548	11595	13639	11295	10520	12061
200	5288	5420	1406	5342	25757	23357	18627	21906	19352	16709	15714	18554	16663	14933	13030	14276	15275	11263	13354	11036	10186	11766
201	5033	5100	1175	4992	25476	23100	18292	21654	19056	16371	15404	18316	16415	14646	12730	14023	15046	10913	13024	10726	9837	11506
202	4860	5798	3902	6518	25060	22401	18868	20905	18890	17049	15494	17448	15668	14406	12727	13373	14118	12210	15089	13028	11050	10989
203	4525	5475	3820	6233	24744	22098	18534	20605	18564	16716	15162	17153	15364	14080	12395	13063	13824	11897	14830	12803	10735	10671
204	4185	5095	3594	5849	24476	21860	18180	20372	18267	16355	14839	16932	15126	13785	12076	12810	13606	11512	14454	12445	10351	10397
205	6735	8214	7429	9431	25155	22170	20315	20642	19446	18660	16483	17123	15579	15041	13744	13536	13852	14616	18110	16268	13431	11497
206	6521	7236	3993	7625	26839	24194	20448	22699	20636	18593	17188	19242	17461	16154	14431	15161	15911	13489	15910	13635	12361	12763
207	6335	7506	5643	8376	25952	23129	20320	21612	19972	18557	16748	18110	16435	15500	13974	14243	14787	13965	16981	14928	12793	11994
208	6997	8180	6168	9039	26484	23623	20967	22102	20552	19212	17364	18593	16946	16086	14592	14783	15278	14640	17629	15548	13468	12569

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
1	5146	5731	5679	4796	5958	7394	10436	10609	8470	10548	6629	5798	3993	6003	6501	10802	5632	7780	4778	8375	7112	7706
2	5436	2117	1749	790	1709	11918	13483	14196	9745	10528	9632	1373	8453	2647	6259	13590	10119	9561	4598	8383	6649	11986
3	6088	3301	2944	1957	1971	11387	12341	13120	8552	9424	8512	2486	7722	3821	7067	12426	9392	10037	3412	7252	5538	11111
4	5856	3518	3213	2186	2523	10833	11971	12688	8372	9428	8117	2877	7176	4009	6908	12087	8846	9703	3299	7229	5555	10592
5	5976	7523	7520	6686	7895	5453	9705	9512	8831	11327	6183	7704	2323	7736	7322	10215	3843	7530	6149	9275	8280	6125
6	4593	6487	6549	5820	7319	6285	11043	10894	9786	12063	7434	6858	3671	6637	5938	11524	5093	6409	6435	9927	8738	7459
7	6167	8087	8113	7315	8597	4772	9805	9448	9320	11910	6449	8342	2102	8269	7480	10369	3420	7278	6864	9895	8956	5826
8	6382	7092	7011	6085	7001	6438	9134	9223	7689	10077	5404	7055	2710	7386	7747	9549	4379	8522	4863	7998	6978	6332
9	7378	7813	7687	6716	7372	6439	8146	8311	6804	9332	4399	7636	2436	8147	8741	8548	4056	9473	4579	7325	6473	5702
10	4234	3664	3601	2736	4180	9353	12067	12452	9286	10829	8184	3757	6071	3969	5452	12330	7709	7818	4653	8603	7062	9760
11	4339	4186	4133	3270	4643	8828	11670	11998	9090	10776	7799	4288	5540	4473	5616	11960	7175	7699	4653	8553	7073	9241
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13	9225	9825	9684	8699	9180	5699	6337	6315	6223	9156	2925	9590	1946	10167	10587	6848	2929	10823	5715	7445	7055	3870
14	7523	5024	4648	3685	2978	11215	10903	11859	6849	7724	7171	4087	7294	5550	8609	10915	8919	11236	1693	5535	3845	10317
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18	10296	10869	10714	9718	10088	5787	5322	5229	5952	9030	2274	10586	2607	11222	11657	5888	2994	11753	6352	7520	7382	3153
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20	9310	7697	7365	6355	5778	10115	8113	9205	4220	5885	4502	6880	6068	8194	10561	8095	7470	12430	1328	3707	2637	8294
21	5385	2660	2353	1325	2144	11283	12819	13503	9210	10160	8958	2076	7768	3157	6333	12944	9436	9397	4101	7981	6275	11283
22	7641	7378	7187	6174	6529	7603	8140	8606	6006	8327	4260	7012	3569	7771	8984	8420	5130	10180	3403	6255	5313	6514
23	5189	777	701	1700	2835	13500	15816	16470	12043	12607	11952	1153	10369	1013	5505	15934	12003	9404	6886	10530	8775	14038
24	8360	6179	5814	4835	4096	10890	9794	10837	5678	6730	6132	5265	6872	6697	9519	9775	8426	11860	546	4511	2920	9591
25	7321	5180	4838	3835	3423	10642	10510	11398	6678	7793	6731	4362	6717	5687	8462	10560	8342	10913	1612	5577	3959	9762
26	6845	4312	3949	2968	2542	11148	11437	12300	7543	8458	7646	3439	7323	4832	7905	11489	8976	10639	2401	6270	4577	10527
27	5956	7216	7190	6328	7467	5881	9613	9527	8490	10925	5999	7336	2523	7455	7314	10086	4123	7777	5675	8853	7825	6307
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29	9238	9339	9154	8142	8411	6761	6309	6646	5337	8170	2535	8974	2873	9722	10600	6686	4006	11238	4706	6395	5974	4796
30	5939	4934	4732	3719	4305	9128	10503	11058	7533	9164	6614	4577	5386	5345	7190	10709	7054	9252	3075	6943	5490	8796
31	5973	4607	4375	3350	3833	9599	10805	11423	7618	9090	6923	4166	5859	5042	7181	10979	7527	9443	2924	6864	5341	9246
32	5938	4245	3989	2958	3381	10027	11174	11834	7823	9147	7302	3738	6309	4700	7099	11324	7978	9548	2952	6924	5339	9699
33	5276	3346	3112	2089	2940	10421	12066	12681	8708	9914	8186	2950	6871	3792	6364	12228	8540	9088	3736	7701	6061	10390
34	4311	3254	3685	4570	6191	14197	18271	18631	15034	15864	14384	4474	11826	2713	3725	18508	13316	7811	9926	13736	11995	15626
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37	2580	3135	3607	4188	6194	12514	17082	17300	14244	15396	13219	4494	10317	2646	2146	17383	11753	6269	9275	13207	11512	14117
38	1922	3229	3685	4110	6209	11843	16562	16730	13879	15151	12715	4565	9694	2807	1708	16886	11112	5773	8988	12946	11277	13491
39	2335	6027	6286	5961	7973	7712	13846	13586	12470	14528	10264	6912	6241	5936	3480	14345	7385	3790	8549	12333	10957	9878
40	2354	5553	5778	5383	7351	7770	13406	13236	11855	13866	9762	6359	5935	5511	3642	13876	7190	4464	7866	11665	10277	9651
41	1758	4005	4461	4873	6983	11798	16968	17048	14469	15828	13149	5342	9901	3574	1034	17324	11251	5159	9648	13616	11964	13676
42	2107	5737	6183	6499	8650	11377	17537	17405	15523	17117	13822	7055	10090	5327	903	17973	11258	3616	10923	14892	13300	13753
43	12282	11983	11734	10703	10516	8357	3428	4415	3629	6805	528	11408	5282	12417	13642	3666	5634	14225	6138	5758	6218	4893
44	11833	11341	11078	10046	9794	8604	4101	5174	3172	6321	686	10726	5253	11785	13187	4238	5825	13967	5389	5114	5483	5388
45	12005	11267	10982	9953	9565	9212	4326	5607	2539	5680	1328	10584	5765	11729	13348	4328	6422	14303	5087	4493	4957	6031
46	11903	10991	10692	9667	9196	9549	4739	6087	2195	5279	1785	10265	5991	11463	13236	4675	6748	14334	4690	4012	4465	6475
47	18924	18402	18105	17079	16511	13227	3601	4932	7120	8843	7164	17665	11420	18869	20286	3011	11091	20628	11980	9537	10944	9067
48	17474	17208	16937	15905	15505	11540	1987	3288	6482	8729	5768	16552	9810	17655	18838	1642	9422	19031	10986	9025	10248	7380
49	17836	17806	17555	16523	16231	11322	2395	2917	7416	9758	6285	17210	9962	18238	19200	2422	9400	19173	11738	9977	11136	7189
50	18609	18226	17941	16912	16422	12678	3162	4340	7160	9083	6870	17528	10990	18683	19972	2696	10597	20210	11891	9636	10977	8520
51	12924	12423	12152	11120	10792	9110	3090	4442	3101	6254	1279	11779	6067	12873	14279	3147	6406	14967	6324	5424	6098	5531
52	17197	16522	16217	15194	14596	12222	2507	4457	5224	7182	5463	15763	9974	16995	18553	1626	9860	19104	10065	7685	9046	8111
53	17204	16385	16069	15051	14379	12547	2923	4945	4907	6703	5535	15590	10153	16867	18555	2007	10123	19225	9859	7309	8728	8467
54	16918	16005	15682	14667	13955	12548	3083	5176	4447	6214	5325	15188	10015	16491	18264	2160	10065	19027	9444	6827	8262	8512
55	14331	12636	12262	11293	10263	12572	5624	7596	950	2634	4603	11661	9065	13155	15610	5044	9785	17133	5924	2771	4306	9212

To be continued on next page...

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DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
56	16186	16084	15831	14799	14523	10228	678	2213	5936	8548	4567	15488	8453	16517	17551	983	8065	17677	10044	8507	9555	6072
57	17452	17332	17073	16042	15715	11212	1948	2865	6857	9210	5829	16716	9664	17769	18816	1874	9185	18887	11214	9417	10582	7058
58	4775	5081	5027	4149	5382	7998	10936	11182	8689	10602	7094	5157	4645	5360	6109	11268	6283	7723	4648	8401	7039	8350
59	8681	8552	8354	7336	7577	7240	6979	7436	5343	7973	3115	8154	3222	8947	10037	7289	4569	10944	3962	6060	5439	5587
60	7205	5425	5117	4093	3911	10090	10112	10934	6516	7859	6295	4716	6156	5911	8396	10200	7779	10656	1687	5633	4105	9212
61	5135	7257	7322	6590	8052	5514	10733	10451	9872	12297	7256	7627	3125	7399	6449	11264	4432	6453	6884	10206	9117	6856
62	7345	7529	7381	6395	6968	6895	8236	8512	6573	9009	4420	7293	2891	7883	8704	8592	4500	9636	4128	6968	6061	6075
63	11037	11198	10999	9980	10104	6876	4478	4791	4892	8017	1135	10781	3708	11590	12402	4939	4107	12744	6040	6646	6718	3804
64	13815	13736	13496	12465	12300	8633	1710	2766	4615	7669	2206	13185	6268	14160	15180	2191	6158	15450	7899	7051	7775	4666
65	9731	9189	8941	7910	7829	8124	6223	6991	4139	6843	2354	8634	4219	9624	11075	6414	5358	12134	3699	5031	4663	5896
66	9520	9848	9679	8675	9012	6283	5996	6167	5612	8550	2407	9529	2552	10216	10885	6446	3494	11297	5333	6863	6537	4166
67	10038	8914	8614	7589	7180	9355	6697	7770	3414	5782	3071	8194	5400	9389	11345	6721	6602	12790	2765	3847	3413	7100
68	8859	10179	10109	9184	9987	4156	7195	6711	7770	10726	4278	10148	648	10453	10191	7836	1476	9866	6992	9003	8534	3263
69	631	4802	5206	5345	7520	10398	16112	16041	14049	15681	12372	6034	8773	4486	797	16531	10026	3925	9494	13456	11886	12495
70	2816	4484	4957	5541	7549	12822	18058	18154	15452	16699	14229	5842	11006	3982	1725	18403	12344	5609	10550	14501	12820	14777
71	694	5158	5534	5562	7730	9769	15684	15552	13808	15553	11984	6326	8249	4892	1388	16127	9460	3543	9391	13328	11800	11941
72	8051	10216	10237	9422	10600	2772	8942	8166	9681	12574	6227	10443	1532	10396	9302	9643	1605	8325	8304	10757	10115	4116
73	2176	4715	5179	5632	7726	12098	17609	17630	15212	16599	13812	6065	10417	4258	953	17985	11710	4855	10416	14385	12738	14165
74	11102	10261	9974	8945	8576	9090	5302	6447	2790	5706	1822	9577	5385	10725	12435	5334	6284	13558	4130	4167	4293	6296
75	11214	10070	9757	8737	8199	9771	5749	7045	2330	5058	2520	9303	5987	10552	12527	5676	6968	13864	3684	3434	3583	7038
76	11034	9726	9402	8387	7778	10045	6212	7526	2398	4873	2984	8922	6189	10217	12332	6113	7253	13807	3250	3105	3121	7439
77	13842	13162	12871	11843	11374	10000	2727	4479	2819	5814	2271	12453	7053	13627	15193	2509	7336	15951	6854	5340	6282	6275
78	13185	12853	12595	11563	11305	8862	2579	3841	3647	6772	1424	12248	6041	13293	14546	2762	6221	15075	6865	6015	6698	5137
79	13008	11888	11565	10550	9898	10528	4413	6093	1327	4500	2557	11082	7098	12377	14332	4131	7747	15498	5367	3697	4601	7202
80	13610	13384	13133	12101	11874	8847	2029	3288	4096	7169	1882	12799	6259	13818	14973	2315	6289	15380	7443	6524	7259	4978
81	18925	18299	17993	16970	16349	13453	3750	5225	6893	8499	7168	17534	11526	18772	20284	3074	11259	20715	11823	9267	10711	9294
82	13149	11826	11486	10483	9713	11052	4883	6635	737	3913	3114	10965	7543	12326	14458	4524	8261	15770	5206	3163	4200	7782
83	12524	11159	10820	9816	9061	10820	5336	6967	994	3994	3036	10301	7184	11659	13826	5055	8015	15217	4546	2861	3674	7740
84	12329	10797	10446	9452	8618	11085	5878	7500	1092	3709	3449	9901	7355	11305	13615	5586	8278	15145	4131	2367	3135	8136
85	14104	12257	11873	10918	9815	12772	6162	8101	1036	2187	4866	11249	9164	12782	15365	5605	9972	17017	5553	2211	3801	9532
86	10324	8814	8479	7472	6822	10207	7145	8383	3127	5107	3741	7982	6230	9312	11597	7066	7463	13286	2294	3066	2551	7943
87	10161	8358	8002	7013	6214	10727	7841	9112	3494	5008	4475	7456	6707	8870	11399	7728	8020	13306	1693	2838	1953	8619
88	3667	2248	2708	3513	5287	13300	17146	17523	13930	14830	13258	3555	10783	1703	3434	17380	12301	7549	8839	12683	10951	14578
89	3165	6354	6553	6084	7964	6906	12914	12632	11707	13881	9369	7086	5285	6341	4390	13427	6443	4478	8030	11709	10410	8930
90	4823	6049	6055	5245	6591	6835	10693	10709	9079	11262	6971	6273	3748	6261	6187	11117	5313	7113	5565	9107	7883	7539
91	10767	11450	11301	10308	10690	5603	4988	4718	6196	9322	2395	11182	2843	11797	12123	5621	2879	12061	6923	7911	7867	2620
92	2176	6363	6672	6471	8556	8148	14695	14379	13376	15414	11146	7368	7022	6198	3033	15210	8073	2925	9402	13214	11816	10582
93	2814	6877	7162	6891	8929	7519	14330	13937	13245	15392	10857	7822	6586	6743	3687	14874	7554	2942	9470	13209	11869	10068
94	1966	5988	6418	6647	8816	10827	17185	16996	15336	17028	13509	7273	9660	5613	1127	17643	10783	3078	10846	14802	13243	13286
95	2941	7390	7746	7671	9805	8655	15890	15450	14779	16850	12432	8504	8116	7147	3201	16442	8992	1495	10838	14651	13253	11504
96	10166	10125	9916	8893	9001	7141	5408	5882	4677	7657	1601	9683	3496	10527	11528	5760	4335	12144	4996	6053	5891	4608
97	9969	9656	9425	8397	8398	7689	5775	6433	4298	7161	1885	9150	3890	10076	11324	6033	4898	12178	4312	5459	5213	5302
98	8197	8855	8734	7765	8385	5758	7338	7351	6682	9441	3766	8684	1714	9182	9560	7813	3181	9937	5293	7570	6939	4661
99	15987	15342	15045	14019	13476	11284	1902	4047	4287	6629	4264	14607	8845	15811	17343	1029	8826	17933	8943	6827	8071	7242
100	14874	13906	13586	12570	11904	11271	3103	5155	2589	5114	3522	13104	8318	14391	16213	2499	8618	17133	7378	5136	6383	7481
101	14126	13558	13275	12245	11819	9913	2239	4031	3281	6218	2429	12872	7133	14017	15481	2053	7304	16129	7306	5817	6769	6084
102	12004	10908	10593	9574	8999	9992	5041	6486	1787	4816	2269	10131	6373	11391	13325	4901	7187	14554	4470	3531	4052	6958
103	21258	20740	20438	19414	18799	15155	5824	6748	9311	10663	9503	19984	13644	21211	22620	5334	13195	22867	14274	11621	13116	11023
104	21034	20450	20143	19121	18476	15104	5660	6705	8964	10269	9274	19679	13490	20924	22395	5119	13088	22708	13956	11253	12762	10959
105	20020	19228	18906	17891	17162	14699	4989	6446	7601	8797	8290	18412	12733	19713	21375	4277	12497	21902	12661	9827	11369	10541
106	20433	19703	19385	18368	17661	14908	5265	6584	8110	9321	8685	18899	13059	20185	21791	4609	12767	22250	13154	10350	11886	10748
107	20808	20169	19859	18838	18170	15026	5498	6646	8643	9914	9047	19386	13324	20647	22168	4914	12962	22534	13654	10914	12433	10873
108	12469	10569	10189	9229	8180	11950	6806	8496	1495	2947	4459	9578	8124	11093	13714	6444	9148	15505	3862	1341	2329	9126
109	6247	1843	1635	2421	2665	14445	16264	17035	12210	12500	12440	1479	11193	2044	6497	16326	12844	10449	7089	10506	8754	14797
110	6845	2490	2297	3054	2963	15100	16737	17560	12553	12690	12938	2069	11818	2641	7024	16772	13474	11024	7475	10752	9010	15400
111	7242	2953	2787	3559	3353	15601	17182	18029	12930	12972	13396	2570	12322	3058	7355	17204	13978	11392	7884	11073	9341	15899
112	4533	1213	1580	2556	4040	13571	16602	17134	13058	13753	12716	2325	10714	767	4597	16771	12303	8638	7913	11648	9898	14461
113	4891	1704	2017	3027	4334	14082	17114	17662	13507	14123	13231	2668	11249	1299	4824	17274	12836	8916	8354	12040	10286	14997
114	5664	2374	2586	3618	4586	14904	17748	18354	13982	14436	13875	3059	12032	2060	5497	17879	13629	9614	8827	12401	10645	15766
115	6314	2943	3093	4114	4824	15557	18227	18882	14335	14657	14367	3438	12645	2683	6096	18335	14251	10220	9193	12666	10913	16364
116	2929	7159	7581	7757	9932	10533	17516	17183	16009	17849	13943	8425	9827	6797	2322	18025	10799	2018	11704	15627	14118	13314
117	3216	7604	8007	8098	10271	9906	17176	16761	15899	17853	13676	8827	9421	7278	2890	17715	10309	1282	11758	15639	14177	12820
118	5274	9717	10107	10133	12291	9591	17828	17162	17158	19339	14572	10908	10000	9408	5037	18449	10573	1076	13380	17154	15790	13018
119	5536	9966	10306	10162	12255	7947	16460	15686	16172	18531	13360	11038	8669	9738	5707	17119	9090	1768	12764	16389	15136	11489
120	4914	9342	9684	9546	11645	7981	16225	15526	15758	18062	13038	10417	8405	9115	5116	16861	8934	1349	12240	15906	14623	11373
121	3608	7734	8019	7736	9756	7074	14434	13914	13664	15924	11086	8674	6619	7597	4346	15020	7414	2622	10102	13763	12481	9921
122	7174	9903	9990	9278	10710	2915	10398	9585	10926	13719	7604	10316	2812	10010	8338	11097	2990	6963	9004	11807	11005	5444
123	6540	9290	9386	8693	10177	3554	10683	9978	10892	13603	7712	9732	2930	9387	7717	11349	3417	6508	8676	11636	10752	5916
124	8286	11019	11096	10361	11725	1779	10061	9040	11167	14082	7634	11397	3041	11135	9426	10819	2558	7775	9735	12270	11605	4782

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DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
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126	9297	12111	12189	11452	12794	759	10093	8862	11718	14716	8050	12488	3778	12224	10399	10902	2813	8463	10652	12989	12428	4574
127	8901	11638	11710	10966	12298	1152	9935	8796	11355	14326	7732	12001	3338	11759	10028	10723	2524	8251	10176	12570	11977	4508
128	16090	15219	14902	13884	13221	11864	2698	4847	3808	5913	4508	14424	9226	15701	17437	1837	9331	18208	8697	6281	7630	7884
129	18929	18689	18416	17385	16959	12636	3415	4232	7794	9786	7246	18025	11172	19138	20293	3120	10675	20395	12433	10293	11598	8497
130	19375	19236	18970	17939	17552	12795	3877	4399	8439	10444	7752	18595	11524	19679	20739	3686	10944	20735	13032	10946	12238	8690
131	9028	4612	4334	4851	3753	16865	17469	18515	12820	12405	13818	3815	13360	4821	9210	17392	15030	13215	8056	10708	9059	16771
132	8753	4371	4119	4700	3770	16751	17568	18575	12987	12650	13886	3661	13297	4549	8900	17510	14965	12925	8159	10916	9249	16749
133	11226	6788	6478	6877	5365	18704	18389	19627	13392	12446	14928	5867	15040	7022	11417	18207	16706	15422	9099	11050	9569	18272
134	11710	7265	6946	7314	5730	19076	18539	19821	13476	12413	15130	6314	15377	7509	11914	18334	17039	15912	9311	11093	9659	18561
135	12108	7663	7345	7709	6103	19448	18791	20100	13687	12541	15415	6712	15734	7905	12305	18571	17394	16307	9605	11277	9877	18893
136	12633	8172	7831	8125	6394	19704	18684	20055	13498	12201	15393	7152	15930	8444	12880	18430	17580	16849	9621	11042	9715	19001
137	13439	8975	8622	8870	7059	20304	18913	20352	13644	12157	15724	7917	16480	9261	13712	18620	18119	17662	10015	11140	9911	19461
138	13750	9289	8913	9083	7170	20290	18547	20038	13223	11614	15447	8167	16415	9608	14086	18224	18039	17984	9814	10694	9542	19296
139	14140	9678	9303	9472	7553	20648	18790	20305	13442	11758	15730	8557	16763	9996	14472	18452	18383	18373	10128	10901	9791	19617
140	13695	9345	9085	9576	8139	21473	20897	22227	15741	14429	17547	8549	17812	9507	13734	20658	19476	17818	11740	13290	11949	21014
141	14181	9849	9596	10100	8673	22006	21390	22735	16211	14844	18059	9071	18346	10001	14196	21142	20010	18289	12257	13747	12429	21543
142	14470	10118	9855	10335	8858	22201	21434	22806	16222	14789	18139	9311	18515	10281	14503	21172	20177	18591	12353	13741	12455	21678
143	14723	10395	10141	10642	9197	22535	21810	23180	16598	15155	18512	9614	18862	10544	14730	21548	20525	18826	12723	14115	12832	22039
144	15149	10835	10586	11097	9660	22998	22242	23623	17014	15528	18959	10068	19326	10977	15137	21972	20988	19239	13175	14522	13257	22499
145	17297	12965	12704	13179	11645	24989	23730	25213	18391	16620	20600	12157	21250	13119	17290	23400	22904	21393	14893	15847	14726	24318
146	17918	13578	13313	13775	12213	25552	24143	25655	18778	16930	21060	12756	21794	13737	17916	23795	23444	22018	15383	16224	15146	24828
147	18266	13939	13679	14151	12603	25944	24539	26054	19170	17307	21461	13130	22191	14091	18248	24189	23841	22354	15784	16615	15544	25229
148	9063	6906	7126	8157	8793	18961	22285	22889	18367	18506	18416	7505	16410	6532	8288	22403	17958	12129	13242	16598	14857	20185
149	9032	6641	6836	7862	8408	18858	21979	22620	17993	18081	18119	7171	16223	6294	8322	22081	17787	12233	12881	16190	14454	19985
150	8685	6068	6241	7262	7754	18418	21364	22030	17342	17418	17510	6545	15702	5745	8058	21455	17282	12043	12237	15530	13795	19452
151	9088	6322	6467	7479	7850	18769	21543	22248	17439	17432	17702	6718	15997	6026	8487	21616	17587	12486	12359	15577	13852	19733
152	9422	6717	6865	7877	8235	19139	21940	22646	17822	17790	18099	7115	16387	6418	8789	22011	17974	12760	12748	15947	14225	20126
153	10316	7634	7771	8777	9049	20063	22810	23541	18621	18495	18979	7992	17313	7342	9644	22867	18901	13571	13576	16695	14986	21048
154	10399	7580	7697	8693	8886	20086	22683	23443	18442	18268	18863	7881	17281	7309	9766	22727	18879	13727	13418	16488	14787	21003
155	10688	7709	7799	8777	8854	20299	22693	23494	18374	18120	18891	7931	17426	7468	10098	22718	19036	14089	13386	16376	14688	21129
156	10925	6699	6504	7150	6143	19211	19734	20845	14918	14183	16141	6113	15750	6789	10890	19615	17420	14994	10338	12670	11106	19167
157	11337	7064	6847	7450	6324	19489	19782	20937	14894	14056	16231	6412	15978	7178	11331	19641	17648	15428	10411	12603	11074	19352
158	11666	7424	7218	7837	6729	19883	20173	21336	15267	14387	16630	6799	16380	7524	11630	20027	18050	15735	10808	12961	11445	19757
159	11955	7683	7463	8053	6870	20079	20210	21403	15257	14306	16697	7015	16543	7798	11940	20048	18213	16040	10870	12923	11433	19888
160	12270	8190	8034	8736	7793	20807	21340	22478	16455	15568	17772	7704	17383	8225	12113	21203	19052	16237	11959	14152	12634	20815
161	10111	6025	5887	6633	5924	18696	19718	20734	15065	14541	16044	5614	15352	6052	10001	19647	17016	14119	10305	12914	11289	18858
162	9798	5651	5495	6221	5485	18289	19283	20296	14647	14160	15607	5197	14927	5700	9733	19216	16592	13842	9871	12511	10877	18425
163	14589	10142	9749	9850	7857	20783	18557	20128	13163	11335	15603	8972	16854	10485	14974	18186	18455	18825	10108	10603	9591	19601
164	14995	10547	10156	10259	8263	21165	18827	20421	13416	11517	15916	9380	17228	10888	15376	18442	18825	19232	10458	10851	9882	19947
165	16001	11546	11161	11281	9294	22174	19632	21269	14193	12147	16807	10394	18226	11876	16359	19218	19815	20237	11421	11621	10740	20898
166	16418	11968	11578	11678	9669	22470	19741	21408	14288	12158	16982	10803	18506	12305	16791	19308	20084	20654	11665	11717	10897	21124
167	12976	8603	8333	8809	7362	20696	20203	21508	15087	13871	16821	7784	17038	8779	13049	19981	18703	17119	11005	12662	11282	20251
168	12235	7936	7704	8268	7017	20268	20247	21468	15250	14231	16765	7231	16702	8067	12239	20070	18371	16334	10935	12892	11427	20017
169	17327	12874	12487	12594	10586	23351	20432	22136	14968	12723	17755	11716	19377	13205	17688	19974	20947	21563	12510	12401	11658	21948
170	12054	8045	7912	8649	7806	20717	21442	22546	16610	15794	17843	7624	17341	8054	11858	21322	19008	15983	12045	14336	12793	20807
171	11854	7911	7797	8563	7807	20620	21509	22583	16725	15970	17884	7547	17286	7898	11626	21404	18950	15750	12102	14477	12914	20780
172	11181	7182	7059	7817	7070	19877	20804	21859	16063	15388	17162	6799	16536	7184	10997	20710	18201	15123	11393	13847	12262	20033
173	10448	6401	6270	7025	6313	19085	20093	21119	15414	14844	16428	6008	15748	6415	10307	20016	17412	14430	10680	13243	11630	19254
174	10897	6862	6731	7479	6724	19543	20467	21516	15741	15098	16820	6460	16194	6875	10740	20377	17859	14864	11055	13538	11944	19688
175	12877	8571	8333	8879	7570	20856	20648	21909	15587	14452	17212	7844	17260	8706	12879	20448	18928	16975	11385	13190	11772	20539
176	9760	6139	6125	7025	6800	18904	20677	21566	16235	15917	16919	6087	15789	6019	9436	20666	17431	13550	11311	14194	12519	19413
177	8366	4640	4631	5546	5498	17406	19338	20169	15045	14937	15547	4634	14300	4529	8139	19360	15939	12264	10031	13113	11401	17939
178	7993	4219	4209	5127	5134	16986	18953	19768	14701	14654	15153	4222	13878	4115	7805	18983	15517	11929	9665	12802	11082	17520
179	10251	5817	5516	5950	4566	17859	17918	19078	13058	12339	14372	4930	14255	6046	10444	17781	15924	14445	8549	10805	9243	17561
180	9867	5431	5129	5569	4228	17497	17684	18814	12878	12249	14108	4547	13912	5663	10070	17562	15581	14065	8295	10664	9074	17242
181	15644	11190	10804	10925	8941	21844	19397	21016	13968	11978	16535	10037	17903	11521	16004	18995	19496	19880	11116	11398	10481	20600
182	13365	8995	8726	9200	7739	21077	20497	21822	15352	14073	17141	8176	17408	9169	13429	20263	19072	17503	11332	12909	11556	20605
183	17036	12636	12343	12740	11082	24391	22802	24328	17429	15579	19747	11737	20591	12833	17117	22449	22233	21187	14101	14874	13810	23567
184	17305	12890	12587	12958	11258	24540	22784	24336	17391	15477	19777	11963	20716	13100	17410	22415	22352	21470	14168	14829	13806	23649
185	17668	13258	12959	13337	11646	24930	23151	24711	17752	15811	20157	12341	21107	13463	17760	22776	22743	21826	14555	15187	14179	24037
186	18073	13667	13369	13750	12058	25339	23505	25078	18097	16119	20534	12753	21512	13869	18158	23123	23147	22228	14946	15530	14542	24431
187	18421	14009	13707	14076	12364	25629	23684	25276	18264	16237	20749	13083	21788	14216	18515	23290	23419	22580	15189	15694	14738	24679
188	18658	14235	13926	14275	12531	25766	23685	25297	18252	16174	20791	13288	21907	14452	18771	23278	23533	22828	15268	15681	14759	24762
189	8289	5712	5899	6925	7490	18025	21040	21686	17069	17202	17180	6233	15325	5376	7670	21141	16900	11666	11951	15291	13550	19080
190	9802	7067	7205	8211	8511	19515	22252	22977	18091	18007	18418	7432	16748	6777	9164	22314	18339	13126	13033	16187	14472	20482
191	9515	5073	4768	5207	3902	17147	17440	18545	12686	12139	13840	4184	13576	5313	9733	17334	15246	13717	8039	10508	8895	16926
192	17579	13231	12964	13420	11852	25191	23802	25307	18444	16620	20708	12402	21432	13394	17588	23459	23082	21686	15025	15893	14803	24468
193	13298	8833	8469	8685	6835	20046	18589	20033	13315	11830	15410	7746	16208	9135	13600	18293	17844	17527	9712	10811	9586	19167

To be continued on next page...

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Calculated:
9/14/2018 10:25 PM/3.0.654

DECIBEL - Main Result

Calculation: A031 AW125-3.15

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WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
194	13024	8562	8218	8497	6736	20024	18848	20249	13624	12239	15601	7531	16230	8838	13277	18577	17876	17242	9854	11145	9861	19264
195	15381	10936	10542	10633	8623	21467	18977	20597	13549	11571	16119	9762	17518	11280	15770	18575	19107	19618	10715	10979	10063	20195
196	17048	12599	12208	12301	10282	23021	20105	21805	14642	12415	17420	11431	19044	12938	17424	19650	20613	21285	12174	12075	11323	21611
197	16787	12345	11950	12025	9992	22696	19772	21469	14310	12099	17082	11164	18716	12691	17181	19320	20283	21024	11842	11742	10986	21275
198	7753	3846	3808	4706	4682	16615	18500	19321	14253	14230	14703	3785	13468	3781	7634	18529	15111	11750	9213	12366	10642	17097
199	9434	5792	5780	6683	6493	18558	20367	21244	15957	15686	16602	5750	15445	5674	9129	20363	17087	13248	11012	13939	12256	19073
200	9127	5457	5444	6349	6189	18223	20058	20923	15677	15449	16286	5419	15109	5342	8845	20060	16750	12967	10713	13681	11990	18739
201	8785	5111	5105	6018	5919	17875	19776	20623	15439	15268	15994	5099	14773	4992	8518	19789	16412	12642	10450	13474	11772	18410
202	10672	6413	6207	6837	5810	18893	19406	20513	14605	13901	15809	5799	15421	6518	10666	19291	17091	14762	10008	12368	10796	18834
203	10402	6115	5899	6514	5475	18566	19087	20186	14305	13642	15482	5476	15088	6234	10424	18977	16758	14509	9686	12085	10501	18500
204	10021	5728	5512	6134	5139	18191	18811	19885	14077	13488	15184	5096	14728	5850	10056	18714	16397	14136	9402	11889	10283	18155
205	13635	9188	8866	9203	7510	20827	19688	21096	14446	12997	16450	8216	17052	9433	13825	19409	18701	17834	10703	11955	10695	20107
206	11611	7626	7502	8256	7479	20318	21178	22252	16399	15661	17553	7237	16970	7625	11411	21074	18635	15537	11771	14157	12590	20458
207	12552	8238	7998	8542	7241	20520	20367	21614	15330	14244	16914	7507	16930	8377	12566	20175	18599	16658	11085	12949	11511	20218
208	13208	8908	8671	9217	7896	21189	20919	22196	15834	14650	17502	8182	17586	9040	13202	20710	19254	17301	11677	13422	12023	20855

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
1	6812	8954	5590	9227	14393	12323	10669	2835	2820	4312	18171	17936	17655	16822	6821	6270	9202
2	2356	13440	10098	5140	16139	13918	12411	5275	5910	8096	20528	20279	20101	18834	11098	9417	12857
3	2885	12689	9395	6270	14946	12725	11216	5390	5909	7974	19335	19086	18910	17639	10788	9529	11801
4	3428	12147	8847	6655	14750	12539	11001	4959	5441	7468	19076	18827	18638	17419	10249	9074	11356
5	8752	7129	3765	11015	14246	12318	10663	3314	2808	3140	17634	17409	17079	16485	5029	5350	8106
6	8100	8299	4982	9939	15436	13450	11789	1931	1490	2644	18944	18716	18397	17741	5354	4629	9487
7	9441	6625	3304	11564	14541	12670	11025	3506	2871	2652	17771	17551	17203	16703	4291	4885	8057
8	7905	7697	4370	10579	13341	11339	9678	3861	3585	4389	16953	16721	16422	15685	6270	6560	7813
9	8308	7292	4102	11267	12351	10366	8707	4866	4571	5164	15949	15717	15419	14682	6629	7378	6908
10	4938	11029	7662	7155	15518	13359	11745	2990	3484	5577	19577	19334	19094	18078	8511	7108	11061
11	5430	10495	7128	7681	15258	13119	11491	2753	3150	5162	19247	19006	18754	17787	8030	6793	10602
12	5929	10146	6777	7998	15422	13306	11667	2270	2622	4625	19324	19086	18821	17913	7521	6265	10490
13	10133	5759	3084	13263	11011	9199	7578	6614	6173	6141	14265	14041	13709	13156	6601	8354	4907
14	3920	12111	8966	7809	13245	11020	9534	6334	6688	8506	17688	17438	17278	15954	10975	10319	10598
15	10072	5537	2461	12941	12017	10215	8593	5814	5311	5139	15192	14972	14627	14132	5667	7344	5605
16	12222	4369	3084	15431	10033	8528	7053	8547	8013	7518	12720	12511	12130	11863	7033	9609	2875
17	12644	4059	3122	15838	10027	8599	7166	8862	8308	7718	12563	12359	11965	11774	7053	9772	2603
18	11046	5271	3206	14288	10216	8516	6943	7672	7204	6997	13283	13064	12716	12254	7037	9173	3821
19	12100	6768	5741	15794	7467	5840	4345	10139	9758	9733	10670	10442	10129	9532	9675	11920	2682
20	6698	10344	7586	10629	10572	8368	6816	7428	7489	8729	14909	14659	14484	13233	10466	10843	8022
21	2929	12754	9419	5826	15596	13381	11851	4886	5467	7605	19935	19686	19498	18271	10537	9041	12160
22	7482	8279	5201	10743	11876	9803	8149	5334	5200	6138	15728	15489	15227	14327	7800	8309	7242
23	2591	15320	11951	2882	18438	16213	14728	6143	6907	9149	22864	22614	22441	21149	12356	10003	15114
24	5016	11506	8503	8980	12073	9851	8357	6867	7103	8706	16510	16260	16102	14778	10896	10663	9616
25	4378	11539	8389	8129	13065	10849	9326	5960	6266	8017	17437	17188	17012	15748	10429	9878	10119
26	3501	12225	9004	7201	13938	11716	10213	5806	6220	8140	18344	18094	17925	16635	10756	9863	11008
27	8336	7436	4067	10714	14021	12058	10399	3331	2926	3537	17505	17278	16960	16307	5508	5720	8116
28	10170	5892	2606	12318	14407	12606	10979	4162	3474	2768	17469	17255	16890	16483	3755	4954	7620
29	9370	6790	4155	12710	10541	8613	6962	6728	6403	6723	14084	13852	13555	12830	7539	8956	5275
30	5226	10348	7062	8288	13776	11611	10002	4249	4493	6224	17888	17644	17416	16354	8729	8088	9697
31	4758	10817	7536	7906	13917	11734	10145	4475	4785	6601	18100	17854	17639	16526	9170	8409	10074
32	4304	11271	7985	7495	14159	11964	10392	4635	5009	6905	18397	18150	17945	16791	9549	8649	10492
33	3785	11857	8525	6655	15058	12858	11293	4345	4844	6904	19308	19061	18856	17697	9746	8471	11326
34	5897	16503	13207	3260	21409	19200	17652	6538	7317	9318	25666	25420	25206	24062	12579	9398	17230
35	5226	16448	13123	2691	20935	18719	17188	6559	7351	9429	25243	24996	24794	23606	12705	9667	16971
36	5320	17093	13762	2226	21338	19117	17605	7220	8013	10094	25694	25446	25254	24027	13370	10314	17539
37	6166	14890	11631	4655	20551	18371	16778	4894	5656	7604	24651	24408	24166	23139	10857	7681	15891
38	6285	14233	10986	5193	20148	17981	16374	4236	4992	6931	24186	23945	23693	22710	10185	7044	15320
39	8515	10282	7218	9059	18248	16237	14577	1228	1341	2741	21766	21539	21215	20569	5984	3213	12191
40	7924	10206	7040	8709	17698	15665	14006	556	975	2927	21293	21064	20751	20054	6205	3780	11832
41	7061	14297	11111	5765	20696	18544	16925	4348	5051	6825	24662	24423	24158	23228	10028	6696	15636
42	8786	14089	11088	7418	21608	19506	17862	4602	5122	6402	25374	25141	24845	24054	9389	5719	16001
43	11458	7195	5861	15194	7578	5804	4225	9789	9452	9575	11030	10796	10509	9781	9747	11786	3352
44	10732	7681	6039	14511	7813	5902	4263	9401	9115	9409	11502	11263	11002	10146	9838	11637	4098
45	10489	8325	6631	14360	7533	5532	3874	9639	9401	9822	11421	11179	10946	9965	10388	12054	4617
46	10111	8762	6949	14032	7603	5533	3875	9597	9398	9932	11635	11389	11177	10107	10644	12164	5112

To be continued on next page...

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DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
47	17392	10787	11335	21416	3182	3973	4531	16402	16016	15841	4410	4187	3866	3652	15203	17964	5860
48	16415	9128	9665	20330	4378	4347	4258	14912	14492	14227	6000	5791	5417	5330	13521	16330	4173
49	17153	8738	9639	20994	5224	5382	5289	15233	14769	14346	6035	5853	5410	5748	13399	16392	4076
50	17317	10197	10840	21293	3764	4331	4679	16061	15652	15408	4819	4609	4239	4242	14683	17511	5326
51	11720	7825	6636	15561	6817	5017	3439	10469	10159	10342	10401	10163	9898	9077	10531	12558	3584
52	15475	10081	10105	19508	3146	2708	2739	14724	14383	14375	6135	5895	5652	4878	14040	16546	4954
53	15244	10487	10367	19316	2774	2153	2311	14768	14455	14531	6213	5967	5772	4777	14313	16718	5354
54	14814	10586	10308	18903	2815	1790	1821	14511	14219	14366	6590	6341	6173	5046	14257	16566	5464
55	11058	11512	9994	15255	5680	3456	2243	12244	12153	12900	10345	10092	10021	8445	13720	15125	7093
56	15450	7917	8308	19273	5354	4781	4192	13605	13168	12869	7361	7153	6774	6635	12177	14967	2860
57	16634	8722	9427	20499	4923	4908	4744	14865	14419	14068	6206	6010	5599	5715	13240	16142	3881
58	6214	9604	6238	8576	14731	12628	10983	2710	2878	4639	18605	18367	18099	17206	7324	6465	9779
59	8535	7513	4688	11900	10916	8906	7245	6260	6018	6611	14638	14401	14125	13297	7790	8834	6080
60	4870	10978	7827	8500	12872	10669	9113	5663	5912	7579	17169	16921	16731	15525	9916	9493	9638
61	8847	7584	4304	10702	15323	13393	11738	2477	1845	2188	18680	18456	18120	17553	4626	4340	9053
62	7910	7718	4552	10959	12264	10241	8581	4910	4686	5455	15966	15732	15447	14646	7050	7649	7120
63	11062	6059	4327	14539	9123	7384	5803	8469	8067	8042	12359	12133	11810	11235	8179	10240	3451
64	13240	6855	6402	16970	6719	5359	4070	11252	10841	10684	9595	9372	9037	8581	10349	12837	2052
65	8783	8008	5513	12417	9793	7744	6085	7388	7188	7815	13660	13420	13169	12237	8867	10040	5724
66	9969	6178	3661	13247	10497	8646	7015	6952	6562	6669	13866	13638	13321	12696	7211	8892	4776
67	8112	9245	6752	11968	9533	7381	5760	7891	7807	8702	13696	13449	13246	12114	10003	10899	6602
68	10916	4666	1580	13672	12245	10547	8962	6189	5601	5055	15172	14959	14588	14232	5069	7186	5327
69	7773	12980	9871	7100	20133	18030	16386	3216	3819	5403	23924	23690	23399	22587	8568	5207	14633
70	7496	15366	12201	5524	21715	19552	17942	5446	6136	7831	25726	25486	25228	24268	10989	7513	16742
71	8053	12377	9299	7645	19820	17739	16089	2746	3280	4772	23534	23302	23002	22238	7925	4585	14147
72	11474	4542	1404	13693	14144	12486	10909	5462	4732	3518	16881	16677	16282	16050	3143	5466	6858
73	7769	14685	11559	6162	21417	19274	17649	4843	5494	7100	25343	25105	24833	23933	10230	6725	16219
74	9506	8543	6471	13355	8405	6330	4674	8800	8611	9202	12402	12158	11934	10900	10056	11432	5348
75	9109	9283	7148	13059	8339	6193	4567	9016	8890	9634	12526	12278	12086	10923	10656	11854	6005
76	8680	9665	7423	12665	8597	6420	4825	8908	8824	9677	12870	12621	12443	11222	10841	11884	6483
77	12282	8539	7569	16221	5828	4038	2497	11417	11125	11334	9527	9285	9045	8130	11485	13550	3911
78	12239	7412	6458	16033	6781	5125	3632	10684	10334	10389	10128	9895	9604	8910	10389	12587	3002
79	10781	9504	7959	14814	6511	4397	2749	10740	10556	11094	10707	10458	10280	9083	11726	13327	5348
80	12810	7211	6530	16585	6603	5100	3718	11078	10699	10650	9729	9501	9190	8604	10478	12828	2551
81	17221	11069	11503	21273	2742	3586	4253	16426	16059	15946	4386	4152	3883	3410	15394	18085	6082
82	10575	10083	8468	14665	6453	4275	2686	10950	10806	11445	10812	10561	10412	9101	12193	13675	5926
83	9929	10033	8212	14006	7115	4927	3351	10361	10242	10961	11474	11223	11070	9768	11853	13186	6146
84	9473	10418	8467	13581	7447	5235	3719	10240	10162	10989	11893	11641	11504	10139	12026	13203	6655
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86	7723	10103	7610	11716	9457	7257	5698	8322	8311	9357	13797	13548	13378	12115	10800	11527	7280
87	7096	10750	8155	11152	9886	7666	6164	8305	8363	9568	14325	14074	13924	12585	11199	11697	8013
88	5117	15520	12200	3393	20298	18092	16538	5624	6416	8504	24540	24295	24079	22944	11781	8801	16125
89	8593	9389	6280	9564	17388	15403	13743	1008	514	2061	20846	20621	20292	19677	5336	3194	11238
90	7408	8604	5239	9540	14872	12842	11182	2303	2130	3518	18521	18289	17989	17242	6107	5487	9297
91	11647	4809	3110	14877	10084	8480	6953	8124	7621	7264	12966	12751	12387	12021	7032	9400	3306
92	9029	10845	7892	9171	19146	17140	15480	2104	2226	3159	22630	22405	22075	21454	6244	2965	12992
93	9449	10254	7365	9772	18900	16929	15269	2165	2041	2550	22287	22065	21724	21161	5590	2371	12560
94	9013	13567	10607	7880	21359	19277	17627	4251	4710	5868	25055	24824	24519	23772	8815	5125	15597
95	10208	11520	8791	9875	20473	18495	16835	3540	3580	3882	23852	23631	23287	22735	6532	2739	14083
96	9959	6764	4520	13447	9633	7739	6098	7662	7331	7573	13152	12919	12624	11900	8149	9801	4554
97	9354	7441	5067	12928	9640	7657	5999	7545	7283	7731	13356	13119	12849	12008	8561	9964	5144
98	9328	6326	3267	12314	11843	9952	8307	5601	5192	5366	15233	15006	14685	14066	6283	7598	5941
99	14367	9325	9070	18363	4050	2916	2208	13520	13188	13227	7344	7105	6856	6050	13017	15411	4213
100	12777	9717	8852	16833	4661	2765	1224	12514	12261	12563	8688	8439	8257	7116	12768	14785	4874
101	12732	8319	7541	16646	5692	4043	2612	11666	11346	11466	9201	8963	8703	7885	11479	13670	3548
102	9900	9244	7384	13880	7521	5397	3756	9758	9596	10222	11687	11439	11249	10089	11038	12452	5554
103	19668	12523	13437	23725	4008	5674	6626	18720	18316	18058	2201	2020	1588	2551	17229	20147	7882
104	19339	12518	13330	23411	3600	5281	6268	18511	18121	17909	2318	2107	1756	2290	17150	20013	7792
105	18010	12298	12742	22120	2213	3812	4881	17551	17206	17148	3366	3118	2962	2163	16638	19299	7328
106	18513	12440	13011	22614	2663	4338	5395	17947	17587	17479	2901	2657	2462	2009	16885	19616	7543
107	19030	12482	13206	23113	3248	4927	5939	18298	17919	17745	2507	2280	1995	2137	17047	19862	7687

To be continued on next page...

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DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
108	8984	11399	9327	13171	7763	5536	4191	10534	10531	11533	12379	12127	12030	10519	12777	13720	7677
109	2076	16167	12805	2372	18582	16354	14924	7182	7937	10182	23105	22853	22705	21325	13368	11072	15703
110	2201	16798	13438	2055	18900	16674	15275	7842	8598	10843	23469	23217	23081	21656	14030	11714	16239
111	2522	17302	13943	1806	19258	17035	15655	8318	9079	11322	23853	23600	23472	22021	14518	12158	16714
112	3789	15588	12228	2648	19451	17231	15716	5987	6780	8978	23806	23558	23368	22138	12241	9567	15756
113	3975	16118	12759	2178	19902	17680	16176	6474	7270	9452	24284	24035	23850	22599	12722	9973	16285
114	4065	16919	13557	1365	20375	18148	16674	7301	8096	10277	24816	24566	24395	23093	13548	10769	16985
115	4191	17547	14183	712	20718	18490	17041	7963	8758	10942	25206	24955	24795	23451	14212	11426	17522
116	10166	13391	10605	9054	21902	19864	18206	4734	5023	5722	25446	25220	24893	24246	8394	4547	15801
117	10564	12804	10107	9682	21688	19683	18023	4595	4767	5195	25130	24907	24569	23984	7729	3852	15392
118	12636	12617	10347	11818	22660	20750	19095	6061	5982	5578	25804	25592	25219	24815	7273	3557	15848
119	12717	10984	8857	12457	21447	19605	17962	5533	5242	4297	24421	24214	23825	23514	5619	2098	14401
120	12099	10994	8707	11848	21130	19256	17607	4971	4725	3991	24197	23987	23608	23242	5680	1912	14218
121	10293	9918	7208	10604	19167	17244	15588	2888	2582	2292	22409	22192	21835	21358	5012	1530	12560
122	11524	5448	2762	13307	15577	13883	12289	4762	3973	2265	18334	18130	17733	17504	2116	4038	8296
123	10974	6053	3206	12682	15751	13998	12383	4123	3333	1716	18646	18438	18053	17750	2525	3683	8658
124	12560	4444	2313	14435	15419	13842	12295	5898	5109	3291	17909	17714	17295	17205	1677	4752	7827
125	12024	4916	2441	13868	15443	13806	12234	5334	4546	2789	18071	17872	17464	17302	1862	4409	8003
126	13636	3734	2591	15523	15588	14130	12634	6964	6170	4245	17798	17614	17173	17227	1688	5408	7753
127	13142	3926	2289	15059	15377	13869	12352	6525	5735	3881	17709	17521	17089	17079	1723	5205	7638
128	14091	10016	9572	18152	3596	2165	1448	13683	13393	13560	7378	7130	6940	5874	13520	15765	4940
129	17862	10048	10916	21799	4377	5046	5365	16353	15917	15575	4729	4543	4111	4492	14701	17645	5357
130	18461	10119	11182	22373	4881	5681	6024	16781	16324	15907	4577	4417	3938	4657	14909	17946	5624
131	2797	18340	15021	3246	18993	16797	15532	9865	10593	12834	23708	23455	23370	21780	15956	13829	17259
132	2811	18281	14950	2870	19194	16992	15705	9669	10407	12652	23891	23638	23545	21979	15796	13599	17306
133	4503	19979	16718	5183	19280	17145	16033	11946	12650	14877	24089	23837	23803	22065	17934	15969	18444
134	4897	20299	17057	5678	19283	17167	16093	12389	13085	15307	24107	23856	23833	22064	18343	16428	18656
135	5281	20647	17414	6025	19434	17332	16285	12785	13480	15700	24266	24016	24001	22210	18730	16826	18946
136	5632	20807	17611	6703	19123	17049	16055	13198	13875	16080	23968	23719	23719	21889	19062	17274	18932
137	6346	21316	18159	7559	19099	17066	16142	13933	14595	16786	23954	23706	23727	21847	19728	18029	19265
138	6530	21199	18088	8102	18558	16553	15676	14111	14750	16916	23415	23168	23201	21294	19798	18234	18983
139	6918	21533	18434	8454	18698	16713	15867	14497	15135	17297	23555	23309	23351	21424	20171	18622	19263
140	7268	22744	19490	7077	21359	19293	18303	14615	15338	17576	26207	25958	25963	24121	20668	18573	21079
141	7801	23277	20024	7501	21781	19728	18759	15133	15858	18097	26633	26384	26395	24536	21195	19079	21593
142	8002	23434	20195	7828	21731	19694	18750	15381	16101	18337	26586	26338	26357	24480	21420	19346	21677
143	8332	23787	20541	8020	22097	20064	19124	15677	16402	18641	26953	26705	26725	24844	21735	19624	22049
144	8794	24249	21005	8405	22473	20450	19527	16127	16854	19093	27329	27082	27108	25213	22192	20064	22497
145	10813	26134	22931	10549	23536	21599	20799	18230	18948	21182	28385	28142	28205	26228	24251	22193	24140
146	11393	26663	23474	11177	23826	21917	21153	18832	19546	21778	28668	28426	28500	26501	24837	22805	24598
147	11778	27063	23871	11495	24196	22294	21538	19204	19921	22155	29036	28794	28871	26865	25220	23167	24999
148	8041	21195	17864	3801	24734	22507	21081	11288	12075	14093	29259	29008	28855	27481	17351	14074	21515
149	7634	21042	17700	3423	24349	22123	20711	11182	11973	14027	28896	28645	28498	27102	17295	14087	21253
150	6974	20551	17200	2778	23695	21469	20062	10747	11542	13631	28250	27998	27853	26449	16906	13781	20668
151	7037	20866	17510	2932	23773	21550	20162	11104	11901	14007	28357	28105	27969	26535	17284	14194	20893
152	7415	21251	17895	3329	24152	21929	20546	11471	12266	14362	28742	28490	28356	26916	17638	14517	21291
153	8202	22178	18823	4213	24928	22709	21347	12392	13188	15276	29547	29294	29169	27699	18550	15395	22191
154	8024	22165	18805	4122	24734	22518	21168	12424	13220	15328	29368	29116	28996	27508	18604	15495	22098
155	7970	22332	18968	4220	24639	22428	21100	12652	13449	15578	29298	29045	28934	27418	18856	15800	22159
156	5191	20732	17407	4189	20945	18782	17601	12055	12808	15053	25722	25469	25413	23735	18225	15898	19607
157	5384	20954	17641	4661	20860	18710	17561	12403	13148	15393	25654	25402	25356	23648	18546	16282	19715
158	5789	21357	18043	4912	21208	19065	17927	12772	13521	15767	26009	25757	25715	23996	18927	16632	20116
159	5940	21514	18210	5242	21151	19019	17904	13018	13761	16006	25962	25711	25676	23936	19154	16901	20195
160	6840	22368	19036	5314	22397	20255	19118	13560	14325	16567	27200	26948	26906	25184	19767	17315	21246
161	4966	20339	16990	3234	21204	19016	17773	11394	12163	14403	25938	25685	25607	23993	17612	15144	19463
162	4528	19914	16568	3024	20801	18610	17357	11020	11785	14027	25528	25275	25193	23589	17227	14805	19025
163	7291	21563	18516	9099	18259	16312	15525	14827	15442	17577	23112	22868	22924	20965	20388	18969	19123
164	7699	21921	18888	9464	18425	16501	15747	15234	15848	17980	23273	23030	23096	21117	20784	19376	19429
165	8722	22892	19882	10332	19004	17135	16452	16264	16879	19011	23837	23596	23682	21662	21810	20405	20306
166	9119	23138	20155	10793	18979	17142	16501	16642	17248	19369	23800	23561	23657	21616	22142	20788	20467
167	6492	21973	18716	6459	20784	18698	17674	13855	14574	16811	25625	25375	25369	23554	19896	17827	20349
168	6099	21666	18372	5561	21097	18976	17884	13256	13995	16239	25917	25666	25639	23879	19372	17162	20272

To be continued on next page...

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DECIBEL - Main Result

Calculation: A031 AW125-3.15

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
169	10035	23981	21022	11624	19473	17689	17112	17559	18164	20282	24269	24033	24147	22073	23045	21705	21222
170	6848	22328	18986	5062	22597	20445	19285	13411	14183	16421	27388	27136	27087	25386	19635	17121	21302
171	6848	22272	18924	4842	22749	20589	19409	13268	14044	16278	27529	27277	27221	25539	19503	16938	21329
172	6110	21523	18175	4199	22130	19959	18756	12546	13319	15556	26895	26642	26579	24920	18775	16248	20599
173	5355	20734	17385	3518	21532	19350	18118	11767	12538	14777	26277	26024	25950	24322	17991	15496	19851
174	5765	21180	17833	3943	21823	19649	18438	12229	12999	15238	26582	26330	26263	24614	18452	15952	20255
175	6666	22215	18933	6188	21350	19249	18196	13882	14617	16860	26184	25933	25918	24126	19984	17798	20730
176	5881	20750	17382	2762	22468	20262	18958	11384	12174	14379	27150	26898	26797	25251	17640	14883	20256
177	4627	19257	15888	1346	21343	19125	17771	9903	10691	12903	25971	25718	25598	24115	16158	13467	18846
178	4283	18835	15466	1012	21015	18795	17427	9493	10280	12495	25626	25374	25249	23783	15747	13083	18441
179	3660	19214	15927	4314	19082	16917	15737	11007	11720	13953	23857	23604	23548	21872	17035	15011	17862
180	3310	18877	15582	4026	18950	16774	15569	10623	11337	13572	23708	23456	23391	21740	16659	14624	17588
181	8365	22584	19561	9999	18857	16967	16256	15910	16527	18662	23697	23455	23533	21528	21468	20051	20041
182	6874	22338	19087	6818	20997	18924	17923	14248	14966	17202	25843	25593	25594	23762	20285	18220	20672
183	10298	25432	22270	10473	22480	20565	19799	17813	18510	20730	27324	27082	27153	25160	23743	21838	23283
184	10493	25535	22393	10798	22359	20466	19730	18034	18723	20936	27197	26956	27035	25026	23928	22076	23308
185	10877	25925	22784	11126	22681	20800	20078	18413	19105	21319	27515	27275	27359	25340	24315	22450	23687
186	11290	26325	23189	11511	22974	21108	20406	18826	19517	21732	27802	27563	27652	25622	24727	22861	24061
187	11607	26587	23464	11876	23070	21224	20547	19153	19841	22052	27891	27652	27749	25705	25036	23196	24271
188	11790	26687	23581	12157	22984	21158	20507	19351	20032	22238	27796	27558	27662	25605	25203	23407	24307
189	6734	20166	16817	2498	23431	21204	19785	10352	11147	13234	27967	27716	27566	26180	16509	13387	20321
190	7675	21618	18262	3650	24408	22187	20816	11848	12644	14742	29014	28762	28633	27176	18018	14895	21625
191	2973	18545	15245	3801	18798	16614	15386	10260	10975	13209	23541	23288	23216	21588	16300	14263	17309
192	11033	26302	23112	10860	23523	21604	20829	18479	19192	21423	28368	28126	28196	26205	24478	22457	24247
193	6147	21032	17886	7542	18772	16738	15813	13737	14391	16573	23627	23379	23399	21522	19496	17844	18950
194	5992	21091	17910	7092	19173	17118	16155	13568	14240	16439	24024	23775	23785	21932	19408	17650	19142
195	8074	22185	19173	9862	18457	16559	15841	15596	16204	18328	23299	23057	23132	21133	21114	19741	19623
196	9743	23645	20688	11413	19181	17386	16797	17254	17856	19969	23983	23747	23857	21790	22722	21402	20888
197	9468	23311	20359	11229	18878	17073	16474	16963	17560	19666	23685	23448	23555	21495	22408	21113	20551
198	3836	18431	15063	976	20572	18350	16979	9161	9944	12168	25177	24925	24799	23338	15410	12814	17996
199	5582	20406	17038	2425	22206	19997	18681	11041	11831	14037	26877	26624	26519	24987	17297	14553	19930
200	5286	20069	16701	2108	21941	19729	18403	10712	11501	13709	26600	26347	26238	24719	16967	14241	19607
201	5031	19730	16362	1762	21721	19506	18165	10362	11151	13359	26365	26112	25998	24496	16617	13896	19302
202	4858	20403	17079	4017	20648	18481	17291	11761	12511	14756	25419	25166	25107	23438	17920	15624	19274
203	4524	20070	16747	3837	20368	18197	16996	11454	12201	14446	25132	24880	24817	23159	17604	15334	18945
204	4184	19711	16384	3520	20178	17997	16775	11068	11815	14060	24927	24674	24604	22968	17220	14948	18635
205	6733	21924	18732	7453	19938	17900	16961	14279	14965	17176	24792	24544	24562	22689	20174	18337	19991
206	6520	21956	18610	4616	22432	20269	19085	12988	13762	15998	27209	26956	26899	25222	19218	16684	20998
207	6333	21888	18603	5896	21129	19019	17950	13546	14281	16523	25957	25706	25686	23907	19647	17466	20429
208	6996	22539	19260	6494	21559	19467	18432	14220	14955	17198	26397	26147	26138	24331	20322	18134	21023

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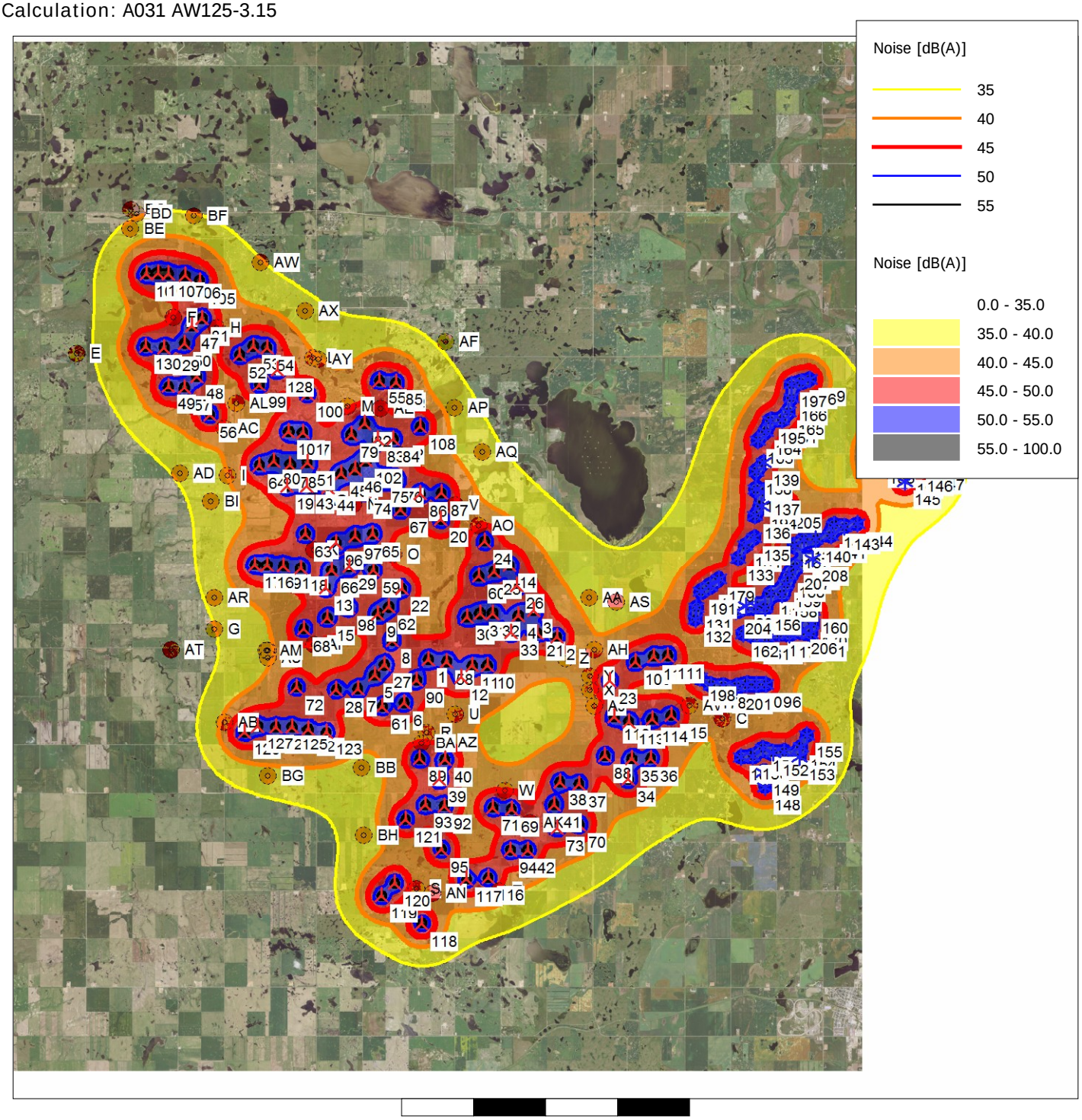
Calculated:
9/14/2018 10:25 PM/3.0.654

DECIBEL - Map 95% rated power

Calculation: A031 AW125-3.15



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 641,190 North: 5,375,412

New WTG Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 95% rated power
Height above sea level from active line object

Project: Description:

Aurora

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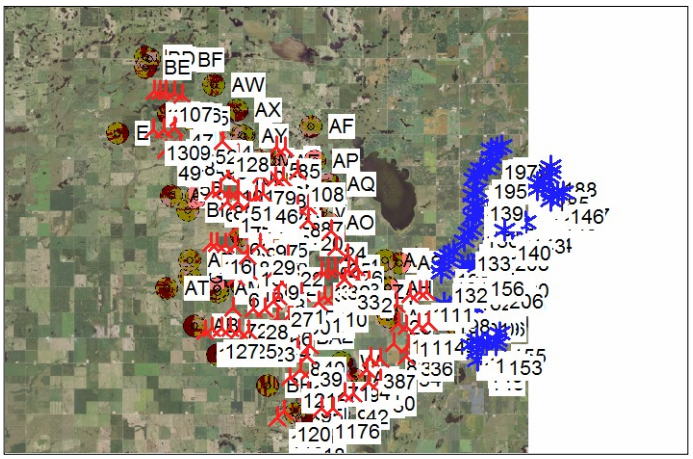
Kevin Walter / kwalter@tradewindenergy.com
Calculated:
9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

Noise calculation model:
ISO 9613-2 General
Wind speed:
95% rated power
Ground attenuation:
General, fixed, Ground factor: 0.5
Meteorological coefficient, C0:
0.0 dB
Type of demand in calculation:
1: WTG noise is compared to demand (DK, DE, SE, NL etc.)
Noise values in calculation:
All noise values are mean values (Lwa) (Normal)
Pure tones:
Pure and Impulse tone penalty are added to WTG source noise
Height above ground level, when no value in NSA object:
1.5 m Don't allow override of model height with height from NSA object
Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:
0.0 dB(A)



Scale 1:500,000

New WTG
Existing WTG
Noise sensitive area

WTGs

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
1	637,619	5,373,512	727.5	T-43	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
2	642,085	5,374,363	728.5	T-41	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
3	641,252	5,375,220	737.7	T-63	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
4	640,729	5,375,038	740.7	T-62	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
5	635,764	5,372,945	724.6	T-45	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
6	636,817	5,372,047	728.5	T-35	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
7	635,193	5,372,473	710.2	T-47	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
8	636,346	5,374,109	734.6	T-56	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
9	635,830	5,374,972	728.5	T-55	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
10	639,692	5,373,363	740.7	T-39	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
11	639,157	5,373,344	739.4	T-38	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
12	638,790	5,372,951	734.6	T-37	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
13	633,988	5,375,810	737.6	T-70	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
14	640,372	5,376,713	738.1	T-77	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
15	634,074	5,374,798	721.2	T-53	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
16	631,934	5,376,511	729.8	T-67	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
17	631,510	5,376,507	731.5	T-66	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
18	633,108	5,376,447	723.9	T-69	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
19	632,563	5,379,145	737.6	T-93	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
20	637,951	5,378,169	715.2	T-80	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
21	641,389	5,374,486	743.7	T-58	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
22	636,640	5,375,835	734.6	T-73	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
23	643,972	5,372,967	712.3	T-28	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
24	639,495	5,377,499	738.7	T-78	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
25	639,840	5,376,489	737.6	T-76	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
26	640,649	5,376,031	731.5	T-79	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
27	636,095	5,373,292	733.9	T-46	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
28	634,438	5,372,432	701.0	T-57	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
29	634,798	5,376,526	725.4	T-71	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
30	638,928	5,374,941	737.6	T-59	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
31	639,384	5,375,074	737.6	T-60	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
32	639,838	5,375,100	737.6	T-61	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
33	640,492	5,374,466	743.6	T-40	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
34	644,695	5,369,685	736.0	T-15	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
35	644,792	5,370,371	743.7	T-16	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
36	645,456	5,370,405	735.1	T-17	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
37	642,975	5,369,494	737.6	T-12	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
38	642,303	5,369,536	734.9	T-13	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
39	638,102	5,369,527	710.5	T-26	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
40	638,282	5,370,192	712.5	T-25	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
41	642,122	5,368,780	734.6	T-10	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
42	641,239	5,367,252	719.1	T-8	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
43	633,243	5,379,162	737.6	T-94	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
44	634,001	5,379,136	737.6	T-95	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
45	634,443	5,379,605	731.5	T-96	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
46	634,918	5,379,749	728.5	T-121	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
47	629,136	5,384,387	713.2	T-142	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
48	629,347	5,382,713	710.2	T-131	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
49	628,366	5,382,343	707.1	T-129	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
50	628,893	5,383,804	717.2	T-141	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
51	633,253	5,379,950	729.4	T-123	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No

To be continued on next page...

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Kevin Walter / kwalter@tradewindenergy.com
Calculated:
9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

...continued from previous page

	X(East)	Y(North)	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data Creator	Name	Wind speed [m/s]	LwA,ref [dB(A)]	Pure tones
52	630,815	5,383,459	711.9	T-144	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
53	631,275	5,383,767	710.7	T-145	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
54	631,767	5,383,732	713.2	T-146	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
55	635,699	5,382,724	710.2	T-122	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
56	629,834	5,381,441	713.0	T-117	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
57	628,926	5,382,328	703.0	T-130	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
58	638,268	5,373,457	731.5	T-44	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
59	635,628	5,376,434	728.5	T-72	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
60	639,307	5,376,310	731.5	T-75	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
61	636,056	5,371,908	719.3	T-34	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
62	636,215	5,375,218	731.5	T-74	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
63	633,243	5,377,581	731.5	T-81	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
64	631,582	5,379,814	726.8	T-98	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
65	635,586	5,377,640	725.5	T-85	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
66	634,183	5,376,389	733.5	T-86	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
67	636,542	5,378,452	715.1	T-87	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
68	633,261	5,374,418	716.3	T-51	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
69	640,641	5,368,602	728.5	T-23	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
70	643,024	5,368,138	728.5	T-11	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
71	639,998	5,368,634	725.4	T-22	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
72	633,064	5,372,478	698.0	T-5	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
73	642,243	5,368,015	730.6	T-9	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
74	635,270	5,379,029	725.4	T-90	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
75	635,883	5,379,448	720.6	T-91	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
76	636,364	5,379,455	716.0	T-92	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
77	633,072	5,380,925	729.9	T-106	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
78	632,659	5,379,855	737.2	T-100	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
79	634,758	5,380,905	718.9	T-107	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
80	632,089	5,379,958	731.5	T-99	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
81	629,494	5,384,648	709.6	T-143	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
82	635,222	5,381,271	716.3	T-108	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
83	635,678	5,380,785	716.0	T-109	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
84	636,220	5,380,785	716.3	T-110	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
85	636,276	5,382,673	710.2	T-124	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
86	637,208	5,379,005	710.9	T-88	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
87	637,941	5,379,046	713.2	T-89	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
88	643,859	5,370,443	732.3	T-14	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
89	637,408	5,370,185	701.0	T-24	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
90	637,234	5,372,817	719.9	T-42	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
91	632,509	5,376,501	722.8	T-68	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
92	638,306	5,368,644	716.3	T-21	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
93	637,648	5,368,666	713.2	T-20	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
94	640,643	5,367,238	719.3	T-19	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
95	638,242	5,367,207	710.2	T-18	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
96	634,318	5,377,326	731.6	T-83	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
97	634,979	5,377,549	725.3	T-84	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
98	634,798	5,375,163	713.2	T-54	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
99	631,532	5,382,484	707.7	T-118	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
100	633,206	5,382,201	722.4	T-120	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
101	632,585	5,380,949	731.5	T-105	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
102	635,298	5,380,049	728.5	T-97	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
103	627,504	5,386,079	711.3	T-147	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
104	627,911	5,386,105	710.2	T-148	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
105	629,368	5,385,888	704.0	T-149	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
106	628,867	5,386,049	710.2	T-150	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
107	628,269	5,386,086	711.9	T-151	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
108	637,149	5,381,224	704.1	T-152	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
109	644,833	5,373,605	713.9	T-153	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
110	645,462	5,373,811	728.5	T-154	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
111	645,966	5,373,838	730.1	T-155	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
112	644,144	5,371,765	710.2	T-156	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
113	644,660	5,371,616	715.4	T-157	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
114	645,479	5,371,724	719.3	T-158	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
115	646,127	5,371,875	717.1	T-159	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
116	639,890	5,366,309	710.2	T-160	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
117	639,135	5,366,239	709.0	T-161	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
118	637,617	5,364,719	707.6	T-162	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
119	636,191	5,365,609	711.4	T-163	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
120	636,640	5,366,042	710.2	T-164	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
121	636,954	5,368,164	711.3	T-165	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
122	633,495	5,371,087	689.0	T-166	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
123	634,130	5,371,006	696.6	T-167	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
124	632,359	5,371,139	688.8	T-168	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
125	632,926	5,371,158	686.0	T-169	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
126	631,283	5,370,947	682.8	T-170	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
127	631,732	5,371,159	684.7	T-171	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
128	632,154	5,382,999	713.2	T-172	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
129	628,195	5,383,647	711.6	T-173	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
130	627,535	5,383,666	710.2	T-174	Yes	GE WIND ENERGY	GE 2.5-127-2,500	2,500	127.0	89.0	USER	112 dBA (+2 dB from standard) with Octave	(95%)	112.0	No
131	646,913	5,375,455	745.7	VESTAS V100 2000 100.0 !O! ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
132	646,888	5,375,080	743.7	VESTAS V100 2000 100.0 !O! ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
133	648,328	5,377,151	749.8	VESTAS V100 2000 100.0 !O! ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
134	648,570	5,377,592	749.8	VESTAS V100 2000 100.0 !O! ...	Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

To be continued on next page...

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9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

...continued from previous page

	X(East)	Y(North)	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Noise data Creator	Name	Wind speed	LwA,ref	Pure tones
			[m]					[kW]	[m]	[m]			[m/s]	[dB(A)]	
135	648,872	5,377,853	752.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
136	648,872	5,378,572	753.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
137	649,189	5,379,368	749.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
138	648,868	5,380,034	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
139	649,124	5,380,328	729.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
140	651,007	5,377,868	748.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
141	651,525	5,378,000	750.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
142	651,616	5,378,348	758.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
143	651,987	5,378,290	755.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
144	652,436	5,378,405	749.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
145	654,047	5,379,834	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
146	654,478	5,380,290	740.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
147	654,876	5,380,346	731.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
148	649,468	5,369,552	735.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
149	649,403	5,370,046	745.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
150	648,989	5,370,563	740.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
151	649,348	5,370,846	749.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
152	649,714	5,370,690	746.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
153	650,635	5,370,574	746.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
154	650,667	5,370,918	744.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
155	650,882	5,371,340	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
156	649,309	5,375,532	733.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
157	649,484	5,375,990	732.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
158	649,889	5,375,994	741.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
159	650,008	5,376,322	740.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
160	650,956	5,375,465	750.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
161	648,982	5,374,557	737.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
162	648,553	5,374,643	733.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
163	648,903	5,381,054	722.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
164	649,170	5,381,363	721.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
165	649,950	5,382,038	713.3	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
166	650,030	5,382,496	712.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
167	650,267	5,377,632	746.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
168	650,119	5,376,640	740.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
169	650,663	5,383,159	707.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
170	650,947	5,375,049	753.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
171	650,911	5,374,694	758.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
172	650,163	5,374,664	746.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
173	649,378	5,374,555	741.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
174	649,818	5,374,694	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
175	650,613	5,377,049	737.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
176	649,406	5,372,982	725.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
177	647,909	5,372,903	716.3	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
178	647,487	5,372,910	715.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
179	647,672	5,376,428	744.3	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
180	647,365	5,376,192	740.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
181	649,728	5,381,758	721.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
182	650,599	5,377,842	746.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
183	653,143	5,380,511	713.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
184	653,130	5,380,927	710.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
185	653,497	5,381,062	704.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
186	653,850	5,381,276	700.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
187	654,022	5,381,604	696.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
188	654,011	5,381,966	694.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
189	648,594	5,370,523	731.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
190	650,092	5,370,737	743.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
191	647,056	5,376,002	741.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
192	654,134	5,380,179	733.9	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
193	648,870	5,379,452	759.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
194	649,079	5,378,913	759.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
195	649,308	5,381,738	716.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
196	650,346	5,383,045	709.6	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
197	650,021	5,382,956	710.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
198	647,090	5,373,129	713.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
199	649,061	5,372,960	722.4	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
200	648,724	5,372,961	720.7	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
201	648,383	5,372,886	719.3	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
202	648,975	5,375,560	735.2	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
203	648,641	5,375,554	726.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
204	648,297	5,375,376	728.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
205	649,928	5,378,956	741.8	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
206	650,591	5,374,779	748.5	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
207	650,301	5,376,922	735.1	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No
208	650,917	5,377,197	740.0	VESTAS V100 2000 100.0 !O!	...Yes	VESTAS	V100-2,000	2,000	100.0	80.0	USER	Mode 0 (105) + 2dB	(95%)	107.0	No

Calculation Results

Licensed user:
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16105 W. 113th Street, Suite 105
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DECIBEL - Main Result

Calculation: GE2.5-127

Sound Level

Noise sensitive area					Demands	Sound Level		Demands fulfilled ?
No.	Name	X(East)	Y(North)	Z [m]	Imission height [m]	Noise [dB(A)]	From WTGs [dB(A)]	Distance to noise demand [m]	Noise
A	1 - Non-Participating	644,116	5,375,554	701.3	1.5	50.0	39.2	1,719	Yes
B	39 - Participating	643,400	5,373,971	711.5	1.5	50.0	42.6	817	Yes
C	2 - Non-Participating	647,930	5,371,801	718.0	1.5	50.0	41.8	884	Yes
D	40 - Participating	643,453	5,372,099	716.3	1.5	50.0	45.1	410	Yes
E	41 - Participating	625,162	5,383,364	711.9	1.5	50.0	35.0	2,058	Yes
F	42 - Participating	628,500	5,384,644	704.1	1.5	50.0	47.2	274	Yes
G	43 - Participating	630,148	5,374,327	691.9	1.5	50.0	37.1	2,211	Yes
H	44 - Participating	629,997	5,384,325	711.4	1.5	50.0	47.3	212	Yes
I	3 - Non-Participating	630,488	5,379,437	722.7	1.5	50.0	41.7	804	Yes
J	4 - Non-Participating	632,031	5,373,676	696.3	1.5	50.0	41.1	1,100	Yes
K	45 - Participating	633,554	5,377,057	735.4	1.5	50.0	49.0	190	Yes
L	46 - Participating	633,395	5,383,413	715.7	1.5	50.0	42.3	885	Yes
M	47 - Participating	634,615	5,381,825	716.9	1.5	50.0	45.9	415	Yes
N	48 - Participating	634,891	5,378,584	728.5	1.5	50.0	48.7	155	Yes
O	5 - Non-Participating	636,328	5,376,974	731.5	1.5	50.0	46.1	498	Yes
P	49 - Participating	636,455	5,380,259	709.9	1.5	50.0	48.8	152	Yes
Q	50 - Participating	636,416	5,382,006	707.4	1.5	50.0	46.4	323	Yes
R	51 - Participating	637,621	5,371,070	716.6	1.5	50.0	44.8	553	Yes
S	6 - Non-Participating	637,411	5,365,868	713.2	1.5	50.0	44.2	451	Yes
T	52 - Participating	640,276	5,365,862	710.2	1.5	50.0	45.5	254	Yes
U	7 - Non-Participating	638,615	5,371,717	720.3	1.5	50.0	43.3	871	Yes
V	8 - Non-Participating	638,435	5,378,666	709.4	1.5	50.0	47.1	251	Yes
W	9 - Non-Participating	640,413	5,369,191	728.5	1.5	50.0	46.8	246	Yes
X	10 - Non-Participating	643,279	5,372,615	722.4	1.5	50.0	44.3	436	Yes
Y	11 - Non-Participating	643,282	5,373,088	726.9	1.5	50.0	44.6	362	Yes
Z	53 - Participating	642,413	5,373,644	734.1	1.5	50.0	44.1	445	Yes
AA	54 - Participating	643,167	5,375,685	714.9	1.5	50.0	40.0	1,362	Yes
AB	12 - Non-Participating	630,584	5,371,240	682.8	1.5	50.0	43.4	416	Yes
AC	13 - Non-Participating	630,347	5,380,996	717.6	1.5	50.0	44.8	348	Yes
AD	14 - Non-Participating	628,838	5,379,465	705.2	1.5	50.0	37.7	1,883	Yes
AE	55 - Participating	635,760	5,381,775	711.0	1.5	50.0	47.1	332	Yes
AF	15 - Non-Participating	637,972	5,384,054	715.8	1.5	50.0	36.2	1,848	Yes
AG	57 - Participating	633,480	5,378,691	739.8	1.5	50.0	49.2	77	Yes
AH	59 - Participating	643,400	5,373,968	711.4	1.5	50.0	42.6	814	Yes
AI	61 - Participating	633,645	5,373,895	713.7	1.5	50.0	46.2	297	Yes
AJ	62 - Participating	643,453	5,372,097	716.3	1.5	50.0	45.1	409	Yes
AK	63 - Participating	641,300	5,368,154	725.4	1.5	50.0	46.7	435	Yes
AL	16 - Non-Participating	630,734	5,381,835	710.2	1.5	50.0	44.5	646	Yes
AM	17 - Non-Participating	631,989	5,373,670	695.8	1.5	50.0	40.9	1,139	Yes
AN	18 - Non-Participating	637,954	5,365,740	710.2	1.5	50.0	42.8	751	Yes
AO	64 - Participating	639,268	5,377,996	720.6	1.5	50.0	46.5	209	Yes
AP	19 - Non-Participating	638,331	5,381,857	701.5	1.5	50.0	39.8	1,009	Yes
AQ	20 - Non-Participating	639,333	5,380,415	707.1	1.5	50.0	38.8	1,606	Yes
AR	21 - Non-Participating	630,142	5,375,377	701.9	1.5	50.0	38.3	1,422	Yes
AS	22 - Non-Participating	644,117	5,375,554	701.3	1.5	50.0	39.2	1,718	Yes
AT	23 - Non-Participating	628,666	5,373,611	682.8	1.5	50.0	34.3	3,381	Yes
AU	24 - Non-Participating	632,030	5,373,428	696.5	1.5	50.0	41.2	1,068	Yes
AV	27 - Non-Participating	646,754	5,372,213	713.2	1.5	50.0	45.1	368	Yes
AW	29 - Non-Participating	631,486	5,386,533	696.9	1.5	50.0	37.2	1,864	Yes
AX	30 - Non-Participating	633,067	5,384,963	707.0	1.5	50.0	38.7	1,428	Yes
AY	31 - Non-Participating	633,553	5,383,375	714.8	1.5	50.0	42.0	883	Yes
AZ	66 - Participating	638,244	5,370,747	710.8	1.5	50.0	46.8	203	Yes
BA	67 - Participating	637,448	5,370,698	712.2	1.5	50.0	47.4	160	Yes
BB	68 - Participating	635,378	5,369,828	692.6	1.5	50.0	40.6	1,373	Yes
BC	32 - Non-Participating	626,925	5,388,203	701.4	1.5	50.0	35.4	1,817	Yes
BD	33 - Non-Participating	627,137	5,388,066	701.0	1.5	50.0	36.3	1,627	Yes
BE	34 - Non-Participating	626,921	5,387,556	704.1	1.5	50.0	38.0	1,213	Yes
BF	35 - Non-Participating	629,137	5,388,039	693.3	1.5	50.0	37.2	1,614	Yes

To be continued on next page...

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Calculated:
9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

...continued from previous page

Noise sensitive area						Demands	Sound Level		Demands fulfilled ?
No.	Name	X(East)	Y(North)	Z	Imission height	Noise	From WTGs	Distance to noise demand	Noise
				[m]	[m]	[dB(A)]	[dB(A)]	[m]	
BG	36 - Non-Participating	632,118	5,369,480	691.6	1.5	50.0	39.8	1,276	Yes
BH	37 - Non-Participating	635,531	5,367,600	699.2	1.5	50.0	39.4	1,199	Yes
BI	38 - Non-Participating	629,941	5,378,583	713.2	1.5	50.0	38.9	1,697	Yes

Distances (m)

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	6810	5799	10452	6003	15882	14390	7516	13229	9271	5591	5393	10764	8839	5759	3695	6847	8579	2442	7647	8099	2053	5218
2	2355	1372	6382	2645	19168	17037	11937	15664	12659	10077	8946	12547	10558	8341	6322	8153	9516	5546	9696	8691	4363	5643
3	2883	2484	7503	3819	18034	15857	11140	14477	11561	9350	7914	11352	9363	7196	5227	6957	8333	5514	10110	9409	4385	4451
4	3426	2876	7896	4008	17654	15551	10605	14192	11146	8804	7453	11132	9134	6830	4808	6747	8195	5040	9752	9188	3937	4293
5	8751	7705	12221	7736	14865	13771	5783	12758	8366	3804	4668	10733	8954	5707	4069	7347	9085	2639	7266	8398	3105	6315
6	8098	6859	11117	6637	16245	15095	7047	14045	9729	5055	5978	11870	10022	6815	4951	8220	9967	1266	6207	7087	1829	6814
7	9440	8343	12755	8269	14807	13890	5375	12941	8404	3383	4868	11086	9369	6119	4642	7888	9611	2805	6968	8340	3505	6990
8	7903	7055	11812	7386	14517	13136	6202	12028	7919	4337	4060	9760	7907	4706	2865	6151	7897	3296	8310	9136	3297	5013
9	8306	7636	12509	8146	13573	12136	5719	11023	6962	4014	3086	8785	6960	3732	2063	5324	7059	4294	9240	10137	4284	4520
10	4937	3758	8385	3968	17639	15891	9592	14634	11028	7667	7164	11860	9868	7093	4935	7618	9243	3089	7834	7524	1967	5450
11	5429	4289	8908	4473	17213	15533	9063	14300	10596	7134	6722	11601	9620	6757	4602	7424	9085	2744	7677	7566	1715	5371
12	5928	4721	9212	4740	17151	15577	8751	14377	10536	6798	6654	11771	9807	6851	4717	7673	9362	2214	7216	7243	1246	5726
13	10131	9590	14507	10166	11618	10400	4117	9404	5041	2896	1320	7626	6047	2917	2613	5087	6655	5972	10515	11769	6178	5285
14	3919	4084	9014	5548	16601	14278	10499	12869	10253	8877	6827	9673	7699	5792	4053	5284	6609	6278	11242	10852	5296	2752
15	10070	9362	14177	9760	12361	11314	3955	10362	5863	2331	2318	8641	7047	3873	3132	5957	7579	5146	9533	10878	5488	5829
16	12220	11744	16676	12335	9635	8829	2821	8051	3264	2836	1710	7055	5953	3612	4418	5873	7092	7871	11969	13528	8224	6849
17	12642	12158	17082	12731	9344	8676	2570	7963	3104	2878	2118	7159	6159	3969	4841	6208	7370	8180	12166	13790	8569	7254
18	11044	10585	15533	11221	10535	9404	3641	8470	3976	2973	756	6972	5585	2783	3262	5073	6469	7020	11420	12784	7260	5770
19	12098	12009	17033	12971	8519	6837	5389	5781	2095	5495	2311	4349	3376	2395	4346	4049	4800	9529	14134	15360	9582	5892
20	6696	6878	11838	8193	13804	11457	8699	10058	7570	7433	4536	6946	4949	3088	2016	2570	4133	7107	12313	12526	6487	693
21	2928	2075	7071	3156	18497	16411	11243	15053	11973	9394	8246	11983	9987	7683	5640	7595	9016	5086	9492	8696	3920	5119
22	7481	7012	11989	7770	13728	11995	6665	10781	7129	5090	3319	8244	6323	3259	1181	4429	6176	4865	9996	10615	4567	3352
23	2591	1156	4127	1011	21493	19385	13891	18009	14956	11962	11192	14866	12885	10678	8631	10473	11782	6628	9666	8009	5501	7947
24	5014	5263	10180	6696	15486	13113	9871	11696	9213	8386	5957	8496	6521	4730	3210	4106	5458	6697	11816	11664	5849	1577
25	4376	4360	9350	5685	16209	13969	9931	12582	9806	8301	6312	9460	7468	5375	3546	5067	6494	5856	10895	10636	4927	2592
26	3500	3437	8421	4830	17135	14892	10639	13500	10716	8934	7168	10349	8365	6298	4423	5955	7322	5812	10667	10177	4770	3442
27	8334	7337	11929	7454	14865	13659	6036	12606	8319	4082	4542	10475	8660	5428	3690	6977	8720	2696	7539	8526	2972	5862
28	10169	9093	13507	9021	14338	13579	4690	12695	8042	2710	4709	11030	9394	6169	4919	8083	9776	3462	7206	8789	4238	7405
29	9368	8973	13956	9721	11816	10275	5144	9158	5201	3973	1353	7028	5302	2060	1594	4084	5714	6143	10973	11989	6140	4219
30	5224	4576	9535	5344	16138	14244	8801	12955	9563	7012	5775	10119	8123	5438	3300	5865	7499	4085	9198	9179	3239	3758
31	4756	4165	9152	5041	16461	14493	9266	13179	9908	7484	6157	10266	8265	5701	3598	5955	7540	4375	9415	9256	3444	3715
32	4302	3737	8739	4699	16843	14820	9721	13489	10307	7936	6581	10517	8515	6050	3979	6169	7707	4599	9546	9249	3597	3832
33	3784	2950	7902	3791	17725	15729	10345	14400	11171	8498	7406	11420	9417	6952	4861	7061	8571	4447	9133	8607	3329	4677
34	5898	4478	3866	2715	23847	22047	15270	20745	17232	13278	13359	17781	15779	13241	11097	13406	14845	7208	8224	5844	6410	10948
35	5227	3860	3449	2186	23540	21660	15169	20337	16935	13182	13076	17320	15322	12864	10735	12933	14336	7204	8647	6382	6322	10451
36	5321	4117	2841	2623	24079	22142	15802	20803	17482	13818	13635	17739	15746	13361	11246	13346	14708	7863	9236	6890	6965	10842
37	6166	4497	5466	2648	22576	20954	13707	19708	15962	11716	12081	16897	14898	12165	10007	12586	14127	5581	6642	4526	4894	10234
38	6285	4569	6066	2809	22024	20465	13066	19240	15416	11075	11538	16490	14496	11697	9541	12214	13790	4927	6115	4197	4285	9916
39	8514	6915	10088	5936	18945	17909	9290	16872	12498	7354	8797	14662	12783	9610	7655	10858	12593	1616	3724	4261	2249	9145
40	7923	6362	9781	5511	18592	17452	9125	16383	12092	7157	8336	14095	12197	9051	7058	10232	11961	1099	4411	4767	1560	8476
41	7061	5346	6547	3576	22368	20910	13196	19714	15777	11216	11913	17037	15050	12182	10035	12802	14404	5049	5539	3453	4574	10551
42	8786	7058	8091	5328	22761	21559	13155	20442	16250	11227	12458	17964	16007	12989	10892	13859	15522	5260	4071	1691	5178	11754
43	11456	11407	16429	12415	9108	7249	5741	6098	2768	5618	2128	4253	2996	1747	3782	3395	4261	9201	13932	15046	9182	5216
44	10730	10724	15743	11784	9798	7785	6163	6554	3526	5805	2127	4319	2758	1047	3176	2699	3751	8841	13699	14683	8737	4458
45	10487	10582	15583	11727	10013	7792	6805	6484	3958	6401	2698	3949	2227	1115	3237	2116	3108	9108	14054	14930	8924	4101
46	10109	10263	15248	11462	10404	8072	7222	6720	4441	6724	3018	3968	2098	1165	3113	1620	2709	9090	14103	14885	8842	3680
47	17391	17662	22620	18868	4103	686	10112	863	5132	11096	8559	4369	6049	8173	10329	8403	7660	15791	20284	21617	15824	10918
48	16413	16551	21551	17654	4235	2108	8425	1738	3469	9428	7050	4108	5343	6913	9038	7520	7105	14284	18676	20086	14382	9949
49	17151	17208	22225	18237	3362	2305	8212	2567	3598	9410	7407	5142	6271	7531	9603	8354	8058	14586	18795	20335	14764	10720
50	17315	17526	22506	18682	3757	927	9561	1220	4650	10604	8201	4519	6055	7952	10096	8352	7735	15439	19856	21249	15513	10837
51	11718	11777	16788	12871	8782	6681	6424	5454	2812	6392	2908	3466	2317	2132	4279	3217	3772	9896	14683	15741	9825	5338
52	15473	15761	20709	16994	5653	2601	9157	1191	4035	9859	6964	2581	4137	6355	8512	6485	5787	14136	18787	19980	14098	9002
53	15243	15588	20509	16866	6127	2911	9508	1395	4401	10120	7087	2149	3864	6320	8467	6256	5434	14195	18922	20041	14110	8791
54	14812	15186	20091	16490	6615	3392	9544	1866	4481	10060	6911	1659	3428	6022	8154	5835	4960	13951	18735	19793	13831	8374
55	11057	11658	16399	13154	10556	7451	10066	5923	6161	9763	6059	2405	1408	4218	5784	2578	1015	11811	16943	17473	11387	4894
56	15448	15487	20504	16515	5052	3470	7121	2889	2108	8070	5750	4071	4797	5809	7882	6726	6607	12969	17318	18755	13103	9037
57	16633	16714	21726	17768	3903	2354	8095	2265	3287	9193	7015	4599	5712	7043	9136	7809	7497	14226	18519	20000	14370	10190
58	6212	5157	9803	5360	16430	14852	8167	13658	9813	6241	5932	11085	9131	6140	4017	7040	8748	2473	7637	7856	1774	5212

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9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

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WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
59	8534	8153	13146	8946	12552	10873	5871	9694	5953	4532	2165	7327	5485	2273	884	3914	5628	5722	10715	11549	5584	3586
60	4868	4714	9731	5909	15807	13648	9371	12285	9357	7738	5801	9242	7241	4967	3052	4872	6388	5504	10612	10493	4645	2513
61	8846	7628	11875	7399	15809	14809	6384	13817	9365	4397	5725	11809	10021	6777	5073	8361	10105	1775	6190	7373	2566	7165
62	7908	7292	12204	7882	13731	12181	6132	11027	7113	4459	3234	8666	6798	3617	1760	5047	6791	4380	9426	10200	4245	4101
63	11060	10780	15784	11589	9937	8508	4491	7484	3322	4089	610	5834	4460	1930	3144	4182	5445	7847	12433	13668	7953	5304
64	13238	13184	18207	14158	7336	5729	5672	4781	1157	6155	3390	4029	3639	3531	5531	4894	5308	10627	15115	16440	10726	6949
65	8781	8632	13656	9622	11892	9964	6369	8714	5406	5325	2114	6174	4296	1172	997	2759	4444	6878	11913	12678	6653	3027
66	9968	9529	14493	10215	11403	10022	4532	8972	4790	3463	917	7068	5453	2306	2223	4488	6044	6334	11005	12164	6440	4823
67	8110	8192	13189	9388	12395	10150	7609	8794	6133	6569	3297	5875	3884	1656	1493	1810	3557	7460	12614	13132	7047	1905
68	10914	10149	14901	10452	12068	11280	3115	10431	5734	1437	2655	8996	7530	4474	3992	6658	8218	5497	9504	11064	5997	6694
69	7773	6037	7961	4488	21390	20119	11953	18987	14849	9994	11032	16488	14531	11520	9418	12386	14055	3900	4231	2764	3715	10303
70	7496	5846	6123	3984	23472	21987	14287	20779	16877	12310	13009	18057	16064	13239	11087	13787	15363	6148	6055	3569	5679	11486
71	8053	6329	8541	4893	20907	19711	11377	18607	14393	9428	10605	16187	14247	11184	9112	12153	13844	3403	3787	2786	3378	10153
72	11472	10444	14882	10396	13452	12994	3453	12238	7421	1582	4606	10940	9475	6374	5556	8489	10101	4770	7911	9787	5603	8194
73	7769	6068	6832	4260	22965	21574	13643	20396	16391	11677	12541	17760	15777	12875	10736	13544	15157	5540	5288	2916	5183	11312
74	9504	9575	14579	10723	10998	8796	6953	7474	4799	6257	2614	4768	2871	584	2311	1708	3190	8299	13334	14087	8041	3185
75	9107	9301	14270	10551	11414	9028	7689	7644	5395	6940	3338	4681	2694	1315	2514	992	2613	8557	13666	14279	8200	2669
76	8678	8920	13870	10216	11865	9422	8059	8016	5876	7223	3694	4948	2946	1711	2481	810	2552	8478	13627	14145	8059	2216
77	12281	12451	17436	13626	8278	5894	7218	4584	2982	7324	3898	2508	1786	2965	5120	3448	3514	10855	15670	16698	10748	5819
78	12237	12247	17265	13291	8278	6343	6072	5203	2211	6211	2938	3633	2776	2568	4665	3817	4329	10089	14772	15932	10085	5897
79	10779	11079	16012	12375	9906	7291	8033	5863	4515	7727	4032	2854	931	2325	4233	1816	1990	10243	15269	16023	9965	4304
80	12808	12798	17818	13817	7719	5903	5956	4843	1683	6282	3250	3694	3141	3121	5184	4377	4787	10469	15061	16301	10512	6476
81	17219	17532	22471	18771	4518	995	10343	598	5305	11262	8609	4092	5848	8118	10276	8229	7409	15825	20381	21661	15825	10757
82	10573	10962	15849	12324	10275	7521	8601	6052	5077	8239	4532	2815	821	2707	4438	1595	1402	10480	15558	16217	10140	4136
83	9928	10298	15193	11658	10828	8150	8503	6694	5362	7990	4291	3481	1487	2337	3866	938	1426	9908	15017	15616	9532	3477
84	9471	9898	14760	11303	11355	8631	8865	7160	5888	8251	4583	3859	1912	2571	3812	576	1237	9815	14964	15465	9379	3065
85	10590	11246	15939	12780	11135	8022	10355	6493	6631	9949	6241	2974	1865	4317	5700	2421	682	11681	16844	17281	11204	4552
86	7722	7980	12918	9311	12811	10375	8470	8962	6734	7430	4141	5829	3831	2355	2213	1463	3104	7945	13138	13496	7423	1272
87	7094	7454	12341	8869	13488	10976	9110	9538	7463	7985	4816	6303	4333	3084	2626	1918	3330	7982	13189	13390	7360	623
88	5118	3558	4291	1705	22728	20919	14251	19619	16115	12263	12245	16665	14663	12113	9969	12296	13752	6270	7907	5817	5397	9852
89	8592	7088	10646	6341	17991	16983	8358	15965	11554	6411	7879	13823	11970	8768	6875	10120	11863	911	4317	5188	1951	8543
90	7407	6274	10745	6261	16030	14703	7245	13595	9452	5273	5614	11270	9381	6225	4255	7483	9226	1789	6951	7591	1766	5972
91	11646	11181	16122	11796	10054	9076	3210	8217	3564	2866	1184	6968	5725	3165	3848	5449	6750	7459	11709	13173	7758	6309
92	9028	7371	10129	6199	19735	18767	9943	17747	13328	8044	9663	15564	13688	10511	8562	11762	13496	2521	2917	3409	3088	10023
93	9448	7825	10749	6744	19286	18412	9397	17428	12934	7527	9336	15348	13504	10294	8412	11654	13397	2404	2808	3843	3200	10031
94	9012	7276	8598	5615	22355	21224	12665	20133	15873	10753	12111	17725	15784	12722	10650	13679	15362	4881	3511	1424	4917	11640
95	10207	8507	10723	7148	20788	19974	10779	19000	14481	8968	10909	16915	15061	11861	9953	13174	14912	3913	1576	2439	4525	11461
96	9957	9682	14692	10525	10967	9349	5137	8225	4373	4307	809	6156	4509	1383	2041	3630	5129	7075	11868	12920	7067	4330
97	9352	9149	14170	10075	11410	9609	5807	8411	4872	4867	1507	6074	4292	1039	1466	3086	4683	6997	11931	12831	6873	3632
98	9326	8684	13556	9181	12654	11383	4725	10344	6070	3141	2266	8369	6665	3423	2371	5359	7032	4972	9655	10794	5143	5050
99	14366	14605	19571	15810	6431	3723	8274	2397	3220	8822	5791	2082	3153	5147	7305	5402	4907	12936	17625	18782	12888	7888
100	12776	13102	18028	14390	8127	5302	8448	3848	3876	8606	5156	1226	1459	3991	6089	3786	3216	11975	16866	17804	11798	6312
101	12730	12870	17865	14015	7806	5509	7057	4254	2585	7294	4011	2594	2211	3303	5460	3931	3974	11089	15834	16934	11027	6279
102	9898	10129	15088	11390	10664	8205	7699	6810	4848	7162	3463	3864	1902	1521	3244	1176	2254	9275	14338	15036	8969	3429
103	19666	19982	24923	21209	3585	1747	12047	3048	7282	13204	10863	6467	8287	10524	12680	10677	9799	18101	22509	23914	18159	13208
104	19338	19676	24606	20923	3882	1576	11990	2743	7149	13095	10664	6110	7955	10262	12419	10353	9442	17899	22356	23722	17934	12888
105	18008	18410	23303	19712	4905	1518	11588	1685	6548	12500	9773	4727	6637	9157	11310	9051	8046	16962	21576	22805	16922	11592
106	18512	18897	23800	20183	4575	1452	11792	2061	6808	12771	10140	5240	7134	9592	11748	9545	8563	17350	21915	23188	17333	12085
107	19028	19384	24304	20645	4131	1461	11909	2468	7010	12968	10463	5782	7645	10007	12165	10049	9112	17691	22189	23521	17707	12586
108	8983	9575	14319	11091	12177	9301	9828	7796	6896	9120	5503	4345	2604	3474	4329	1188	1072	10165	15358	15678	9620	2863
109	2077	1479	3585	2043	21959	19714	14703	18304	15485	12802	11795	15067	13114	11119	9148	10699	11892	7644	10722	8985	6498	8158
110	2202	2069	3183	2640	22436	20127	15323	18701	15996	13432	12343	15421	13486	11599	9667	11077	12206	8306	11310	9492	7160	8542
111	2524	2570	2830	3057	22882	20539	15826	19105	16460	13936	12823	15802	13879	12049	10136	11476	12567	8792	11693	9798	7651	8946
112	3790	2329	3786	768	22246	20264	14229	18919	15664	12263	11839	15850	13857	11495	9393	11458	12830	6560	8950	7058	5529	8957
113	3976	2672	3276	1300	22764	20758	14763	19405	16187	12796	12367	16312	14322	12000	9906	11918	13264	7060	9251	7234	6045	9406
114	4066	3062	2453	2061	23416	21336	15551	19962	16859	13589	13063	16813	14834	12616	10550	12421	13707	7885	9969	7838	6864	9891
115	4193	3440	1805	2684	23907	21766	16166	20376	17371	14211	13599	17182	15216	13087	11046	12800	14034	8544	10586	8391	7514	10261
116	10165	8428	9737	6798	22535	21586	12617	20554	16148	10772	12477	18296	16388	13255	11245	14367	16078	5274	2518	590	5556	12443
117	10563	8831	10407	7279	22102	21257	12090	20263	15778	10284	12173	18108	16228	13054	11096	14274	16000	5062	1763	1202	5502	12447
118	12635	10912	12511	9409	22423	21912	12169	21035	16354	10556	12990	19165	17368	14131	12323	15584	17329	6352	1168	2895	7069	13972
119	12716	11041	13272	9739	20902	20530	10607	19714	14958	9077	11748	18022	16292	13040	11366	14653	16399	5645	1247	4092	6571	13249
120	12099	10420	12675	9116	20780	20305	10525	19452	14740	8917	11439	17671	15912	12664	10936	14219	15966	5123	790	3641	6009	12751
121	10292	8677	11564	7598	19238	18523	9182	17595	12996	7391	9521	15659	13860	10623	8833	12106	13853	2982	2340	4042	3923	10607
122	11523	10317	14454	10010	14838	14448	4658	13692	8875	2974	5971	12326	10796	7627	6533	9639	11304	4127	6525	8561	5159	9047
123	10973	9733	13823	9387	15269	14755	5185	13946	9184	3396	6079	12429	10830	7617	6360	9541	11235	3492	6096	8015	4541	8787
124	12559	11398	15585	11135	14187	14046	3879	13396	8507	2558	6038	12317	10921	7864	7057	9998	11600	5263	7301	9515	6283	9673
125	12022	10845	15018	10569	14467	14194	4214	13489	8631	2673	5933	12264	10800	7682	6738	9762	11396	4696	6935	9059	5716	9313
126	13635	12489	16669	12224	13844	13977	3565	13440	8528	2830	6519	12644	11377	8447	7860	10653	12193	6340	7959	10331	7373	10523
127	13141	12002	16211	11758	13862	13867	3542	13280	8372	2535	6173	12366	11049	8070	7412	10253	11816	5890	7761	10053	6906	10064

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Calculated:
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DECIBEL - Main Result

Calculation: GE2.5-127

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
128	14090	14421	19347	15700	7002	4008	8902	2532	3933	9325	6105	1308	2727	5195	7330	5100	4376	13123	17920	18965	13002	7630
129	17860	18023	23019	19136	3046	1042	9524	1925	4795	10684	8495	5206	6674	8395	10521	8929	8384	15718	20026	21501	15841	11388
130	18459	18593	23596	19677	2392	1373	9699	2548	5158	10956	8940	5865	7316	8941	11050	9549	9035	16137	20355	21894	16296	11992
131	2799	3814	3793	4820	23145	20579	16803	19101	16901	14988	13455	15687	13850	12423	10694	11509	12374	10274	13498	11665	9101	9066
132	2813	3660	3441	4548	23252	20727	16757	19256	16969	14923	13480	15859	14004	12498	10729	11648	12556	10097	13217	11345	8930	9183
133	4505	5865	5365	7021	23985	21197	18399	19685	17986	16664	14774	16193	14488	13513	12002	12273	12864	12313	15700	13867	11130	10009
134	4899	6312	5827	7508	24109	21274	18710	19756	18176	16997	15026	16253	14583	13715	12258	12405	12931	12744	16186	14367	11560	10192
135	5283	6709	6125	7904	24343	21475	19054	19955	18453	17352	15339	16446	14800	14000	12575	12648	13131	13137	16583	14754	11952	10469
136	5633	7149	6837	8442	24190	21258	19200	19733	18405	17539	15393	16217	14623	13981	12646	12531	12921	13523	17110	15345	12337	10438
137	6347	7915	7672	9260	24357	21352	19698	19822	18701	18078	15805	16304	14780	14320	13083	12765	13043	14236	17916	16183	13052	10777
138	6531	8164	8287	9607	23939	20884	19571	19353	18390	17997	15600	15838	14365	14052	12908	12415	12607	14382	18219	16573	13202	10523
139	6919	8554	8610	9994	24154	21071	19903	19541	18657	18342	15910	16029	14586	14339	13229	12669	12819	14766	18609	16958	13586	10818
140	7270	8548	6803	9506	26424	23506	21158	21981	20579	19434	17472	18465	16863	16132	14707	14748	15167	15013	18135	16104	13835	12598
141	7803	9069	7167	10000	26903	23965	21691	22438	21086	19968	17996	18921	17337	16644	15232	15238	15631	15535	18612	16550	14358	13107
142	8004	9309	7513	10281	26925	23959	21842	22430	21156	20135	18108	18912	17353	16726	15350	15281	15634	15774	18909	16867	14594	13185
143	8334	9612	7653	10544	27301	24333	22196	22804	21530	20483	18475	19286	17728	17099	15715	15657	16009	16078	19152	17077	14900	13558
144	8796	10066	7995	10976	27722	24737	22659	23208	21973	20946	18930	19689	18146	17546	16172	16089	16420	16531	19569	17471	15355	14004
145	10815	12155	10097	13118	29101	25997	24526	24467	23563	22862	20681	20961	19534	19197	17949	17598	17765	18618	21722	19619	17437	15657
146	11394	12754	10722	13736	29478	26342	25051	24813	24006	23402	21173	21314	19923	19662	18452	18024	18144	19214	22346	20246	18032	16126
147	11780	13128	11013	14090	29868	26725	25451	25196	24406	23800	21575	21700	20315	20063	18853	18422	18535	19591	22687	20567	18409	16528
148	8042	7507	2724	6533	27957	25836	19902	24442	21401	17919	17595	21225	19268	17149	15092	16852	18041	11944	12608	9906	11067	14312
149	7635	7173	2291	6295	27659	25497	19726	24094	21119	17748	17331	20855	18906	16838	14798	16492	17656	11827	12700	10041	10917	13951
150	6976	6547	1629	5745	27048	24862	19214	23455	20519	17242	16746	20207	18261	16220	14192	15847	17001	11379	12494	9901	10438	13307
151	7039	6719	1709	6027	27234	25001	19513	23583	20725	17547	16971	20309	18374	16398	14390	15964	17082	11729	12934	10351	10768	13426
152	7417	7116	2102	6418	27631	25393	19902	23973	21123	17934	17370	20693	18761	16794	14788	16352	17462	12099	13215	10602	11147	13815
153	8204	7993	2970	7343	28504	26229	20828	24800	22011	18861	18270	21496	19576	17665	15674	17172	18245	13023	14037	11381	12074	14640
154	8026	7882	2875	7310	28380	26073	20800	24638	21904	18839	18181	21318	19407	17540	15566	17007	18057	13046	14185	11556	12078	14480
155	7972	7932	2988	7468	28392	26038	20948	24593	21943	18996	18247	21250	19353	17556	15607	16962	17974	13264	14540	11938	12273	14444
156	5193	6112	3978	6788	25385	22717	19199	21220	19222	17377	15828	17758	15984	14737	13061	13695	14427	12510	15329	13233	11354	11317
157	5386	6411	4468	7178	25416	22699	19408	21195	19306	17606	15966	17719	15973	14822	13193	13711	14387	12843	15755	13689	11679	11369
158	5790	6797	4628	7523	25803	23073	19812	21567	19705	18008	16370	18086	16349	15220	13597	14095	14754	13219	16070	13967	12058	11762
159	5942	7014	4975	7798	25825	23063	19960	21553	19767	18171	16470	18063	16347	15285	13696	14113	14733	13454	16370	14287	12288	11809
160	6841	7703	4753	8224	26977	24261	20840	22756	20851	19010	17475	19277	17535	16366	14707	15274	15944	14041	16601	14363	12898	12925
161	4968	5613	2950	6051	25397	22832	18836	21352	19128	16974	15630	17928	16101	14656	12884	13764	14609	11884	14471	12305	10749	11320
162	4529	5197	2910	5700	24964	22409	18408	20930	18690	16550	15192	17512	15679	14219	12445	13338	14196	11501	14183	12068	10360	10889
163	7291	8969	9304	10483	23853	20717	19925	19187	18486	18415	15861	15686	14309	14228	13221	12473	12523	15065	19044	17471	13893	10737
164	7700	9377	9642	10886	24091	20929	20282	19401	18781	18784	16199	15908	14562	14547	13572	12763	12770	15470	19452	17872	14299	11069
165	8723	10391	10435	11875	24824	21609	21251	20084	19635	19774	17136	16612	15337	15450	14533	13612	13534	16501	20462	18849	15330	11999
166	9120	10800	10900	12303	24883	21637	21495	20117	19780	20044	17350	16660	15429	15636	14773	13758	13623	16868	20874	19284	15700	12212
167	6493	7782	6283	8778	25751	22869	20389	21347	19861	18661	16723	17835	16204	15405	13955	14060	14525	14247	17427	15440	13068	11878
168	6101	7229	5311	8066	25847	23054	20105	21540	19829	18329	16570	18044	16348	15351	13795	14135	14717	13682	16659	14596	12513	11859
169	10036	11712	11683	13204	25502	22214	22336	20700	20516	20907	18165	17270	16104	16422	15613	14501	14294	17783	21786	20177	16616	13028
170	6850	7624	4433	8054	27093	24412	20812	22912	20924	18966	17508	19443	17682	16440	14745	15400	16111	13907	16356	14081	12774	13025
171	6850	7546	4154	7897	27170	24521	20767	23026	20967	18908	17517	19566	17788	16486	14761	15490	16235	13775	16130	13825	12652	13094
172	6112	6798	3631	7184	26472	23852	20018	22361	20246	18159	16780	18913	17118	15767	14027	14806	15585	13046	15491	13238	11918	12392
173	5357	6007	3112	6415	25769	23189	19232	21705	19511	17370	16021	18274	16456	15037	13273	14126	14952	12263	14788	12587	11131	11691
174	5767	6459	3455	6874	26136	23526	19674	22038	19904	17817	16435	18594	16792	15426	13682	14476	15267	12724	15227	13003	11592	12057
175	6667	7843	5895	8705	26223	23382	20646	21863	20266	18886	17059	18357	16696	15797	14286	14518	15038	14302	17301	15232	13130	12286
176	5883	6088	1890	6019	26374	23940	19306	22482	19990	17390	16368	19110	17233	15559	13675	14856	15818	11939	13946	11579	10865	12357
177	4628	4634	1102	4529	25038	22685	17819	21245	18607	15897	14944	17920	16011	14204	12276	13613	14662	10450	12638	10385	9370	11090
178	4284	4223	1195	4115	24652	22321	17397	20886	18209	15475	14537	17576	15658	13815	11877	13256	14329	10036	12294	10084	8952	10728
179	3662	4928	4634	6045	23555	20859	17650	19360	17446	15881	14132	15894	14128	12962	11358	11853	12563	11390	14724	12898	10209	9505
180	3311	4545	4428	5662	23333	20672	17318	19178	17186	15539	13838	15726	13938	12701	11065	11643	12397	11008	14341	12529	9828	9267
181	8366	10034	10119	11519	24619	21424	20943	19898	19380	19456	16843	16417	15113	15173	14229	13357	13315	16150	20105	18495	14978	11709
182	6875	8174	6605	9168	26030	23123	20752	21599	20175	19030	17063	18084	16473	15726	14298	14349	14782	14639	17813	15815	13459	12193
183	10299	11735	10151	12832	28126	24988	23813	23459	22681	22191	19891	19960	18575	18353	17184	16690	16794	18168	21493	19498	16983	14824
184	10494	11961	10504	13099	28074	24910	23911	23382	22691	22310	19955	19891	18537	18389	17261	16688	16749	18376	21769	19804	17190	14868
185	10879	12338	10806	13462	28428	25253	24301	23726	23066	22701	20341	20239	18897	18770	17649	17061	17107	18758	22128	20146	17573	15252
186	11292	12750	11173	13869	28764	25573	24700	24048	23434	23105	20730	20566	19243	19149	18043	17425	17449	19171	22532	20540	17986	15635
187	11608	13081	11542	14215	28915	25704	24960	24180	23634	23377	20968	20707	19409	19368	18291	17619	17612	19493	22882	20900	18307	15863
188	11791	13286	11845	14451	28883	25652	25056	24130	23658	23491	21038	20667	19396	19417	18374	17639	17595	19681	23124	21166	18495	15922
189	6735	6235	1439	5377	26720	24560	18834	23159	20181	16861	16398	19929	17976	15898	13859	15561	16738	10986	12114	9536	10050	13020
190	7676	7433	2409	6777	27946	25684	20265	24258	21448	18299	17705	20964	19039	17107	15112	16633	17721	12475	13584	10960	11519	14099
191	2974	4182	4291	5312	23099	20470	16991	18982	16921	15204	13543	15542	13736	12436	10772	11424	12218	10646	13990	12198	9466	9024
192	11035	12400	10425	13394	29147	26021	24690	24491	23658	23040	20816	20990	19588	19309	18093	17679	17812	18859	22011	19926	17676	15772
193	6148	7744	7709	9133	24029	21022	19412	19493	18383	17803	15503	15975	14452	14006	12785	12442	12714	14028	17772	16080	12845	10465
194	5993	7528	7204	8837	24328	21363	19479	19835	18598	17835	15636	16317	14754	14192	12898	12696	13036	13885	17502	15743	12700	10647
195	8075	9759	10033	11279	24201	21011	20544	19484	18961	19066	16435	16002	14694	14758	13828	12938	12895	15824	19835	18266	14655	11299
196	9744	11427	11501	12936	25187	21906	22000	20390	20184	20573	17828	16956	15779	16086	15277	14168	13969	17474	21503	19917	16308	12691

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9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

...continued from previous page

WTG	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
197	9469	11161	11350	12690	24863	21588	21666	20071	19848	20243	17492	16633	15447	15749	14943	13832	13638	17177	21237	19677	16013	12355
198	3838	3785	1572	3781	24200	21868	16985	20434	17760	15069	14095	17127	15207	13363	11429	12804	13883	9690	12100	9963	8592	10275
199	5584	5751	1620	5674	26065	23649	18962	22195	19670	17045	16039	18833	16949	15245	13351	14567	15548	11595	13639	11295	10520	12061
200	5288	5420	1406	5342	25757	23357	18627	21906	19352	16709	15714	18554	16663	14933	13030	14276	15275	11263	13354	11036	10186	11766
201	5033	5100	1175	4992	25476	23100	18292	21654	19056	16371	15404	18316	16415	14646	12730	14023	15046	10913	13024	10726	9837	11506
202	4860	5798	3902	6518	25060	22401	18868	20905	18890	17049	15494	17448	15668	14406	12727	13373	14118	12210	15089	13028	11050	10989
203	4525	5475	3820	6233	24744	22098	18534	20605	18564	16716	15162	17153	15364	14080	12395	13063	13824	11897	14830	12803	10735	10671
204	4185	5095	3594	5849	24476	21860	18180	20372	18267	16355	14839	16932	15126	13785	12076	12810	13606	11512	14454	12445	10351	10397
205	6735	8214	7429	9431	25155	22170	20315	20642	19446	18660	16483	17123	15579	15041	13744	13536	13852	14616	18110	16268	13431	11497
206	6521	7236	3993	7625	26839	24194	20448	22699	20636	18593	17188	19242	17461	16154	14431	15161	15911	13489	15910	13635	12361	12763
207	6335	7506	5643	8376	25952	23129	20320	21612	19972	18557	16748	18110	16435	15500	13974	14243	14787	13965	16981	14928	12793	11994
208	6997	8180	6168	9039	26484	23623	20967	22102	20552	19212	17364	18593	16946	16086	14592	14783	15278	14640	17629	15548	13468	12569

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
1	5146	5731	5679	4796	5958	7394	10436	10609	8470	10548	6629	5798	3993	6003	6501	10802	5632	7780	4778	8375	7112	7706
2	5436	2117	1749	790	1709	11918	13483	14196	9745	10528	9632	1373	8453	2647	6259	13590	10119	9561	4598	8383	6649	11986
3	6088	3301	2944	1957	1971	11387	12341	13120	8552	9424	8512	2486	7722	3821	7067	12426	9392	10037	3412	7252	5538	11111
4	5856	3518	3213	2186	2523	10833	11971	12688	8372	9428	8117	2877	7176	4009	6908	12087	8846	9703	3299	7229	5555	10592
5	5976	7523	7520	6686	7895	5453	9705	9512	8831	11327	6183	7704	2323	7736	7322	10215	3843	7530	6149	9275	8280	6125
6	4593	6487	6549	5820	7319	6285	11043	10894	9786	12063	7434	6858	3671	6637	5938	11524	5093	6409	6435	9927	8738	7459
7	6167	8087	8113	7315	8597	4772	9805	9448	9320	11910	6449	8342	2102	8269	7480	10369	3420	7278	6864	9895	8956	5826
8	6382	7092	7011	6085	7001	6438	9134	9223	7689	10077	5404	7055	2710	7386	7747	9549	4379	8522	4863	7998	6978	6332
9	7378	7813	7687	6716	7372	6439	8146	8311	6804	9332	4399	7636	2436	8147	8741	8548	4056	9473	4579	7325	6473	5702
10	4234	3664	3601	2736	4180	9353	12067	12452	9286	10829	8184	3757	6071	3969	5452	12330	7709	7818	4653	8603	7062	9760
11	4339	4186	4133	3270	4643	8828	11670	11998	9090	10776	7799	4288	5540	4473	5616	11960	7175	7699	4653	8553	7073	9241
12	4096	4501	4494	3688	5161	8383	11663	11895	9331	11134	7820	4720	5232	4740	5414	11993	6839	7259	5068	8919	7484	8982
13	9225	9825	9684	8699	9180	5699	6337	6315	6223	9156	2925	9590	1946	10167	10587	6848	2929	10823	5715	7445	7055	3870
14	7523	5024	4648	3685	2978	11215	10903	11859	6849	7724	7171	4087	7294	5550	8609	10915	8919	11236	1693	5535	3845	10317
15	8463	9460	9365	8418	9136	4985	7233	7014	7178	10043	3937	9362	1000	9760	9817	7789	2371	9855	6100	8243	7694	3974
16	11202	11996	11853	10864	11264	5441	4758	4279	6508	9663	2673	11745	3125	12336	12553	5458	2842	12339	7484	8337	8367	2120
17	11524	12396	12259	11273	11687	5348	4638	3986	6770	9937	2942	12158	3373	12732	12870	5385	2877	12548	7901	8669	8746	1774
18	10296	10869	10714	9718	10088	5787	5322	5229	5952	9030	2274	10586	2607	11222	11657	5888	2994	11753	6352	7520	7382	3153
19	12677	12549	12312	11282	11155	8149	2888	3739	4141	7306	1024	12010	5360	12972	14041	3253	5505	14448	6803	6374	6889	4479
20	9310	7697	7365	6355	5778	10115	8113	9205	4220	5885	4502	6880	6068	8194	10561	8095	7470	12430	1328	3707	2637	8294
21	5385	2660	2353	1325	2144	11283	12819	13503	9210	10160	8958	2076	7768	3157	6333	12944	9436	9397	4101	7981	6275	11283
22	7641	7378	7187	6174	6529	7603	8140	8606	6006	8327	4260	7012	3569	7771	8984	8420	5130	10180	3403	6255	5313	6514
23	5189	777	701	1700	2835	13500	15816	16470	12043	12607	11952	1153	10369	1013	5505	15934	12003	9404	6886	10530	8775	14038
24	8360	6179	5814	4835	4096	10890	9794	10837	5678	6730	6132	5265	6872	6697	9519	9775	8426	11860	546	4511	2920	9591
25	7321	5180	4838	3835	3423	10642	10510	11398	6678	7793	6731	4362	6717	5687	8462	10560	8342	10913	1612	5577	3959	9762
26	6845	4312	3949	2968	2542	11148	11437	12300	7543	8458	7646	3439	7323	4832	7905	11489	8976	10639	2401	6270	4577	10527
27	5956	7216	7190	6328	7467	5881	9613	9527	8490	10925	5999	7336	2523	7455	7314	10086	4123	7777	5675	8853	7825	6307
28	6797	8843	8868	8066	9315	4035	9492	8990	9436	12148	6332	9092	1665	9021	8086	10106	2744	7560	7368	10197	9364	5208
29	9238	9339	9154	8142	8411	6761	6309	6646	5337	8170	2535	8974	2873	9722	10600	6686	4006	11238	4706	6395	5974	4796
30	5939	4934	4732	3719	4305	9128	10503	11058	7533	9164	6614	4577	5386	5345	7190	10709	7054	9252	3075	6943	5490	8796
31	5973	4607	4375	3350	3833	9599	10805	11423	7618	9090	6923	4166	5859	5042	7181	10979	7527	9443	2924	6864	5341	9246
32	5938	4245	3989	2958	3381	10027	11174	11834	7823	9147	7302	3738	6309	4700	7099	11324	7978	9548	2952	6924	5339	9699
33	5276	3346	3112	2089	2940	10421	12066	12681	8708	9914	8186	2950	6871	3792	6364	12228	8540	9088	3736	7701	6061	10390
34	4311	3254	3685	4570	6191	14197	18271	18631	15034	15864	14384	4474	11826	2713	3725	18508	13316	7811	9926	13736	11995	15626
35	4536	2706	3108	4046	5556	14235	17932	18364	14548	15288	14042	3856	11691	2184	4137	18140	13221	8259	9415	13179	11431	15481
36	5187	3102	3453	4445	5755	14896	18452	18927	14944	15567	14563	4114	12316	2622	4726	18638	13857	8834	9794	13488	11734	16100
37	2580	3135	3607	4188	6194	12514	17082	17300	14244	15396	13219	4494	10317	2646	2146	17383	11753	6269	9275	13207	11512	14117
38	1922	3229	3685	4110	6209	11843	16562	16730	13879	15151	12715	4565	9694	2807	1708	16886	11112	5773	8988	12946	11277	13491
39	2335	6027	6286	5961	7973	7712	13846	13586	12470	14528	10264	6912	6241	5936	3480	14345	7385	3790	8549	12333	10957	9878
40	2354	5553	5778	5383	7351	7770	13406	13236	11855	13866	9762	6359	5935	5511	3642	13876	7190	4464	7866	11665	10277	9651
41	1758	4005	4461	4873	6983	11798	16968	17048	14469	15828	13149	5342	9901	3574	1034	17324	11251	5159	9648	13616	11964	13676
42	2107	5737	6183	6499	8650	11377	17537	17405	15523	17117	13822	7055	10090	5327	903	17973	11258	3616	10923	14892	13300	13753
43	12282	11983	11734	10703	10516	8357	3428	4415	3629	6805	528	11408	5282	12417	13642	3666	5634	14225	6138	5758	6218	4893
44	11833	11341	11078	10046	9794	8604	4101	5174	3172	6321	686	10726	5253	11785	13187	4238	5825	13967	5389	5114	5483	5388
45	12005	11267	10982	9953	9565	9212	4326	5607	2539	5680	1328	10584	5765	11729	13348	4328	6422	14303	5087	4493	4957	6031
46	11903	10991	10692	9667	9196	9549	4739	6087	2195	5279	1785	10265	5991	11463	13236	4675	6748	14334	4690	4012	4465	6475
47	18924	18402	18105	17079	16511	13227	3601	4932	7120	8843	7164	17665	11420	18869	20286	3011	11091	20628	11980	9537	10944	9067
48	17474	17208	16937	15905	15505	11540	1987	3288	6482	8729	5768	16552	9810	17655	18838	1642	9422	19031	10986	9025	10248	7380
49	17836	17806	17555	16523	16231	11322	2395	2917	7416	9758	6285	17210	9962	18238	19200	2422	9400	19173	11738	9977	11136	7189
50	18609	18226	17941	16912	16422	12678	3162	4340	7160	9083	6870	17528	10990	18683	19972	2696	10597	20210	11891	9636	10977	8520
51	12924	12423	12152	11120	10792	9110	3090	4442	3101	6254	1279	11779	6067	12873	14279	3147	6406	14967	6324	5424	6098	5531
52	17197	16522	16217	15194	14596	12222	2507	4457	5224	7182	5463	15763	9974	16995	18553	1626	9860	19104	10065	7685	9046	8111
53	17204	16385	16069	15051	14379	12547	2923	4945	4907	6703	5535	15590	10153	16867	18555	2007	10123	19225	9859	7309	8728	8467
54	16918	16005	15682	14667	13955	12548	3083	5176	4447	6214	5325	15188	10015	16491	18264	2160	10065	19027	9444	6827	8262	8512
55	14331	12636	12262	11293	10263	12572	5624	7596	950	2634	4603	11661	9065	13155	15610	5044	9785	17133	5924	2771	4306	9212

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Calculated:
9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

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WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
56	16186	16084	15831	14799	14523	10228	678	2213	5936	8548	4567	15488	8453	16517	17551	983	8065	17677	10044	8507	9555	6072
57	17452	17332	17073	16042	15715	11212	1948	2865	6857	9210	5829	16716	9664	17769	18816	1874	9185	18887	11214	9417	10582	7058
58	4775	5081	5027	4149	5382	7998	10936	11182	8689	10602	7094	5157	4645	5360	6109	11268	6283	7723	4648	8401	7039	8350
59	8681	8552	8354	7336	7577	7240	6979	7436	5343	7973	3115	8154	3222	8947	10037	7289	4569	10944	3962	6060	5439	5587
60	7205	5425	5117	4093	3911	10090	10112	10934	6516	7859	6295	4716	6156	5911	8396	10200	7779	10656	1687	5633	4105	9212
61	5135	7257	7322	6590	8052	5514	10733	10451	9872	12297	7256	7627	3125	7399	6449	11264	4432	6453	6884	10206	9117	6856
62	7345	7529	7381	6395	6968	6895	8236	8512	6573	9009	4420	7293	2891	7883	8704	8592	4500	9636	4128	6968	6061	6075
63	11037	11198	10999	9980	10104	6876	4478	4791	4892	8017	1135	10781	3708	11590	12402	4939	4107	12744	6040	6646	6718	3804
64	13815	13736	13496	12465	12300	8633	1710	2766	4615	7669	2206	13185	6268	14160	15180	2191	6158	15450	7899	7051	7775	4666
65	9731	9189	8941	7910	7829	8124	6223	6991	4139	6843	2354	8634	4219	9624	11075	6414	5358	12134	3699	5031	4663	5896
66	9520	9848	9679	8675	9012	6283	5996	6167	5612	8550	2407	9529	2552	10216	10885	6446	3494	11297	5333	6863	6537	4166
67	10038	8914	8614	7589	7180	9355	6697	7770	3414	5782	3071	8194	5400	9389	11345	6721	6602	12790	2765	3847	3413	7100
68	8859	10179	10109	9184	9987	4156	7195	6711	7770	10726	4278	10148	648	10453	10191	7836	1476	9866	6992	9003	8534	3263
69	631	4802	5206	5345	7520	10398	16112	16041	14049	15681	12372	6034	8773	4486	797	16531	10026	3925	9494	13456	11886	12495
70	2816	4484	4957	5541	7549	12822	18058	18154	15452	16699	14229	5842	11006	3982	1725	18403	12344	5609	10550	14501	12820	14777
71	694	5158	5534	5562	7730	9769	15684	15552	13808	15553	11984	6326	8249	4892	1388	16127	9460	3543	9391	13328	11800	11941
72	8051	10216	10237	9422	10600	2772	8942	8166	9681	12574	6227	10443	1532	10396	9302	9643	1605	8325	8304	10757	10115	4116
73	2176	4715	5179	5632	7726	12098	17609	17630	15212	16599	13812	6065	10417	4258	953	17985	11710	4855	10416	14385	12738	14165
74	11102	10261	9974	8945	8576	9090	5302	6447	2790	5706	1822	9577	5385	10725	12435	5334	6284	13558	4130	4167	4293	6296
75	11214	10070	9757	8737	8199	9771	5749	7045	2330	5058	2520	9303	5987	10552	12527	5676	6968	13864	3684	3434	3583	7038
76	11034	9726	9402	8387	7778	10045	6212	7526	2398	4873	2984	8922	6189	10217	12332	6113	7253	13807	3250	3105	3121	7439
77	13842	13162	12871	11843	11374	10000	2727	4479	2819	5814	2271	12453	7053	13627	15193	2509	7336	15951	6854	5340	6282	6275
78	13185	12853	12595	11563	11305	8862	2579	3841	3647	6772	1424	12248	6041	13293	14546	2762	6221	15075	6865	6015	6698	5137
79	13008	11888	11565	10550	9898	10528	4413	6093	1327	4500	2557	11082	7098	12377	14332	4131	7747	15498	5367	3697	4601	7202
80	13610	13384	13133	12101	11874	8847	2029	3288	4096	7169	1882	12799	6259	13818	14973	2315	6289	15380	7443	6524	7259	4978
81	18925	18299	17993	16970	16349	13453	3750	5225	6893	8499	7168	17534	11526	18772	20284	3074	11259	20715	11823	9267	10711	9294
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83	12524	11159	10820	9816	9061	10820	5336	6967	994	3994	3036	10301	7184	11659	13826	5055	8015	15217	4546	2861	3674	7740
84	12329	10797	10446	9452	8618	11085	5878	7500	1092	3709	3449	9901	7355	11305	13615	5586	8278	15145	4131	2367	3135	8136
85	14104	12257	11873	10918	9815	12772	6162	8101	1036	2187	4866	11249	9164	12782	15365	5605	9972	17017	5553	2211	3801	9532
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87	10161	8358	8002	7013	6214	10727	7841	9112	3494	5008	4475	7456	6707	8870	11399	7728	8020	13306	1693	2838	1953	8619
88	3667	2248	2708	3513	5287	13300	17146	17523	13930	14830	13258	3555	10783	1703	3434	17380	12301	7549	8839	12683	10951	14578
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91	10767	11450	11301	10308	10690	5603	4988	4718	6196	9322	2395	11182	2843	11797	12123	5621	2879	12061	6923	7911	7867	2620
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93	2814	6877	7162	6891	8929	7519	14330	13937	13245	15392	10857	7822	6586	6743	3687	14874	7554	2942	9470	13209	11869	10068
94	1966	5988	6418	6647	8816	10827	17185	16996	15336	17028	13509	7273	9660	5613	1127	17643	10783	3078	10846	14802	13243	13286
95	2941	7390	7746	7671	9805	8655	15890	15450	14779	16850	12432	8504	8116	7147	3201	16442	8992	1495	10838	14651	13253	11504
96	10166	10125	9916	8893	9001	7141	5408	5882	4677	7657	1601	9683	3496	10527	11528	5760	4335	12144	4996	6053	5891	4608
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109	6247	1843	1635	2421	2665	14445	16264	17035	12210	12500	12440	1479	11193	2044	6497	16326	12844	10449	7089	10506	8754	14797
110	6845	2490	2297	3054	2963	15100	16737	17560	12553	12690	12938	2069	11818	2641	7024	16772	13474	11024	7475	10752	9010	15400
111	7242	2953	2787	3559	3353	15601	17182	18029	12930	12972	13396	2570	12322	3058	7355	17204	13978	11392	7884	11073	9341	15899
112	4533	1213	1580	2556	4040	13571	16602	17134	13058	13753	12716	2325	10714	767	4597	16771	12303	8638	7913	11648	9898	14461
113	4891	1704	2017	3027	4334	14082	17114	17662	13507	14123	13231	2668	11249	1299	4824	17274	12836	8916	8354	12040	10286	14997
114	5664	2374	2586	3618	4586	14904	17748	18354	13982	14436	13875	3059	12032	2060	5497	17879	13629	9614	8827	12401	10645	15766
115	6314	2943	3093	4114	4824	15557	18227	18882	14335	14657	14367	3438	12645	2683	6096	18335	14251	10220	9193	12666	10913	16364
116	2929	7159	7581	7757	9932	10533	17516	17183	16009	17849	13943	8425	9827	6797	2322	18025	10799	2018	11704	15627	14118	13314
117	3216	7604	8007	8098	10271	9906	17176	16761	15899	17853	13676	8827	9421	7278	2890	17715	10309	1282	11758	15639	14177	12820
118	5274	9717	10107	10133	12291	9591	17828	17162	17158	19339	14572	10908	10000	9408	5037	18449	10573	1076	13380	17154	15790	13018
119	5536	9966	10306	10162	12255	7947	16460	15686	16172	18531	13360	11038	8669	9738	5707	17119	9090	1768	12764	16389	15136	11489
120	4914	9342	9684	9546	11645	7981	16225	15526	15758	18062	13038	10417	8405	9115	5116	16861	8934	1349	12240	15906	14623	11373
121	3608	7734	8019	7736	9756	7074	14434	13914	13664	15924	11086	8674	6619	7597	4346	15020	7414	2622	10102	13763	12481	9921
122	7174	9903	9990	9278	10710	2915	10398	9585	10926	13719	7604	10316	2812	10010	8338	11097	2990	6963	9004	11807	11005	5444
123	6540	9290	9386	8693	10177	3554	10683	9978	10892	13603	7712	9732	2930	9387	7717	11349	3417	6508	8676	11636	10752	5916
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To be continued on next page...

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Calculated:
9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

...continued from previous page

WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
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126	9297	12111	12189	11452	12794	759	10093	8862	11718	14716	8050	12488	3778	12224	10399	10902	2813	8463	10652	12989	12428	4574
127	8901	11638	11710	10966	12298	1152	9935	8796	11355	14326	7732	12001	3338	11759	10028	10723	2524	8251	10176	12570	11977	4508
128	16090	15219	14902	13884	13221	11864	2698	4847	3808	5913	4508	14424	9226	15701	17437	1837	9331	18208	8697	6281	7630	7884
129	18929	18689	18416	17385	16959	12636	3415	4232	7794	9786	7246	18025	11172	19138	20293	3120	10675	20395	12433	10293	11598	8497
130	19375	19236	18970	17939	17552	12795	3877	4399	8439	10444	7752	18595	11524	19679	20739	3686	10944	20735	13032	10946	12238	8690
131	9028	4612	4334	4851	3753	16865	17469	18515	12820	12405	13818	3815	13360	4821	9210	17392	15030	13215	8056	10708	9059	16771
132	8753	4371	4119	4700	3770	16751	17568	18575	12987	12650	13886	3661	13297	4549	8900	17510	14965	12925	8159	10916	9249	16749
133	11226	6788	6478	6877	5365	18704	18389	19627	13392	12446	14928	5867	15040	7022	11417	18207	16706	15422	9099	11050	9569	18272
134	11710	7265	6946	7314	5730	19076	18539	19821	13476	12413	15130	6314	15377	7509	11914	18334	17039	15912	9311	11093	9659	18561
135	12108	7663	7345	7709	6103	19448	18791	20100	13687	12541	15415	6712	15734	7905	12305	18571	17394	16307	9605	11277	9877	18893
136	12633	8172	7831	8125	6394	19704	18684	20055	13498	12201	15393	7152	15930	8444	12880	18430	17580	16849	9621	11042	9715	19001
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138	13750	9289	8913	9083	7170	20290	18547	20038	13223	11614	15447	8167	16415	9608	14086	18224	18039	17984	9814	10694	9542	19296
139	14140	9678	9303	9472	7553	20648	18790	20305	13442	11758	15730	8557	16763	9996	14472	18452	18383	18373	10128	10901	9791	19617
140	13695	9345	9085	9576	8139	21473	20897	22227	15741	14429	17547	8549	17812	9507	13734	20658	19476	17818	11740	13290	11949	21014
141	14181	9849	9596	10100	8673	22006	21390	22735	16211	14844	18059	9071	18346	10001	14196	21142	20010	18289	12257	13747	12429	21543
142	14470	10118	9855	10335	8858	22201	21434	22806	16222	14789	18139	9311	18515	10281	14503	21172	20177	18591	12353	13741	12455	21678
143	14723	10395	10141	10642	9197	22535	21810	23180	16598	15155	18512	9614	18862	10544	14730	21548	20525	18826	12723	14115	12832	22039
144	15149	10835	10586	11097	9660	22998	22242	23623	17014	15528	18959	10068	19326	10977	15137	21972	20988	19239	13175	14522	13257	22499
145	17297	12965	12704	13179	11645	24989	23730	25213	18391	16620	20600	12157	21250	13119	17290	23400	22904	21393	14893	15847	14726	24318
146	17918	13578	13313	13775	12213	25552	24143	25655	18778	16930	21060	12756	21794	13737	17916	23795	23444	22018	15383	16224	15146	24828
147	18266	13939	13679	14151	12603	25944	24539	26054	19170	17307	21461	13130	22191	14091	18248	24189	23841	22354	15784	16615	15544	25229
148	9063	6906	7126	8157	8793	18961	22285	22889	18367	18506	18416	7505	16410	6532	8288	22403	17958	12129	13242	16598	14857	20185
149	9032	6641	6836	7862	8408	18858	21979	22620	17993	18081	18119	7171	16223	6294	8322	22081	17787	12233	12881	16190	14454	19985
150	8685	6068	6241	7262	7754	18418	21364	22030	17342	17418	17510	6545	15702	5745	8058	21455	17282	12043	12237	15530	13795	19452
151	9088	6322	6467	7479	7850	18769	21543	22248	17439	17432	17702	6718	15997	6026	8487	21616	17587	12486	12359	15577	13852	19733
152	9422	6717	6865	7877	8235	19139	21940	22646	17822	17790	18099	7115	16387	6418	8789	22011	17974	12760	12748	15947	14225	20126
153	10316	7634	7771	8777	9049	20063	22810	23541	18621	18495	18979	7992	17313	7342	9644	22867	18901	13571	13576	16695	14986	21048
154	10399	7580	7697	8693	8886	20086	22683	23443	18442	18268	18863	7881	17281	7309	9766	22727	18879	13727	13418	16488	14787	21003
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157	11337	7064	6847	7450	6324	19489	19782	20937	14894	14056	16231	6412	15978	7178	11331	19641	17648	15428	10411	12603	11074	19352
158	11666	7424	7218	7837	6729	19883	20173	21336	15267	14387	16630	6799	16380	7524	11630	20027	18050	15735	10808	12961	11445	19757
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160	12270	8190	8034	8736	7793	20807	21340	22478	16455	15568	17772	7704	17383	8225	12113	21203	19052	16237	11959	14152	12634	20815
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162	9798	5651	5495	6221	5485	18289	19283	20296	14647	14160	15607	5197	14927	5700	9733	19216	16592	13842	9871	12511	10877	18425
163	14589	10142	9749	9850	7857	20783	18557	20128	13163	11335	15603	8972	16854	10485	14974	18186	18455	18825	10108	10603	9591	19601
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165	16001	11546	11161	11281	9294	22174	19632	21269	14193	12147	16807	10394	18226	11876	16359	19218	19815	20237	11421	11621	10740	20898
166	16418	11968	11578	11678	9669	22470	19741	21408	14288	12158	16982	10803	18506	12305	16791	19308	20084	20654	11665	11717	10897	21124
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178	7993	4219	4209	5127	5134	16986	18953	19768	14701	14654	15153	4222	13878	4115	7805	18983	15517	11929	9665	12802	11082	17520
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183	17036	12636	12343	12740	11082	24391	22802	24328	17429	15579	19747	11737	20591	12833	17117	22449	22233	21187	14101	14874	13810	23567
184	17305	12890	12587	12958	11258	24540	22784	24336	17391	15477	19777	11963	20716	13100	17410	22415	22352	21470	14168	14829	13806	23649
185	17668	13258	12959	13337	11646	24930	23151	24711	17752	15811	20157	12341	21107	13463	17760	22776	22743	21826	14555	15187	14179	24037
186	18073	13667	13369	13750	12058	25339	23505	25078	18097	16119	20534	12753	21512	13869	18158	23123	23147	22228	14946	15530	14542	24431
187	18421	14009	13707	14076	12364	25629	23684	25276	18264	16237	20749	13083	21788	14216	18515	23290	23419	22580	15189	15694	14738	24679
188	18658	14235	13926	14275	12531	25766	23685	25297	18252	16174	20791	13288	21907	14452	18771	23278	23533	22828	15268	15681	14759	24762
189	8289	5712	5899	6925	7490	18025	21040	21686	17069	17202	17180	6233	15325	5376	7670	21141	16900	11666	11951	15291	13550	19080
190	9802	7067	7205	8211	8511	19515	22252	22977	18091	18007	18418	7432	16748	6777	9164	22314	18339	13126	13033	16187	14472	20482
191	9515	5073	4768	5207	3902	17147	17440	18545	12686	12139	13840	4184	13576	5313	9733	17334	15246	13717	8039	10508	8895	16926
192	17579	13231	12964	13420	11852	25191	23802	25307	18444	16620	20708	12402	21432	13394	17588	23459	23082	21686	15025	15893	14803	24468
193	13298	8833	8469	8685	6835	20046	18589	20033	13315	11830	15410	7746	16208	9135	13600	18293	17844	17527	9712	10811	9586	19167

To be continued on next page...

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9/17/2018 10:43 AM/3.0.654

DECIBEL - Main Result

Calculation: GE2.5-127

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WTG	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
194	13024	8562	8218	8497	6736	20024	18848	20249	13624	12239	15601	7531	16230	8838	13277	18577	17876	17242	9854	11145	9861	19264
195	15381	10936	10542	10633	8623	21467	18977	20597	13549	11571	16119	9762	17518	11280	15770	18575	19107	19618	10715	10979	10063	20195
196	17048	12599	12208	12301	10282	23021	20105	21805	14642	12415	17420	11431	19044	12938	17424	19650	20613	21285	12174	12075	11323	21611
197	16787	12345	11950	12025	9992	22696	19772	21469	14310	12099	17082	11164	18716	12691	17181	19320	20283	21024	11842	11742	10986	21275
198	7753	3846	3808	4706	4682	16615	18500	19321	14253	14230	14703	3785	13468	3781	7634	18529	15111	11750	9213	12366	10642	17097
199	9434	5792	5780	6683	6493	18558	20367	21244	15957	15686	16602	5750	15445	5674	9129	20363	17087	13248	11012	13939	12256	19073
200	9127	5457	5444	6349	6189	18223	20058	20923	15677	15449	16286	5419	15109	5342	8845	20060	16750	12967	10713	13681	11990	18739
201	8785	5111	5105	6018	5919	17875	19776	20623	15439	15268	15994	5099	14773	4992	8518	19789	16412	12642	10450	13474	11772	18410
202	10672	6413	6207	6837	5810	18893	19406	20513	14605	13901	15809	5799	15421	6518	10666	19291	17091	14762	10008	12368	10796	18834
203	10402	6115	5899	6514	5475	18566	19087	20186	14305	13642	15482	5476	15088	6234	10424	18977	16758	14509	9686	12085	10501	18500
204	10021	5728	5512	6134	5139	18191	18811	19885	14077	13488	15184	5096	14728	5850	10056	18714	16397	14136	9402	11889	10283	18155
205	13635	9188	8866	9203	7510	20827	19688	21096	14446	12997	16450	8216	17052	9433	13825	19409	18701	17834	10703	11955	10695	20107
206	11611	7626	7502	8256	7479	20318	21178	22252	16399	15661	17553	7237	16970	7625	11411	21074	18635	15537	11771	14157	12590	20458
207	12552	8238	7998	8542	7241	20520	20367	21614	15330	14244	16914	7507	16930	8377	12566	20175	18599	16658	11085	12949	11511	20218
208	13208	8908	8671	9217	7896	21189	20919	22196	15834	14650	17502	8182	17586	9040	13202	20710	19254	17301	11677	13422	12023	20855

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
1	6812	8954	5590	9227	14393	12323	10669	2835	2820	4312	18171	17936	17655	16822	6821	6270	9202
2	2356	13440	10098	5140	16139	13918	12411	5275	5910	8096	20528	20279	20101	18834	11098	9417	12857
3	2885	12689	9395	6270	14946	12725	11216	5390	5909	7974	19335	19086	18910	17639	10788	9529	11801
4	3428	12147	8847	6655	14750	12539	11001	4959	5441	7468	19076	18827	18638	17419	10249	9074	11356
5	8752	7129	3765	11015	14246	12318	10663	3314	2808	3140	17634	17409	17079	16485	5029	5350	8106
6	8100	8299	4982	9939	15436	13450	11789	1931	1490	2644	18944	18716	18397	17741	5354	4629	9487
7	9441	6625	3304	11564	14541	12670	11025	3506	2871	2652	17771	17551	17203	16703	4291	4885	8057
8	7905	7697	4370	10579	13341	11339	9678	3861	3585	4389	16953	16721	16422	15685	6270	6560	7813
9	8308	7292	4102	11267	12351	10366	8707	4866	4571	5164	15949	15717	15419	14682	6629	7378	6908
10	4938	11029	7662	7155	15518	13359	11745	2990	3484	5577	19577	19334	19094	18078	8511	7108	11061
11	5430	10495	7128	7681	15258	13119	11491	2753	3150	5162	19247	19006	18754	17787	8030	6793	10602
12	5929	10146	6777	7998	15422	13306	11667	2270	2622	4625	19324	19086	18821	17913	7521	6265	10490
13	10133	5759	3084	13263	11011	9199	7578	6614	6173	6141	14265	14041	13709	13156	6601	8354	4907
14	3920	12111	8966	7809	13245	11020	9534	6334	6688	8506	17688	17438	17278	15954	10975	10319	10598
15	10072	5537	2461	12941	12017	10215	8593	5814	5311	5139	15192	14972	14627	14132	5667	7344	5605
16	12222	4369	3084	15431	10033	8528	7053	8547	8013	7518	12720	12511	12130	11863	7033	9609	2875
17	12644	4059	3122	15838	10027	8599	7166	8862	8308	7718	12563	12359	11965	11774	7053	9772	2603
18	11046	5271	3206	14288	10216	8516	6943	7672	7204	6997	13283	13064	12716	12254	7037	9173	3821
19	12100	6768	5741	15794	7467	5840	4345	10139	9758	9733	10670	10442	10129	9532	9675	11920	2682
20	6698	10344	7586	10629	10572	8368	6816	7428	7489	8729	14909	14659	14484	13233	10466	10843	8022
21	2929	12754	9419	5826	15596	13381	11851	4886	5467	7605	19935	19686	19498	18271	10537	9041	12160
22	7482	8279	5201	10743	11876	9803	8149	5334	5200	6138	15728	15489	15227	14327	7800	8309	7242
23	2591	15320	11951	2882	18438	16213	14728	6143	6907	9149	22864	22614	22441	21149	12356	10003	15114
24	5016	11506	8503	8980	12073	9851	8357	6867	7103	8706	16510	16260	16102	14778	10896	10663	9616
25	4378	11539	8389	8129	13065	10849	9326	5960	6266	8017	17437	17188	17012	15748	10429	9878	10119
26	3501	12225	9004	7201	13938	11716	10213	5806	6220	8140	18344	18094	17925	16635	10756	9863	11008
27	8336	7436	4067	10714	14021	12058	10399	3331	2926	3537	17505	17278	16960	16307	5508	5720	8116
28	10170	5892	2606	12318	14407	12606	10979	4162	3474	2768	17469	17255	16890	16483	3755	4954	7620
29	9370	6790	4155	12710	10541	8613	6962	6728	6403	6723	14084	13852	13555	12830	7539	8956	5275
30	5226	10348	7062	8288	13776	11611	10002	4249	4493	6224	17888	17644	17416	16354	8729	8088	9697
31	4758	10817	7536	7906	13917	11734	10145	4475	4785	6601	18100	17854	17639	16526	9170	8409	10074
32	4304	11271	7985	7495	14159	11964	10392	4635	5009	6905	18397	18150	17945	16791	9549	8649	10492
33	3785	11857	8525	6655	15058	12858	11293	4345	4844	6904	19308	19061	18856	17697	9746	8471	11326
34	5897	16503	13207	3260	21409	19200	17652	6538	7317	9318	25666	25420	25206	24062	12579	9398	17230
35	5226	16448	13123	2691	20935	18719	17188	6559	7351	9429	25243	24996	24794	23606	12705	9667	16971
36	5320	17093	13762	2226	21338	19117	17605	7220	8013	10094	25694	25446	25254	24027	13370	10314	17539
37	6166	14890	11631	4655	20551	18371	16778	4894	5656	7604	24651	24408	24166	23139	10857	7681	15891
38	6285	14233	10986	5193	20148	17981	16374	4236	4992	6931	24186	23945	23693	22710	10185	7044	15320
39	8515	10282	7218	9059	18248	16237	14577	1228	1341	2741	21766	21539	21215	20569	5984	3213	12191
40	7924	10206	7040	8709	17698	15665	14006	556	975	2927	21293	21064	20751	20054	6205	3780	11832
41	7061	14297	11111	5765	20696	18544	16925	4348	5051	6825	24662	24423	24158	23228	10028	6696	15636
42	8786	14089	11088	7418	21608	19506	17862	4602	5122	6402	25374	25141	24845	24054	9389	5719	16001
43	11458	7195	5861	15194	7578	5804	4225	9789	9452	9575	11030	10796	10509	9781	9747	11786	3352
44	10732	7681	6039	14511	7813	5902	4263	9401	9115	9409	11502	11263	11002	10146	9838	11637	4098
45	10489	8325	6631	14360	7533	5532	3874	9639	9401	9822	11421	11179	10946	9965	10388	12054	4617
46	10111	8762	6949	14032	7603	5533	3875	9597	9398	9932	11635	11389	11177	10107	10644	12164	5112

To be continued on next page...

DECIBEL - Main Result

Calculation: GE2.5-127

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
47	17392	10787	11335	21416	3182	3973	4531	16402	16016	15841	4410	4187	3866	3652	15203	17964	5860
48	16415	9128	9665	20330	4378	4347	4258	14912	14492	14227	6000	5791	5417	5330	13521	16330	4173
49	17153	8738	9639	20994	5224	5382	5289	15233	14769	14346	6035	5853	5410	5748	13399	16392	4076
50	17317	10197	10840	21293	3764	4331	4679	16061	15652	15408	4819	4609	4239	4242	14683	17511	5326
51	11720	7825	6636	15561	6817	5017	3439	10469	10159	10342	10401	10163	9898	9077	10531	12558	3584
52	15475	10081	10105	19508	3146	2708	2739	14724	14383	14375	6135	5895	5652	4878	14040	16546	4954
53	15244	10487	10367	19316	2774	2153	2311	14768	14455	14531	6213	5967	5772	4777	14313	16718	5354
54	14814	10586	10308	18903	2815	1790	1821	14511	14219	14366	6590	6341	6173	5046	14257	16566	5464
55	11058	11512	9994	15255	5680	3456	2243	12244	12153	12900	10345	10092	10021	8445	13720	15125	7093
56	15450	7917	8308	19273	5354	4781	4192	13605	13168	12869	7361	7153	6774	6635	12177	14967	2860
57	16634	8722	9427	20499	4923	4908	4744	14865	14419	14068	6206	6010	5599	5715	13240	16142	3881
58	6214	9604	6238	8576	14731	12628	10983	2710	2878	4639	18605	18367	18099	17206	7324	6465	9779
59	8535	7513	4688	11900	10916	8906	7245	6260	6018	6611	14638	14401	14125	13297	7790	8834	6080
60	4870	10978	7827	8500	12872	10669	9113	5663	5912	7579	17169	16921	16731	15525	9916	9493	9638
61	8847	7584	4304	10702	15323	13393	11738	2477	1845	2188	18680	18456	18120	17553	4626	4340	9053
62	7910	7718	4552	10959	12264	10241	8581	4910	4686	5455	15966	15732	15447	14646	7050	7649	7120
63	11062	6059	4327	14539	9123	7384	5803	8469	8067	8042	12359	12133	11810	11235	8179	10240	3451
64	13240	6855	6402	16970	6719	5359	4070	11252	10841	10684	9595	9372	9037	8581	10349	12837	2052
65	8783	8008	5513	12417	9793	7744	6085	7388	7188	7815	13660	13420	13169	12237	8867	10040	5724
66	9969	6178	3661	13247	10497	8646	7015	6952	6562	6669	13866	13638	13321	12696	7211	8892	4776
67	8112	9245	6752	11968	9533	7381	5760	7891	7807	8702	13696	13449	13246	12114	10003	10899	6602
68	10916	4666	1580	13672	12245	10547	8962	6189	5601	5055	15172	14959	14588	14232	5069	7186	5327
69	7773	12980	9871	7100	20133	18030	16386	3216	3819	5403	23924	23690	23399	22587	8568	5207	14633
70	7496	15366	12201	5524	21715	19552	17942	5446	6136	7831	25726	25486	25228	24268	10989	7513	16742
71	8053	12377	9299	7645	19820	17739	16089	2746	3280	4772	23534	23302	23002	22238	7925	4585	14147
72	11474	4542	1404	13693	14144	12486	10909	5462	4732	3518	16881	16677	16282	16050	3143	5466	6858
73	7769	14685	11559	6162	21417	19274	17649	4843	5494	7100	25343	25105	24833	23933	10230	6725	16219
74	9506	8543	6471	13355	8405	6330	4674	8800	8611	9202	12402	12158	11934	10900	10056	11432	5348
75	9109	9283	7148	13059	8339	6193	4567	9016	8890	9634	12526	12278	12086	10923	10656	11854	6005
76	8680	9665	7423	12665	8597	6420	4825	8908	8824	9677	12870	12621	12443	11222	10841	11884	6483
77	12282	8539	7569	16221	5828	4038	2497	11417	11125	11334	9527	9285	9045	8130	11485	13550	3911
78	12239	7412	6458	16033	6781	5125	3632	10684	10334	10389	10128	9895	9604	8910	10389	12587	3002
79	10781	9504	7959	14814	6511	4397	2749	10740	10556	11094	10707	10458	10280	9083	11726	13327	5348
80	12810	7211	6530	16585	6603	5100	3718	11078	10699	10650	9729	9501	9190	8604	10478	12828	2551
81	17221	11069	11503	21273	2742	3586	4253	16426	16059	15946	4386	4152	3883	3410	15394	18085	6082
82	10575	10083	8468	14665	6453	4275	2686	10950	10806	11445	10812	10561	10412	9101	12193	13675	5926
83	9929	10033	8212	14006	7115	4927	3351	10361	10242	10961	11474	11223	11070	9768	11853	13186	6146
84	9473	10418	8467	13581	7447	5235	3719	10240	10162	10989	11893	11641	11504	10139	12026	13203	6655
85	10592	11834	10174	14806	6152	3942	2812	12088	12033	12877	10864	10611	10553	8931	13833	15092	7541
86	7723	10103	7610	11716	9457	7257	5698	8322	8311	9357	13797	13548	13378	12115	10800	11527	7280
87	7096	10750	8155	11152	9886	7666	6164	8305	8363	9568	14325	14074	13924	12585	11199	11697	8013
88	5117	15520	12200	3393	20298	18092	16538	5624	6416	8504	24540	24295	24079	22944	11781	8801	16125
89	8593	9389	6280	9564	17388	15403	13743	1008	514	2061	20846	20621	20292	19677	5336	3194	11238
90	7408	8604	5239	9540	14872	12842	11182	2303	2130	3518	18521	18289	17989	17242	6107	5487	9297
91	11647	4809	3110	14877	10084	8480	6953	8124	7621	7264	12966	12751	12387	12021	7032	9400	3306
92	9029	10845	7892	9171	19146	17140	15480	2104	2226	3159	22630	22405	22075	21454	6244	2965	12992
93	9449	10254	7365	9772	18900	16929	15269	2165	2041	2550	22287	22065	21724	21161	5590	2371	12560
94	9013	13567	10607	7880	21359	19277	17627	4251	4710	5868	25055	24824	24519	23772	8815	5125	15597
95	10208	11520	8791	9875	20473	18495	16835	3540	3580	3882	23852	23631	23287	22735	6532	2739	14083
96	9959	6764	4520	13447	9633	7739	6098	7662	7331	7573	13152	12919	12624	11900	8149	9801	4554
97	9354	7441	5067	12928	9640	7657	5999	7545	7283	7731	13356	13119	12849	12008	8561	9964	5144
98	9328	6326	3267	12314	11843	9952	8307	5601	5192	5366	15233	15006	14685	14066	6283	7598	5941
99	14367	9325	9070	18363	4050	2916	2208	13520	13188	13227	7344	7105	6856	6050	13017	15411	4213
100	12777	9717	8852	16833	4661	2765	1224	12514	12261	12563	8688	8439	8257	7116	12768	14785	4874
101	12732	8319	7541	16646	5692	4043	2612	11666	11346	11466	9201	8963	8703	7885	11479	13670	3548
102	9900	9244	7384	13880	7521	5397	3756	9758	9596	10222	11687	11439	11249	10089	11038	12452	5554
103	19668	12523	13437	23725	4008	5674	6626	18720	18316	18058	2201	2020	1588	2551	17229	20147	7882
104	19339	12518	13330	23411	3600	5281	6268	18511	18121	17909	2318	2107	1756	2290	17150	20013	7792
105	18010	12298	12742	22120	2213	3812	4881	17551	17206	17148	3366	3118	2962	2163	16638	19299	7328
106	18513	12440	13011	22614	2663	4338	5395	17947	17587	17479	2901	2657	2462	2009	16885	19616	7543
107	19030	12482	13206	23113	3248	4927	5939	18298	17919	17745	2507	2280	1995	2137	17047	19862	7687

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DECIBEL - Main Result

Calculation: GE2.5-127

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WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
108	8984	11399	9327	13171	7763	5536	4191	10534	10531	11533	12379	12127	12030	10519	12777	13720	7677
109	2076	16167	12805	2372	18582	16354	14924	7182	7937	10182	23105	22853	22705	21325	13368	11072	15703
110	2201	16798	13438	2055	18900	16674	15275	7842	8598	10843	23469	23217	23081	21656	14030	11714	16239
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114	4065	16919	13557	1365	20375	18148	16674	7301	8096	10277	24816	24566	24395	23093	13548	10769	16985
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119	12717	10984	8857	12457	21447	19605	17962	5533	5242	4297	24421	24214	23825	23514	5619	2098	14401
120	12099	10994	8707	11848	21130	19256	17607	4971	4725	3991	24197	23987	23608	23242	5680	1912	14218
121	10293	9918	7208	10604	19167	17244	15588	2888	2582	2292	22409	22192	21835	21358	5012	1530	12560
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123	10974	6053	3206	12682	15751	13998	12383	4123	3333	1716	18646	18438	18053	17750	2525	3683	8658
124	12560	4444	2313	14435	15419	13842	12295	5898	5109	3291	17909	17714	17295	17205	1677	4752	7827
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128	14091	10016	9572	18152	3596	2165	1448	13683	13393	13560	7378	7130	6940	5874	13520	15765	4940
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133	4503	19979	16718	5183	19280	17145	16033	11946	12650	14877	24089	23837	23803	22065	17934	15969	18444
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149	7634	21042	17700	3423	24349	22123	20711	11182	11973	14027	28896	28645	28498	27102	17295	14087	21253
150	6974	20551	17200	2778	23695	21469	20062	10747	11542	13631	28250	27998	27853	26449	16906	13781	20668
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152	7415	21251	17895	3329	24152	21929	20546	11471	12266	14362	28742	28490	28356	26916	17638	14517	21291
153	8202	22178	18823	4213	24928	22709	21347	12392	13188	15276	29547	29294	29169	27699	18550	15395	22191
154	8024	22165	18805	4122	24734	22518	21168	12424	13220	15328	29368	29116	28996	27508	18604	15495	22098
155	7970	22332	18968	4220	24639	22428	21100	12652	13449	15578	29298	29045	28934	27418	18856	15800	22159
156	5191	20732	17407	4189	20945	18782	17601	12055	12808	15053	25722	25469	25413	23735	18225	15898	19607
157	5384	20954	17641	4661	20860	18710	17561	12403	13148	15393	25654	25402	25356	23648	18546	16282	19715
158	5789	21357	18043	4912	21208	19065	17927	12772	13521	15767	26009	25757	25715	23996	18927	16632	20116
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To be continued on next page...

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DECIBEL - Main Result

Calculation: GE2.5-127

...continued from previous page

WTG	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI
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171	6848	22272	18924	4842	22749	20589	19409	13268	14044	16278	27529	27277	27221	25539	19503	16938	21329
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175	6666	22215	18933	6188	21350	19249	18196	13882	14617	16860	26184	25933	25918	24126	19984	17798	20730
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178	4283	18835	15466	1012	21015	18795	17427	9493	10280	12495	25626	25374	25249	23783	15747	13083	18441
179	3660	19214	15927	4314	19082	16917	15737	11007	11720	13953	23857	23604	23548	21872	17035	15011	17862
180	3310	18877	15582	4026	18950	16774	15569	10623	11337	13572	23708	23456	23391	21740	16659	14624	17588
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182	6874	22338	19087	6818	20997	18924	17923	14248	14966	17202	25843	25593	25594	23762	20285	18220	20672
183	10298	25432	22270	10473	22480	20565	19799	17813	18510	20730	27324	27082	27153	25160	23743	21838	23283
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191	2973	18545	15245	3801	18798	16614	15386	10260	10975	13209	23541	23288	23216	21588	16300	14263	17309
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194	5992	21091	17910	7092	19173	17118	16155	13568	14240	16439	24024	23775	23785	21932	19408	17650	19142
195	8074	22185	19173	9862	18457	16559	15841	15596	16204	18328	23299	23057	23132	21133	21114	19741	19623
196	9743	23645	20688	11413	19181	17386	16797	17254	17856	19969	23983	23747	23857	21790	22722	21402	20888
197	9468	23311	20359	11229	18878	17073	16474	16963	17560	19666	23685	23448	23555	21495	22408	21113	20551
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199	5582	20406	17038	2425	22206	19997	18681	11041	11831	14037	26877	26624	26519	24987	17297	14553	19930
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202	4858	20403	17079	4017	20648	18481	17291	11761	12511	14756	25419	25166	25107	23438	17920	15624	19274
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205	6733	21924	18732	7453	19938	17900	16961	14279	14965	17176	24792	24544	24562	22689	20174	18337	19991
206	6520	21956	18610	4616	22432	20269	19085	12988	13762	15998	27209	26956	26899	25222	19218	16684	20998
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208	6996	22539	19260	6494	21559	19467	18432	14220	14955	17198	26397	26147	26138	24331	20322	18134	21023

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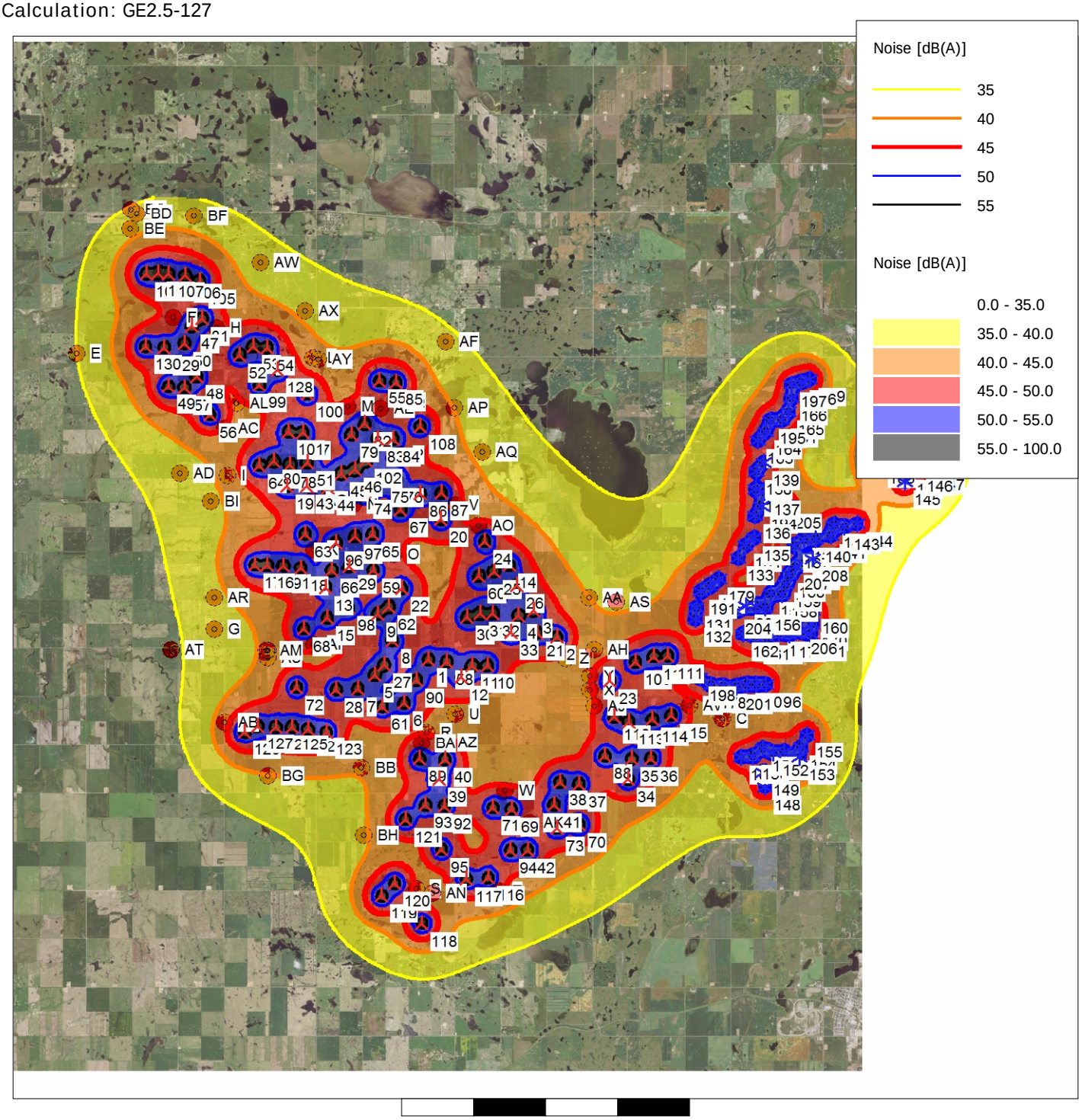
Calculated:
9/17/2018 10:43 AM/3.0.654

DECIBEL - Map 95% rated power

Calculation: GE2.5-127



Map: US Naval Research Laboratory , Print scale 1:200,000, Map center UTM WGS84 Zone: 13 East: 641,190 North: 5,375,412

New WTG Existing WTG Noise sensitive area

Noise calculation model: ISO 9613-2 General. Wind speed: 95% rated power
Height above sea level from active line object

Site Characterization Study for the Aurora Wind Energy Project Williams County, North Dakota

Final Report

Prepared for:

Aurora Wind Project, LLC

16105 West 113th Street, Suite 105

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Prepared by:

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4007 State Street, Suite 109
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August 25, 2017

EXECUTIVE SUMMARY

This report contains a biological site characterization of the Aurora Wind Energy Project (Project) in Williams County, North Dakota, in accordance with the Tier 2 site characterization study set forth in the US Fish and Wildlife Service's *Land-Based Wind Energy Guidelines*. The purpose of this report is to provide an initial characterization of the biological resources in the Project with respect to their potential importance for wind energy development at the site. This assessment was based on a comprehensive review of available technical literature and publicly available databases.

The Project encompasses about 54,316.1 acres (ac; 21,980.9 hectares [ha]) in Williams County, North Dakota. The Project falls within the Northwestern Glaciated Plains Level III Ecoregion. Much of the Northwestern Glaciated Plains region, which stretches from Saskatchewan, Canada in the north, along the Missouri River through the Dakotas, and south to northern Nebraska, was originally characterized by fescue grasslands, tall and short-grass prairie, scattered mixed trees and shrubs, and seasonal wetlands, but is now primarily farmland. Today, most of the area is a productive agricultural area with a variety of crops including wheat, corn, soybeans, and sunflowers. Though most of the Project is made up of cultivated cropland, there is some open water, shrub/scrub, woody wetlands, deciduous forest, and low intensity developed areas.

The Project has the potential to be utilized by migrating birds for stopover habitat. Given its location, the Project may also receive use by some sensitive bird species that migrate along the Missouri River, which is located to the south of the Project. In particular, the Missouri River might serve as a corridor that is used by migrating whooping cranes, piping plovers, rufa red knots, interior least terns, raptors, and other bird types. There is also some potential for impacts to individual birds of some species, particularly during the spring and fall migration seasons. Bald and golden eagles have the potential occur in the Project year-round.

The Project is likely to see increased waterfowl use during the spring and fall migration periods. However, high use of wind energy sites by water-associated birds has not been strongly correlated with fatalities, as evidenced by low waterbird fatalities at facilities in Minnesota, Wisconsin, Iowa, and Oregon, despite high use by waterfowl and waterbirds.

Given the species overall range, there is limited potential for the federally listed northern long-eared bat to forage and utilize forests, buildings, and bridges within the Project; however, suitable roosting habitat is limited within the Project. More suitable roosting habitat, consisting of larger connected tracts of forest habitat, exists along the White Earth and Missouri Rivers outside of the Project.

The development of a commercial wind energy facility in the proposed Project area is likely to generate relatively minor adverse impacts on a variety of birds, including songbirds. These impacts may include both collision mortality and displacement. Collision is relevant for a wide

variety of migratory species, and displacement is relevant for grassland-affiliated species. None of these potential impacts are expected to result in population-level effects to the species.

STUDY PARTICIPANTS

Western EcoSystems Technology

Clayton Derby	Project Manager,
Carmen Boyd	Data Manager
Wendy Bruso	Report Manager
Katie Michaels	Technical Editing Coordinator
Sarah Hamilton	Report Writer
Sofia Agudelo	Technical Editor

REPORT REFERENCE

Western Ecosystems Technology, Inc. (WEST). 2017. Site Characterization Study for the Aurora Wind Energy Project, Williams County, North Dakota. Prepared for Tradewind Energy, Inc., Lenexa, Kansas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 25, 2017. 55 pages + appendices

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INTRODUCTION

Knowledge of potential biological resource issues early in the development of wind energy facilities helps the industry identify, avoid, and minimize potential conflicts with wildlife. Aurora Wind Project, LLC, a subsidiary of Tradewind Energy, Inc., contracted Western EcoSystems Technology, Inc. (WEST) to describe the environmental resources at the proposed Aurora Wind Energy Project (Project). The purpose of this report is to describe biological resources present within and surrounding the proposed Project, identify potential risks to biological resources, recommend baseline monitoring studies, if warranted, and compare site characteristics with those at other wind energy facilities for which pre- and post-construction wildlife studies are publicly available. This report is meant to meet the guidance for a Tier 2 site characterization study as described by the US Fish and Wildlife Service's (USFWS) *Land-Based Wind Energy Guidelines* (WEG; USFWS 2012d).

STUDY AREA

The Project encompasses 54,318.0 acres (ac; 21,981.7 hectares [ha]) in Williams County, North Dakota (Figure 1). The Project falls within the Northwestern Glaciated Plains Level III Ecoregion (US Environmental Protection Agency 2010). Much of the Northwestern Glaciated Plains region was originally characterized by fescue grasslands, tall and short-grass prairie, mixed trees and shrubs, and seasonal wetlands, but is now primarily cultivated cropland (Griffith 2010). The Northern Glaciated Plains region is now a productive agricultural area with a variety of crops including wheat (*Triticum* spp), corn (*Zea mays*), soybeans (*Glycine max*), and sunflowers (*Helianthus sp*; Griffith 2010). The majority of the land use/land cover within the Project is cultivated crops, herbaceous grassland, developed open space, and emergent herbaceous wetlands (US Geological Service [USGS] National Land Cover Database [NLCD] 2011, Homer et al. 2015). Though most of the Project is made up of cultivated cropland, there is some open water, shrub/scrub, woody wetlands, deciduous forest, and low intensity developed areas (each making up less than 1% of the Project). Tom Berg Lake is within the Project area (Figure 2) and several larger lakes are within two miles (mi; 3.2 kilometers [km]) of the Project. According to the USGS National Elevation Dataset (NED), the topography of the Project is gently rolling hills (Figure 3) with elevation ranging from approximately 669 to 755 meters (m; 2,195 to 2,477 feet [ft]) above mean sea level (Figure 4; USGS NED 2012).

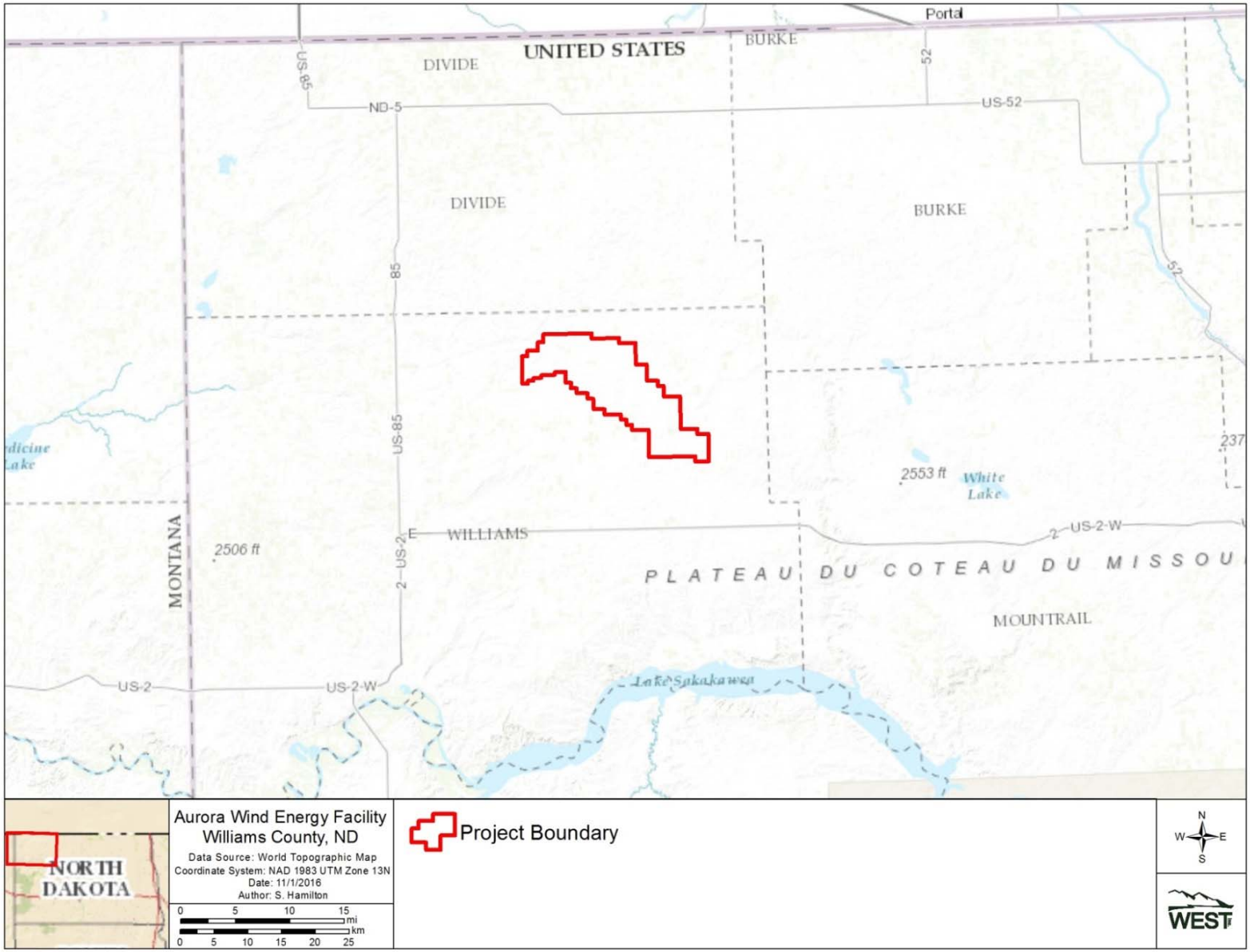

Figure 1. Location of the Aurora Wind Energy Project in Williams County, North Dakota.

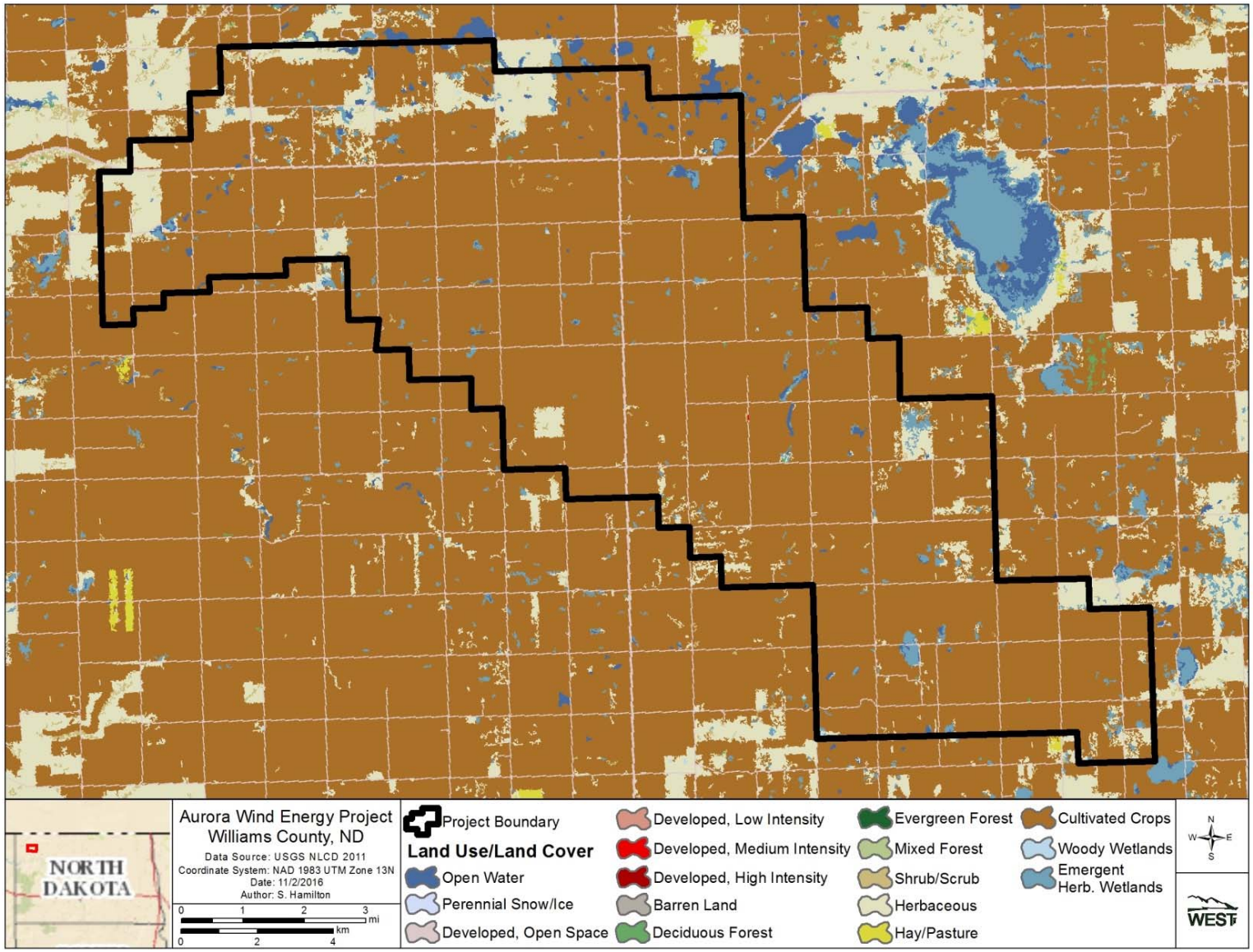

Figure 2. Land use/land cover types within the Aurora Wind Energy Project in Williams County, North Dakota (USGS NLCD 2011; Homer et al. 2015).

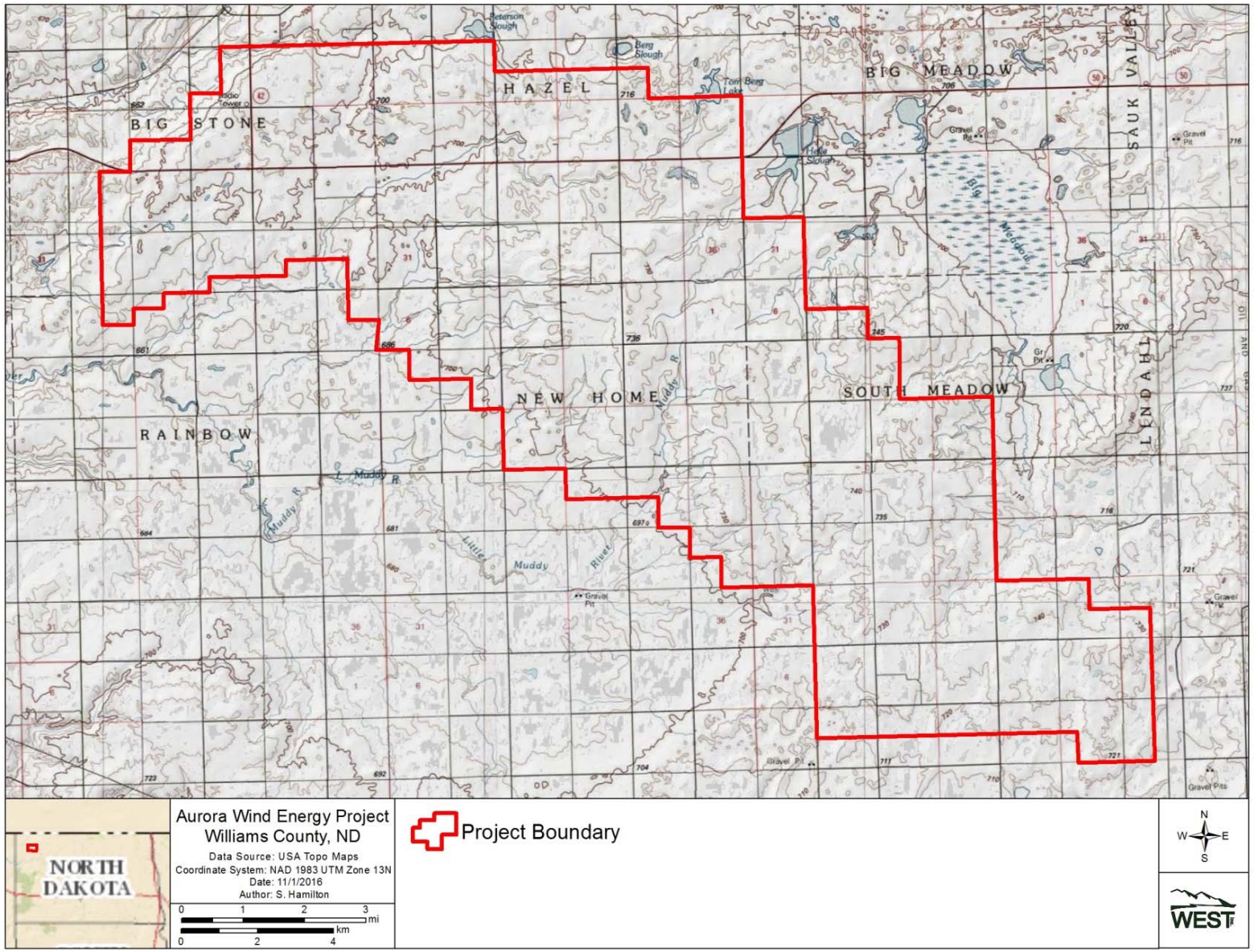

Figure 3. Topography of the Aurora Wind Energy Project in Williams County, North Dakota.

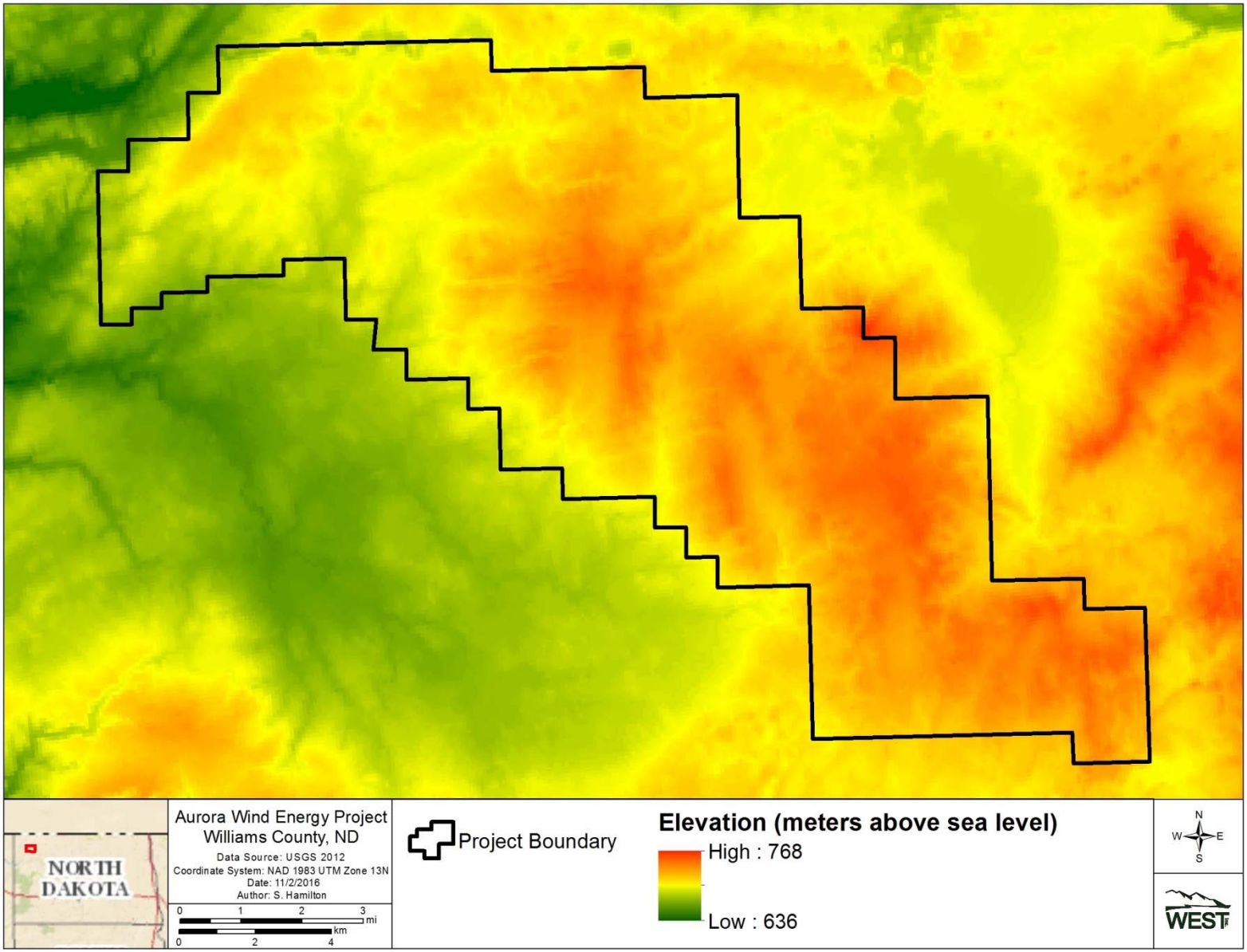

Figure 4. Elevation of the Aurora Wind Energy Project in Williams County, North Dakota (USGS 2012).

METHODS

Biological resources within the Project area were evaluated through a comprehensive desktop review of existing, publicly available data. Several sources of data were used in the desktop review including technical literature, field guides, and datasets. In addition to identifying biological resources within the Project area, this report presents existing information and results of studies conducted at other wind energy facilities from WEST's cumulative database of fatalities at wind energy facilities.

LAND USE/LAND COVER

According to the USGS NLCD (2011), the dominant cover type is cultivated crops which compose approximately 87% of the Project area. Herbaceous communities make up an additional 6.5% of the Project area, and may contain some native grassland (USGS NLCD 2011, Homer et al. 2015). Developed open space and emergent herbaceous wetlands cover about 4% and 2% of the Project area, respectively. Each of the other land cover types represents less than 1% of the Project (Table 1, Figure 2).

Table 1. Land use/land cover types present within the Aurora Wind Energy Project in Williams County, North Dakota.

Land Use/Land Cover	Acres	Percent Composition
Cultivated Crop	47,105.8	86.7
Herbaceous	3,555.7	6.5
Developed, Open Space	2,034.0	3.7
Emergent Herbaceous Wetlands	844.9	1.6
Open Water	488.8	<1
Shrub/Scrub	211.5	<1
Woody Wetlands	33.7	<1
Deciduous Forest	19.7	<1
Developed, Low Intensity	19.7	<1
Developed, Medium Intensity	1.1	<1
Mixed Forest	1.1	<1
Total	**54,316.0**	**100**

Source: USGS NLCD 2011

Wetlands and Riparian Areas

Formal wetland delineations for the Project have not been completed. USFWS National Wetland Inventory (NWI) data (USFWS NWI 2014) show approximately 1,401.5 ac (567.2 ha; 2.6 %) of the Project area is made up of wetlands (Table 2, Figure 5). According to the USFWS NWI (2014) freshwater emergent wetlands account for 1,281.5 ac (518.6 ha), followed by lakes that make up 59.8 ac (24.2 ha; Table 2). According to the National Hydrography Dataset (NHD), one named river, the Little Muddy River, that flows west from within the Project area (USGS NHD 2015). Several unnamed streams and lakes occur within the Project (Figure 5). Additionally, there is

potential for depressions within croplands and grasslands to be saturated and/or to hold water, which may provide stopover habitat for shorebirds or waterfowl during migration.

Table 2. National Wetland Inventory wetland types present within the Aurora Wind Energy Project in Williams County, North Dakota.

Wetland Type	Acres	Percent Composition
Freshwater Emergent Wetland	1,281.5	91.4
Lake	59.8	4.3
Freshwater Pond	51.6	3.7
Freshwater Forested/Shrub Wetland	4.9	0.3
Other	3.7	0.3
Total	**1,401.5**	**100**

Source: USFWS NWI 2014

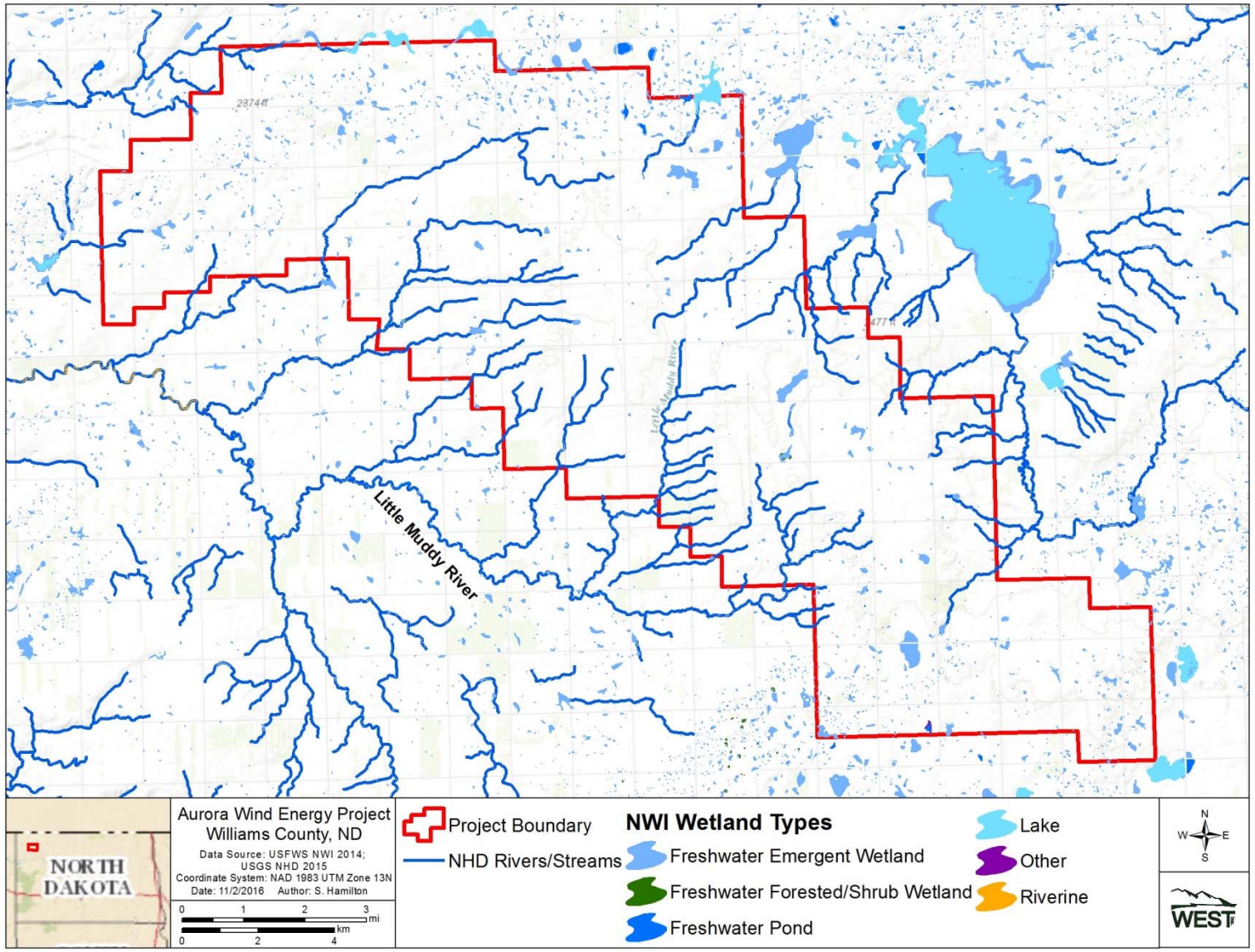

Figure 5. National Wetlands Inventory wetland types and National Hydrography Dataset rivers and streams within the Aurora Wind Energy Project in Williams County, North Dakota (USFWS NWI 2014, USGS NHD 2015).

Federal- and State-Managed Lands

Based on the Protected Areas Database of the United States (PADUS), there are three state-managed wildlife lands located within 10 mi (16.1 km) of the Project (Figure 6; USGS PADUS 2012). The closest state-managed lands to the Project are McGregor Dam Wildlife Management Area (WMA; located approximately 6.6 mi [10.6 km] east of the Project) and Blue Ridge WMA (located about 8.8 mi [14.2 km] west of the Project; Figure 6). While there are no federally owned lands within the Project area, there are three federally owned lands within 10 mi (16.1 km) of the Project (Figure 6). The closest federally owned land to the Project is Williams County Waterfowl Production Area (WPA; located about 0.5 mi [0.8 km] west of the Project; Figure 6). Additionally, there may be other lands protected through federal grassland and/or wetland easements.

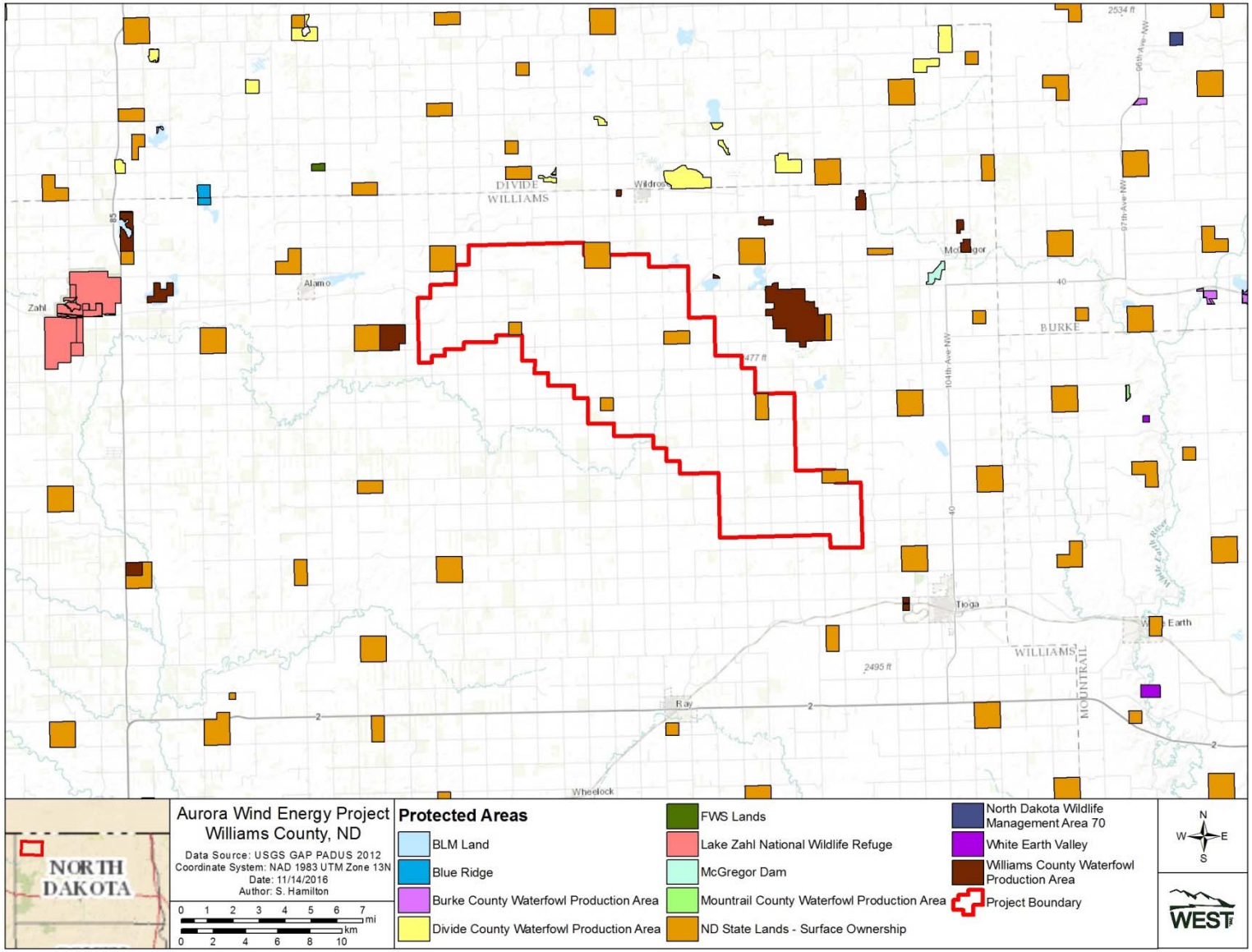

Figure 6. Federal, state, and locally managed lands within and adjacent to the Aurora Wind Energy Project in Williams County, North Dakota (USGS PADUS 2012).

FEDERAL- AND STATE-PROTECTED SPECIES

WEST reviewed the USFWS county distribution list of federally endangered, threatened, proposed, and candidate species to determine which species may occur in Williams County, North Dakota (USFWS 2016). The state of North Dakota does not have a state threatened and endangered species list; instead, the North Dakota Game and Fish Department (NDGFD) maintains a list of Species of Conservation Priority (SCP; Dyke et al. 2015). Species are classified into three levels according to their conservation need: Level I species are the highest level of conservation priority, Level II species are of a moderate level of conservation priority, and Level III species are also of a moderate level of conservation priority but are thought to be peripheral or non-breeding in North Dakota (Dyke et al. 2015). Table 3 lists threatened, endangered, and SCP with potential to occur in the Project area based on geographic range and habitat preferences (Dyke et al. 2015, USFWS 2016). Agency correspondence can be incorporated when available. For observation data of birds, WEST consulted the eBird database, a citizen-based bird observation network (Sullivan et al. 2014, eBird 2016a).

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status[1]	Habitat	Potential Occurrence within the Project
MAMMALS			
big brown bat *Eptesicus fuscus*	SCP Level I	Uses standing snags and hollow trees of coniferous and deciduous forests. Also uses bridges, buildings, and tunnels.	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
little brown bat *Myotis lucifugus*	SCP Level I	Generally uses buildings as roosts that are near feeding areas with flying insects	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Northern long-eared bat *Myotis septentrionalis*	FT; SCP Level I	Roosts and forages during spring and summer in mature forest interior and riparian areas. May roost in old buildings; typically avoids open habitats. Congregates in wooded areas surrounding caves and mines in autumn, and hibernates in caves and mines.	The study area is not likely to contain habitat for northern long-eared bat, although the winter distribution of northern long-eared bat reaches into Williams County.
BIRDS			
American bittern *Botaurus lentiginosus*	SCP Level I	Utilizes a variety of wetlands, but usually larger wetlands with tall emergent vegetation	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Baird's sparrow *Ammodramus bairdii*	SCP Level I	Large tracts of native mixed-grass prairie or pastures	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
black tern *Chlidonias niger*	SCP Level I	Uses shallow wetland complexes, usually larger than 20 hectares, with open water and emergent vegetation	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status[1]	Habitat	Potential Occurrence within the Project
black-billed cuckoo *Coccyzus erythropthalmus*	SCP Level I	Nests in trees and brush. Uses riparian zones, shelterbelts, and wooded areas.	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
chestnut-collared longspur *Calcarius ornatus*	SCP Level I	Mixed-grass and shortgrass prairie	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
ferruginous hawk *Buteo regalis*	SCP Level I	Large areas of native prairie	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Franklin's gull *Leucophaeus pipixcan*	SCP Level I	Large wetlands; often feeds in tilled agricultural fields	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
grasshopper sparrow *Ammodramus savannarum*	SCP Level I	Tall or mixed-grass prairie, hayfields, and meadows	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
greater sage-grouse *Centrocercus urophasianus*	SCP Level I	Sagebrush ecosystem	The Project is not likely to contain suitable habitat for this species.
horned grebe *Podiceps auritus*	SCP Level I	Wetlands and ponds with emergent vegetation and open area	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
lark bunting *Calamospiza melanocorys*	SCP Level I	Sagebrush ecosystems or mixed-grass prairie with shrubs and cropland interspersed	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
least tern – interior population *Sternula antillarum*	FE; SCP Level II	Nests on barren to sparsely vegetated sandbars along rivers, sand and gravel pits, and lake and reservoir shorelines	The Project may contain suitable habitat for this species. Least terns may pass through during migration.

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status[1]	Habitat	Potential Occurrence within the Project
long-billed curlew *Numenius americanus*	SCP Level I	Shrub-steppe prairie or short-grass prairie	The Project is on the edge of this species' range; therefore, the Project is not likely to contain suitable habitat for this species.
marbled godwit *Limosa fedoa*	SCP Level I	Utilize a variety of wetlands and nest in grazed native prairie	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Nelson's sparrow *Ammodramus nelsoni*	SCP Level I	Use shallow marshes, fens, and wet meadows	The Project is on the edge of this species' range; therefore, the Project is not likely to contain suitable habitat for this species.
red-headed woodpecker *Melanerpes erythrocephalus*	SCP Level I	Natural stands of mature deciduous trees	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Sprague's pipit *Anthus spragueii*	SCP Level I	Large areas of native mixed-grass prairie	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Swainson's hawk *Buteo swainsoni*	SCP Level I	Utilizes grassland and cropland with wooded thickets interspersed	The Project likely contains suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
Wilson's phalarope *Phalaropus tricolor*	SCP Level I	Mudflats and shallow wetlands	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
yellow rail *Coturnicops noveboracensis*	SCP Level I	Wet meadows and fens	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
piping plover *Charadrius melodus*	FT; SCP Level II	In the Midwest, breeds on sparsely vegetated beaches of large lakes or sand spits	The Project may contain suitable habitat for this species, and piping plovers may pass through during migration.

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status[1]	Habitat	Potential Occurrence within the Project
rufa red knot *Calidris canutus rufa*	FT; SCP Level III	May occassionally be found on mudflats, sandbars, shallowly flooded areas, and pond margins along the Missouri River	The Project is not likely to contain suitable habitat for this species, although rufa red knots may pass through during migration.
whooping crane *Grus Americana*	FE; SCP Level III	Herbaceous wetlands and grasslands	The Project is within the known migration corridor for whooping cranes; therefore, occurrence within the Project is possible.
AMPHIBIANS			
Canadian toad *Anaxyrus hemiophrys*	SCP Level I	Prairies with relatively soft soil in or near water	The Project likely contains suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
plains spadefoot *Spea bombifrons*	SCP Level I	Dry grasslands with gravelly or sandy soil	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
REPTILES			
plains hog-nosed snake *Heterodon nasicus*	SCP Level I	Dry grasslands with gravelly or sandy soil	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
smooth green snake *Opheodrys vernalis*	SCP Level I	Grasslands and upland hills	The Project may contain suitable habitat for this species. Further surveys would be needed to identify presence of this species in the Project.
FISH			
blue sucker *Cycleptus elongatus*	SCP Level I	Large rivers and lower parts of major tributaries	The Project may contain suitable habitat for this species.
pallid sturgeon *Scaphirhynchus albus*	FE	Inhabits the Missouri River	The study area is not likely to contain suitable habitat for this species.
sicklefin chub *Marcrhybopsis meeki*	SCP Level I	Primary channels of turbid, large rivers	The Project likely contains suitable habitat for this species.
sturgeon chub *Marcrhybopsis gelida*	SCP Level I	Medium to large, turbid rivers	The Project is not likely to contain suitable habitat for this species.

Table 3. Federally listed threatened and endangered species, and State Species of Conservation Priority, with known or potential occurrence in Williams County, North Dakota. Likelihood of occurrence within the Aurora Wind Energy Project in Williams County, North Dakota, is based on distribution ranges and habitat preferences.

Species	Status[1]	Habitat	Potential Occurrence within the Project
INSECTS			
monarch butterfly *Danaus plexippus*	SCP Level I	Open fields and meadows with milkweed	The Project likely contains suitable habitat for this species.

Sources: Dyke et al. 2015; USFWS 2016

[1] FE = Federally listed endangered; FT = Federally listed threatened species. North Dakota Species of Conservation Priority (SCP): Level I = Highest Level of Priority; Level II = Moderate Level of Priority; Level III = Lower Level of Priority.

Federally Listed Animals

Several federally listed species may occur in Williams County, North Dakota (USFWS 2016), including the northern long-eared bat (NLEB; *Myotis septentrionalis*), a federally threatened species throughout its range (USFWS 2013b). Habitats within the Project area might be used as stopover sites during migration for the federally endangered least tern (*Sternula antillarum*), the federally threatened piping plover (*Charadrius melodus*), and the federally threatened rufa red knot (*Calidris canutus rufa*). Additionally, the Project is within the known migration corridor for whooping cranes (*Grus americana*); therefore, their occurrence within the Project is possible (WEST 2016b). Finally, the federally endangered pallid sturgeon (*Scaphirhynchus albus*) is unlikely to occur within the Project due to a lack of suitable habitat, and will also likely be restricted to the Missouri River.

Northern Long-Eared Bat

Habitat for NLEB is limited in the Project area given the limited amount (approximately 54.5 ac [22.1 ha]) of forest and woodland cover; Table 1, Figure 2; USGS NLCD 2011); however NLEB may also use structures such as bridges, barns, and buildings available within the Project for roosting (USFWS 2014a). Although there is some potential for NLEB to make use of the Project during summer and migration, more suitable habitat, consisting of larger connected tracts of forest habitat along the White Earth and Missouri Rivers, exists outside of the Project (USGS NLCD 2011).

The NLEB is a forest-dependent species, generally relying on forest features for both foraging and roosting during the summer months (USFWS 2013b, 2014a). In particular, NLEB appears to be a forest interior species that requires adequate canopy closure for both roosting and foraging habitat (Lausen 2009). Additionally, riparian areas are considered critical resource areas for many species of bats because they support higher concentrations of prey, provide drinking areas, and act as unobstructed commuting corridors (Grindal et al. 1999). While NLEB is associated with forest habitats, it also occurs in agricultural settings where forest habitats have been highly

fragmented. During the summer, NLEB roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees (USFWS 2007, 2013a, 2014a).

Male and non-reproductive females NLEB may also roost in cooler places, like caves and mines. The NLEB seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices, and the species has also been found, rarely, roosting in structures like barns and sheds (USFWS 2014a). The NLEB is expected to be closely tied to intact forested habitats; for example, Henderson and Broders (2008) found that NLEB do not travel more than 255 ft (78 m) from the edge of intact forest structures. During the winter, NLEB hibernate in caves or occasionally abandoned mines (USFWS 2014a). No winter impacts on NLEB are expected in the Project as the species is not active during this time of year. There is no evidence of caves or mines within the Project based on desktop analysis (North Dakota Industrial Commission 2002, 2013); however, correspondence with the USFWS and NDGFD may be needed to determine that no hibernacula are known to be located within the Project.

Least Tern – Interior Population

There is some potential for the interior least tern to migrate through, or utilize, the wetlands and waterbodies present within and around the Project for stopover habitat. This species nests in barren and sparsely vegetated areas, usually near foraging areas where they hover and dive into standing or flowing water to catch small fish (All About Birds 2016). The breeding season for the interior least tern is April through August, with nesting occurring in small colonies. Breeding occurs in isolated areas along the Missouri, Mississippi, Ohio, Red, and Rio Grande river systems (Thompson et al. 1997, US Fish and Wildlife Service (USFWS) 2013c). Wintering occurs along coastal areas of Central and South America, and the Caribbean Islands (Thompson et al. 1997). There is one documented occurrence in Williams County and four documented observations in adjacent counties (eBird 2016b).

Piping Plover

There is potential for piping plovers to utilize wetlands and waterbodies near or within the Project area and/or to migrate through the Project. Critical habitat was designated in 2002 for the Northern Great Plains Breeding Population, which includes 19 critical habitat units in five states (Minnesota, Montana, Nebraska, North Dakota, and South Dakota; USFWS 2002b). There are three units of critical habitat within 20 mi (32.2 km) of the Project, with the nearest unit being 9.2 mi (14.8 km) west of the Project (Figure 7; USFWS 2002b). The Missouri River provides breeding habitat and may attract piping plovers during migration. There are six documented occurrences within Williams County according to the eBird database (eBird 2016b). The nearest sighting to the Project is approximately three mi (4.8 km) to the north in Divide County (eBird 2016). Additionally, the eBird database shows numerous piping plover observations at Lostwood National Wildlife Refuge (NWR) about 24.5 mi (39.4 km) east of the Project (eBird 2016). The Northern Great Plains population of piping plovers in Montana, North Dakota, South Dakota, and Nebraska (with limited locations in Minnesota and Colorado) nests on sandbar islands and shorelines of the Missouri, Platte, Niobrara, Loup, and Elkhorn rivers as well as in alkaline wetlands (USFWS 2012e).

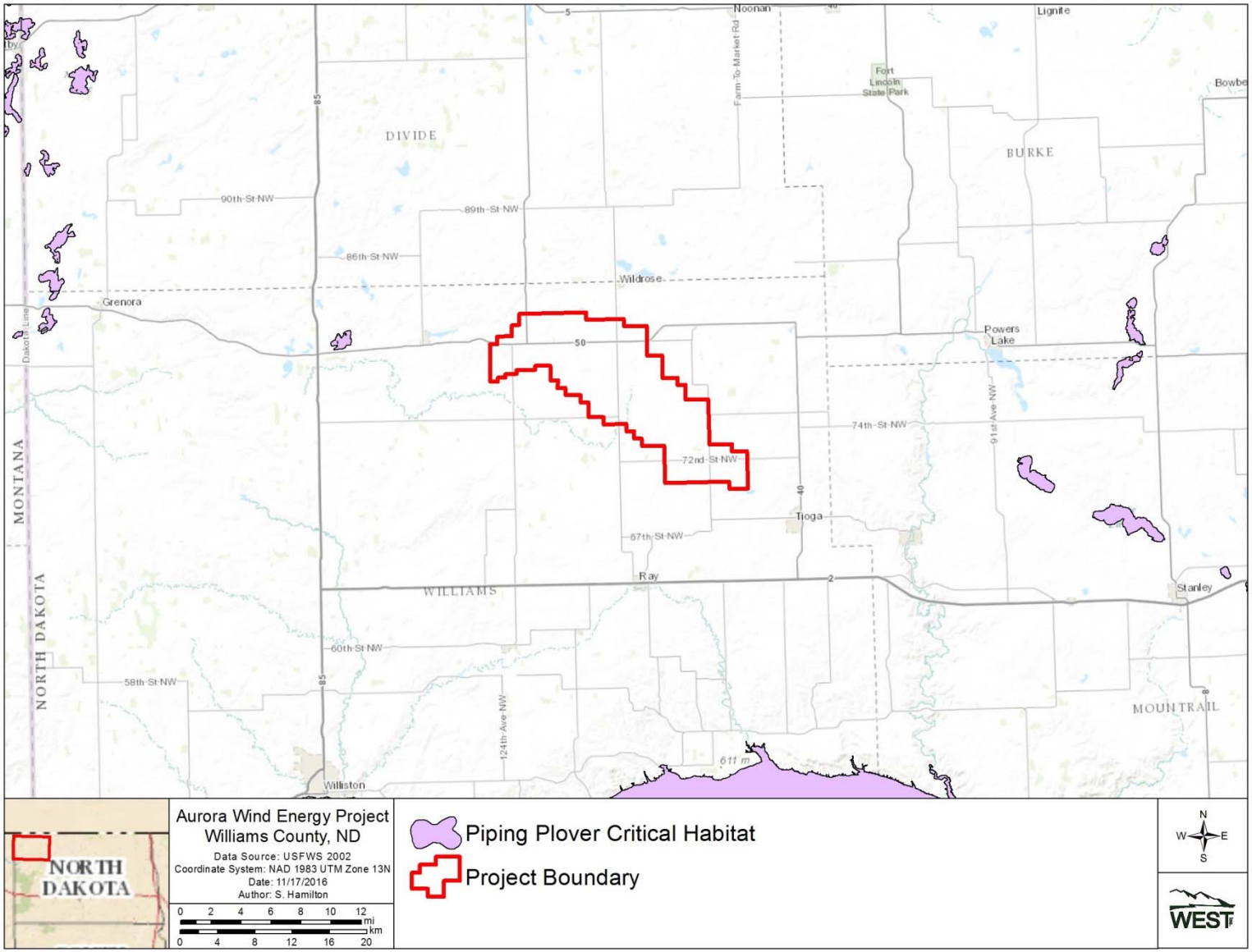

Figure 7. Critical habitat for the Northern Great Plains breeding population of the piping plover, in relation to the Aurora Wind Energy Project in Williams County, North Dakota (USFWS 2002b).

Rufa Red Knot

There is some potential for the rufa red knot to migrate through the Project or to utilize wetlands and waterbodies for stopover habitat. No critical habitat for this species has been designated at this time (USFWS 2015). There are no documented occurrences within Williams County (eBird 2016).The red knot is a medium-sized shorebird identified in the breeding season by red plumage. Red knots migrate from breeding grounds in the Canadian Arctic to multiple wintering regions in the southeast United States, northeast Gulf of Mexico, and as far south as Tierra del Fuego (Baker et al. 2013). During migration, they use stopover areas along the eastern coast of South America and the United States, and they also use stopovers in the Northern Plains of the Midwestern United States (Baker et al. 2013).

Whooping Crane

The Project is located within the federally endangered whooping crane migration corridor where approximately 75% of whooping crane observations have been recorded during migration (Figure 8; Cooperative Whooping Crane Tracking Project 2007, 2010). Therefore, it is possible that whooping cranes could utilize wetlands and waterbodies within the Project area for stopover habitat during migration. The whooping crane migrates from its breeding grounds in Wood Buffalo National Park, Canada, to its wintering areas in Aransas National Wildlife Refuge, Texas (USFWS 2013d). Threats to wild cranes include habitat destruction, chemical spills in its wintering habitat, lead poisoning, collisions with manmade objects such as fences and power lines, disease (e.g., avian cholera and parasites), and shooting (USFWS 2013d). Cranes typically utilize shallow wetlands and marshes, the edges and sandbars of shallow rivers, and agricultural fields near a water source during migration (USFWS 2013d). Thus, suitable whooping crane stopover habitat includes shallow livestock ponds surrounded by agricultural and grassland parcels and freshwater emergent wetlands. Some of these habitat features are scattered throughout the Project. Please see the Whooping Crane Habitat Review for more detailed information (WEST 2016b).

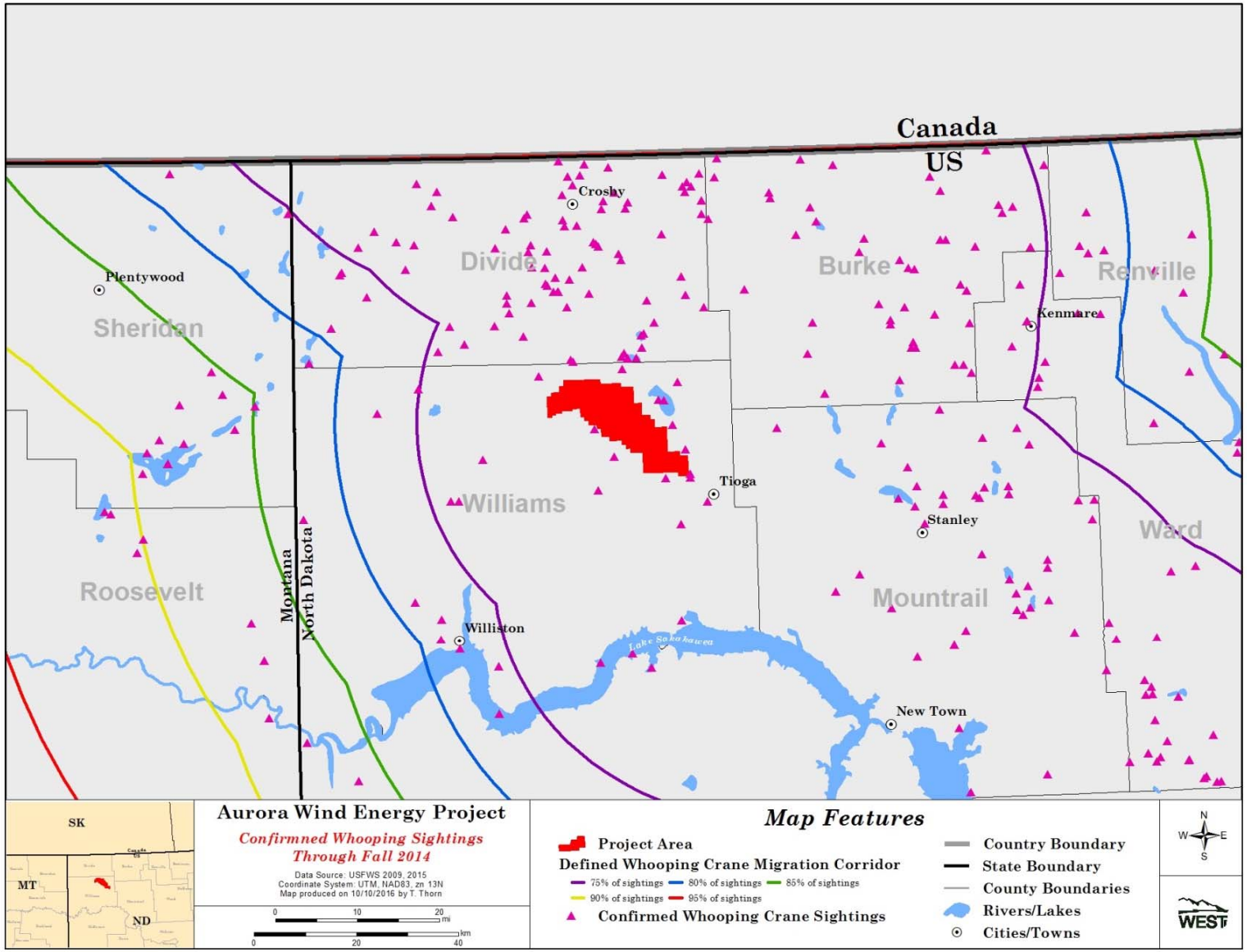

Figure 8. Whooping crane migration corridor in relation to the Aurora Wind Energy Project in Williams County, North Dakota.

Pallid Sturgeon

There is little potential for the pallid sturgeon to occur within the Project area. The pallid sturgeon feeds in river bottoms of the Missouri River and is no longer found in its historic range that extended into the smaller river tributaries (USFWS 2014b). Pallid sturgeons are identified by a flattened snout, long slender tail, and bony plates rather than scales. Pallid sturgeons are scarce in the upper Missouri River and slightly more common in the Mississippi and Atchafalaya rivers; they are absent from other tributaries (USFWS 1998).

Eagles

Bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles are both protected by the Bald and Golden Eagle Protection Act (1940) and the Migratory Bird Treaty Act (MBTA; 1918). Potential impacts to bald or golden eagles are a primary concern for most land-based wind energy facilities in the United States, as both species may spend substantial amounts of time flying at the rotor-swept altitudes of commercial wind turbine rotors, where they may be exposed to collision risk (Strickland et al. 2011). While there are no known bald or golden eagle nests within 10 mi (16 km) of the Project, there is potential for both species to use the Project area. Please see the Stage 1 Eagle Use/Risk Assessment for more detailed information on bald and golden eagle use (WEST 2016a).

GENERAL WILDLIFE

Birds

Raptors

Potential impacts to raptors other than eagles are a concern for most land-based wind energy facilities in the United States because of many raptors' tendency to spend significant portions of time flying at the rotor-swept altitudes of commercial wind turbine rotors where they may be exposed to collision risk (Strickland et al. 2011). Furthermore, all native species of raptors that occur in the United States are protected by the MBTA.

The majority of the Project is made up of tilled agriculture (86.7%), followed by herbaceous grassland/pasture (6.5%) and developed, open space (3.7%). However, there are several areas that may provide habitat and foraging opportunities for resident and migrating raptors. Forested areas are present throughout the Project area as woodlots and wooded riparian areas surrounding creeks, ponds, and drainages (Table 1, Figure 2). Based on the presence of forested habitat and foraging areas, the Project area will likely support nesting raptors. There is also potential for raptor species to fly over the Project during migration.

<u>Areas of Potentially High Prey Density</u>

Rodent and other prey populations present in the Project are likely to consist of mice, voles, rabbits, and ground squirrels. These are unlikely to be at high densities in agricultural fields, but may be more concentrated in grasslands and along edges of fields and roads. Densities, however,

are unlikely to be higher in the Project area than the surrounding area. Songbirds and insects are also prey for a number of raptor species and populations may increase in grassland areas in the summer.

Potential for Raptor Migration

Several factors influence the migratory pathways of raptors, the most significant of which is geography. Two geographical features are primarily used by raptors during migration: ridgelines and the shorelines of large bodies of water. Updrafts formed as the wind hits the ridges and thermals created over land, not water, make for energy-efficient travel over long distances (Liguori 2005). It is for this reason that raptors in migration tend to follow corridors or pathways such as prominent ridges with defined edges.

The general topography within the Project area is gently rolling hills. It is likely that raptors will migrate through the Project in a broad-front fashion as there are no prominent north-south ridges or valleys that would funnel migrants (HawkMountain 2016, Liguori 2005; Figures 2 and 3). There is also potential for raptor use within the Project area to be affected by the proximity to the Missouri River and associated WMAs, which may provide foraging areas for raptors using the river corridor.

Avian Migration

The Project is located within the Central Flyway (Flyways.us 2016), which is used by migrating waterfowl, waterbirds, shorebirds, songbirds, and raptors. It is likely that the 1,401.5 ac (567.2 ha) of NWI-mapped wetlands and open water found within the Project area (Table 2; USFWS NWI 2014), as well as flooded agricultural fields, provide foraging and stopover habitat for migrating waterfowl. Additionally, the nearby WMAs, the Missouri River, and the associated wetlands have the potential to increase waterfowl use in the Project area.

Important Bird Areas

Passerines are the most abundant bird group in most terrestrial ecosystems and are the most often reported fatalities at wind energy facilities (National Research Council [NRC] 2010). Areas that provide essential habitat for these and other bird species have been identified by the National Audubon Society (Audubon) as Important Bird Areas (IBAs; Audubon 2016). There are three global-level IBAs within 40 mi (64.4 km) of the Project: the Lostwood NWR IBA, located about 23 mi (37.0 km) east of the Project, the Medicine Lake NWR IBA, located about 36.6 mi (58.9 km) west of the Project, and the Westby Prairie-Wetland Complex IBA, located about 37.1 mi (59.7 km) northeast of the Project (Audubon 2016). These IBAs provide native habitats in an area that is largely cultivated (USGS NLCD 2011). The mosaic of native prairies and wetlands within these IBAs could provide key habitat for raptors, waterbirds, waterfowl, and songbirds (Audubon 2016).

USFWS Birds of Conservation Concern

The USFWS lists 27 species as Birds of Conservation Concern (BCC) within the Prairie Pothole Bird Conservation Region where the Project is located (USFWS 2008; Appendix B). These species do not receive special protection (unless they are also listed by the USFWS), but have been identified as vulnerable to population declines in the area by the USFWS (2002a, 2008). Most of these species utilize grasslands and wetlands and may be found within the Project area

(e.g., prairies and wetlands). Additionally, the proximity of the Missouri River to the Project provides potential for migrating birds to fly over the Project and to utilize stopover habitats such as lakes and wetland complexes.

USGS Breeding Bird Survey

One USGS Breeding Bird Survey (BBS) route, Wild Rose, is located within the Project and three additional routes are located within 40 mi (64.4 km) of the Project (Figure 9; USGS 2016). BBS routes are typically 24.5 mi (39.4 km) long and consist of 50, three-minute counts along the length of the route (USGS 2001). The BBS provides information about what species may occur in the Project area, either transiently or during the breeding season.

Along the Wild Rose BBS Route, a total of 86 species were observed from 2012 to 2015 (Pardieck et al. 2016). Nine of these species are listed as USFWS BCC (USFWS 2008, Pardieck et al. 2016; Appendix B): Baird's sparrow (*Ammodramus bairdii*), black tern (*Chlidonias niger*), chestnut-collared longspur (*Calcarius ornatus*), grasshopper sparrow (*Ammodramus savannarum*), horned grebe (*Podiceps auritus*), marbled godwit (*Limosa fedoa*), Sprague's pipit (*Anthus spragueii*), Swainson's hawk (*Buteo swainsoni*), and upland sandpiper (*Bartramia longicauda*). In 2015, 1,398 individual bird observations of 70 species were made on the Wild Rose Route (Pardieck et al. 2016). The most abundant birds observed that year were the red-winged blackbird (*Agelaius phoeniceus*), ring-billed gull (*Larus delawarensis*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), western meadowlark (*Sturnella neglecta*), and brown-headed cowbird (*Molothrus ater*). Eleven North Dakota Level I Species of Conservation Priority (Table 3) have been observed along the Wild Rose BBS Route, but no federally listed threatened or endangered species have been recorded during BBS surveys conducted along this Route.

Along the Powers Lake Route, 81 species were observed from 2012 to 2015 (Pardieck et al. 2016). Nine of these species are listed as USFWS BCC (USFWS 2008, Pardieck et al. 2016; Appendix A): American bittern (*Botaurus lentiginosus*), Baird's sparrow, black tern, chestnut-collared longspur, grasshopper sparrow, marbled godwit, short-eared owl (*Asio flammeus*), Sprague's pipit, and upland sandpiper. In 2015, 1,020 individual bird observations of 63 species were made on the Powers Lake Route (Pardieck et al. 2016). The most abundant bird species observed that year were the red-winged blackbird, brown-headed cowbird, western meadowlark, mallard (*Anas platyrhynchos*), and clay-colored sparrow (*Spizella pallida*). No federally listed threatened or endangered species have been recorded at the Powers Lake BBS Route.

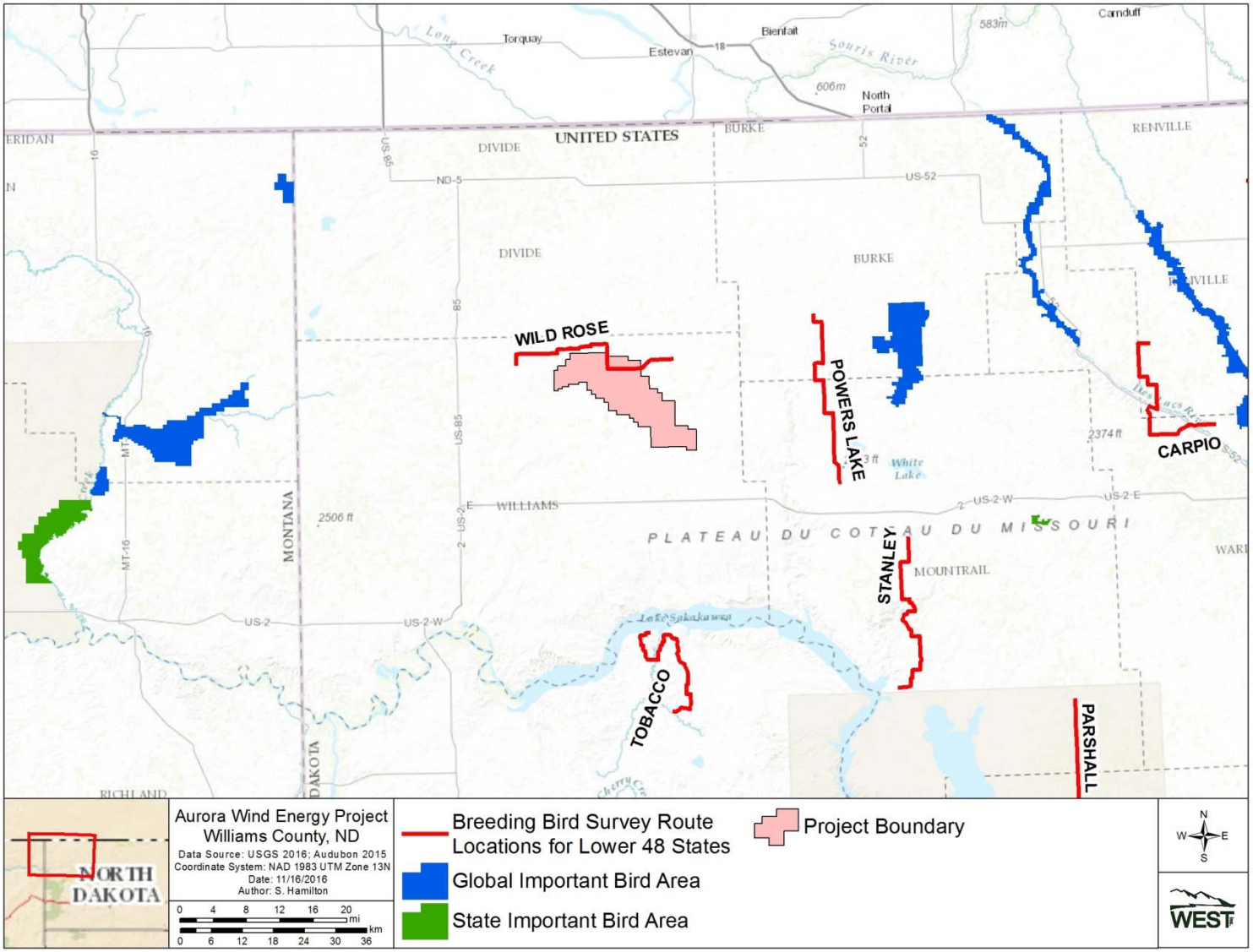

Figure 9. Breeding Bird Survey routes and Important Bird Areas near the Aurora Wind Energy Project in Williams County, North Dakota (Audubon 2016, USGS 2016).

Grassland-Dependent Bird Species of Concern

Indirect impacts of wind energy facilities have been raised as a general concern by the USFWS, for projects across the United States. In particular, the USFWS has expressed concern over the potential impacts of wind development on species of habitat fragmentation concern, including species that need large intact tracts of a particular habitat, such as grassland areas. Some grassland bird species are known or suspected to be susceptible to this effect, perhaps because of their behavioral aversion to trees and other tall structures (Strickland et al. 2011).

Displacement of grassland nesting birds is often one of the primary concerns of wildlife agencies in regards to the siting of wind facilities in and near grasslands. Recent research has focused on the potential displacement of grassland passerines at wind energy facilities, and some uncertainty currently exists over the effects of wind energy facilities on the breeding success of these birds. In Minnesota, researchers found that breeding passerine density on Conservation Reserve Program grasslands was reduced in the immediate vicinity of wind turbines (Leddy et al. 1999), but changes in density at broader scales were not detected (Johnson et al. 2000). Erickson et al. (2004) documented a decrease in density of some native grassland passerines, such as grasshopper sparrow, near wind turbines in Washington; however, it was not determined if the decreased density of grassland birds after the project was operating was the result of behavioral disturbance or habitat loss. Piorkowski (2006) conducted a displacement study at a wind energy facility in Oklahoma where, of the grassland species present in the wind resource area, only the western meadowlark showed significantly lower densities near wind turbines. Piorkowski (2006) suggested that habitat characteristics were more important to determining passerine breeding densities than the presence of wind turbines. More recent and complete research at several projects and over several years has indicated displacement of several species out to 984 ft (300 m; Shaffer and Buhl 2015).

The proposed Project contains grasslands, and sensitive grassland avian species are likely to be present. Sharp-tailed grouse (*Tympanuchus phasianellus*), Le Conte's sparrow (*Ammodramus leconteii*), chestnut-collared longspur, and bobolink (*Dolichonyx oryzivorus*) depend on large blocks of grasslands (Johnson and Igl 2001) and may occur in the Project area (Jennings et al. 2005). These species could be susceptible to the adverse effects of grassland habitat fragmentation if this type of disturbance occurs as a result of Project construction. Although grassland habitats within the Project have already been fragmented, primarily due to conversion to agriculture (Figure 2), grassland areas with the potential to support grassland birds are still present within the Project area, especially in the northwestern portion. Facility development in areas with limited native grasslands, wetlands, and shrublands would likely have lower direct (e.g., mortality or injury) and indirect (e.g., displacement) impacts to wildlife, particularly to grassland-nesting bird species. Limiting the footprint of any proposed improvements, as well as utilizing existing roads and/or transmission corridors, could help to minimize any additional fragmentation.

Data from publicly available fatality studies can be used to make general comparisons of possible fatality rates that may be found at the Project. The overall bird fatality rate at wind energy facilities

in the United States (with publicly available data) ranges between three to five birds per megawatt (MW) per year (MW/year; National Wind Coordinating Collaborative [NWCC] 2010). Annual wind energy facility-related bird fatalities likely make up 0.01% to 0.02% (e.g., one out of every 5,000 to 10,000 bird fatalities) of known anthropogenic sources of bird fatalities (Erickson et al. 2001). Bird fatalities related to wind energy facilities are unlikely to affect current population trends of most North American songbirds (NWCC 2010, Erickson et al. 2014). Although songbirds may collide with wind turbines at the Project, these collisions are not expected to result in any measurable change to local or regional songbird populations.

Bats

Bats are often directly impacted by wind energy facilities. The Project is located within the range of the following bat species: big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), little brown bat (*Myotis lucifugus*), long-eared myotis (*M. evotis*), long-legged myotis (*M. volans*), northern long-eared bat, silver-haired bat (*Lasionycteris noctivagans*), and western red bat (*L. blossevillii*; Bat Conservation International 2016).

Direct Impacts

Bat casualties have been reported from most wind energy facilities where post-construction fatality data are publicly available. Reported estimates of bat mortality at wind energy facilities have ranged from 0.02 – 53.3 bats/MW/year (Arnett et al. 2008).

To date, most bat casualties at wind energy facilities are of migratory species (e.g., hoary and eastern red bat), which conduct long fall migrations between summer roosts and winter areas (Gruver 2002, Johnson et al. 2003b). Based on publicly available data, at least 19 species of bats have been recovered during carcass searches at wind energy facilities throughout the United States (Anderson et al. 2004, Johnson 2005, Kunz et al. 2007, NRC 2007, Baerwald 2008, Chatfield et al. 2009, Jacques Whitford Stantec Limited 2009, Piorkowski and O'Connell 2010), seven of which are potential residents and/or migrants in the Project (Table 4). The highest numbers of bat fatalities found at wind energy facilities to date have occurred in eastern North America on ridge tops dominated by deciduous forests (NWCC 2004). However, Jain (2005), Barclay et al. (2007), and Gruver et al. (2009), have also reported relatively high fatality rates from facilities located in grassland and agricultural habitats in Iowa, Canada, and Wisconsin.

The majority of bat fatalities at Midwestern wind energy facilities have occurred during the post-breeding or fall migration season, typically between August and September (Johnson 2005, Arnett et al. 2008). Migratory tree-roosting species (e.g., eastern red, hoary, and silver-haired bats) account for approximately 75% of reported bats killed in the Midwest and nationally (Arnett et al. 2008; Gruver et al. 2009, 2011). Thus, fatality risk for bats in the Project is expected to be greatest for migrating tree-roosting bat species during the late summer or early fall. A recent paper by Frick et al. (2017) indicated that overall impacts to hoary bats from wind turbines could lead to population-level effects.

Table 4. Summary of bat fatalities, by species, from studies conducted at wind energy facilities in North America.

Common Name	Scientific Name	# Fatalities[1]	% Composition
hoary bat[2]	*Lasiurus cinereus*	5,498	36.6
eastern red bat[2]	*Lasiurus borealis*	3,711	24.7
silver-haired bat[2]	*Lasionycteris noctivagans*	2,594	17.3
little brown bat[2]	*Myotis lucifugus*	1,038	6.9
tri-colored bat[2]	*Perimyotis subflavus*	644	4.3
big brown bat[2]	*Eptesicus fuscus*	582	3.9
Mexican free-tailed bat	*Tadarida brasiliensis*	517	3.4
unidentified bat		326	2.2
unidentified *Myotis*	*Myotis* spp.	39	0.3
northern long-eared bat[2]	*Myotis septentrionalis*	30	0.2
Seminole bat	*Lasiurus seminolus*	14	0.1
western red bat	*Lasiurus blossevillii*	13	0.1
evening bat	*Nycticeius humeralis*	7	<0.1
big free-tailed bat	*Nyctinomops macrotis*	6	<0.1
unidentified free-tailed bat		3	<0.1
western yellow bat	*Lasiurus xanthinus*	3	<0.1
eastern small-footed bat	*Myotis leibii*	2	<0.1
Indiana bat	*Myotis sodalis*	2	<0.1
pocketed free-tailed bat	*Nyctinomops femorosacca*	2	<0.1
unidentified *Lasiurus* bat	*Lasiurus* spp.	2	<0.1
canyon bat	*Pipistrellus hesperus*	1	<0.1
cave bat	*Myotis velifer*	1	<0.1
long-legged bat	*Myotis volans*	1	<0.1
Total	**19 species**	**15,036**	**100**

[1] These are raw data and are not corrected for searcher efficiency or scavenging.
[2] Potential resident or migrant in the Project (Bat Conservation International [BCI] 2016).
Note: Cumulative fatalities and species from data compiled by Western EcoSystems Technology, Inc. from publicly available fatality documents (listed in Appendix B).
Additional notes on bat species and numbers:
Indiana bat fatalities in this table are also reported by USFWS (2010, 2011a). Five additional Indiana bat fatalities have been reported in USFWS (USFWS 2011b, 2012a, 2012d; Pruitt and Okajima 2014), but these five are not included in this summary of bats found as fatalities.
One long-eared bat (*Myotis evotis*) was an incidental fatality recorded at Tehachapi, California (Anderson et al. 2004), but was not part of a formal search and is not included above.
An additional 677 bat fatalities (evening bat, eastern red bat, hoary bat, tricolored bat, Mexican free-tailed bat, and unidentified bat) have been found in Texas (Hale and Karsten 2010), but the number of fatalities by species is not reported.
Canyon bat, formerly known as western pipistrelle (*Pipistrellus hesperus*; BCI 2015a), and tri-colored bat, formerly known as eastern pipistrelle (*Pipistrellus subflavus*; BCI 2015b).

Indirect Impacts

Indirect impacts to bats are poorly understood due to their complex ecology and the inherent difficulty in monitoring bat populations. Indirect effects of wind energy facilities on bats largely occur from loss of habitat, such as clearing of forests or degradation of wetlands and riparian

habitats. Indirect impacts to bats at the Project are unlikely due to the limited amount of forest cover present and could be further reduced with selective siting of turbine locations.

TIER 2 and Stage 1 QUESTIONS

As described in the WEG (USFWS 2012d), Tier 2 studies help to identify potential issues that may need to be addressed before further actions can be taken with the development or operations of a Project. The following discussion provides answers to the WEG's Tier 2 questions for the proposed Project.

1. *Are there known species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?*

   The proposed Project is in the overall range of the NLEB, with small amounts of suitable summer habitat within the Project. The larger wooded tracks and smaller connected tracts of riparian woodland around creeks and drainages may provide habitat for the species.

   There is potential for the Northern Great Plains breeding population of piping plovers to utilize wetlands and waterbodies near or within the Project and/or to migrate through the Project. Additionally, there are three piping plover critical habitat units within 20 mi (32.2 km) of the Project, with the closest one located 9.2 mi (14.8 km) west of the Project.

   There is potential for the rufa red knot, whooping crane, and interior least tern population to migrate through or utilize the wetlands and waterbodies present within and around the Project as stopover habitat. There is also potential for bald and golden eagle use within the Project

2. *Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information?*

   There is no state- or federal-owned land within the Project where wind development would be precluded. However, there are three units of Williams County WPA within two mi (3.2 km) of the Project, and these areas would preclude wind development. There is also potential for USFWS grassland and wetland easements within the Project.

3. *Are there plant communities of concern present or likely to be present at the site?*

   There are no documented occurrences of federally listed plant species known to occur in within Williams County, North Dakota or the Project (USFWS 2016). However, native prairie and wetland habitats that may support sensitive plant species exist within the Project. Plant communities within the Project cannot be fully characterized based on the available data. Therefore, site-specific Tier 3 studies would be required to better address this question.

4. *Are there known critical areas of congregation of species of concern, including, but not limited to: maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?*

There are state and federally owned and managed lands near or adjacent to the Project, as well as the Missouri River that may attract migrating waterfowl, sensitive bird species, and eagles year-round. Numerous piping plover observations have been documented at Lostwood NWR, about 24.5 mi (39.4 km) east of the Project. The northwestern portion of the Project may contain some suitable habitat, such as grasslands and pastures, for congregating species of concern. There is some potential for sharp-tailed grouse leks given the limited grassland areas.

5. *Using best available scientific information, has the relevant federal, state, tribal, and/or local agency independently demonstrated the potential presence of a population of a species of habitat fragmentation concern?*

   In general, potentially suitable habitat types within the Project area are already highly fragmented but several grassland obligate avian species that show a wide range of area sensitivity could occur within the proposed Project area.

6. *Which species of birds and bats, especially those known to be at risk by wind energy facilities, are likely to use the proposed Project based on an assessment of site attributes?*

   As discussed above, the Project is located within the potential range of the several bat species. No caves or hibernacula are known to occur within the Project based on publicly available information. There is some suitable summer and migratory habitat for NLEB.

   The Project may be used year-round by eagles. Due to its proximity to the Missouri River, raptors and waterfowl use of the Project may be particularly high during migration. Fixed-point avian use surveys conducted to characterize bird species composition, distribution, and rates of use of the Project may provide data that could aid in designing the proposed Project to avoid or minimize impacts to birds.

7. *Is there a potential for significant adverse impacts to species of concern based on the answers to the questions above, and considering the design of the proposed Project?*

   Design of the Project is not yet developed. The Project largely lacks features that may concentrate migrating birds. Given its location, the Project may receive use by some sensitive species during migration, such as the federally listed rufa red knot, whooping crane, and interior least tern. The potential exists for raptors to occur during some or all seasons. Raptor migration pathways are difficult to define in flat landscapes, and while use by migrating raptors is not expected to be concentrated, the Project will likely receive some use by migrating raptors. The Missouri River, a known migratory corridor for raptors, may influence raptor use of the Project.

SUMMARY AND CONCLUSIONS

Cultivated cropland and hay/pasture account for the majority (93.2%) of the Project area. The Project does not contain WPAs and WMAs, although there are three units of Williams County WPA within two mi (3.2 km) of the proposed Project. Herbaceous grasslands (3,555.7 ac [1,438.9 ha]), emergent herbaceous wetlands (844.9 ac [341.9 ha]), and deciduous and mixed forests

(20.8 acres [8.4 ha]) are present within the Project and may provide habitat for some wildlife species. Given the wildlife areas near the Project, and the Project's proximity to the Missouri River, use by some sensitive bird species is possible within the Project.

There is potential for year-round bald and golden eagle use of the Project due to the available foraging and nesting habitat provided by the Missouri River. Bald and golden eagles will likely occur in low numbers. The potential risk of bald and golden eagles interacting with wind turbines in the Project could be greater during the migratory season than the breeding season; however, no migration concentration sites have been documented or are thought to occur within the Project area. Based on available information, adverse impacts on eagle populations resulting from development of the proposed Project are not likely.

The IBAs, WPAs, and WMAs surrounding the Project are utilized by migrating birds for stopover habitat, and the nearby Missouri River is a known migration corridor for raptors and other bird types. There is potential for impacts to individuals, particularly during the spring and fall migration seasons. Based on eBird observations and BBS data, there is potential for species of concern to occur within the proposed Project. Waterfowl migrate through the Project along the Central Flyway (Flyways.us 2016); therefore, increased waterfowl use of stopover habitats within the Project is expected during migration.

Several bat species could occur within the Project area. Migratory tree-roosting species (e.g., eastern red, western red, hoary, and silver-haired bats) account for approximately 75% of reported bats killed in the Midwest and nationally (Arnett et al. 2008; Gruver et al. 2009, 2011). Thus, fatality risk for bat species is expected to be greatest for tree-roosting bats that are migrating through the Project during the late summer or early fall.

Suitable NLEB summer roosting habitat is more common along the White Earth and Missouri rivers and tributaries compared to the Project; however, there is some potential for the NLEB to occur within the Project area. Based on publicly available information, no hibernacula or caves are known to occur within the Project area.

REFERENCES

AECOM. 2013. Annual Monitoring Report: July 2012 - June 2013. Solano Wind Project - Phase 3. Prepared for SMUD - Environmental Management, Sacramento, California. Prepared by AECOM, Sacramento, California. September 2013.

All About Birds. 2016. Species Profiles. Cornell Lab of Ornithology. Accessed August 2016. Available from: http://www.allaboutbirds.org

Anderson, R., N. Neuman, J. Tom, W. P. Erickson, M. D. Strickland, M. Bourassa, K. J. Bay, and K. J. Sernka. 2004. Avian Monitoring and Risk Assessment at the Tehachapi Pass Wind Resource Area, California. Period of Performance: October 2, 1996 - May 27, 1998. NREL/SR-500-36416. National Renewable Energy Laboratory, Golden, Colorado. September 2004. Available online at: http://www.nrel.gov/docs/fy04osti/36416.pdf

ARCADIS U.S., Inc. 2013. Fall 2012 and Spring 2013 Avian and Bat Post-Construction Mortality Monitoring Report: Pioneer Trail Wind Farm. Prepared for E.On Climate & Renewables, North America. Prepared by ARCADIS U.S., Inc., Milwaukee, Wisconsin. August 2013.

Arnett, E. B., K. Brown, W. P. Erickson, J. Fiedler, B. L. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, C. P. Nicholson, T. O'Connell, M. Piorkowski, and R. Tankersley, Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management 72(1): 61-78.

Arnett, E. B., W. P. Erickson, J. Kerns, and J. Horn. 2005. Relationships between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines. Prepared for the Bats and Wind Energy Cooperative. March 2005.

Arnett, E. B., M. R. Schirmacher, C. D. Hein, and M. M. P. Huso. 2011. Patterns of Bird and Bat Fatality at the Locust Ridge Ii Wind Project, Pennsylvania. 2009-2010 Final Report. Prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission (PGC). Prepared by Bat Conservation International (BCI), Austin, Texas. January 2011.

Arnett, E. B., M. R. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2009. Effectiveness of Changing Wind Turbine Cut-in Speed to Reduce Bat Fatalities at Wind Facilities: 2008 Annual Report. Prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. April 2009. Available online at: http://www.batsandwind.org/pdf/Curtailment_2008_Final_Report.pdf

Arnett, E. B., M. R. Schirmacher, M. M. P. Huso, and J. P. Hayes. 2010. Patterns of Bat Fatality at the Casselman Wind Project in South-Central Pennsylvania. 2009 Annual Report. Annual report prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. January 2010.

Baerwald, E. F. 2008. Variation in the Activity and Fatality of Migratory Bats at Wind Energy Facilities in Southern Alberta: Causes and Consequences. Thesis. University of Calgary, Calgary, Alberta, Canada.

Baker, A., P. Gonzalez, R. I. G. Morrison, and B. A. Harrington. 2013. Red Knot (Calidris Canutus). A. Poole, ed. The Birds of North America Online. Cornell Lab of Ornithology. Ithaca, New York. Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/563; doi: 10.2173/bna.563

Barclay, R. M. R., E. F. Baerwald, and J. Gruver. 2007. Variation in Bat and Bird Fatalities at Wind Energy Facilities: Assessing the Effects of Rotor Size and Tower Height. Canadian Journal of Zoology 85: 381-387.

Bat Conservation International, Inc. (BCI). 2015a. Species Profiles: Parastrellus Hesperus. Canyon bat, formerly western pipistrelle (Pipistrellus hesperus). Updated March 2015. Bat Conservation International, Inc. Austin, Texas. Available online at: http://www.batcon.org/resources/media-education/species-profiles/detail/1937

Bat Conservation International, Inc. (BCI). 2015b. Species Profiles: Perimyotis Subflavus. Tri-colored bat, formerly eastern pipistrelle (Pipistrellus subflavus). Updated March 2015. Bat Conservation International, Inc. Austin, Texas. Available online at: http://www.batcon.org/resources/media-education/species-profiles/detail/2345

BHE Environmental, Inc. (BHE). 2010. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Interim Report prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2010.

BHE Environmental, Inc. (BHE). 2011. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Final Report. Prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2011.

BioResource Consultants, Inc. (BRC). 2010. 2009/2010 Annual Report: Bird and Bat Mortality Monitoring, Pine Tree Wind Farm, Kern County, California. To the Los Angeles Department of Water and Power, from AECOM, Irvine, California. Report prepared by BioResource Consultants, Inc., Ojai, California. October 14, 2010.

Brown, K., K. S. Smallwood, and B. Karas. 2013. Final 2012-2013 Annual Report, Avian and Bat Monitoring Project, Vasco Winds, Llc. Prepared for NextEra Energy Resources, Livermore, California. Prepared by Ventus Environmental Solutions, Portland, Oregon. September 2013.

Brown, W. K. and B. L. Hamilton. 2004. Bird and Bat Monitoring at the Mcbride Lake Wind Farm, Alberta, 2003-2004. Report for Vision Quest Windelectric, Inc., Calgary, Alberta, Canada. September 2004.

Brown, W. K. and B. L. Hamilton. 2006a. Bird and Bat Interactions with Wind Turbines Castle River Wind Facility, Alberta, 2001-2002. Report for Vision Quest Windelectric, Inc., Calgary, Alberta, Canada.

Brown, W. K. and B. L. Hamilton. 2006b. Monitoring of Bird and Bat Collisions with Wind Turbines at the Summerview Wind Power Project, Alberta: 2005-2006. Prepared for Vision Quest Windelectric, Calgary, Alberta by TAEM Ltd., Calgary, Alberta, and BLH Environmental Services, Pincher Creek, Alberta. September 2006. Available online at: http://www.batsandwind.org/pdf/Brown2006.pdf

Chatfield, A. and K. Bay. 2014. Post-Construction Studies for the Mustang Hills and Alta Viii Wind Energy Facilities, Kern County, California. Final Report for the First Year of Operation: July 2012 - October 2013. Prepared for EverPower Wind Holdings, Inc. and Brookfield Renewable Energy Group. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. February 28, 2014.

Chatfield, A., W. Erickson, and K. Bay. 2009. Avian and Bat Fatality Study, Dillon Wind-Energy Facility, Riverside County, California. Final Report: March 26, 2008 - March 26, 2009. Prepared for Iberdrola Renewables, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 3, 2009.

Chatfield, A., W. P. Erickson, and K. Bay. 2010. Final Report: Avian and Bat Fatality Study at the Alite Wind-Energy Facility, Kern County, California. Final Report: June 15, 2009 – June 15, 2010. Prepared for CH2M HILL, Oakland, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Chatfield, A., D. Riser-Espinoza, and K. Bay. 2014. Bird and Bat Mortality Monitoring at the Alta Wind Energy Center, Phases I - V, Kern County, California. Final Report for the Second Year of Operation: March 4, 2013 - March 6, 2014. Prepared for Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 22, 2014.

Chatfield, A. and D. Russo. 2014. Post-Construction Avian and Bat Fatality Monitoring for the Pinyon Pines I & Ii Wind Energy Project, Kern County, California. Final Report for the First Year of Operation: March 2013 - March 2014. Prepared for MidAmerican Renewables, LLC, Des Moines, Iowa, and Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 28, 2014.

Chatfield, A., M. Sonnenberg, and K. Bay. 2012. Avian and Bat Mortality Monitoring at the Alta-Oak Creek Mojave Project, Kern County, California. Final Report for the First Year of Operation March 22, 2011 – June 15, 2012. Prepared for Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 12, 2012.

Chodachek, K., K. Adachi, and G. DiDonato. 2015. Post Construction Fatality Surveys for the Prairie Rose Wind Energy Facility, Rock County, Minnesota. Final Report: April 15 to June 13, 2014, and August 15 to October 29, 2014. Prepared for Enel Green Power, North America, San Diego, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. January 23, 2015.

Chodachek, K., C. Derby, K. Adachi, and T. Thorn. 2014. Post-Construction Fatality Surveys for the Pioneer Prairie Ii Wind Energy Facility, Mitchell County, Iowa. Final Report: July 1 - October 18, 2013. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology Inc. (WEST), Bismarck, North Dakota. April 2014.

Chodachek, K., C. Derby, M. Sonnenberg, and T. Thorn. 2012. Post-Construction Fatality Surveys for the Pioneer Prairie Wind Farm I Llc Phase Ii, Mitchell County, Iowa: April 4, 2011 – March 31, 2012. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 27, 2012.

Cooperative Whooping Crane Tracking Project (CWCTP). 2007. Cwctp-Gis. Whooping Crane Migration Corridor Gis Layer Created Based on Crane Observations through Fall 2007. GIS layers from M. Tacha, CWCTP, US Fish and Wildlife Service (USFWS), Grand Island, Nebraska.

Cooperative Whooping Crane Tracking Project (CWCTP). 2010. Cwctp-Gis. Whooping Crane Sightings Gis Layer Created Based on Crane Observations through Fall 2010, Us Fish and Wildlife Service, Grand Island, Ne.

Derby, C., K. Chodachek, and K. Bay. 2010a. Post-Construction Bat and Bird Fatality Study Crystal Lake Ii Wind Energy Center, Hancock and Winnebago Counties, Iowa. Final Report: April 2009- October 2009. Prepared for NextEra Energy Resources, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. June 2, 2010.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010b. Post-Construction Fatality Survey for the Buffalo Ridge I Wind Project. May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc., Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010c. Post-Construction Fatality Surveys for the Elm Creek Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010d. Post-Construction Fatality Surveys for the Moraine Ii Wind Project: March - December 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010e. Post-Construction Fatality Surveys for the Winnebago Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011a. Post-Construction Fatality Surveys for the Barton I and Ii Wind Project: Iri. March 2010 - February 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: September 28, 2011.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011b. Post-Construction Fatality Surveys for the Rugby Wind Project: Iberdrola Renewables, Inc. March 2010 - March 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: October 14, 2011.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012a. Post-Construction Casualty Surveys for the Buffalo Ridge Ii Wind Project. Iberdrola Renewables: March 2011- February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012b. Post-Construction Fatality Surveys for the Elm Creek Ii Wind Project. Iberdrola Renewables: March 2011-February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. October 8, 2012.

Derby, C., K. Chodachek, T. Thorn, K. Bay, and S. Nomani. 2011c. Post-Construction Fatality Surveys for the Prairiewinds Nd1 Wind Facility, Basin Electric Power Cooperative, March - November 2010. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 2, 2011.

Derby, C., K. Chodachek, T. Thorn, and A. Merrill. 2012c. Post-Construction Surveys for the Prairiewinds Nd1 (2011) Wind Facility Basin Electric Power Cooperative: March - October 2011. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western Ecosystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., A. Dahl, K. Bay, and L. McManus. 2011d. 2010 Post-Construction Monitoring Results for the Wessington Springs Wind Energy Facility, South Dakota. Final Report: March 9 – November 16, 2010. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 22, 2011.

Derby, C., A. Dahl, and G. DiDonato. 2014. Post-Construction Fatality Monitoring Studies for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2013 - February 2014. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., A. Dahl, W. Erickson, K. Bay, and J. Hoban. 2007. Post-Construction Monitoring Report for Avian and Bat Mortality at the Nppd Ainsworth Wind Farm. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, for the Nebraska Public Power District.

Derby, C., A. Dahl, and D. Fox. 2013a. Post-Construction Fatality Monitoring Studies for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2012 - February 2013. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 13, 2013.

Derby, C., A. Dahl, and A. Merrill. 2012d. Post-Construction Monitoring Results for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2011 - February 2012. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. September 27, 2012.

Derby, C., A. Dahl, A. Merrill, and K. Bay. 2010f. 2009 Post-Construction Monitoring Results for the Wessington Springs Wind-Energy Facility, South Dakota. Final Report. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 19, 2010.

Derby, C., G. Iskali, S. Howlin, T. Thorn, T. Lyon, and A. Dahl. 2013b. Post-Construction Monitoring Results for the Big Smile Wind Farm, Roger Mills County, Oklahoma. Final Report: March 2012 to February 2013. Prepared for Acciona Wind Energy, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. June 12, 2013.

Derby, C., G. Iskali, M. Kauffman, T. Thorn, T. Lyon, and A. Dahl. 2013c. Post-Construction Monitoring Results, Red Hills Wind Farm, Roger Mills and Custer Counties, Oklahoma. Final Report: March 2012 to March 2013. Prepared for Acciona Wind Energy, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. June 12, 2013.

Derby, C., J. Ritzert, and K. Bay. 2010g. Bird and Bat Fatality Study, Grand Ridge Wind Resource Area, Lasalle County, Illinois. January 2009 - January 2010. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. July 13, 2010. Revised January 2011.

Downes, S. and R. Gritski. 2012a. Harvest Wind Project Wildlife Monitoring Report: January 2010 – January 2012. Prepared for Harvest Wind Project, Roosevelt, Washington. Prepared by Northwest Wildlife Consultants, Inc., Pendleton, Oregon May 1, 2012.

Downes, S. and R. Gritski. 2012b. White Creek Wind I Wildlife Monitoring Report: November 2007 - November 2011. Prepared for White Creek Wind I, LLC, Roosevelt, Washington. Prepared by Northwest Wildlife Consultants, Inc., Pendleton, Oregon May 1, 2012.

Dyke, S. R., S. K. Johnson, and P. T. Isakson. 2015. North Dakota State Wildilfe Action Plan. North Dakota Game and Fish Department. Bismarck, North Dakota. Available online at: https://gf.nd.gov/wildlife/swap

eBird. 2016a. Ebird: An Online Database of Bird Distribution and Abundance. eBird, Cornell Lab of Ornithology, Ithaca, New York. Accessed January 2016. Available online at: http://ebird.org/content/ebird/

eBird. 2016b. Ebird: An Online Database of Bird Distribution and Abundance [Web Application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Accessed August 2016. Available online at: http://ebird.org/content/ebird/

Enk, T., K. Bay, M. Sonnenberg, J. Baker, M. Kesterke, J. R. Boehrs, and A. Palochak. 2010. Biglow Canyon Wind Farm Phase I Post-Construction Avian and Bat Monitoring Second Annual Report, Sherman County, Oregon. January 26, 2009 - December 11, 2009. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc.(WEST) Cheyenne, Wyoming, and Walla Walla, Washington. April 2010.

Enk, T., K. Bay, M. Sonnenberg, and J. R. Boehrs. 2012a. Year 1 Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase Iii, Sherman County, Oregon. September 13, 2010 - September 9, 2011. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. April 24, 2012.

Enk, T., K. Bay, M. Sonnenberg, and J. R. Boehrs. 2012b. Year 2 Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase Ii, Sherman County, Oregon. September 13, 2010 - September 15, 2011. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. April 23, 2012.

Enk, T., K. Bay, M. Sonnenberg, J. Flaig, J. R. Boehrs, and A. Palochak. 2011a. Year 1 Post-Construction Avian and Bat Monitoring Report: Biglow Canyon Wind Farm Phase Ii, Sherman County, Oregon. September 10, 2009 - September 12, 2010. Prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. January 7, 2011.

Enk, T., C. Derby, K. Bay, and M. Sonnenberg. 2011b. 2010 Post-Construction Fatality Monitoring Report, Elkhorn Valley Wind Farm, Union County, Oregon. January – December 2010. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Walla Walla, Washington, and Cheyenne, Wyoming. December 8, 2011.

Enz, T. and K. Bay. 2010. Post-Construction Avian and Bat Fatality Monitoring Study, Tuolumne Wind Project, Klickitat County, Washington. Final Report: April 20, 2009 - April 7, 2010. Prepared for Turlock Irrigation District, Turlock, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 6, 2010.

Enz, T. and K. Bay. 2011. Post-Construction Monitoring at the Linden Ranch Wind Farm, Klickitat County, Washington. Final Report: June 30, 2010 - July 17, 2011. Prepared for EnXco. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. November 10, 2011.

Enz, T., K. Bay, S. Nomani, and M. Kesterke. 2011. Bird and Bat Fatality Monitoring Study, Windy Flats and Windy Point Ii Wind Energy Projects, Klickitat County, Washington. Final Report: February 1, 2010 - January 14, 2011. Prepared for Windy Flats Partners, LLC, Goldendale, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 19, 2011.

Enz, T., K. Bay, M. Sonnenberg, and A. Palochak. 2012. Post-Construction Monitoring Studies for the Combine Hills Turbine Ranch, Umatilla County, Oregon. Final Report: January 7 - December 2, 2011. Prepared for Eurus Energy America Corporation, San Diego, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Walla Walla, Washington.

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Annual Report. July 2001 - December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 2004. Available online at: http://www.west-inc.com/reports/swp_final_dec04.pdf

Erickson, W. P., J. D. Jeffrey, and V. K. Poulton. 2008. Puget Sound Energy Wild Horse Wind Facility Avian and Bat Monitoring: First Annual Report: January–December, 2007. Prepared for Puget Sound Energy, Ellensburg, Washington. Prepared by by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 2008.

Erickson, W. P., G. D. Johnson, M. D. Strickland, and K. Kronner. 2000. Avian and Bat Mortality Associated with the Vansycle Wind Project, Umatilla County, Oregon. Technical Report prepared by WEST, Inc., for Umatilla County Department of Resource Services and Development, Pendleton, Oregon. 21 pp.

Erickson, W. P., K. Kronner, and K. J. Bay. 2007. Stateline 2 Wind Project Wildlife Monitoring Report, January - December 2006. Technical report submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee.

Erickson, W. P., K. Kronner, and R. Gritski. 2003. Nine Canyon Wind Power Project Avian and Bat Monitoring Report. September 2002 – August 2003. Prepared for the Nine Canyon Technical Advisory Committee and Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon. October 2003. Available online at: http://www.west-inc.com/reports/nine_canyon_monitoring_final.pdf

Erickson, W. P., K. Kronner, and R. Gritski. 2005. Nine Canyon Wind Project Phase Ii, Fall 2004 Avian and Bat Monitoring Report: July 25 – November 2, 2004. Prepared for the Nine Canyon Technical Advisory Committee, Energy Northwest, by Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. March 2005.

Erickson, W. P. and L. Sharp. 2005. Phase 1 and Phase 1a Avian Mortality Monitoring Report for 2004-2005 for the Smud Solano Wind Project. Prepared for Sacramento Municipal Utility District (SMUD), Sacramento, California. Prepared by URS Sacramento, California and Western EcoSystems Technology, Inc. (WEST). August 2005.

Erickson, W. P., M. M. Wolfe, K. J. Bay, D. H. Johnson, and J. L. Gehring. 2014. A Comprehensive Analysis of Small Passerine Fatalities from Collisions with Turbines at Wind Energy Facilities. PLoS ONE 9(9): e107491. doi: 10.1371/journal.pone.0107491.

Fagen Engineering, LLC. 2014. 2013 Avian and Bat Monitoring Annual Report: Big Blue Wind Farm, Blue Earth, Minnesota. Prepared for Big Blue Wind Farm. Prepared by Fagen Engineering, LLC. May 2014.

Fagen Engineering, LLC. 2015. 2014 Avian and Bat Monitoring Annual Report: Big Blue Wind Farm, Blue Earth, Minnesota. Prepared for Big Blue Wind Farm. Prepared by Fagen Engineering, LLC.

Fiedler, J. K., T. H. Henry, R. D. Tankersley, and C. P. Nicholson. 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005. Tennessee Valley Authority. June 28, 2007.

Fishman Ecological Services LLC. 2003. Carcass Survey Results for Seawest Windpower, Inc., Condon Site 2002-2003. Prepared for SeaWest WindPower Inc.

Flyways.us. 2016. Central Flyway. A collaborative effort of waterfowl managers across the continent. US Fish and Wildlife Service (USFWS). Accessed August 2016. Flyways.us homepage available online: https://flyways.us/. Flyway information available online: http://flyways.us/flyways/info

Frick, W. F., E. F. Baerwald, J. F. Pollock, R. M. R. Barclay, J. A. Szymanski, T. J. Weller, A. L. Russell, S. C. Loeb, R. A. Medellin, and L. P. McGuire. 2017. Fatalities at Wind Turbines May Threaten Population Viability of a Migratory Bat. Biological Conservation 209: 172-177. http://dx.doi.org/10.1016/j.biocon.2017.02.023.

Golder Associates. 2010. Report on Fall Post-Construction Monitoring, Ripley Wind Power Project, Acciona Wind. Report Number 09-1126-0029. Submitted to Suncor Energy Products Inc., Calgary, Alberta, and Acciona Wind Energy Canada, Toronto, Ontario. February 2010.

Good, R. E., W. P. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011. Bat Monitoring Studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana: April 13 - October 15, 2010. Prepared for Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 28, 2011.

Good, R. E., A. Merrill, S. Simon, K. Murray, and K. Bay. 2012. Bat Monitoring Studies at the Fowler Ridge Wind Farm, Benton County, Indiana: April 1 - October 31, 2011. Prepared for the Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. January 31, 2012.

Good, R. E., J. P. Ritzert, and K. Adachi. 2013a. Post-Construction Monitoring at the Top Crop Wind Farm, Gundy and Lasalle Counties, Illinois. Final Report: May 2012 - May 2013. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. October 22, 2013.

Good, R. E., M. L. Ritzert, and K. Adachi. 2013b. Post-Construction Monitoring at the Rail Splitter Wind Farm, Tazwell and Logan Counties, Illinois. Final Report: May 2012 - May 2013. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. October 22, 2013.

Good, R. E., M. Sonnenburg, and S. Simon. 2013c. Bat Evaluation Monitoring Studies at the Fowler Ridge Wind Farm, Benton County, Indiana: August 1 - October 15, 2012. Prepared for the Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. January 31, 2013.

Grehan, J. R. 2008. Steel Winds Bird Mortality Study, Final Report, Lackawanna, New York. Prepared for Steel Winds LLC. April 2008.

Griffith, G. 2010. Level Iii North American Terrestrial Ecoregions: United Stated Descriptions. Prepared for North American Commission for Environmental Cooperation.

Grindal, S. D., J. L. Morissette, and R. M. Brigham. 1999. Concentration of Bat Activity in Riparian Habitats over an Elevational Gradient. Canadian Journal of Zoology 77(6): 972-977. doi: 10.1139/z99-062.

Gritski, R., S. Downes, and K. Kronner. 2010. Klondike Iii (Phase 1) Wind Power Project Wildlife Monitoring: October 2007-October 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon, for Klondike Wind Power III LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 21, 2010 (Updated September 2010).

Gritski, R., S. Downes, and K. Kronner. 2011. Klondike Iiia (Phase 2) Wind Power Project Wildlife Monitoring: August 2008 - August 2010. Updated Final. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon, for Klondike Wind Power III LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. Updated April 2011.

Gritski, R. and K. Kronner. 2010a. Hay Canyon Wind Power Project Wildlife Monitoring Study: May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Hay Canyon Wind Power Project LLC. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. September 20, 2010.

Gritski, R. and K. Kronner. 2010b. Pebble Springs Wind Power Project Wildlife Monitoring Study: January 2009 - January 2010. Prepared for Iberdrola Renewables, Inc. (IRI), and the Pebble Springs Advisory Committee. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 20, 2010.

Gritski, R., K. Kronner, and S. Downes. 2008. Leaning Juniper Wind Power Project, 2006 − 2008. Wildlife Monitoring Final Report. Prepared for PacifiCorp Energy, Portland, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 30, 2008.

Grodsky, S. M. and D. Drake. 2011. Assessing Bird and Bat Mortality at the Forward Energy Center. Final Report. Public Service Commission (PSC) of Wisconsin. PSC REF#:152052. Prepared for Forward Energy LLC. Prepared by Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, Wisconsin. August 2011.

Gruver, J. 2002. Assessment of Bat Community Structure and Roosting Habitat Preferences for the Hoary Bat (Lasiurus Cinereus) near Foote Creek Rim, Wyoming. Thesis. University of Wyoming, Laramie, Wyoming. 149 pp.

Gruver, J., K. Bay, M. Kesterke, W. Erickson, K. Murray, and M. Ritzert. 2011. A Summary of Bat Studies and Fatalities from Wind Energy Facilities in the United States with an Emphasis on the Midwest. Oral Presentation (invited) given to the 2nd Joint Meeting Northeastern Bat Working Group, Midwest Bat Working Group, Southeastern Bat Diversity Network, and 21st Colloquium on the Conservation of Mammals in the Eastern United States, Louisville, Kentucky. February 23-25, 2011.

Gruver, J., M. Sonnenberg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 - October 31, 2008 and March 15 - June 4, 2009. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

Hale, A. M. and K. B. Karsten. 2010. Estimating Bird and Bat Mortality at a Wind Energy Facility in North-Central Texas. Presented at the National Wind Coordinating Collaborative (NWCC) Research Meeting VIII, October 19-21, 2010, Lakewood, Colorado. Available online at: http://nationalwind.org/wp-content/uploads/assets/research_meetings/Research_Meeting_VIII_Hale.pdf

Harvey & Associates. 2013. Montezuma Ii Wind Energy Center: Post Construction Monitoring Report, Year-1. Prepared by NextEra Montezuma II Wind, LLC, Juno Beach, Florida. Prepared by H.T. Harvey & Associates, Los Gatos, California. September 3, 2013.

HawkMountain. 2016. Hawk Mountain Sanctuary. Kempton, Pennsylvania. Accessed December 2016. Online At: Http://Www.Hawkmountain.Org/.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2013a. Avian and Bat Post-Construction Monitoring at the Pinnacle Wind Farm, Mineral County, West Virginia, 2012. Final Report. Bat Conservation International, Austin, Texas, and ABR, Inc., Forest Grove, Oregon. April 2013.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2013b. Effectiveness of an Operational Mitigation Experiment to Reduce Bat Fatalities at the Pinnacle Wind Farm, Mineral County, West Virginia, 2012. Bat Conservation International, Austin, Texas, and ABR, Inc., Forest Grove, Oregon. April 2013.

Henderson, L. E. and H. G. Broders. 2008. Movements and Resource Selection of the Northern Long-Eared Myotis (Myotis Septentrionalis) in a Forest-Agriculture Landscape. Journal of Mammalogy 89: 952-963.

Homer, C. G., J. A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulston, N. D. Herold, J. D. Wickham, and K. Megown. 2015. Completion of the 2011 National Land Cover Database for the Conterminous United States-Representing a Decade of Land Cover Change Information. Photogrammetric Engineering and Remote Sensing 81(5): 345-354. Available online at: http://www.mrlc.gov/nlcd2011.php

Howe, R. W., W. Evans, and A. T. Wolf. 2002. Effects of Wind Turbines on Birds and Bats in Northeastern Wisconsin. Prepared by University of Wisconsin-Green Bay, for Wisconsin Public Service Corporation and Madison Gas and Electric Company, Madison, Wisconsin. November 21, 2002. 104 pp.

ICF International. 2012. Montezuma Wind Llc (Montezuma I) 2011 Avian and Bat Fatality Monitoring Report. Prepared for NextEra Energy Resources. Prepared by ICF International, Sacramento, California. May 17, 2012.

ICF International. 2013. Montezuma Wind Llc (Montezuma I) 2012 Avian and Bat Fatality Monitoring Report. Prepared for NextEra Energy Resources. Prepared by ICF International, Sacramento, California. May 2013.

Insignia Environmental. 2009. 2008/2009 Annual Report for the Buena Vista Avian and Bat Monitoring Project. Prepared for Contra Costa County, Martinez, California. Prepared by Insignia Environmental, Palo Alto, California. September 4, 2009.

Jacques Whitford Stantec Limited (Jacques Whitford). 2009. Ripley Wind Power Project Postconstruction Monitoring Report. Project No. 1037529.01. Report to Suncor Energy Products Inc., Calgary, Alberta, and Acciona Energy Products Inc., Calgary, Alberta. Prepared for the Ripley Wind Power Project Post-Construction Monitoring Program. Prepared by Jacques Whitford, Markham, Ontario. April 30, 2009.

Jain, A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. M.S. Thesis. Iowa State University, Ames, Iowa.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2007. Annual Report for the Maple Ridge Wind Power Project: Post-Construction Bird and Bat Fatality Study – 2006. Final Report. Prepared for PPM Energy and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2009a. Annual Report for the Maple Ridge Wind Power Project: Post-Construction Bird and Bat Fatality Study - 2007. Final report prepared for PPM Energy and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study. May 6, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, A. Fuerst, and C. Hansen. 2009b. Annual Report for the Noble Ellenburg Windpark, Llc, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Histed, and J. Meacham. 2009c. Annual Report for the Noble Clinton Windpark, Llc, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, and M. Lehman. 2009d. Maple Ridge Wind Power Avian and Bat Fatality Study Report - 2008. Annual Report for the Maple Ridge Wind Power Project, Post-construction Bird and Bat Fatality Study - 2008. Prepared for Iberdrola Renewables, Inc, Horizon Energy, and the Technical Advisory Committee (TAC) for the Maple Ridge Project Study. Prepared by Curry and Kerlinger, LLC. May 14, 2009.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, J. Quant, and D. Pursell. 2009e. Annual Report for the Noble Bliss Windpark, Llc, Postconstruction Bird and Bat Fatality Study - 2008. Prepared for Noble Environmental Power, LLC by Curry and Kerlinger, LLC. April 13, 2009.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, A. Fuerst, and A. Harte. 2010a. Annual Report for the Noble Bliss Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 9, 2010.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and A. Harte. 2011a. Annual Report for the Noble Wethersfield Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2010b. Annual Report for the Noble Clinton Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 9, 2010.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2010c. Annual Report for the Noble Ellenburg Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2009. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. March 14, 2010.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2011b. Annual Report for the Noble Altona Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and K. Russell. 2011c. Annual Report for the Noble Chateaugay Windpark, Llc: Postconstruction Bird and Bat Fatality Study - 2010. Prepared for Noble Environmental Power, LLC. Prepared by Curry and Kerlinger, LLC, Cape May, New Jersey. January 22, 2011.

Jeffrey, J. D., K. Bay, W. P. Erickson, M. Sonneberg, J. Baker, M. Kesterke, J. R. Boehrs, and A. Palochak. 2009a. Portland General Electric Biglow Canyon Wind Farm Phase I Post-Construction Avian and Bat Monitoring First Annual Report, Sherman County, Oregon. January 2008 - December 2008. Technical report prepared for Portland General Electric Company, Portland, Oregon. Prepared by Western EcoSystems Technology (WEST) Inc., Cheyenne, Wyoming, and Walla Walla, Washington. April 29, 2009.

Jeffrey, J. D., W. P. Erickson, K. Bay, M. Sonneberg, J. Baker, J. R. Boehrs, and A. Palochak. 2009b. Horizon Wind Energy, Elkhorn Valley Wind Project, Post-Construction Avian and Bat Monitoring, First Annual Report, January-December 2008. Technical report prepared for Telocaset Wind Power Partners, a subsidiary of Horizon Wind Energy, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming, and Walla Walla, Washington. May 4, 2009.

Jennings, B., T. Cable, and R. Burrows. 2005. Birds of the Great Plains. Lone Pine Publishing International Inc., Canada.

Johnson, D. and L. Igl. 2001. Area Requirements of Grassland Birds: A Regional Perspective. Auk 118(1): 24-34.

Johnson, G., W. Erickson, and J. White. 2003a. Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon. Technical report prepared for Northwestern Wind Power, Goldendale, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 2003. http://www.west-inc.com

Johnson, G. D. 2005. A Review of Bat Mortality at Wind-Energy Developments in the United States. Bat Research News 46(2): 45-49.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000. Final Report: Avian Monitoring Studies at the Buffalo Ridge Wind Resource Area, Minnesota: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 22, 2000. 212 pp. http://www.west-inc.com

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2003b. Mortality of Bats at a Large-Scale Wind Power Development at Buffalo Ridge, Minnesota. American Midland Naturalist 150: 332-342.

Johnson, G. D., M. K. Perlik, W. P. Erickson, and M. D. Strickland. 2004. Bat Activity, Composition and Collision Mortality at a Large Wind Plant in Minnesota. Wildlife Society Bulletin 32(4): 1278-1288.

Johnson, G. D., M. Ritzert, S. Nomani, and K. Bay. 2010a. Bird and Bat Fatality Studies, Fowler Ridge I Wind-Energy Facility Benton County, Indiana. Unpublished report prepared for British Petroleum Wind Energy North America Inc. (BPWENA) by Western EcoSystems Technology, Inc. (WEST).

Johnson, G. D., M. Ritzert, S. Nomani, and K. Bay. 2010b. Bird and Bat Fatality Studies, Fowler Ridge Iii Wind-Energy Facility, Benton County, Indiana. April 2 - June 10, 2009. Prepared for BP Wind Energy North America. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Kerlinger, P. 2002a. An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont: July 1996-July 1998. NREL/SR-500-28591. Prepared for Vermont Public Service, Montpelier, Vermont. US Department of Energy, National Renewable Energy Laboratory, Golden, Colorado. March 2002. 95 pp. Available online at: http://www.nrel.gov/docs/fy02osti/28591.pdf

Kerlinger, P. 2002b. Avian Fatality Study at the Madison Wind Power Project, Madison, New York. Report to PG&E Generating.

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2009. Revised Post-Construction Avian Monitoring Study for the Shiloh I Wind Power Project, Solano County, California. Final Report: October 2009. Third Year Report (Revised 2010). Prepared for Iberdrola Renewables, Inc. (IRI). Prepared by Curry and Kerlinger, LLC., McLean, Virginia. Available online at: https://www.solanocounty.com/civicax/filebank/blobdload.aspx?blobid=8914

Kerlinger, P., R. Curry, L. Culp, A. Hasch, and A. Jain. 2010. Post-Construction Avian Monitoring Study for the Shiloh Ii Wind Power Project, Solano County, California. Year One Report. Prepared for enXco Development Inc. Prepared by Curry and Kerlinger, LLC, McLean, Virginia. September 2010. Available online at: https://www.solanocounty.com/civicax/filebank/blobdload.aspx?blobid=12118

Kerlinger, P., R. Curry, L. Culp, A. Jain, C. Wilkerson, B. Fischer, and A. Hasch. 2006. Post-Construction Avian and Bat Fatality Monitoring Study for the High Winds Wind Power Project, Solano County, California: Two Year Report. Prepared for High Winds LLC, FPL Energy. Prepared by Curry and Kerlinger, LLC, MacLean, Virginia. April 2006. Available online at: http://www.co.solano.ca.us/civicax/filebank/blobdload.aspx?blobid=8915

Kerlinger, P., R. Curry, A. Hasch, and J. Guarnaccia. 2007. Migratory Bird and Bat Monitoring Study at the Crescent Ridge Wind Power Project, Bureau County, Illinois: September 2005 - August 2006. Final draft prepared for Orrick Herrington and Sutcliffe, LLP. May 2007.

Kerlinger, P., R. Curry, A. Hasch, J. Guarnaccia, and D. Riser-Espinoza. 2013a. Post-Construction Bird and Bat Studies at the Shiloh Ii Wind Project, Llc, Solano County, California. Final Report. Prepared for EDF Renewable Energy (formerly known as enXco). Prepared by Curry and Kerlinger, LLC, McLean, Virginia. December 2012 (Revised June 2013).

Kerlinger, P., R. Curry, A. Hasch, J. Guarnaccia, and D. Riser-Espinoza. 2013b. Post-Construction Bird and Bat Studies at the Shiloh Iii Wind Project, Llc, Solano County, California. Report on Year 1 Results. Prepared for EDF Renewable Energy (formerly known as enXco). Prepared by Curry and Kerlinger, LLC, McLean, Virginia. August 2013.

Kerlinger, P., J. Guarnaccia, R. Curry, and C. J. Vogel. 2014. Bird and Bat Fatality Study, Heritage Garden I Wind Farm, Delta County, Michigan: 2012-2014. Prepared for Heritage Sustainable Energy, LLC. Prepared by Curry and Kerlinger, LLC, McLean, Virginia. November 2014.

Kerlinger, P., J. Guarnaccia, L. Slobodnik, and R. Curry. 2011a. A Comparison of Bat Mortality in Farmland and Forested Habitats at the Noble Bliss and Wethersfield Windparks, Wyoming County, New York. Report Prepared for Noble Environmental Power. Report prepared by Curry & Kerlinger, LLC, Cape May Point, New Jersey. November 2011.

Kerlinger, P., D. S. Reynolds, J. Guarnaccia, L. Slobodnik, and R. Curry. 2011b. An Examination of the Relationship between Bat Abundance and Fatalities at the Noble Altona Windpark, Clinton County, New York. Report prepared for Noble Environmental Power. Report prepared by Curry & Kerlinger, LLC, Cape May Point, New Jersey, and North East Ecological Services. December 2011.

Kerns, J. and P. Kerlinger. 2004. A Study of Bird and Bat Collision Fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003. Prepared for FPL Energy and the Mountaineer Wind Energy Center Technical Review Committee. February 14, 2004. 39 pp.

Krenz, J. D. and B. R. McMillan. 2000. Final Report: Wind-Turbine Related Bat Mortality in Southwestern Minnesota. Minnesota Department of Natural Resources, St. Paul, Minnesota.

Kronner, K., B. Gritski, and S. Downes. 2008. Big Horn Wind Power Project Wildlife Fatality Monitoring Study: 2006−2007. Final report prepared for PPM Energy and the Big Horn Wind Project Technical Advisory Committee by Northwest Wildlife Consultants, Inc. (NWC), Mid-Columbia Field Office, Goldendale, Washington. June 1, 2008.

Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007. Ecological Impacts of Wind Energy Development on Bats: Questions, Hypotheses, and Research Needs. In press. Frontiers in Ecology and the Environment 5.

Lausen, C. 2009. Status of the Northern Myotis (Myotis Septentrionalis) in Alberta. Alberta Wildlife Status Report No. 3: (Update 2009).

Leddy, K. L., K. F. Higgins, and D. E. Naugle. 1999. Effects of Wind Turbines on Upland Nesting Birds in Conservation Reserve Program Grasslands. Wilson Bulletin 111(1): 100-104.

Liguori, J. 2005. Hawks from Every Angle: How to Identify Raptors in Flight. Princeton University Press, Princeton, New Jersey.

Martin, C., E. Arnett, and M. Wallace. 2013. Evaluating Bird and Bat Post-Construction Impacts at the Sheffield Wind Facility, Vermont: 2012 Annual Report. Prepared for Bat Conservation International and First Wind. Prepared by Department of Natural Resources Management, Texas Tech University, Lubbock, Texas. March 25, 2013.

Miller, A. 2008. Patterns of Avian and Bat Mortality at a Utility-Scaled Wind Farm on the Southern High Plains. Thesis. Texas Tech University,

Minnesota Public Utilities Commission (MPUC). 2012. Lakefield Wind Project Avian and Bat Fatality Monitoring. MPUC Site Permit Quarterly Report and USFWS Special Purpose – Utility (Avian Take Monitoring) 30-Day Report: April 1 – September 30, 2012. USFWS Permit No: MB70161A-0; MDNR Permit No: 17930; MPUC Permit No: IP-6829/WS-09-1239, Permit Special Condition VII.B. October 15, 2012.

National Audubon Society (Audubon). 2016. The Important Bird Areas. Data accessed June 2016. Audubon homepage: http://www.audubon.org/. IBAs by state available online: http://www.audubon.org/bird/iba

National Research Council (NRC). 2007. Environmental Impacts of Wind-Energy Projects. National Academies Press. Washington, D.C. www.nap.edu

National Research Council (NRC). 2010. Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use. National Academies Press, Washington, D.C.,

National Wind Coordinating Collaborative (NWCC). 2004. Wind Turbine Interactions with Birds and Bats: A Summary of Research Results and Remaining Questions. Fact Sheet. 2nd Edition. November 2004. Available online at: http://nationalwind.org/wp-content/uploads/assets/archive/Wind_Turbine_Interactions_with_Birds_and_Bats_-_A_Summary_of_Research_Results_and_Remaining_Questions__2004_.pdf

National Wind Coordinating Collaborative (NWCC). 2010. Wind Turbine Interactions with Birds, Bats, and Their Habitats: A Summary of Research Results and Priority Questions. NWCC c/o RESOLVE, Washington, D.C. Available online at: http://www.nationalwind.org/publications/bbfactsheet.aspx

Natural Resource Solutions Inc. (NRSI). 2011. Harrow Wind Farm 2010 Post-Construction Monitoring Report. Project No. 0953. Prepared for International Power Canada, Inc., Markham, Ontario. Prepared by NRSI. August 2011.

New Jersey Audubon Society (NJAS). 2008a. Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority - Jersey Atlantic Wind Power Facility: Periodic Report Covering Work Conducted between 1 August and 30 September 2008. Submitted to New Jersey Board of Public Utilities, New Jersey Clean Energy Program, Newark, New Jersey. Submitted by New Jersey Audubon Society, Center for Research and Education, Cape May Court House, New Jersey. Available online at: http://www.njcleanenergy.com/files/file/Renewable_Programs/Wind/ACUA_Interim%20Report_Jan-Sep08_all.pdf

New Jersey Audubon Society (NJAS). 2008b. Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority - Jersey Atlantic Wind Power Facility: Periodic Report Covering Work Conducted between 20 July and 31 December 2007. Submitted to New Jersey Board of Public Utilities, New Jersey Clean Energy Program, Newark, New Jersey. Submitted by New Jersey Audubon Society, Center for Research and Education, Cape May Court House, New Jersey. Available online at: http://www.njcleanenergy.com/files/file/Renewable_Programs/CORE/ACUAReportwithimages123107LowRes.pdf

New Jersey Audubon Society (NJAS). 2009. Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority - Jersey Atlantic Wind Power Facility: Project Status Report Iv. Available online at: http://www.njcleanenergy.com/files/file/Renewable_Programs/Wind/ACUA_Quarterly%20report_to-date_Jan-Aug09_1c.pdf

Nicholson, C. P., J. R.D. Tankersley, J. K. Fiedler, and N. S. Nicholas. 2005. Assessment and Prediction of Bird and Bat Mortality at Wind Energy Facilities in the Southeastern United States. Final Report. Tennessee Valley Authority, Knoxville, Tennessee.

Normandeau Associates, Inc. 2010. Stetson Mountain Ii Wind Project Year 1 Post-Construction Avian and Bat Mortality Monitoring Study, T8 R4 Nbpp, Maine. Prepared for First Wind, LLC, Portland, Maine. Prepared by Normandeau Associates, Inc., Falmouth, Maine. December 2, 2010.

Normandeau Associates, Inc. 2011. Year 3 Post-Construction Avian and Bat Casualty Monitoring at the Stetson I Wind Farm, T8 R4 Nbpp, Maine. Prepared for First Wind Energy, LLC, Portland, Maine. Prepared by Normandeau Associates, Inc., Falmouth, Maine. December 2011.

North American Datum (NAD). 1983. Nad83 Geodetic Datum.

North Dakota Industrial Commission. 2002. North Dakota Geological Survey Homepage. Geological Survey, Department of Mineral Resources, North Dakota Industrial Commission. Caves in North Dakota. Online at: https://www.dmr.nd.gov/ndgs/ndnotes/caves/caves_h.asp

North Dakota Industrial Commission. 2013. Oil and Gas Homepage. Oil and Gas Division, Department of Mineral Resources, North Dakota Industrial Commission. Available online at: https://www.dmr.nd.gov/oilgas/

Northwest Wildlife Consultants, Inc. (NWC) and Western EcoSystems Technology, Inc. (WEST). 2007. Avian and Bat Monitoring Report for the Klondike Ii Wind Power Project. Sherman County, Oregon. Prepared for PPM Energy, Portland, Oregon. Managed and conducted by NWC, Pendleton, Oregon. Analysis conducted by WEST, Cheyenne, Wyoming. July 17, 2007.

Osborn, R. G., K. F. Higgins, C. D. Dieter, and R. E. Usgaard. 1996. Bat Collisions with Wind Turbines in Southwestern Minnesota. Bat Research News 37: 105-108.

Osborn, R. G., K. F. Higgins, R. E. Usgaard, C. D. Dieter, and R. G. Neiger. 2000. Bird Mortality Associated with Wind Turbines at the Buffalo Ridge Wind Resource Area, Minnesota. American Midland Naturalist 143: 41-52.

Pardieck, K. L., D. J. Ziolkowski, Jr., M. A. R. Hudson, and K. Campbell. 2016. North American Breeding Bird Survey Dataset 1966 - 2015, Version 2015.1. US Geological Survey, Patuxent Wildlife Research Center. Information available online at: www.pwrc.usgs.gov/BBS/RawData/

Piorkowski, M. D. 2006. Breeding Bird Habitat Use and Turbine Collisions of Birds and Bats Located at a Wind Farm in Oklahoma Mixed-Grass Prairie. Thesis. Oklahoma State University, Stillwater, Oklahoma. 112 pp. July 2006. http://www.batsandwind.org/pdf/Piorkowski_2006.pdf

Piorkowski, M. D. and T. J. O'Connell. 2010. Spatial Pattern of Summer Bat Mortality from Collisions with Wind Turbines in Mixed-Grass Prairie. American Midland Naturalist 164: 260-269.

Poulton, V. and W. P. Erickson. 2010. Post-Construction Bat and Bird Fatality Study, Judith Gap Wind Farm, Wheatland County, Montana. Final Report: Results from June-October 2009 Study and Comparison with 2006-2007 Study. Prepared for Judith Gap Energy, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 2010.

Pruitt, L. and J. Okajima. 2014. Indiana Bat Fatalities at Wind Energy Facilities. US Fish and Wildlife Service (USFWS) Bloomington Indiana Field Office. Update December 2014. Available online at: http://www.fws.gov/midwest/wind/wildlifeimpacts/pdf/IndianaBatFatalitiesUpdatedDec2014.pdf

Sapphos Environmental, Inc. (Sapphos). 2014. Pacific Wind Energy Project: Year I Avian and Bat Fatality Monitoring Report. Prepared for Pacific Wind, LLC, San Diego, California. Prepared by Sapphos, Pasadena, California. September 15, 2014.

Shaffer, J. A. and D. A. Buhl. 2015. Effects of Wind-Energy Facilities on Breeding Grassland Bird Distributions. Conservation Biology: doi: 10.1111/cobi.12569.

Stantec Consulting, Inc. (Stantec). 2008. 2007 Spring, Summer, and Fall Post-Construction Bird and Bat Mortality Study at the Mars Hill Wind Farm, Maine. Prepared for UPC Wind Management, LLC, Cumberland, Maine. Prepared by Stantec (formerly Woodlot Alternatives, Inc.), Topsham, Maine. January 2008.

Stantec Consulting, Inc. (Stantec). 2009a. Post-Construction Monitoring at the Mars Hill Wind Farm, Maine - Year 2, 2008. Prepared for First Wind Management, LLC, Portland, Maine. Prepared by Stantec Consulting, Topsham, Maine. January 2009.

Stantec Consulting, Inc. (Stantec). 2009b. Post-Construction Monitoring at the Munnsville Wind Farm, New York: 2008. Prepared for E.ON Climate and Renewables, Austin, Texas. Prepared by Stantec Consulting, Topsham, Maine. January 2009.

Stantec Consulting, Inc. (Stantec). 2009c. Stetson I Mountain Wind Project: Year 1 Post-Construction Monitoring Report, 2009 for the Stetson Mountain Wind Project in Penobscot and Washington Counties, Maine. Prepared for First Wind Management, LLC. Portland, Maine. Prepared by Stantec, Topsham, Maine. December 2009.

Stantec Consulting, Inc. (Stantec). 2010. Cohocton and Dutch Hill Wind Farms Year 1 Post-Construction Monitoring Report, 2009, for the Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. January 2010.

Stantec Consulting, Inc. (Stantec). 2011a. Cohocton and Dutch Hill Wind Farms Year 2 Post-Construction Monitoring Report, 2010, for the Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Prepared for Canandaigua Power Partners, LLC, and Canandaigua Power Partners II, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. October 2011.

Stantec Consulting, Inc. (Stantec). 2011b. Post-Construction Monitoring 2010 Final Annual Report – Year 1, Milford Wind Corridor Phase I, Milford, Utah. Prepared for First Wind Management, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. August 2011.

Stantec Consulting, Inc. (Stantec). 2012a. 2011 Post-Construction Monitoring Report, Kibby Wind Power Project, Franklin County, Maine. Prepared for TransCanada Hydro Northeast, Inc., North Walpole, New Hampshire. Prepared by Stantec, Topsham, Maine. March 2012.

Stantec Consulting, Inc. (Stantec). 2012b. Post-Construction Monitoring 2011 - 2012, Milford Wind Corridor Phase I and Ii, Milford, Utah. Prepared for First Wind Management, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. May 2012.

Stantec Consulting, Inc. (Stantec). 2013a. Palouse Wind Post-Construction Wildlife Monitoring Report, 2012-2013. Prepared for Palouse Wind, Whitman County, Washington. Prepared by Stantec, Topsham, Maine. December 2013.

Stantec Consulting, Inc. (Stantec). 2013b. Record Hill Wind Project Post-Construction Monitoring Report, 2012. Prepared for Record Hill Wind LLC, Lyme, New Hampshire. Prepared by Stantec, Topsham, Maine. March 2013. Available online at: http://www.maine.gov/dep/ftp/WindPowerProjectFiles/PostConstructionMonitoring/RH%202012%20PCM%20Report_031313.pdf

Stantec Consulting, Inc. (Stantec). 2013c. Rollins Wind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, Portland, Maine. Prepared by Stantec, Topsham, Maine. March 2013.

Stantec Consulting, Inc. (Stantec). 2013d. Steel Winds I and Ii Post-Construction Monitoring Report, 2012, Lackwanna and Hamburg, New York. Prepared for First Wind Management, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. April 2013.

Stantec Consulting, Inc. (Stantec). 2013e. Stetson Ii Wind Project Post-Construction Monitoring Report, 2012. Prepared for First Wind, Portland, Maine. Prepared by Stantec, Topsham, Maine. March 2013.

Stantec Consulting, Inc. (Stantec). 2014. Stetson I Wind Project 2013 Post-Construction Wildlife Monitoring Report, Year 5. Stetson I Wind Project, Washington County, Maine. Prepared for First Wind, Portland, Maine. Prepared by Stantec, Topsham, Maine. February 2014.

Stantec Consulting, Inc. (Stantec). 2015. Record Hill Wind Project Year 2 Post-Construction Wildlife Monitoring Report, 2014. Prepared for Record Hill Wind LLC and Wagner Forest Management, Ltd., Lyme, New Hampshire. Prepared by Stantec Consulting, Topsham, Maine. March 2015.

Stantec Consulting Ltd. (Stantec Ltd.). 2008. Melancthon I Wind Plant Post-Construction Bird and Bat Monitoring Report: 2007. File No. 160960220. Prepared for Canadian Hydro Developers, Inc., Guelph, Ontario. Prepared by Stantec Ltd., Guelph, Ontario. June 2008.

Stantec Consulting Ltd. (Stantec Ltd.). 2010a. Wolfe Island Ecopower Centre Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 1: May - June 2009. File No. 160960494. Prepared for Canadian Hydro Developers, Inc.'s wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Ltd., Guelph, Ontario. February 2010.

Stantec Consulting Ltd. (Stantec Ltd.). 2010b. Wolfe Island Ecopower Centre Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 2: July - December 2009. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Ltd., Guelph, Ontario. May 2010.

Stantec Consulting Ltd. (Stantec Ltd.). 2011a. Wolfe Island Wind Plant Post-Construction Follow-up Plan. Bird and Bat Resources Monitoring Report No. 3: January - June 2010. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. January 2011.

Stantec Consulting Ltd. (Stantec Ltd.). 2011b. Wolfe Island Wind Plant Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 4: July - December 2010. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. July 2011.

Stantec Consulting Ltd. (Stantec Ltd.). 2011c. Wolfe Island Wind Plant Post-Construction Followup Plan. Bird and Bat Resources Monitoring Report No. 5: January - June 2011. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. December 2011.

Stantec Consulting Ltd. (Stantec Ltd.). 2012. Wolfe Island Wind Plant Post-Construction Follow-up Plan. Bird and Bat Resources Monitoring Report No. 6: July-December 2011. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. July 2012.

Stantec Consulting Ltd. (Stantec Ltd.). 2014. Wolfe Island Wind Plant Post-Construction Follow-up Plan. Bird and Bat Resources Monitoring Report No. 7: January - June 2012. File No. 160960494. Prepared for TransAlta Corporation's wholly owned subsidiary, Canadian Renewable Energy Corporation. Prepared by Stantec Consulting Ltd., Guelph, Ontario. April 2014. Available online at: http://www.transalta.com/sites/default/files/WolfeIsland_TransAlta_PostConstruction_BirdBat_Report_7.pdf

Stantec Consulting Services, Inc. (Stantec Consulting). 2012. Post-Construction Monitoring, Summer 2011 - Spring 2012. Year 1 Annual Report. Kittitas Valley Wind Power Project, Cle Elum, Washington. Prepared for Sagebrush Power Partners, LLC, Houston, Texas. Prepared by Stantec Consulting, Salt Lake City, Utah.

Stantec Consulting Services, Inc. (Stantec Consulting). 2013. Kittitas Valley Wind Power Project, Cle Elum, Washington. Post-Construction Monitoring: Summer 2012 - Spring 2013. Year 2 Annual Report. Prepared for Sagebrush Power Partners LLC, Houston Texas. Prepared by Stantec Consulting, Salt Lake City, Utah.

Strickland, M. D., E. B. Arnett, W. P. Erickson, D. H. Johnson, G. D. Johnson, M. L. Morrison, J. A. Shaffer, and W. Warren-Hicks. 2011. Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. Prepared for the National Wind Coordinating Collaborative (NWCC), Washington, D.C., USA. June 2011. Available online at: http://www.batsandwind.org/pdf/Comprehensive_Guide_to_Studying_Wind_Energy_Wildlife_Interactions_2011.pdf

Sullivan, B. L., J. L. Aycrigg, J. H. Barry, R. E. Bonney, N. Bruns, C. B. Cooper, T. Damoulas, A. A. Dhondt, T. Dietterich, A. Farnsworth, D. Fink, J. W. Fitzpatrick, T. Fredericks, J. Gerbracht, C. Gomes, W. M. Hochachka, M. J. Iliff, C. Lagoze, F. A. La Sorte, M. Merrifield, W. Morris, T. B. Phillips, M. Reynolds, A. D. Rodewald, K. V. Rosenberg, N. M. Trautmann, A. Wiggins, D. W. Winkler, W.-K. Wong, C. L. Wood, J. Yu, and S. Kelling. 2014. The Ebird Enterprise: An Integrated Approach to Development and Application of Citizen Science. Biological Conservation 169: 31-40. doi: 10.1016/j.biocon.2013.11.003.

Tetra Tech. 2013. Spruce Mountain Wind Project Post-Construction Bird and Bat Fatality and Raptor Monitoring: Year 1 Annual Report. Prepared for Patriot Renewables. Prepared by Tetra Tech, Portland, Maine. May 2013.

Thompson, B. C., J. A. Jackson, J. Burger, L. A. Hill, E. M. Kirsch, and J. L. Atwood. 1997. Least Tern (Sternula Antillarum). A. Poole, ed. The Birds of North America Online. Cornell Lab of Ornithology, Ithaca, New York. Accessed June 17, 2011. Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/290; doi: 10.2173/bna.290

Thompson, J. and K. Bay. 2012. Post-Construction Fatality Surveys for the Dry Lake Ii Wind Project: February 2011 – February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 6, 2012.

Thompson, J., D. Solick, and K. Bay. 2011. Post-Construction Fatality Surveys for the Dry Lake Phase I Wind Project. Iberdrola Renewables: September 2009 - November 2010. Prepared for Iberdrola Renewables, Portland, Oregon. Prepared by Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming. February 10, 2011.

Tidhar, D., L. McManus, Z. Courage, and W. L. Tidhar. 2012a. 2010 Post-Construction Fatality Monitoring Study and Bat Acoustic Study for the High Sheldon Wind Farm, Wyoming County, New York. Final Report: April 15 - November 15, 2010. Prepared for High Sheldon Wind Farm, Sheldon Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Waterbury, Vermont. April 15, 2012.

Tidhar, D., L. McManus, D. Solick, Z. Courage, and K. Bay. 2012b. 2011 Post-Construction Fatality Monitoring Study and Bat Acoustic Study for the High Sheldon Wind Farm, Wyoming County, New York. Final Report: April 15 - November 15, 2011. Prepared for High Sheldon Wind Farm, Sheldon Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Waterbury, Vermont. April 25, 2012.

Tidhar, D., J. Ritzert, M. Sonnenberg, M. Lout, and K. Bay. 2013a. 2012 Post-Construction Fatality Monitoring Study for the Maple Ridge Wind Farm, Lewis County, New York. Final Report: July 12 - October 15, 2012. Prepared for EDP Renewables North, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), NE/Mid-Atlantic Branch, Waterbury, Vermont. February 12, 2013.

Tidhar, D., M. Sonnenberg, and D.P. Young, Jr. 2013b. 2012 Post-Construction Carcass Monitoring Study for the Beech Ridge Wind Farm, Greenbrier County, West Virginia. Final Report: April 1 - October 28, 2012. Prepared for Beech Ridge Wind Farm, Beech Ridge Energy, LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), NE/Mid-Atlantic Branch, Waterbury, Vermont. January 18, 2013.

Tidhar, D., W. Tidhar, and M. Sonnenberg. 2010. Post-Construction Fatality Surveys for Lempster Wind Project, Iberdrola Renewables. Prepared for Lempster Wind, Llc, Lempster Wind Technical Advisory Committee, and Iberdrola Renewables, Inc. Prepared by Western EcoSystems Technology Inc. (WEST), Waterbury, Vermont. September 30, 2010.

Tidhar, D., W. L. Tidhar, L. McManus, and Z. Courage. 2011. 2010 Post-Construction Fatality Surveys for the Lempster Wind Project, Lempster, New Hampshire. Prepared for Iberdrola Renewables, Inc. and the Lempster Wind Technical Committee. Prepared by Western EcoSystems Technology, Inc., Waterbury, Vermont. May 18, 2011.

Tierney, R. 2007. Buffalo Gap I Wind Farm Avian Mortality Study: February 2006-January 2007. Final Survey Report. Prepared for AES SeaWest, Inc. TRC, Albuquerque, New Mexico. TRC Report No. 110766-C-01. May 2007.

Tierney, R. 2009. Buffalo Gap 2 Wind Farm Avian Mortality Study: July 2007 - December 2008. Final Survey Report. Submitted by TRC, Albuquerque, New Mexico. TRC Report No. 151143-B-01. June 2009.

TRC Environmental Corporation. 2008. Post-Construction Avian and Bat Fatality Monitoring and Grassland Bird Displacement Surveys at the Judith Gap Wind Energy Project, Wheatland County, Montana. Prepared for Judith Gap Energy, LLC, Chicago, Illinois. TRC Environmental Corporation, Laramie, Wyoming. TRC Project 51883-01 (112416). January 2008.

URS Corporation. 2010a. Final Goodnoe Hills Wind Project Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 16, 2010.

URS Corporation. 2010b. Final Marengo I Wind Project Year One Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 22, 2010.

URS Corporation. 2010c. Final Marengo Ii Wind Project Year One Avian Mortality Monitoring Report. Prepared for PacifiCorp, Salt Lake City, Utah. Prepared by URS Corporation, Seattle, Washington. March 22, 2010.

US Environmental Protection Agency (USEPA). 2010. Level Iii and Iv Ecoregion Metadata. March 1, 2010 (Ver. 20100201). National Health and Environmental Effects Research Laboratory, USEPA. Available online at http://www.epa.gov/wed/pages/ecoregions.htm; Level III ecoregions of the continental United States available at http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm; Level IV Ecoregion data available online at: ftp://ftp.epa.gov/wed/ecoregions/

US Fish and Wildlife Service (USFWS). 1998. Fact Sheet: Pallid Sturgeon (Scaphirhynchus Albus). Endangered Species, Midwest Region, USFWS. March 1998. Last updated April 14, 2015. Accessed August 2016. Information available online at: https://www.fws.gov/midwest/endangered/fishes/PallidSturgeon/palld_fc.html

US Fish and Wildlife Service (USFWS). 2002a. Birds of Conservation Concern 2002. USFWS Division of Migratory Bird Management December 2002. Arlington, Virginia.

US Fish and Wildlife Service (USFWS). 2002b. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Northern Great Plains Breeding Population of the Piping Plover; Final Rule. Department of the Interior Fish and Wildlife Service. 50 Code of Federal Regulations (CFR) Part 17. RIN 1018-AH96. 67 Federal Register (FR) 176: 57638-57717. September 11, 2002. Available online at: http://ecos.fws.gov/docs/federal_register/fr3943.pdf

US Fish and Wildlife Service (USFWS). 2007. Indiana Bat (Myotis Sodalis) Draft Recovery Plan: First Revision. US Department of Interior, Fish and Wildlife Service, Region 3. USFWS. Fort Snelling, Minnesota. 260 pp. Available online at: http://ecos.fws.gov/docs/recovery_plan/070416.pdf

US Fish and Wildlife Service (USFWS). 2008. Birds of Conservation Concern 2008. December 2008. Division of Migratory Bird Management. Arlington, Virginia. Available online at: https://www.fws.gov/migratorybirds/pdf/grants/BirdsofConservationConcern2008.pdf

US Fish and Wildlife Service (USFWS). 2010. U.S. Fish and Wildlife Service and Wind Farm Owners Work Together. News release prepared by G. Parham, USFWS. February 8, 2010.

US Fish and Wildlife Service (USFWS). 2011a. U.S. Fish and Wildlife Service Seeks Input on Developing Indiana Bat Habitat Conservation Plan for Wind Facility in Benton County. News release prepared by G. Parham, USFWS. May 25, 2011. Available online at: http://www.fws.gov/midwest/Endangered/permits/hcp/FowlerRidge/NR_FowlerNOI25May2011.html; Information on fatalities at: http://www.fws.gov/midwest/Endangered/permits/hcp/FowlerRidge/FowlerRidgeSummary.html

US Fish and Wildlife Service (USFWS). 2011b. U.S. Fish and Wildlife Service Statement on Indiana Bat Fatality at North Allegheny Wind Facility. Lowell Whitney, Northeast Regional HCP Coordinator, USFWS.

US Fish and Wildlife Service (USFWS), in Press Release: November 29, 2012. Last updated: June 15, 2016. (2012a). Information available at: https://www.fws.gov/midwest/news/604.html

US Fish and Wildlife Service (USFWS). 2012b. Endangered Indiana Bat Found Dead at Ohio Wind Facility; Steps Underway to Reduce Future Mortalities. Newsroom, Midwest Region, USFWS. November 29, 2012. Available online at: http://www.fws.gov/midwest/news/604.html

US Fish and Wildlife Service (USFWS). 2012c. Indiana Bat Fatality at West Virginia Wind Facility. West Virginia Field Office, Northeast Region, USFWS. Last updated August 23, 2012. Available online at: http://www.fws.gov/westvirginiafieldoffice/ibatfatality.html

US Fish and Wildlife Service (USFWS). 2012d. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online at: http://www.fws.gov/cno/pdf/Energy/2012_Wind_Energy_Guidelines_final.pdf

US Fish and Wildlife Service (USFWS). 2012e. Piping Plover. Endangered Species, USFWS, Mountain-Prairie Region. Updated September 4, 2012. Available online at: https://www.fws.gov/mountain-prairie/es/species/birds/pipingplover/

US Fish and Wildlife Service (USFWS). 2013a. 2013 Revised Range-Wide Indiana Bat Summer Survey Guidelines. May 2013. Available online at: http://www.fws.gov/arkansas-es/docs/FinalRevised2013IndianaBatSummerSurveyGuidelines5May2013.pdf

US Fish and Wildlife Service (USFWS). 2013b. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species. Docket No. FWS-R5-ES-2011-0024. 78 Federal Register (FR) 191: 61046-61080. October 2, 2013.

US Fish and Wildlife Service (USFWS). 2013c. Least Tern (Sterna Antillarum). 5-Year Review: Summary and Evaluation. USFWS, Southeast Region, Mississippi Field Office, Jackson, Mississippi. October 24, 2013. Available online at: http://ecos.fws.gov/docs/five_year_review/doc4294.pdf

US Fish and Wildlife Service (USFWS). 2013d. Species Profile: Whooping Crane (Grus Americana). USFWS Environmental Conservation Online System (ECOS). Updated March, 2013. ECOS available at: http://ecos.fws.gov/ecos/indexPublic.do; Whooping crane profile available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B003

US Fish and Wildlife Service (USFWS). 2014a. Northern Long-Eared Bat Interim Conference and Planning Guidance. USFWS Regions 2, 3, 4, 5, and 6. January 6, 2014. Available online at: http://www.fws.gov/northeast/virginiafield/pdf/NLEBinterimGuidance6Jan2014.pdf

US Fish and Wildlife Service (USFWS). 2014b. Revised Recovery Plan for the Pallid Sturgeon (Scaphirhynchus Albus). USFWS, Denver, Colorado. 115 pp. + frontmatter. Available online at: http://ecos.fws.gov/docs/recovery_plan/Pallid%20Sturgeon%20Recovery%20Plan%20First%20Revision%20signed%20version%20012914_3.pdf

US Fish and Wildlife Service (USFWS). 2015. Red Knot (Calidris Canutus Rufa). Species Profile and Species Assessment Form. USFWS Environmental Conservation Online System (ECOS). Updated January 2015. ECOS available at: http://ecos.fws.gov/ecos/indexPublic.do; Red knot species profile and species assessment form available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0DM

US Fish and Wildlife Service (USFWS). 2016. Species by County Report. Environmental Conservation Online System (ECOS). Accessed December 2016. Williams County report available online at: https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=38105

US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). 2014. Nwi Data Mapper. Updated May 1, 2014. Fort Snelling, Minnesota. Wetlands Mapper: http://www.fws.gov/wetlands/Data/Mapper.html

US Geological Survey (USGS). 2001. North American Bbs Methodology Training. Accessed October 2016. USGS Breeding Bird Surveys (BBS), Patuxent Wildlife Research Center. Laurel, Maryland. Methodology Training available online at: http://www.pwrc.usgs.gov/BBS/participate/training/; Description and Methods available online at: http://www.pwrc.usgs.gov/BBS/participate/training/1.html

US Geological Service (USGS) National Elevation Dataset (NED). 2012. The National Map. Raster digital data. Available online: http://nationalmap.gov/elevation.html

US Geological Survey (USGS) Protected Areas of the US (PADUS) Viewer. 2012. USGS National Gap Analysis Program. Accessed September 5, 2012. Information available online at: http://gis1.usgs.gov/csas/gap/viewer/padus/Map.aspx

US Geological Survey (USGS). 2015. National Hydrography Dataset (Nhd). USGS NHD Extracts: North Dakota. Last accessed August 2015. Information available online at: http://nhd.usgs.gov/; State data available online at: ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/HighResolution/

US Geological Survey (USGS). 2016. Information on Routes. North American Breeding Bird Survey, Patuxent Wildlife Research Center, USGS. Accessed August 2016. Online at: https://www.pwrc.usgs.gov/BBS/RouteMap/Map.cfm#

US Geological Survey (USGS) National Land Cover Data (NLCD). 2011. National Land Cover Database Nlcd, Muti-Resolution Land Characteristics Consortium (Mrlc). Usgs Earth Resources Observation and Science (Eros) Center, Sioux Falls, South Dakota. Information available online at: http://www.mrlc.gov/nlcd11_leg.php

US Geological Survey (USGS) National Land Cover Database (NLCD). 2011. National Land Cover Database 2011 (Nlcd 2011). Multi-Resolution Land Characteristics Consortium (MRLC), National Land Cover Database (NLCD). USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. Available online at: http://www.mrlc.gov/nlcd2011.php; Legend at: http://www.mrlc.gov/nlcd11_leg.php

USA Topo. 2015. USA Topo Maps. US Geological Survey (USGS) topographical maps for the United States. ArcGIS. ESRI, producers of ArcGIS software. Redlands, California.

Ventus Environmental Solutions (Ventus). 2012. Vantage Wind Energy Center Avian and Bat Monitoring Study: March 2011- March 2012. Prepared for Vantage Wind Energy, LLC, Chicago, Illinois. Prepared by Ventus, Portland, Oregon. May 16, 2012.

Western EcoSystems Technology, Inc. (WEST). 2006. Diablo Winds Wildlife Monitoring Progress Report, March 2005 - February 2006. Technical report submitted to FPL Energy and Alameda County California. WEST. Cheyenne, Wyoming.

Western EcoSystems Technology, Inc. (WEST). 2008. Diablo Winds Wildlife Monitoring Progress Report: March 2005 – February 2007. Prepared by WEST, Cheyenne, Wyoming. August 2008.

Western EcoSystems Technology, Inc. (WEST). 2011. Post-Construction Fatality Surveys for the Barton Chapel Wind Project: Iberdrola Renewables. Version: July 2011. Iberdrola Renewables, Portland, Oregon.

Western EcoSystems Technology, Inc. (WEST). 2016a. Stage 1 Initial Site Assessment of Eagle Use/Risk. Aurora Wind Energy Project, Williams County, North Dakota. Prepared for Aurora Wind, Llc., Lenaxa, Kansas. Prepared by West, Bismarck, North Dakota. October 31, 2016.

Western Ecosystems Technology, Inc. (WEST). 2016b. Whooping Crane Habitat Review. Aurora Wind Energy Project, Williams County, North Dakota. Prepared for Aurora Wind, Llc., Lenaxa, Kansas. Prepared by West, Bismarck, North Dakota. October 10, 2016.

Young, D.P., Jr., K. Bay, S. Nomani, and W. Tidhar. 2009a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: March - June 2009. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. August 17, 2009.

Young, D.P., Jr., K. Bay, S. Nomani, and W. Tidhar. 2010a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: April - July 2010. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 27, 2010.

Young, D.P., Jr., K. Bay, S. Nomani, and W. Tidhar. 2010b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2009. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 12, 2010.

Young, D.P., Jr., W. P. Erickson, K. Bay, S. Nomani, and W. Tidhar. 2009b. Mount Storm Wind Energy Facility, Phase 1 Post-Construction Avian and Bat Monitoring, July - October 2008. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 17, 2009.

Young, D.P., Jr., W. P. Erickson, R. E. Good, M. D. Strickland, and G. D. Johnson. 2003. Avian and Bat Mortality Associated with the Initial Phase of the Foote Creek Rim Windpower Project, Carbon County, Wyoming, Final Report, November 1998 - June 2002. Prepared for Pacificorp, Inc. Portland, Oregon, SeaWest Windpower Inc. San Diego, California, and Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming. January 10, 2003. Available online at: http://west-inc.com/reports/fcr_final_mortality.pdf

Young, D.P., Jr., W. P. Erickson, J. Jeffrey, and V. K. Poulton. 2007. Puget Sound Energy Hopkins Ridge Wind Project Phase 1 Post-Construction Avian and Bat Monitoring First Annual Report, January - December 2006. Technical report for Puget Sound Energy, Dayton, Washington and Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Western EcoSystems Technology, Inc. (WEST) Cheyenne, Wyoming, and Walla Walla, Washington. 25 pp.

Young, D.P., Jr., J. Jeffrey, W. P. Erickson, K. Bay, V. K. Poulton, K. Kronner, R. Gritski, and J. Baker. 2006. Eurus Combine Hills Turbine Ranch. Phase 1 Post Construction Wildlife Monitoring First Annual Report: February 2004 - February 2005. Technical report prepared for Eurus Energy America Corporation, San Diego, California, and the Combine Hills Technical Advisory Committee, Umatilla County, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla Washington, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. February 21, 2006. Available online at: http://wind.nrel.gov/public/library/young7.pdf

Young, D.P., Jr., J. D. Jeffrey, K. Bay, and W. P. Erickson. 2009c. Puget Sound Energy Hopkins Ridge Wind Project, Phase 1, Columbia County, Washington. Post-Construction Avian and Bat Monitoring, Second Annual Report: January - December, 2008. Prepared for Puget Sound Energy, Dayton, Washington, and the Hopkins Ridge Wind Project Technical Advisory Committee, Columbia County, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. May 20, 2009.

Young, D.P., Jr., M. Kauffman, M. Lout, and K. Bay. 2014a. 2013 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland. April - November 2013. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. February 18, 2014.

Young, D.P., Jr., M. Lout, Z. Courage, S. Nomani, and K. Bay. 2012a. 2011 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland: April - November 2011. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. April 20, 2012. Revised November 25, 2013.

Young, D.P., Jr., M. Lout, L. McManus, and K. Bay. 2014b. 2013 Post-Construction Monitoring Study, Beech Ridge Wind Energy Project, Greenbrier and Nicholas Counties, West Virginia. Final Report: April 1 - November 15, 2013. Prepared for Beech Ridge Energy, LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Burlington, Vermont. January 28, 2014.

Young, D.P., Jr., C. Nations, M. Lout, and K. Bay. 2013. 2012 Post-Construction Monitoring Study, Criterion Wind Project, Garrett County, Maryland. April - November 2012. Prepared for Criterion Power Partners, LLC, Oakland, Maryland. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Waterbury, Vermont. January 15, 2013.

Young, D.P., Jr., S. Nomani, Z. Courage, and K. Bay. 2011a. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: April - July 2011. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. August 29, 2011.

Young, D.P., Jr., S. Nomani, Z. Courage, and K. Bay. 2012b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2011. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 27, 2012.

Young, D.P., Jr., S. Nomani, W. Tidhar, and K. Bay. 2011b. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2010. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (WEST), Inc., Cheyenne, Wyoming. February 10, 2011.

Appendix A. Bird Species of Conservation Concern within the Prairie Potholes Region

Appendix A. US Fish and Wildlife Service Birds of Conservation Concern within the Bird Conservation Region 11 (Prairie Potholes) and their presence/absence on Breeding Bird Surveys conducted in the vicinity of the Aurora Wind Energy Project in Williams County, North Dakota.

Species	Recorded from 2012 - 2015 on Wild Rose Breeding Bird Survey Route?	Recorded from 2012 - 2015 on Powers Lake Breeding Bird Survey Route?
horned grebe	yes	no
American bittern	no	yes
least bittern	no	no
bald eagle	no	no
Swainson's hawk	yes	no
peregrine falcon	no	no
yellow rail	no	no
mountain plover	no	no
solitary sandpiper	no	no
upland sandpiper	yes	yes
long-billed curlew	no	no
Hudsonian godwit	no	no
marbled godwit	yes	yes
buff-breasted sandpiper	no	no
short-billed dowitcher	no	no
black tern	yes	yes
black-billed cuckoo	no	no
short-eared owl	no	yes
red-headed woodpecker	no	no
Sprague's pipit	yes	yes
grasshopper sparrow	yes	yes
Baird's sparrow	yes	yes
Nelson's sharp-tailed sparrow	no	no
McCown's longspur	no	no
Smith's longspur	no	no
chestnut-collared longspur	yes	yes
dickcissel	no	no

Sources: Pardieck et al. 2016, USFWS 2008.

Appendix B. Summary of Publicly Available Studies from North American Wind Energy Facilities that Report Bat Fatality Data

Appendix B. Summary of publicly available studies from North American wind energy facilities that report bat fatality data.

Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Alite, CA (09-10)	Chatfield et al. 2010	Maple Ridge, NY (07-08)	Jain et al. 2009d
Alta Wind I, CA (11-12)	Chatfield et al. 2012	Maple Ridge, NY (12)	Tidhar et al. 2013a
Alta Wind I-V, CA (13-14)	Chatfield et al. 2014	Marengo I, WA (09-10)	URS Corporation 2010b
Alta Wind II-V, CA (11-12)	Chatfield et al. 2012	Marengo II, WA (09-10)	URS Corporation 2010c
Alta VIII, CA (12-13)	Chatfield and Bay 2014	Mars Hill, ME (07)	Stantec 2008
Barton I & II, IA (10-11)	Derby et al. 2011a	Mars Hill, ME (08)	Stantec 2009a
Barton Chapel, TX (09-10)	WEST 2011	McBride, Alb (04)	Brown and Hamilton 2004
Beech Ridge, WV (12)	Tidhar et al. 2013b	Melancthon, Ont (Phase I; 07)	Stantec Ltd. 2008
Beech Ridge, WV (13)	Young et al. 2014b	Meyersdale, PA (04)	Arnett et al. 2005
Big Blue, MN (13)	Fagen Engineering 2014	Milford I, UT (10-11)	Stantec 2011b
Big Blue, MN (14)	Fagen Engineering 2015	Milford I & II, UT (11-12)	Stantec 2012b
Big Horn, WA (06-07)	Kronner et al. 2008	Montezuma I, CA (11)	ICF International 2012
Big Smile, OK (12-13)	Derby et al. 2013b	Montezuma I, CA (12)	ICF International 2013
Biglow Canyon, OR (Phase I; 08)	Jeffrey et al. 2009a	Montezuma II, CA (12-13)	Harvey & Associates 2013
Biglow Canyon, OR (Phase I; 09)	Enk et al. 2010	Moraine II, MN (09)	Derby et al. 2010d
Biglow Canyon, OR (Phase II; 09-10)	Enk et al. 2011a	Mount Storm, WV (Fall 08)	Young et al. 2009b
Biglow Canyon, OR (Phase II; 10-11)	Enk et al. 2012b	Mount Storm, WV (09)	Young et al. 2009a, 2010b
Biglow Canyon, OR (Phase III; 10-11)	Enk et al. 2012a	Mount Storm, WV (10)	Young et al. 2010a, 2011b
Blue Sky Green Field, WI (08; 09)	Gruver et al. 2009	Mount Storm, WV (11)	Young et al. 2011a, 2012b
Buena Vista, CA (08-09)	Insignia Environmental 2009	Mountaineer, WV (03)	Kerns and Kerlinger 2004
Buffalo Gap I, TX (06)	Tierney 2007	Mountaineer, WV (04)	Arnett et al. 2005
Buffalo Gap II, TX (07-08)	Tierney 2009	Munnsville, NY (08)	Stantec 2009b
Buffalo Mountain, TN (00-03)	Nicholson et al. 2005	Mustang Hills, CA (12-13)	Chatfield and Bay 2014
Buffalo Mountain, TN (05)	Fiedler et al. 2007	Nine Canyon, WA (02-03)	Erickson et al. 2003
Buffalo Ridge, MN (94-95)	Osborn et al. 1996, 2000	Nine Canyon II, WA (04)	Erickson et al. 2005
Buffalo Ridge, MN (00)	Krenz and McMillan 2000	Noble Altona, NY (10)	Jain et al. 2011b
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000	Noble Altona, NY (11)	Kerlinger et al. 2011b
Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000	Noble Bliss, NY (08)	Jain et al.2009e
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000	Noble Bliss, NY (09)	Jain et al. 2010a
Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000	Noble Bliss/Wethersfield, NY (11)	Kerlinger et al. 2011a
Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000	Noble Chateaugay, NY (10)	Jain et al. 2011c
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000	Noble Clinton, NY (08)	Jain et al. 2009c
Buffalo Ridge, MN (Phase II; 01/Lake Benton I)	Johnson et al. 2004	Noble Clinton, NY (09)	Jain et al. 2010b
Buffalo Ridge, MN (Phase II; 02/Lake Benton I)	Johnson et al. 2004	Noble Ellenburg, NY (08)	Jain et al. 2009b
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000	Noble Ellenburg, NY (09)	Jain et al. 2010c
Buffalo Ridge, MN (Phase III; 01/Lake Benton II)	Johnson et al. 2004	Noble Wethersfield, NY (10)	Jain et al. 2011a
Buffalo Ridge, MN (Phase III; 02/Lake Benton II)	Johnson et al. 2004	NPPD Ainsworth, NE (06)	Derby et al. 2007
Buffalo Ridge I, SD (09-10)	Derby et al. 2010b	Oklahoma Wind Energy Center, OK (04; 05)	Piorkowski and O'Connell 2010
Buffalo Ridge II, SD (11-12)	Derby et al. 2012a	Pacific, CA (12-13)	Sapphos 2014
Casselman, PA (08)	Arnett et al. 2009	Palouse Wind, WA (12-13)	Stantec 2013a
Casselman, PA (09)	Arnett et al. 2010	Pebble Springs, OR (09-10)	Gritski and Kronner 2010b
Castle River, Alb. (01)	Brown and Hamilton 2006a	Pine Tree, CA (09-10)	BioResource Consultants 2010
Castle River, Alb. (02)	Brown and Hamilton 2006a	Pinnacle, WV (12)	Hein et al. 2013a
Cedar Ridge, WI (09)	BHE Environmental 2010	Pinnacle Operational Mitigation Study (12)	Hein et al. 2013b
Cedar Ridge, WI (10)	BHE Environmental 2011	Pinyon Pines I & II, CA (13-14)	Chatfield and Russo 2014
Cohocton/Dutch Hill, NY (09)	Stantec 2010	Pioneer Prairie I, IA (Phase II; 11-12)	Chodachek et al. 2012
Cohocton/Dutch Hills, NY (10)	Stantec 2011a	Pioneer Prairie II, IA (13)	Chodachek et al. 2014
Combine Hills, OR (Phase I; 04-05)	Young et al. 2006	Pioneer Trail, IL (12-13)	ARCADIS U.S. 2013
Combine Hills, OR (11)	Enz et al. 2012	Prairie Rose, MN (14)	Chodachek et al. 2015
Condon, OR	Fishman Ecological Services 2003	PrairieWinds ND1 (Minot), ND (10)	Derby et al. 2011c
Crescent Ridge, IL (05-06)	Kerlinger et al. 2007	PrairieWinds ND1 (Minot), ND (11)	Derby et al. 2012c
Criterion, MD (11)	Young et al. 2012a	PrairieWinds SD1 (Crow Lake), SD (11-12)	Derby et al. 2012d
Criterion, MD (12)	Young et al. 2013	PrairieWinds SD1 (Crow Lake), SD (12-13)	Derby et al. 2013a
Criterion, MD (13)	Young et al. 2014a	PrairieWinds SD1 (Crow Lake), SD (13-14)	Derby et al. 2014
Crystal Lake II, IA (09)	Derby et al. 2010a	Rail Splitter, IL (12-13)	Good et al. 2013b
Diablo Winds, CA (05-07)	WEST 2006, 2008	Record Hill, ME (12)	Stantec 2013b
Dillon, CA (08-09)	Chatfield et al. 2009	Record Hill, ME (14)	Stantec 2015
Dry Lake I, AZ (09-10)	Thompson et al. 2011	Red Canyon, TX (06-07)	Miller 2008
Dry Lake II, AZ (11-12)	Thompson and Bay 2012	Red Hills, OK (12-13)	Derby et al. 2013c
Elkhorn, OR (08)	Jeffrey et a. 2009b	Ripley, Ont (08)	Jacques Whitford 2009
Elkhorn, OR (10)	Enk et al. 2011b	Ripley, Ont (08-09)	Golder Associates 2010
Elm Creek, MN (09-10)	Derby et al. 2010c	Rollins, ME (12)	Stantec 2013c
Elm Creek II, MN (11-12)	Derby et al. 2012b	Rugby, ND (10-11)	Derby et al. 2011b
Foote Creek Rim, WY (Phase I; 99)	Young et al. 2003	Searsburg, VT (97)	Kerlinger 2002a
Foote Creek Rim, WY (Phase I; 00)	Young et al. 2003	Sheffield, VT (12)	Martin et al. 2013
Foote Creek Rim, WY (Phase I; 01-02)	Young et al. 2003	Sheffield Operational Mitigation Study (12)	Martin et al. 2013
Forward Energy Center, WI (08-10)	Grodsky and Drake 2011	Shiloh I, CA (06-09)	Kerlinger et al. 2009

Appendix B. Summary of publicly available studies from North American wind energy facilities that report bat fatality data.

Data from the following sources:

Project, Location	Reference	Project, Location	Reference
Fowler I, IN (09)	Johnson et al. 2010a	Shiloh II, CA (09-10)	Kerlinger et al. 2010
Fowler III, IN (09)	Johnson et al. 2010b	Shiloh II, CA (10-11)	Kerlinger et al. 2013a
Fowler I, II, III, IN (10)	Good et al. 2011	Shiloh III, CA (12-13)	Kerlinger et al. 2013b
Fowler I, II, III, IN (11)	Good et al. 2012	SMUD Solano, CA (04-05)	Erickson and Sharp 2005
Fowler I, II, III, IN (12)	Good et al. 2013c	Solano III, CA (12-13)	AECOM 2013
Goodnoe, WA (09-10)	URS Corporation 2010a	Spruce Mountain, ME (12)	Tetra Tech 2013
Grand Ridge I, IL (09-10)	Derby et al. 2010g	Stateline, OR/WA (01-02)	Erickson et al. 2004
Harrow, Ont (10)	Natural Resource Solutions 2011	Stateline, OR/WA (03)	Erickson et al. 2004
Harvest Wind, WA (10-12)	Downes and Gritski 2012a	Stateline, OR/WA (06)	Erickson et al. 2007
Hay Canyon, OR (09-10)	Gritski and Kronner 2010a	Steel Winds I, NY	Grehan 2008
Heritage Garden I, MI (12-14)	Kerlinger et al. 2014	Steel Winds I & II, NY (12)	Stantec 2013d
High Sheldon, NY (10)	Tidhar et al. 2012a	Stetson Mountain I, ME (09)	Stantec 2009c
High Sheldon, NY (11)	Tidhar et al. 2012b	Stetson Mountain I, ME (11)	Normandeau Associates 2011
High Winds, CA (03-04)	Kerlinger et al. 2006	Stetson Mountain I, ME (13)	Stantec 2014
High Winds, CA (04-05)	Kerlinger et al. 2006	Stetson Mountain II, ME (10)	Normandeau Associates 2010
Hopkins Ridge, WA (06)	Young et al. 2007	Stetson Mountain II, ME (12)	Stantec 2013e
Hopkins Ridge, WA (08)	Young et al. 2009c	Summerview, Alb (05-06)	Brown and Hamilton 2006b
Jersey Atlantic, NJ (08)	NJAS 2008a, 2008b, 2009	Summerview, Alb (06; 07)	Baerwald 2008
Judith Gap, MT (06-07)	TRC 2008	Top Crop I & II, IL (12-13)	Good et al. 2013a
Judith Gap, MT (09)	Poulton and Erickson 2010	Top of Iowa, IA (03)	Jain 2005
Kewaunee County, WI (99-01)	Howe et al. 2002	Top of Iowa, IA (04)	Jain 2005
Kibby, ME (11)	Stantec 2012a	Tuolumne (Windy Point I), WA (09-10)	Enz and Bay 2010
Kittitas Valley, WA (11-12)	Stantec Consulting 2012	Vansycle, OR (99)	Erickson et al. 2000
Kittitas Valley, WA (12-13)	Stantec Consulting 2013	Vantage, WA (10-11)	Ventus Environmental Solutions 2012
Klondike, OR (02-03)	Johnson et al. 2003a	Vasco, CA (12-13)	Brown et al. 2013
Klondike II, OR (05-06)	NWC and WEST 2007	Wessington Springs, SD (09)	Derby et al. 2010f
Klondike III (Phase I), OR (07-09)	Gritski et al. 2010	Wessington Springs, SD (10)	Derby et al. 2011d
Klondike IIIa (Phase II), OR (08-10)	Gritski et al. 2011	White Creek, WA (07-11)	Downes and Gritski 2012b
Lakefield Wind, MN (12)	Minnesota Public Utilities Commission (MPUC) 2012	Wild Horse, WA (07)	Erickson et al. 2008
Leaning Juniper, OR (06-08)	Gritski et al. 2008	Windy Flats, WA (10-11)	Enz et al. 2011
Lempster, NH (09)	Tidhar et al. 2010	Winnebago, IA (09-10)	Derby et al. 2010e
Lempster, NH (10)	Tidhar et al. 2011	Wolfe Island, Ont (May-June 09)	Stantec Ltd. 2010a
Linden Ranch, WA (10-11)	Enz and Bay 2011	Wolfe Island, Ont (July-December 09)	Stantec Ltd. 2010b
Locust Ridge, PA (Phase II; 09)	Arnett et al. 2011	Wolfe Island, Ont (January-June 10)	Stantec Ltd. 2011a
Locust Ridge, PA (Phase II; 10)	Arnett et al. 2011	Wolfe Island, Ont (July-December 10)	Stantec Ltd. 2011b
Madison, NY (01-02)	Kerlinger 2002b	Wolfe Island, Ont (January-June 11)	Stantec Ltd. 2011c
Maple Ridge, NY (06)	Jain et al. 2007	Wolfe Island, Ont (July-December 11)	Stantec Ltd. 2012
Maple Ridge, NY (07)	Jain et al. 2009a	Wolfe Island, Ont (January-June 12)	Stantec Ltd. 2014

Two Indiana bat fatalities are reported by USFWS (2010, 2011a), among other reports. Five additional Indiana bat fatalities have been reported (USFWS 2011b, 2012b, 2012c; Pruitt and Okajima 2014), but are not included in this list of public reports. One incidental long-eared bat (*Myotis evotis*) was recorded at Tehachapi, California (Anderson et al. 2004), but is not included in this list of public reports. Additional bat fatalities (evening bat, eastern red bat, hoary bat, tricolored bat, Mexican free-tailed bat, and unidentified bat) have been found in Texas (Hale and Karsten 2010), but the number of fatalities by species is not reported.

Memorandum

BURNS McDONNELL

Date: September 19, 2018

To: Jennifer Dean, Tradewind Energy, Inc.

From: Justin Bailey, Burns & McDonnell

Subject: Aurora Wind Project Wetland Delineation Summary

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) was retained by Aurora Wind Project, LLC (Aurora Wind) to provide wetland delineation services for the proposed Aurora Wind Project (Project) in Mountrail and Williams Counties, North Dakota

Aurora plans to construct a new 300-megawatt wind farm and associated overhead transmission line in Mountrail and Williams Counties, North Dakota. The proposed Project would include construction of up to 121 wind turbines, associated access roads and underground collection lines, other appurtenant facilities, an approximately 20-mile-long overhead transmission line, and one substation. The Project is located approximately 2 miles north of Tioga, ND.
A wetland delineation was completed July 19 through 26, 2018, in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual (1987 Manual) and the 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region – Version 2.0 (Regional Supplement). Locations of identified features were surveyed using a sub-meter accurate global positioning system (GPS) unit. Natural color photographs taken onsite and wetland dataforms from the Regional Supplement were completed. The full wetland delineation report will be provided at a later date. The delineation was conducted based on the proposed Project layout plus a buffer area to allow for small Project design modifications (Survey Corridor). The Survey Corridor included in the wetland delineation totaled approximately 4,540 acres.

Within the Project Area for the wind facility, a total of 131 wetlands, comprised of 3 wetland types (PEM, PUB, and PAB) and encompassing a total of 51.64 acres, were identified. A total of 6 streams, consisting of two stream types (intermittent and ephemeral) and equaling 2,954 linear feet, were also identified.

Burns & McDonnell is working with Aurora to avoid and minimize impacts to wetlands and other waters of the U.S. to the greatest extent practicable. If all impacts cannot completely be avoided, Project construction will comply with the Section 404 permitting process regulated by the U.S. Army Corps of Engineers, Omaha District.

JEB

Avian Use Study

Aurora Wind Energy Project

Williams County, North Dakota

Final Report

May 2016 – May 2017

Prepared for:

Aurora Wind Project, LLC

16105 West 113th Street
Lenexa, Kansas 66219

Prepared by:

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February 6, 2018

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1 INTRODUCTION

Aurora Wind Project, LLC (Aurora) is considering the development of the Aurora Wind Energy Project (Project) in Williams County, North Dakota (Figure 1). To support development of the Project, Aurora contracted Western EcoSystems Technology, Inc. (WEST) to conduct pre-construction baseline avian surveys to estimate temporal and spatial bird use of the Project area. The methods for this study were consistent with the US Fish and Wildlife Service's (USFWS) *Eagle Conservation Plan Guidance, Module 1 – Land-Based Wind Energy Guidance* (ECPG; USFWS 2013) and *Final Land-Based Wind Energy Guidelines* (USFWS 2012).

The objectives of the study were to: 1) assess the relative abundance and spatial and temporal distribution of avian species in the Project area, and 2) identify and assess the potential risk of adverse impacts to avian species or groups, especially eagles and federally listed and sensitive avian species. This report describes the results of the fixed-point bird use surveys and incidental wildlife observations conducted in the Project area from May 24, 2016 – May 7, 2017.

2 STUDY AREA

The proposed Project area encompasses 21,981.7 hectares (54,317.9 acres) in Williams County, approximately 48.8 kilometers (30.3 miles) northeast of the city of Williston, in northwest North Dakota (Figure 1). The Project is located in the Glaciated Dark Brown Prairie Level IV Ecoregion (US Environmental Protection Agency 2016), in an area of nearly flat to gently rolling topography. This ecoregion was previously dominated by short- and mixed- grass prairies but has extensively been converted to agricultural and livestock production lands. Oil and gas extraction are also a major activities in the region.

Figure 1. Location of the Aurora Wind Energy Project in Williams County, North Dakota.

According to the US Geological Survey (USGS) National Land Cover Database (NLCD; USGS NLCD 2011, Homer et al. 2015), the majority of land cover within the Project area is cultivated crops (86.7%). Grassland/herbaceous (6.6%), developed (3.8%), and water/wetlands (2.5%), are the next most common land covers. Trees and shrubs make up the remaining portion of the Project area (Table 1, Figure 2).

Table 1. US Geological Survey (USGS) National Land Cover Database (NLCD) land cover types within the Aurora Wind Energy Project in Williams County, North Dakota.

Cover Type	Acres	% Composition
Cultivated Crops	47,091.1	86.7
Grassland/Herbaceous	3,564.8	6.6
Developed	2,074.4	3.8
Water/Wetlands	1,352.7	2.5
Shrub/Scrub	214.1	0.4
Forest	20.9	<0.1
Total	**54,318.0**	**100**

Data Sources: USGS NLCD 2011, Homer et al. 2015

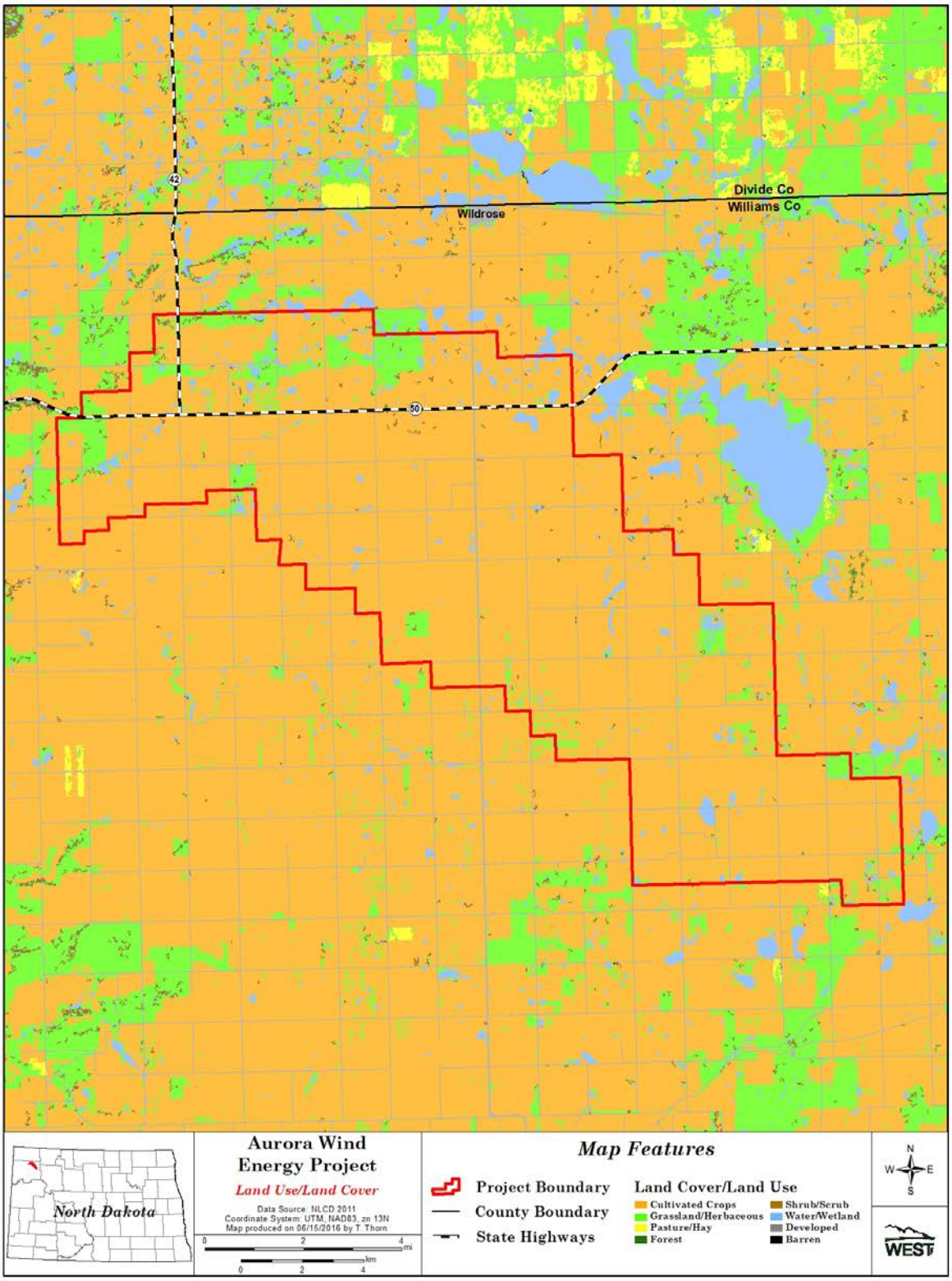


Figure 2. US Geological Survey (USGS) National Land Cover Database (NLCD) land cover types within and adjacent to the Aurora Wind Energy Project in Williams County, North Dakota (Sources: USGS NLCD 2011, Homer et al. 2015).

3 METHODS

3.1 Fixed-Point Bird Use Surveys

Bird use surveys were conducted using methods described by Reynolds et al. (1980). Thirty-three observation points consisting of 800-meter (m; 2,625-foot [ft]) radius circular plots were established within the Project area. These fixed-point circular plots covered approximately 30% of the Project area (Figure 3). Observation points (the center of the 800-m [2,625-ft] plot) were separated by at least 1,600 m (5,249 ft) to avoid overlap and were located along public roads using a systematic sampling scheme with a random start in ArcGIS (a Geographic Information System software program).

Each of the 33 fixed-point count locations were surveyed once per month, with odd points generally visited one week and even points visited two weeks later so that the biologist was on site during multiple weeks each month. Surveys were conducted during daylight hours; survey periods were varied to approximately cover all daylight hours during a season. To the extent practical, each fixed-point count location was surveyed roughly the same number of times, but some were missed due to weather and road conditions.

Fixed-point count surveys were conducted for 60 minutes (min), with all small and large birds recorded for the first 10 min, then only large birds being recorded for the remaining 50 min of each 60-min survey (small birds within 100 m [328 ft], large birds within 800 m [2,625 ft]). All large and small birds seen during each fixed-point count survey were recorded using a unique observation number. In some cases, observations represented repeated sightings of the same individual. Observations of large birds outside the 800-m plot were recorded and included in the development of species composition, relative abundance, and species diversity metrics, but were not included in analyses of avian use and flight heights. Large birds included waterbirds, waterfowl, shorebirds, rails and coots, grebes and loons, gulls and terns, diurnal raptors (kites, buteos, accipiters, eagles, falcons, northern harrier [*Circus cyaneus*], and osprey [*Pandion haliaetus*]), owls, vultures, upland game birds, doves/pigeons, some cuckoos, large corvids (e.g., ravens, magpies, and crows), and goatsuckers. Small birds included passerines (excluding large corvids), most cuckoos, swifts and hummingbirds, woodpeckers, and kingfishers.

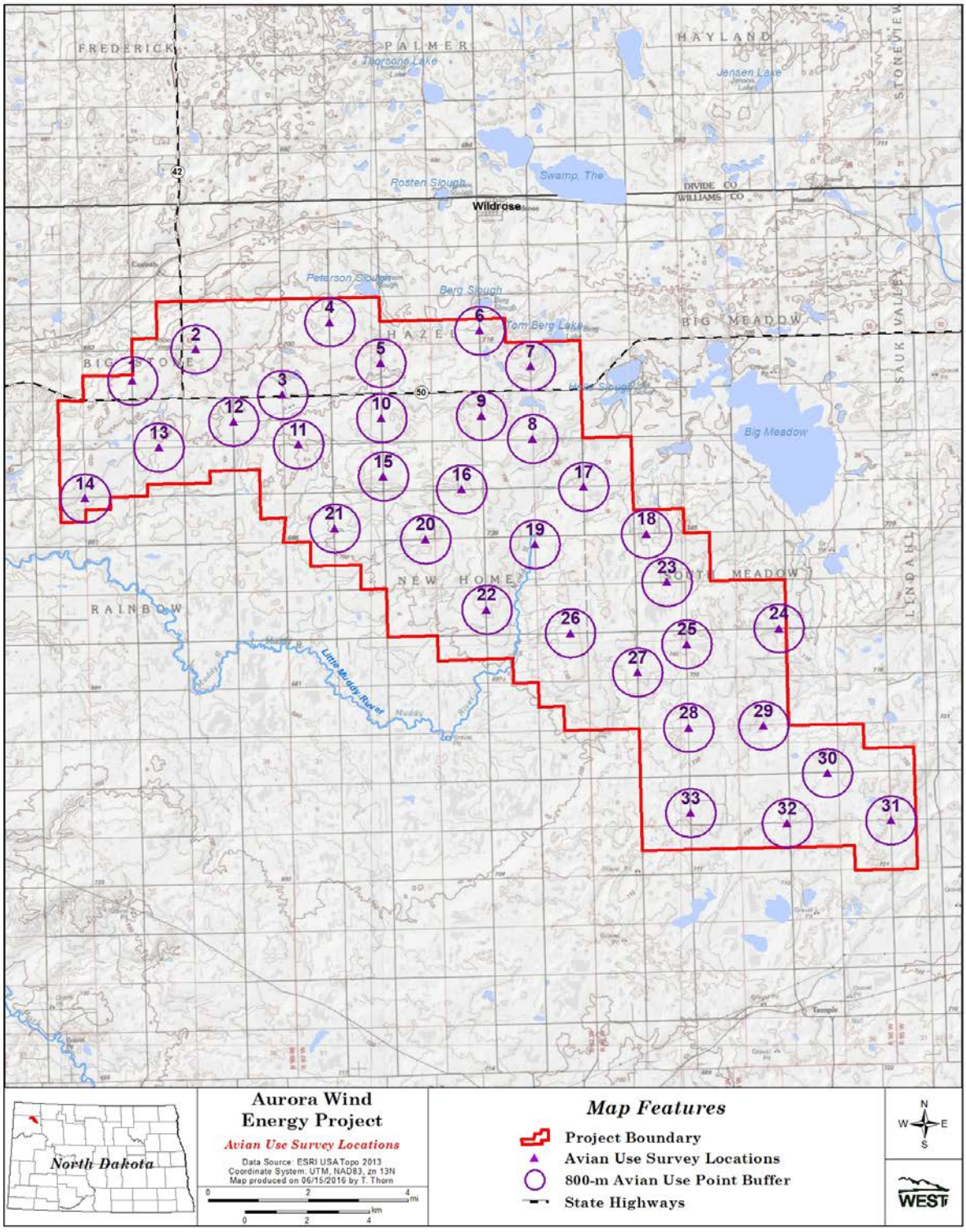


Figure 3. Locations of fixed-point counts and circular plots within the Aurora Wind Energy Project in Williams County, North Dakota, where avian use surveys were conducted from May 24, 2016 – May 7, 2017.

The following information was recorded during each bird use survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). Additionally, the following data were recorded for each observation:

- Observation number
- Species (or best possible identification)
- Number of individuals
- Sex/Age class (to the extent possible)
- Distance from plot center when first observed
- Closest distance observed
- Flight height above ground level (AGL)
- Flight direction
- Activity (flying compared to perched)

Approximate flight height, flight direction, and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval; the approximate lowest and highest heights were also recorded.

For bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*) observations, flight height, distance, and activity (i.e., flying or perched) were recorded during each 1-min interval, per the ECPG. The perch locations and flight paths of eagles were mapped to qualitatively assess areas of eagle use within the Project area.

3.2 Incidental Wildlife Observations

Incidental wildlife observations provide records of wildlife seen outside of the standardized surveys. In addition to large bird species (especially raptors), biologists recorded endangered and threatened species, species of concern, and rare or unusual species. Incidental observations were recorded in a similar fashion to standardized surveys, where the date, time, observation number, species, number of individuals, sex/age class, distance from observer, flight height AGL (for bird species), flight direction, and activity, were recorded. Biologists recorded the location of sensitive species by Universal Transverse Mercator (commonly, UTM) coordinates using a hand-held Global Positioning System (commonly, GPS) unit.

3.3 Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. A data technician then compared a sample of records from an electronic database to the raw data forms and corrected any errors. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems

identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

A Microsoft® SQL Server database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and data analysis. All data forms and electronic data files were retained for reference. QA/QC measures implemented for report writing included review of the final document by a technical editor, statistician, peer (research biologist), project manager, and senior manager.

4 DATA ANALYSIS

4.1 Species Composition, Relative Abundance, Species Richness and Diversity

Species composition (i.e., species and bird types observed during the surveys), relative abundance (i.e., number of observations and groups of each species and bird type by season), and diversity (i.e., total number of unique species observed within each season) were compiled for all birds observed during the bird use surveys, irrespective of distance from observer (i.e., including incidental observations). Species richness by season was calculated by averaging the total number of species observed within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. In addition, species composition for each bird type, regardless of distance from observer, was calculated for major groups.

4.2 Bird Use, Percent of Use, and Frequency of Occurrence

Large bird use for fixed-point avian use surveys was calculated as the number of birds per 800-m plot per 60-min survey; small bird use was calculated as number of birds per 100-m plot per 10-min survey. Mean bird use was calculated by season by first summing the number of birds seen within each plot during a visit, then averaging across all plots within each visit, and finally by averaging across all visits within the season. Overall mean bird use was calculated as a weighted average of seasonal values by the number of calendar days in each season (as defined by the season dates; spring = mid-March through late May, summer = late May through end of August, fall = early September through mid-November, winter = mid-November through mid-March). Percent of use was calculated as the proportion of large or small bird use that was attributable to a particular bird type or species, and frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed.

4.3 Flight Height

Flight height data were used to estimate bird use within a rotor-swept height (RSH) range between 25 - 150 m (82 - 492 ft) AGL. The groups' (a single bird or a flock of two or more) flight heights when first observed were used to calculate the percentage of the different groups flying at different height categories: below the RSH (zero - 25 m [zero - 82 ft] AGL), at RSH (25 - 150 m [82 - 492 ft] AGL), and greater than the RSH (more than 150 m [492 ft] AGL).

4.4 Spatial Use

Small bird and large bird spatial use was evaluated by comparing bird mean use among survey plots for each bird type. In addition, eagle flight paths were mapped to qualitatively identify areas of concentrated use and/or consistent flight patterns.

4.5 Statistical Analysis

For analysis purposes, a visit was defined as the required length of time, in days, to survey all of the plots once within the Project area. Visits were assigned according to the following criteria: 1) a single visit had to be completed in a single season, and 2) a visit could be spread across multiple dates, but a single date could not contain surveys from multiple visits. Under certain circumstances, such as extreme weather conditions, plots were not surveyed during some visits. In these cases, a visit might not have constituted a survey of all plots.

5 RESULTS

5.1 Fixed-Point Bird Use Surveys

5.1.1 Species Composition, Relative Abundance, and Diversity

A total of 345 60-min fixed-point bird use surveys were conducted at 33 survey points in the Project area during the one year of surveys (Table 2). A total of 8,702 bird observations within 953 separate groups (defined as one or more individual birds) were recorded during the fixed-point bird use surveys conducted from May 24, 2016 – May 7, 2017 (Appendix A). The most commonly recorded bird type was waterfowl, which composed 38.0% of all observations throughout all seasons, with the majority (1,205 observations in 39 groups) of the waterfowl observations comprised of Canada geese (*Branta candensis;* Appendix A). Passerines were the second most abundant bird type observed, accounting for 16.1% of all observations throughout the study (1,402 observations in 306 groups; Appendix A).

Ten unique diurnal raptor species totaling 195 observations in 188 groups were identified during surveys (Appendix A). Diurnal raptors accounted for 2.2% of all bird observations, with northern harriers being the most commonly recorded diurnal raptor species (38.5% of diurnal raptor observations). There was one bald eagle recorded in spring and two golden eagles in two separate groups observed in fall (Appendix A).

During fixed-point bird use surveys, 65 unique bird species were recorded; species diversity was lowest in winter (10 unique species) compared to all other seasons (Table 2). Species richness for large birds was highest during spring (2.70 species/800-m plot/60-min survey), followed by fall (1.77), summer (1.22), and winter (0.29; Table 2). Small bird richness was highest during summer (1.51 species/100-m plot/10-min survey), followed by 1.31 in spring, 0.44 in fall, and 0.14 in winter (Table 2).

Table 2. Summary of species richness (number unique species/plot[a]/survey[b]), diversity (number of unique species), and sample size (number of visits and surveys conducted) by season and overall during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Season	Number of Visits	Number Surveys Conducted	Number Unique Species	Species Richness[c]	
				Large Birds	Small Birds
Spring	2	59	37	2.70	1.31
Summer	3	97	37	1.22	1.51
Fall	3	99	32	1.77	0.44
Winter	4	90	10	0.29	0.14
Overall	**12**	**345**	**65**	**1.35**	**0.82**

[a.] 800-meter (m; 2,625-foot [ft]) radius plot for large birds and 100-m (328-ft) radius plot for small birds.

[b.] Per 60-minute (min) survey for large birds and per 10-min survey for small birds.

[c.] Please note that small birds surveys used smaller viewsheds and shorter survey periods than those used for large bird surveys; direct comparison between large and small bird use is not possible.

5.1.2 Bird Use, Percent of Use, and Frequency of Occurrence

Large bird use, as determined by the number of birds/800-m plot/60-min survey, was higher during fall (42.45) and spring (39.28) compared to summer (3.96) and winter (3.44; Table 3). Small bird use, as determined by the number of birds/100-m plot/10-min survey was lowest in winter (0.69) compared to all other seasons (Table 3).

Table 3. Mean bird use (number of birds/plot[a]/survey[b]), percent of total use (%), and frequency of occurrence (%), for each bird type and raptor subtype by season during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

	Mean Use				Percent (%) of Use				Frequency of Occurrence (%)			
Type/Raptor Subtype	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	19.55	0.15	2.10	0	49.8	3.7	4.9	0	12.6	6.2	9.1	0
Waterfowl	8.68	0.75	25.94	0.42	22.1	18.9	61.1	12.1	57.6	10.3	23.2	0.8
Shorebirds	1.84	0.48	4.82	0	4.7	12.1	11.3	0	27.9	9.3	7.1	0
Gulls/Terns	8.32	1.30	6.06	0	21.2	32.9	14.3	0	41.1	18.8	1.0	0
Diurnal Raptors	0.46	0.49	1.14	0	1.2	12.4	2.7	0	32.5	32.9	54.5	0
Accipiters	*0*	*0.01*	*0*	*0*	*0*	*0.3*	*0*	*0*	*0*	*1.0*	*0*	*0*
Buteos	*0.18*	*0.26*	*0.42*	*0*	*0.5*	*6.5*	*1.0*	*0*	*13.3*	*19.6*	*25.3*	*0*
Harriers	*0.19*	*0.10*	*0.55*	*0*	*0.5*	*2.6*	*1.3*	*0*	*17.2*	*10.3*	*31.3*	*0*
Eagles	*0.02*	*0*	*0.02*	*0*	*<0.1*	*0*	*<0.1*	*0*	*1.9*	*0*	*2.0*	*0*
Falcons	*0.05*	*0.01*	*0.01*	*0*	*0.1*	*0.3*	*<0.1*	*0*	*5.0*	*1.0*	*1.0*	*0*
Other Raptors	*0.02*	*0.11*	*0.14*	*0*	*<0.1*	*2.8*	*0.3*	*0*	*1.5*	*6.1*	*13.1*	*0*
Owls	0	0	0.01	0.01	0	0	<0.1	0.3	0	0	1.0	1.2
Upland Game Birds	0.21	0.17	0.56	2.59	0.5	4.4	1.3	75.3	14.9	12.3	17.2	17.5
Doves/Pigeons	0.19	0.55	1.81	0.39	0.5	13.9	4.3	11.4	8.4	21.5	26.3	4.4
Large Corvids	0.05	0.07	0.02	0.03	0.1	1.8	<0.1	0.8	3.4	1.0	2.0	2.9
Large Birds Overall	**39.28**	**3.96**	**42.45**	**3.44**	**100**	**100**	**100**	**100**				
Passerines	4.22	6.22	2.96	0.64	91.3	100	98.0	93.4	66.3	84.6	35.4	8.5
Woodpeckers	0	0	0.01	0.01	0	0	0.3	1.9	0	0	1.0	1.3
Unidentified Birds	0.40	0	0.05	0.03	8.7	0	1.7	4.7	3.8	0	1.0	3.2
Small Birds Overall	**4.62**	**6.22**	**3.02**	**0.69**	**100**	**100**	**100**	**100**				

[a.] 800-meter (m; 2,625-foot [ft]) radius plot for large birds and 100-m (328-ft) radius plot for small birds.

[b.] Per 10-minute (min) survey for small birds; per 60-min survey for large birds.

Waterbirds

Waterbird use was highest during spring (19.55 birds/800-m plot/60-min survey), due entirely to use by sandhill cranes (*Grus canadensis*), compared to other times of the year (fall 2.10, summer 0.15, and winter 0; Table 3, Appendix B). Waterbirds accounted for 49.8% of the overall large bird use during spring, 4.9% during fall, 3.7% during summer, and 0% during winter. Waterbirds were observed during 12.6% of spring surveys, 9.1% of fall surveys, 6.2% of summer surveys, and 0% of winter surveys (Table 3, Appendix B).

Waterfowl

Waterfowl had the highest use during the fall (25.94 birds/800-m plot/60-min survey), due mostly to use by Canada geese, compared to other times of the year (spring 8.68, summer 0.75, and winter 0.42; Table 3, Appendix B). Waterfowl accounted for 61.1% of large bird use in the fall, followed by spring (22.1%), summer (18.9%), and winter (12.1%). Waterfowl were observed most frequently during the spring surveys (57.6%), followed by fall (23.2%), summer (10.3%), and winter (0.8%; Table 3, Appendix B).

Shorebirds

Shorebirds had the highest use during fall (4.82 birds/800-m plot/60-min survey), due mostly to use by black-bellied plover (*Pluvialis squatarola*), compared to other times of the year (spring 1.84, summer 0.48, and winter 0; Table 3, Appendix B). Shorebirds accounted for 12.1% of large bird use during summer, 11.3% during fall, 4.7% during spring, and 0% during winter. Shorebirds were observed during 27.9% of spring surveys, 9.3% of summer surveys, 7.1% of fall surveys, and 0% of winter surveys (Table 3, Appendix B).

Gulls/Terns

Mean use of the Project area by gulls/terns over the study period was highest during spring and fall (8.32 and 6.06 birds/800-m plot/60-min survey in spring, respectively) compared to summer and winter (1.30 and zero, respectively; Table 3). Gulls/terns accounted for 32.9% of large bird use in summer (with ringed-billed gull [*Larus delawarensis*] composing 29.2% of observations), 21.2% in spring (with Franklin's gull [*Leucophaeus pipixcan*] composing 17.7% of observations), 14.3% in fall, and 0% in winter (Table 3, Appendix B).

Diurnal Raptors

Diurnal raptor use was highest during the fall (1.14 birds/800-m plot/60-min survey), followed by summer and spring (0.49 each); no diurnal raptor use was recorded in the winter (Table 3, Appendix B). Harriers and buteos had the highest use of diurnal raptor subtypes across the three seasons in which diurnal raptors were observed (fall 0.55, spring 0.19, and summer 0.10 for harriers; fall 0.42, summer 0.26, and spring 0.18 birds/800-m plot/60-min survey, for buteos; Table 3). Northern harrier was the only harrier species observed while red-tailed (*Buteo jamaicensis*) and Swainson's (*Buteo swainsoni)* hawks contributed the most to buteo use across season (Appendix B). Diurnal raptors accounted for 12.4% of overall large bird use during summer, 2.7% during fall, and 1.2% in spring. Diurnal raptors were observed during 54.5% of fall surveys, 32.9% of summer surveys, and 32.5% of spring surveys (Table 3, Appendix B).

Eagle use was restricted to spring and fall (0.02 birds/800-m plot/60-min survey; Table 3), with bald eagles composing the totality of observations during spring and golden eagles the totality of observations during fall (Appendix B).

Owls

Mean use of the Project area by owls was low, with 0.01 birds/800-m plot/60-min survey during fall and winter and no owl use during spring and summer (Table 3); barred (*Strix varia*) and snowy (*Bubo scandiacus*) owls composed the totality of observations during fall and winter, respectively (Appendix B). Owls accounted for less than 0.1% of large bird use in fall and 0.3% in winter, and were observed during 1.2% of winter surveys and 1.0% of fall surveys (Table 3, Appendix B).

Upland Game Birds

Upland game birds had the highest mean use during the winter (2.59 birds/800-m plot/60-min survey) compared to any other season (0.56 in fall, 0.21 in spring, and 0.17 in summer; Table 3), with the majority of use attributable to ring-necked pheasants (*Phasianus colchicus*); this species was the only upland game bird observed during spring, summer, and fall surveys (Appendix B). Upland game birds composed 75.3% of overall large bird use during the winter, 4.4% of use during summer, 1.3% during the fall, and 0.5% during spring. Upland game birds were observed during 17.5% of winter surveys, 17.2% of fall surveys, 14.9% of spring surveys, and 12.3% of summer surveys (Table 3).

Doves/Pigeons

Use of the Project area by doves/pigeons ranged from a mean of 0.19 birds/800-m plot/60-min survey in spring to 1.81 in fall, with rock pigeons (*Columba livia*) being observed in all seasons (Table 3, Appendix B). Doves/pigeons composed 13.9% of large bird use in summer, 11.4% in winter, 4.3% in fall, and 0.5% in spring. Doves/pigeons were observed during 26.3% of fall surveys, 21.5% of summer surveys, 8.4% of spring surveys, and 4.4% of winter surveys (Table 3, Appendix B).

Large Corvids

American crow (*Corvus brachyrhynchos*) and black-billed magpie (*Pica hudsonia*) were the only large corvid species observed during surveys; mean use by these species was less than 0.1% birds/800-m plot/60-min survey during all seasons (Table 3, Appendix B). Large corvids composed 1.8% of use in summer compared to 0.8% or less in all other seasons, and were observed during 3.4% of spring surveys, 2.9% of winter surveys, 2.0% of fall surveys, and 1.0% of summer surveys (Table 3, Appendix B).

Passerines

Passerine mean use was highest during the summer (6.22 birds/100-m plot/10-min survey), followed by spring (4.22), fall (2.96), and winter (0.64; Table 3). Passerines composed 100% of small bird use in summer, 98.0% in fall, 93.4% in winter, and 91.3% in spring. Passerines were observed most frequently during summer (84.6% of surveys), spring (66.3%), and fall (35.4%), followed by far by winter (8.5%; Table 3). Horned larks (*Eremophila alpestris*) were the only

passerine species observed in all seasons, with mean use ranging from 0.1 - 0.43 birds/100-m plot/10 min survey (Appendix B).

5.1.3 Flight Height

A total of 430 groups of large birds were observed flying within the 800-m plot, totaling 5,279 individual observations, while 170 groups of small birds were observed flying within a 100-m plot, totaling 821 individual observations (Table 4). Overall, 34.5% of flying large birds and 8.2% of flying small birds were recorded within the RSH (25 - 150 m [82 – 492 ft] AGL). Flying diurnal raptors were mostly (60.9%) observed below RSH compared to 36.7% within RSH; the buteo subgroup had the highest (65.8%) percentage within the RSH. The three eagle observations were all observed above RSH (Table 4). Large bird types that were most often recorded in the RSH were gulls/terns (71.0%) and waterbirds (54.0%; Table 4). Waterfowl were recorded flying relatively above (46.3%) or below (43.5%) the RSH. The majority of all other large bird groups we observed flying below RSH (Table 4). Appendix C shows the flight characteristics for each species observed during the bird use surveys.

Table 4. Flight height characteristics by bird type[a] and raptor subtype during the fixed-point[b] bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Bird Type/Raptor Subtype	# Groups Flying	# Obs. Flying	Mean Flight Height (meters)	% Obs. Flying	% Within Flight Height Categories		
					0 - 25 meters	25 - 150 meters[c]	> 150 meters
Waterbirds	34	1,175	170.09	94.3	1.1	54.0	44.9
Waterfowl	76	2,246	94.63	70.7	43.5	10.2	46.3
Shorebirds	21	286	15.14	44.7	60.5	39.5	0
Gulls/Terns	64	1,086	16.81	85.8	29.0	71.0	0
Diurnal Raptors	164	169	32.37	89.9	60.9	36.7	2.4
Accipiters	*1*	*1*	*4.00*	*100*	*100*	*0*	*0*
Buteos	*70*	*73*	*47.86*	*93.6*	*32.9*	*65.8*	*1.4*
Harriers	*72*	*74*	*9.74*	*98.7*	*93.2*	*6.8*	*0*
Eagles	*3*	*3*	*200.00*	*100*	*0*	*0*	*100*
Falcons	*3*	*3*	*11.67*	*60.0*	*100*	*0*	*0*
Other Raptors	*15*	*15*	*41.20*	*57.7*	*40.0*	*60.0*	*0*
Owls	2	2	11.00	100	100	0	0
Upland Game Birds	21	134	4.19	43.1	100	0	0
Doves/Pigeons	42	169	7.55	59.7	94.1	5.9	0
Large Corvids	6	12	9.83	80.0	91.7	8.3	0
Large Birds Overall	**430**	**5,279**	**46.89**	**74.1**	**35.7**	**34.5**	**29.7**
Passerines	166	798	4.79	65.9	91.6	8.4	0
Woodpeckers	1	1	2.00	50.0	100	0	0
Unidentified Birds	3	22	10.00	75.9	100	0	0
Small Birds Overall	**170**	**821**	**4.86**	**66.1**	**91.8**	**8.2**	**0**

Obs. = Observations.

[a] 800-meter (m; 2,625-foot [ft]) radius plot for large birds and 100-m (328-ft) radius plot for small birds.

[b] Per 10-minute (min) survey for small birds; per 60-min survey for large birds.

[c] The likely "rotor-swept height" for potential collision with a turbine blade, or 25 - 150 m (82 - 492 ft) above ground level.

5.1.4 Large Bird Spatial Use

For all large bird species combined, use was highest at Point 29 (80.38 birds/800-m plot/60-min survey), largely due to gulls/terns observations. The rest of large bird use ranged from a mean of one - 73.18 birds/800-m plot/60-min survey at Point 22 and Point 3, respectively (Appendix D).

Only 18 points had waterbird use recorded, with the highest (40.25 birds/800-m plot/60-min survey) at Point 30, and ranging from 0.08 - 21.38 birds/800-m plot/60-min survey at all other points with waterbird observations (Appendix D).

Waterfowl were recorded at 25 of the 33 observation points (Appendix D). Waterfowl use was highest at Point 3 (70.82 birds/800-m plot/60-min survey), ranging from 0.18 - 53.78 birds/800-m plot/60-min survey at all other points with waterfowl observations (Appendix D).

Shorebird use was observed at 22 of the 33 observation points, with shorebirds use being highest at Point 25 (17.00 birds/800-m plot/60-min survey) and ranging from 0.08 - 10.62 birds/800-m plot/60-min survey at the remaining survey points with shorebird observations (Appendix D).

All but five of the survey points had gulls/terns use recorded, with Point 29 having the highest (75.75 birds/800-m plot/60-min survey); gull/tern mean use values ranged from 0.08 - 15.09 birds/800-m plot/60-min survey at the remaining survey points with gulls/terns observations (Appendix D).

Diurnal raptor use was recorded at all 33 observation points and ranged from 0.08 - 1.50 birds/800-m plot/60-min survey at Point 2 and Point 7, respectively (Appendix D). The subgroup buteos was observed at 31 of the 33 survey points while the subgroup harriers was recorded at 27 survey points. The highest (1.12 birds/800-m plot/60-min survey) mean use for buteos occurred at Point 6 while use by harriers was highest (0.88 birds/800-m plot/60-min survey) at Point 14 (Appendix D). Eagles were observed at only three points (points 3, 15, and 21; Appendix D). No isolated or predominant flight patterns for eagles (e.g., location or direction of flight paths) could be determined (Figure 4).

Owl use was documented at two points while large corvid use was observed at six points. The highest mean use for owls was 0.12 birds/800-m plot/60-min survey and the highest mean use for large corvids was 0.67 birds/800-m plot/60-min survey (Appendix D). The highest (6.08 birds/800-m plot/60-min survey) mean use for upland game birds occurred at Point 15 with use ranging from 0.08 - 3.27 birds/800-m plot/60-min surveys at the rest of the points with upland gamebird observations (Appendix D). Doves/pigeons use was documented at 29 of the 33 survey points with the highest mean use at Point 29 (3.91 birds/800-m plot/60-min survey). Mean use at the remaining points with doves/pigeons observations ranged from 0.09 - 3.25 birds/800-m plot/60-min survey (Appendix D).

5.1.5 Small Bird Spatial Use

Passerine use was observed at all 33 observation points, with the highest mean use at Point 17 (16.92 birds/100-m plot per 10-min survey; Appendix D). Passerine mean use ranged from 0.45 - 12.75 birds/100-m plot/10-min survey at the remaining survey points with passerine observations (Appendix D).

5.2 Sensitive Species Observations

No federally listed species were observed incidentally or during scheduled avian use surveys conducted at the Project (Table 5). The state of North Dakota does not designate species as endangered or threatened but uses a three level system to categorize species of conservation priority based on their conservation need (Dyke et al. 2015). There were five Level I (LI) species recorded in 58 groups totaling 522 individuals, with Franklin's gulls making up the bulk of the LI observations (472 individuals; Table 5). Ten Level II conservation priority species were recorded in 199 groups totaling 432 individuals. American white pelican (*Pelecanus erythrorhynchos;* 140 individuals) and western meadowlark (*Sturnella neglecta;* 102 individuals) composed over half of the LII species observations (Table 5). There were no Level III (LIII) bird species (whooping crane [*Grus americana*], red knot [*Calidris canutus rufa*], peregrine falcon [*Falco peregrinus*], Brewer's sparrow [*Spizella breweri*], or McCown's longspur [*Rhynchophanes mccownii*]) observed during the surveys.

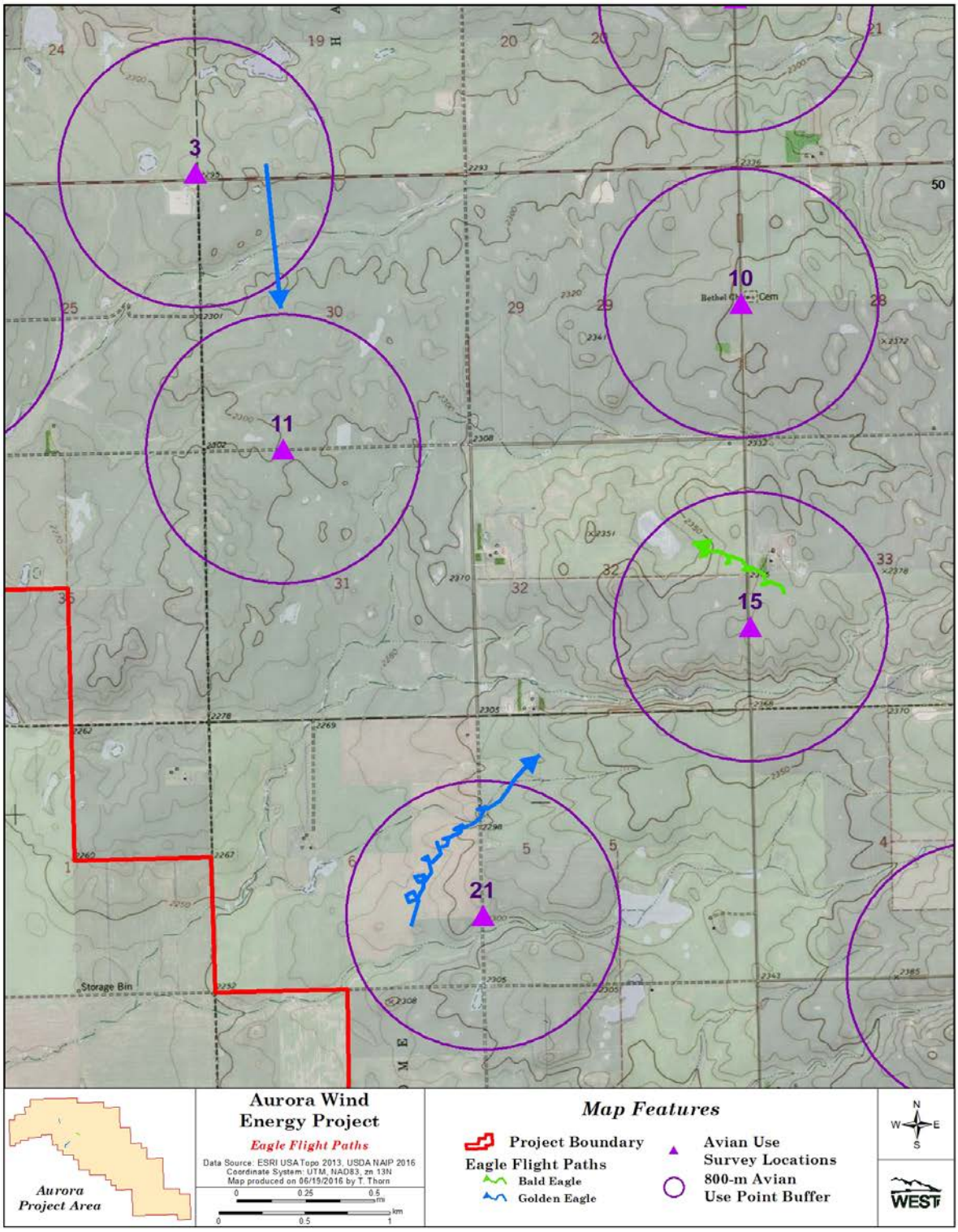


Figure 4. Bald and golden eagle flight paths recorded during fixed-point avian use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Table 5. Summary of sensitive species observed during the fixed-point bird use surveys (FP) and incidentally (Inc.) at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

			FP		Inc.		Total	
Species	**Scientific Name**	**Status[a]**	**# Groups**	**# Obs.**	**# Groups**	**# Obs.**	**# Groups**	**# Obs.**
ferruginous hawk	*Buteo regalis*	LI	2	2	0	0	2	2
Franklin's gull	*Leucophaeus pipixcan*	LI	15	472	0	0	15	472
marbled godwit	*Limosa fedoa*	LI	3	6	0	0	3	6
Swainson's hawk	*Buteo swainsoni*	LI	30	30	5	9	35	39
upland sandpiper	*Bartramia longicauda*	LI	3	3	0	0	3	3
American avocet	*Recurvirostra americana*	LII	1	2	0	0	1	2
American kestrel	*Falco sparverius*	LII	4	4	0	0	4	4
American white pelican	*Pelecanus erythrorhynchos*	LII	1	140	0	0	1	140
bald eagle	*Haliaeetus leucocephalus*	LII, BGEPA	1	1	1	1	2	2
canvasback	*Aythya valisineria*	LII	1	2	0	0	1	2
golden eagle	*Aquila chrysaetos*	LII, BGEPA	2	2	0	0	2	2
northern harrier	*Circus cyaneus*	LII	73	75	6	6	79	81
northern pintail	*Anas acuta*	LII	23	52	0	0	23	52
sharp-tailed grouse	*Tympanuchus phasianellus*	LII	14	45	0	0	14	45
western meadowlark	*Sturnella neglecta*	LII	72	102	0	0	72	102
Total	**15 species**		**245**	**938**	**12**	**16**	**257**	**954**

Obs. = Observations.

[a.] LI = Level I State Species of Conservation Priority; LII = Level II State Species of Conservation Priority (Dyke et al. 2015); BGEPA = Bald and Golden Eagle Protection Act (1940).

5.3 Incidental Wildlife Observations

Nine avian and one mammalian species were incidentally observed outside of the standardized fixed-point bird use surveys, totaling 27 observations within 20 separate groups (Table 6). Swainson's hawks composed the majority (nine individuals) of the incidental observations, followed by northern harrier (six individuals) and tundra swan (*Cygnus columbianus*; four individuals).

Table 6. Birds incidentally observed outside of the standardized avian use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Species	Scientific Name	# Groups	# Observations
tundra swan	*Cygnus columbianus*	1	4
bald eagle	*Haliaeetus leucocephalus*	1	1
northern harrier	*Circus cyaneus*	6	6
rough-legged hawk	*Buteo lagopus*	1	1
red-tailed hawk	*Buteo jamaicensis*	1	1
Swainson's hawk	*Buteo swainsoni*	5	9
snowy owl	*Bubo scandiacus*	2	2
turkey vulture	*Cathartes aura*	1	1
northern flicker	*Colaptes auratus*	1	1
moose	*Alces alces*	1	1
Total	**10 species**	**20**	**27**

6 SUMMARY

The avian use studies at the Project provide a baseline of information that can be compared to the results of other studies in the region and nationally. Diurnal raptors occur in most areas with the potential for wind energy development (National Research Council 2007). Annual mean diurnal raptor use at the Project was calculated as the number of birds per 10-min survey; therefore direct comparisons with other projects for which use has been reported on a per 20-min survey basis are not possible. Although not directly comparable, annual mean raptor use at the Project (0.16 raptors/plot/10-min survey) was at the lower end of use values reported at other wind energy facilities in North America with available data that implemented similar protocols and had data for three or four seasons (Figure 5). The annual mean diurnal raptor use at these wind energy facilities ranged from 0.06 - 2.34 raptors/plot/20-min survey (Kerlinger et al. 2005, Chatfield et al. 2010). Raptor use within the Project area was within the range of use values reported at other regional projects (Sunflower and Prairie Winds in North and South Dakota, respectively; Figure 5).

Several projects within mixed tilled agriculture and grasslands have available data on direct impacts to birds (Appendix E). Overall, the direct impact to all birds and raptors in these landscapes is generally low and ranges from 0.37 - 8.75 all birds/Megawatt (MW) and zero - 0.47 raptors/MW. Given the Project location within a similar landscape in the Midwest, it is expected that the direct impacts will be within these ranges.

Eagle use was low and restricted to spring and fall, with one bald eagle observed during spring and two golden eagles observed during fall point count surveys (Appendix B). Impacts to eagles are expected to be low.

No federally listed species or State LIII avian species were observed incidentally or during scheduled avian use surveys conducted at the Project. Several observations of more abundant State LI and LII species were made (Table 5). Overall, impacts to listed species and state species of concern are expected to be low.

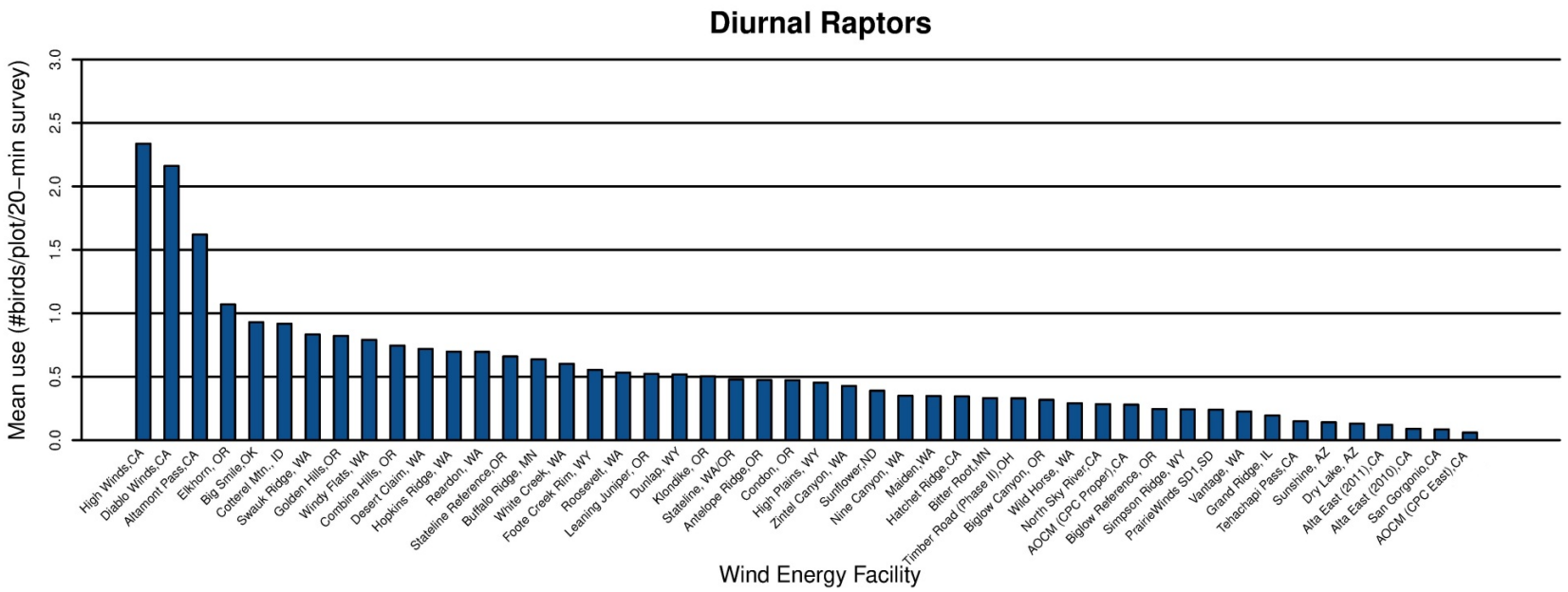


Figure 5. Comparison of annual diurnal raptor use (raptors/survey plot/20-minute survey) recorded at wind energy facilities in North America.

Figure 5 (*continued*). Comparison of annual diurnal raptor use (raptors/survey plot/20-minute survey) recorded at wind energy facilities in North America.

Data from the following sources:

Study and Location	Reference	Study and Location	Reference	Study and Location	Reference
High Winds, CA	Kerlinger et al. 2005	Foote Creek Rim, WY	Johnson et al. 2000b	North Sky River, CA	Erickson et al. 2011
Diablo Winds, CA	WEST 2006	Roosevelt, WA	NWC and WEST 2004	AOCM (CPC Proper), CA	Chatfield et al. 2010
Altamont Pass, CA	Orloff and Flannery 1992	Leaning Juniper, OR	Kronner et al. 2005	Biglow Reference, OR	WEST 2005c
Elkhorn, OR	WEST 2005a	Dunlap, WY	Johnson et al. 2009a	Simpson Ridge, WY	Johnson et al. 2000b
Big Smile (Dempsey), OK	Derby et al. 2010c	Klondike, OR	Johnson et al. 2002	Prairie Winds SD1	Derby et al. 2010b
Cotterel Mtn., ID	BLM 2006	Stateline, WA/OR	Erickson et al. 2003b	Vantage, WA	Jeffrey et al. 2007
Swauk Ridge, WA	Erickson et al. 2003c	Antelope Ridge, OR	WEST 2009	Grand Ridge, IL	Derby et al. 2009
Golden Hills, OR	Jeffrey et al. 2008	Condon, OR	Erickson et al. 2002b	Tehachapi Pass, CA	Anderson et al. 2000, Erickson et al. 2002b
Windy Flats, WA	Johnson et al. 2007	High Plains, WY	Johnson et al. 2009b	Sunshine, AZ	WEST and the CPRS 2006
Combine Hills, OR	Young et al. 2003a	Zintel Canyon, WA	Erickson et al. 2002a, 2003a	Dry Lake, AZ	Young et al. 2007a
Sunflower	Derby and Thorn 2014	Nine Canyon, WA	Erickson et al. 2001	Alta East (2011), CA	Chatfield et al. 2011
Desert Claim, WA	Young et al. 2003b	Maiden, WA	Young et al. 2002	Alta East (2010), CA	Chatfield et al. 2011
Hopkins Ridge, WA	Young et al. 2003c	Hatchet Ridge, CA	Young et al. 2007b	San Gorgonio, CA	Anderson et al. 2000, Erickson et al. 2002b
Reardon, WA	WEST 2005b	Bitter Root. MN	Derby and Dahl 2009	AOCM (CPC East), CA	Chatfield et al. 2010
Stateline Reference, OR	URS et al. 2001	Timber Road (Phase II), OH	Good et al. 2010		
Buffalo Ridge, MN	Johnson et al. 2000a	Biglow Canyon, OR	WEST 2005c		
White Creek, WA	NWC and WEST 2005	Wild Horse, WA	Erickson et al. 2003d		

7 REFERENCES

Anderson, R., D. Strickland, J. Tom, N. Neumann, W. Erickson, J. Cleckler, G. Mayorga, G. Nuhn, A. Leuders, J. Schneider, L. Backus, P. Becker, and N. Flagg. 2000. Avian Monitoring and Risk Assessment at Tehachapi Pass and San Gorgonio Pass Wind Resource Areas, California: Phase 1 Preliminary Results. *In*: Proceedings of the National Avian Wind Power Planning Meeting III (PNAWPPM-III), May 1998, San Diego, California. National Wind Coordinating Collaborative (NWCC)/RESOLVE, Washington, D.C. Pp 31-46.

ArcGIS. GIS Software. ESRI, Redlands, California.

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) § 668-668d. Bald Eagle Protection Act of 1940, June 8, 1940, Chapter 278, Section (§) 2, 54 Statute (Stat.) 251; Expanded to include the related species of the golden eagle October 24, 1962, Public Law (PL) 87-884, 76 Stat. 1246. As amended: October 23, 1972, PL 92-535, § 2, 86 Stat. 1065; November 8, 1978, PL 95-616, § 9, 92 Stat. 3114.

BHE Environmental, Inc. (BHE). 2010. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Interim Report prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2010.

BHE Environmental, Inc. (BHE). 2011. Post-Construction Bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Final Report. Prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2011.

Bureau of Land Management (BLM). 2006. Final Environmental Impact Statement for the Proposed Cotterel Wind Power Project and Proposed Resource Management Plan Amendment. FES 06-07. Serial No. IDI-33676. Prepared for the US Department of the Interior (USDOI), BLM, Twin Falls District, Burley Field Office, Cassia County, Idaho, on behalf of Windland, Inc., Boise, Idaho, and Shell WindEnergy Inc., Houston, Texas. March 2006.

Chatfield, A., W. P. Erickson, and K. Bay. 2010. Avian Baseline Studies at the Sun Creek Wind Resource Area, Kern County, California. Final Report: May 2009 - May 2010. Prepared for CH2M HILL, Oakland, California. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. September 30, 2010.

Chatfield, A., W. P. Erickson, and K. Bay. 2011. Avian Baseline Studies at the Alta East Wind Resource Area, Kern County, California. Final Report: July 10, 2010 - June 1, 2011. Prepared for CH2M HILL, Oakland, California. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. July 13, 2011. Appendix D-8. *In:* Bureau of Land Management (BLM). 2013. Alta East Wind Project: Proposed Plan Amendment and Final Environmental Impact Statement. CACA #0052537. US Department of the Interior BLM. February 2013. Available online: http://www.blm.gov/ca/st/en/fo/ridgecrest/alta_east_wind_project.html; 2011 Avian Baseline Report (Appendix D-8) available online at: http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/ridgecrest/alta_east_wind.Par.22191.File.dat/D8%20Avian%20Baseline%20Studies%202011.pdf

Chatfield, A. and D. Russo. 2014. Post-Construction Avian and Bat Fatality Monitoring for the Pinyon Pines I & II Wind Energy Project, Kern County, California. Final Report for the First Year of Operation: March 2013 - March 2014. Prepared for MidAmerican Renewables, LLC, Des Moines, Iowa, and Alta Windpower Development, LLC, Mojave, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 28, 2014.

Chodachek, K., C. Derby, M. Sonnenberg, and T. Thorn. 2012. Post-Construction Fatality Surveys for the Pioneer Prairie Wind Farm I LLC Phase II, Mitchell County, Iowa: April 4, 2011 – March 31, 2012. Prepared for EDP Renewables, North America LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 27, 2012.

Derby, C. and A. Dahl. 2009. Wildlife Studies for the Bitter Root Wind Resource Area, Yellow, Medicine, and Lincoln Counties, Minnesota. Annual Report: March 25, 2008 - October 8, 2008. Prepared for Buffalo Ridge Power Partners, Argyle, New York. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismark, North Dakota. April 16, 2009. *In:* Minnesota Department of Commerce, Office of Energy Security. 2010. Bitter Root Wind Farm Project, Environmental Report. Site Permit Application, Appendix F. Minnesota Public Utilities Commission, Docket 25538. March 2010. April 16, 2009.

Derby, C., K. Bay, and J. Ritzert. 2009. Bird Use Monitoring, Grand Ridge Wind Resource Area, La Salle County, Illinois. Year One Final Report, March 2008 - February 2009. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 29, 2009.

Derby, C., J. Ritzert, and K. Bay. 2010a. Bird and Bat Fatality Study, Grand Ridge Wind Resource Area, Lasalle County, Illinois. January 2009 - January 2010. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. July 13, 2010. Revised January 2011.

Derby, C., K. Bay, and A. Dahl. 2010b. Wildlife Baseline Studies for the Prairiewinds Sd1 Crow Lake Wind Resource Area, Aurora, Brule, and Jerauld Counties, South Dakota. Final Report: March 2009 - February 2010. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 3, 2010.

Derby, C., K. Bay, and A. Dahl. 2010c. Wildlife Baseline Studies for the Dempsey Wind Resource Area, Roger Mills County, Oklahoma. Final Report: March 2008 – February 2009. Prepared for HDR Engineering, Minneapolis, Minnesota, and Dempsey Ridge Wind Farm, LLC, a wholly owned subsidiary of Acciona Wind Energy USA LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. February 10, 2010.

Derby, C., A. Dahl, A. Merrill, and K. Bay. 2010d. 2009 Post-Construction Monitoring Results for the Wessington Springs Wind-Energy Facility, South Dakota. Final Report. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 19, 2010.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010e. Post-Construction Fatality Survey for the Buffalo Ridge I Wind Project. May 2009 - May 2010. Prepared for Iberdrola Renewables, Inc., Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010f. Post-Construction Fatality Surveys for the Elm Creek Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010g. Post-Construction Fatality Surveys for the Moraine II Wind Project: March - December 2009. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., K. Chodachek, K. Bay, and A. Merrill. 2010h. Post-Construction Fatality Surveys for the Winnebago Wind Project: March 2009- February 2010. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., A. Dahl, K. Bay, and L. McManus. 2011a. 2010 Post-Construction Monitoring Results for the Wessington Springs Wind Energy Facility, South Dakota. Final Report: March 9 – November 16, 2010. Prepared for Wessington Wind Energy Center, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 22, 2011.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011b. Post-Construction Fatality Surveys for the Barton I and II Wind Project: Iri. March 2010 - February 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: September 28, 2011.

Derby, C., K. Chodachek, K. Bay, and S. Nomani. 2011c. Post-Construction Fatality Surveys for the Rugby Wind Project: Iberdrola Renewables, Inc. March 2010 - March 2011. Prepared for Iberdrola Renewables, Inc. (IRI), Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. Version: October 14, 2011.

Derby, C., K. Chodachek, T. Thorn, K. Bay, and S. Nomani. 2011d. Post-Construction Fatality Surveys for the Prairiewinds Nd1 Wind Facility, Basin Electric Power Cooperative, March - November 2010. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 2, 2011.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012a. Post-Construction Casualty Surveys for the Buffalo Ridge II Wind Project. Iberdrola Renewables: March 2011- February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., K. Chodachek, and M. Sonnenberg. 2012b. Post-Construction Fatality Surveys for the Elm Creek II Wind Project. Iberdrola Renewables: March 2011-February 2012. Prepared for Iberdrola Renewables, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. October 8, 2012.

Derby, C., A. Dahl, and A. Merrill. 2012c. Post-Construction Monitoring Results for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2011 - February 2012. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. September 27, 2012.

Derby, C., K. Chodachek, T. Thorn, and A. Merrill. 2012d. Post-Construction Surveys for the Prairiewinds Nd1 (2011) Wind Facility Basin Electric Power Cooperative: March - October 2011. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western Ecosystems Technology, Inc. (WEST), Bismarck, North Dakota. August 31, 2012.

Derby, C., A. Dahl, and D. Fox. 2013. Post-Construction Fatality Monitoring Studies for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2012 - February 2013. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. November 13, 2013.

Derby, C. and T. Thorn. 2014. Avian Use Surveys for the Sunflower Wind Project, Morton and Stark Counties, North Dakota. Final Report: March 2013 through February 2014. Prepared for Sunflower Wind Project, LLC, Santa Barbara, California. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Derby, C., A. Dahl, and G. DiDonato. 2014. Post-Construction Fatality Monitoring Studies for the Prairiewinds Sd1 Wind Energy Facility, South Dakota. Final Report: March 2013 - February 2014. Prepared for Basin Electric Power Cooperative, Bismarck, North Dakota. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota.

Dyke, S. R., S. K. Johnson, and P. T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department, Bismarck, North Dakota. Available online: https://gf.nd.gov/wildlife/swap

Erickson, W. P., E. Lack, M. Bourassa, K. Sernka, and K. Kronner. 2001. Wildlife Baseline Study for the Nine Canyon Wind Project, Final Report May 2000-October 2001. Technical report prepared for Energy Northwest, Richland, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon.

Erickson, W. P., G. D. Johnson, K. Bay, and K. Kronner. 2002a. Ecological Baseline Study for the Zintel Canyon Wind Project. Final Report April 2001 – June 2002. Technical report prepared for Energy Northwest. Prepared for Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. June 2002.

Erickson, W. P., G. D. Johnson, D. P. Young, D. Strickland, R. Good, M. Bourassa, K. Bay, and K. Sernka. 2002b. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical report prepared for Bonneville Power Administration, Portland, Oregon by WEST, Inc., Cheyenne, Wyoming. December 2002. http://www.bpa.gov/Power/pgc/wind/Avian_and_Bat_Study_12-2002.pdf

Erickson, W. P., K. Kronner, and R. Gritski. 2003a. Nine Canyon Wind Power Project Avian and Bat Monitoring Report. September 2002 – August 2003. Prepared for the Nine Canyon Technical Advisory Committee and Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon. October 2003. Available online at: http://www.west-inc.com/reports/nine_canyon_monitoring_final.pdf

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2003b. Stateline Wind Project Wildlife Monitoring Annual Report, Results for the Period July 2001 - December 2002. Technical report submitted to FPL Energy, the Oregon Office of Energy, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc., Cheyenne, Wyoming. May 2003.

Erickson, W. P., J. Jeffrey, D. P. Young, K. Bay, R. Good, K. Sernka, and K. Kronner. 2003c. Wildlife Baseline Study for the Kittitas Valley Wind Project: Summary of Results from 2002 Wildlife Surveys. Final Report: February 2002– November 2002. Prepared for Zilkha Renewable Energy, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. January 2003.

Erickson, W. P., D. P. Young, G. D. Johnson, J. Jeffrey, K. Bay, R. Good, and H. Sawyer. 2003d. Wildlife Baseline Study for the Wild Horse Wind Project. Summary of Results from 2002-2003 Wildlife Surveys May 10, 2002- May 22, 2003. Prepared for Zilkha Renewable Energy, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. November 2003. Available online: http://www.efsec.wa.gov/wildhorse/apl/Exhibits%20PDF/E14-Ecological%20Baseline%20Study-%2011_20_03.pdf

Erickson, W. P., A. Chatfield, and K. Bay. 2011. Avian Baseline Studies for the North Sky River Wind Energy Project, Kern County, California. Final Report: May 18, 2010 – May 26, 2011. Final Report. Prepared for CH2M HILL, Portland Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 7, 2011.

ESRI. 2013. USA Topo. ArcGIS Resource Center. ESRI, producers of ArcGIS software. Redlands, California.

Fagen Engineering, LLC. 2014. 2013 Avian and Bat Monitoring Annual Report: Big Blue Wind Farm, Blue Earth, Minnesota. Prepared for Big Blue Wind Farm. Prepared by Fagen Engineering, LLC. May 2014.

Fagen Engineering, LLC. 2015. 2014 Avian and Bat Monitoring Annual Report: Big Blue Wind Farm, Blue Earth, Minnesota. Prepared for Big Blue Wind Farm. Prepared by Fagen Engineering, LLC.

Good, R. E., M. Ritzert, and K. Bay. 2010. Wildlife Baseline Studies for the Timber Road Phase II Wind Resource Area, Paulding County, Ohio. Final Report: September 2, 2008 - August 19, 2009. Prepared for Horizon Wind Energy, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. April 28, 2010.

Good, R. E., M. L. Ritzert, and K. Adachi. 2013a. Post-Construction Monitoring at the Rail Splitter Wind Farm, Tazwell and Logan Counties, Illinois. Final Report: May 2012 - May 2013. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. October 22, 2013.

Good, R. E., J. P. Ritzert, and K. Adachi. 2013b. Post-Construction Monitoring at the Top Crop Wind Farm, Gundy and Lasalle Counties, Illinois. Final Report: May 2012 - May 2013. Prepared for EDP Renewables, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bloomington, Indiana. October 22, 2013.

Gruver, J., M. Sonnenberg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 - October 31, 2008 and March 15 - June 4, 2009. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

Homer, C. G., J. A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulston, N. D. Herold, J. D. Wickham, and K. Megown. 2015. Completion of the 2011 National Land Cover Database for the Conterminous United States-Representing a Decade of Land Cover Change Information. Photogrammetric Engineering and Remote Sensing 81(5): 345-354. Available online from: http://www.mrlc.gov/nlcd2011.php

Howe, R. W., W. Evans, and A. T. Wolf. 2002. Effects of Wind Turbines on Birds and Bats in Northeastern Wisconsin. Prepared by University of Wisconsin-Green Bay, for Wisconsin Public Service Corporation and Madison Gas and Electric Company, Madison, Wisconsin. November 21, 2002. 104 pp.

Jacques Whitford Stantec Limited (Jacques Whitford). 2009. Ripley Wind Power Project Postconstruction Monitoring Report. Project No. 1037529.01. Report to Suncor Energy Products Inc., Calgary, Alberta, and Acciona Energy Products Inc., Calgary, Alberta. Prepared for the Ripley Wind Power Project Post-Construction Monitoring Program. Prepared by Jacques Whitford, Markham, Ontario. April 30, 2009.

Jain, A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. Iowa State University, Ames, Iowa.

Jeffrey, J. D., V. K. Poulton, K. J. Bay, K. F. Flaig, C. C. Roderick, W. P. Erickson, and J. E. Baker. 2007. Wildlife and Habitat Baseline Study for the Proposed Vantage Wind Power Project, Kittitas County, Washington. Final Report. Prepared for Invenergy. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington. August 2007. Available online: https://www.co.kittitas.wa.us/uploads/cds/land-use/Wind%20Farm/WSA-07-01%20Vantage%20Wind%20%20Power%20Project%20Application/VANTAGE_WILDLIFE_BASELINE%20REPORT_8.27.07.pdf

Jeffrey, J. D., W. P. Erickson, K. J. Bay, V. K. Poulton, W. L. Tidhar, and J. E. Baker. 2008. Wildlife Baseline Studies for the Golden Hills Wind Resource Area, Sherman County, Oregon. Final Report May 2006 – October 2007. Prepared for BP Alternative Energy North America Inc., Houston, Texas, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000a. Final Report: Avian Monitoring Studies at the Buffalo Ridge Wind Resource Area, Minnesota: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 22, 2000. 212 pp.

Johnson, G. D., D. P. Young, W. P. Erickson, C. E. Derby, M. D. Strickland, R. E. Good, and J. W. Kern. 2000b. Final Report: Wildlife Monitoring Studies, Seawest Windpower Project, Carbon County, Wyoming, 1995-1999. Final report prepared for SeaWest Energy Corporation, San Diego, California, and the Bureau of Land Management, Rawlins, Wyoming, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 9, 2000.

Johnson, G. D., W. P. Erickson, K. Bay, and K. Kronner. 2002. Baseline Ecological Studies for the Klondike Wind Project, Sherman County, Oregon. Final report prepared for Northwestern Wind Power, Goldendale, Washington. Prepared by Western EcoSystems Technology, Inc. (WEST) Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. May 29, 2002. Available online: http://wind.nrel.gov/public/library/johnson5.pdf

Johnson, G. D., J. Jeffrey, J. Baker, and K. Bay. 2007. Baseline Avian Studies for the Windy Flats Wind Energy Project, Klickitat County, Washington. Prepared for Windy Point Partners, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. May 29, 2007. Available online: http://www.efsec.wa.gov/Whistling%20Ridge/Adjudication/Cross%20Exhibits/06.06C%20Windy%20Flats-Environmental%20Report%20Excerpt.pdf

Johnson, G. D., K. Bay, and J. Eddy. 2009a. Wildlife Baseline Studies for the Dunlap Ranch Wind Resource Area, Carbon and Albany Counties, Wyoming. June 4, 2008 - May 27, 2009. Prepared for CH2M HILL, Englewood, Colorado. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 25, 2009. Available online at: http://amlportal.state.wy.us/out/downloads/Dunlap%20Addendum4.pdf

Johnson, G. D., K. Bay, and J. Eddy. 2009b. Wildlife Baseline Studies for the High Plains Wind Resource Area, Carbon and Albany Counties, Wyoming. Prepared for CH2M HILL. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., M. Ritzert, S. Nomani, and K. Bay. 2010. Bird and Bat Fatality Studies, Fowler Ridge I Wind-Energy Facility Benton County, Indiana. Unpublished report prepared for British Petroleum Wind Energy North America Inc. (BPWENA) by Western EcoSystems Technology, Inc. (WEST).

Kerlinger, P., L. Culp, and R. Curry. 2005. Post-Construction Avian Monitoring Study for the High Winds Wind Power Project, Solano County, California. Year One Report. Prepared for High Winds, LLC and FPL Energy.

Kerlinger, P., J. Guarnaccia, R. Curry, and C. J. Vogel. 2014. Bird and Bat Fatality Study, Heritage Garden I Wind Farm, Delta County, Michigan: 2012-2014. Prepared for Heritage Sustainable Energy, LLC. Prepared by Curry and Kerlinger, LLC, McLean, Virginia. November 2014.

Kronner, K., R. Gritski, J. Baker, V. Marr, G. Johnson, and K. Bay. 2005. Wildlife Baseline Study for the Leaning Juniper Wind Power Project, Gilliam County, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC) and Western Ecosystems Technology, Inc. (WEST). Prepared for PPM Energy, Portland, Oregon and CH2M HILL, Portland, Oregon by NWC, Pendleton, Oregon, and WEST, Cheyenne, Wyoming. November 3, 2005.

National Research Council (NRC). 2007. Environmental Impacts of Wind-Energy Projects. National Academies Press. Washington, D.C. www.nap.edu

North American Datum (NAD). 1983. NAD83 Geodetic Datum.

Northwest Wildlife Consultants, Inc. (NWC) and Western Ecosystems Technology, Inc. (WEST). 2004. Ecological Baseline Studies for the Roosevelt Wind Project, Klickitat County, Washington. Final Report. Prepared by NWC, Pendleton, Oregon, and WEST, Inc., Cheyenne, Wyoming. September 2004.

Northwest Wildlife Consultants, Inc. (NWC), and Western EcoSystems Technology, Inc. (WEST). 2005. Ecological Baseline Studies and Wildlife Impact Assessment for the White Creek Wind Power Project, Klickitat County, Washington. Prepared for Last Mile Electric Cooperative, Goldendale, Washington. Prepared by K. Kronner, R. Gritski, and J. Baker, NWC, Goldendale, Washington, and G.D. Johnson, K. Bay, R.Good, and E. Lack, WEST, Cheyenne Wyoming. January 12, 2005.

Orloff, S. and A. Flannery. 1992. Wind Turbine Effects on Avian Activity, Habitat Use, and Mortality in Altamont Pass and Solano County Wind Resource Areas, 1989-1991. Final Report P700-92-001 to Alameda, Contra Costa, and Solano Counties, and the California Energy Commission, Sacramento, California, by Biosystems Analysis, Inc., Tiburon, California. March 1992.

Osborn, R. G., K. F. Higgins, C. D. Dieter, and R. E. Usgaard. 1996. Bat Collisions with Wind Turbines in Southwestern Minnesota. Bat Research News 37: 105-108.

Osborn, R. G., K. F. Higgins, R. E. Usgaard, C. D. Dieter, and R. G. Neiger. 2000. Bird Mortality Associated with Wind Turbines at the Buffalo Ridge Wind Resource Area, Minnesota. American Midland Naturalist 143: 41-52.

Reynolds, R. T., J. M. Scott, and R. A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. Condor 82(3): 309-313.

Stantec Consulting Ltd. (Stantec Ltd.). 2008. Melancthon I Wind Plant Post-Construction Bird and Bat Monitoring Report: 2007. File No. 160960220. Prepared for Canadian Hydro Developers, Inc., Guelph, Ontario. Prepared by Stantec Ltd., Guelph, Ontario. June 2008.

Strickland, D. and G. D. Johnson. 2006. Overview of What We Know About Avian/Wind Interaction. Presented at the National Wind Coordinating Collaborative (NWCC) Wildlife Workgroup Research Meeting VI, November 14, San Antonio, Texas.

URS Corporation, Western EcoSystems Technology, Inc. (WEST), and Northwest Wildlife Consultants, Inc. (NWC). 2001. Avian Baseline Study for the Stateline Project. Prepared for FPL Energy Vansycle, LLC, Juno Beach, Florida.

US Environmental Protection Agency (USEPA). 2016. Level Iii and Level Iv Ecoregions of the Continental United States. Last updated on March 22, 2016. Available online at: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

US Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online at: http://www.fws.gov/cno/pdf/Energy/2012_Wind_Energy_Guidelines_final.pdf

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Executive Summary and frontmatter + 103 pp. Available online at: https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf

US Geological Survey (USGS) National Land Cover Database (NLCD). 2011. National Land Cover Database 2011 (NLCD 2011). Multi-Resolution Land Characteristics Consortium (MRLC), National Land Cover Database (NLCD). USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. Information available online at: http://www.mrlc.gov/nlcd2011.php; Legend information available at: http://www.mrlc.gov/nlcd11_leg.php

Western EcoSystems Technology, Inc. (WEST). 2005a. Ecological Baseline Study at the Elkhorn Wind Power Project. Exhibit A. Final report prepared for Zilkha Renewable Energy, LLC, Portland, Oregon, by WEST, Cheyenne, Wyoming. June 2005.

Western EcoSystems Technology, Inc. (WEST). 2005b. Ecological Baseline Study for the Proposed Reardan Wind Project, Lincoln County, Washington. Draft Final Report. Prepared for Energy Northwest, Richland, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 2005.

Western EcoSystems Technology, Inc. (WEST). 2005c. Wildlife and Habitat Baseline Study for the Proposed Biglow Canyon Wind Power Project, Sherman County, Oregon. March 2004 - August 2005. Prepared for Orion Energy LLC., Oakland, California. WEST, Cheyenne, Wyoming. October, 2005.

Western EcoSystems Technology, Inc. (WEST). 2006. Diablo Winds Wildlife Monitoring Progress Report, March 2005 - February 2006. Technical report submitted to FPL Energy and Alameda County California. WEST. Cheyenne, Wyoming.

Western EcoSystems Technology, Inc. (WEST) and the Colorado Plateau Research Station (CPRS). 2006. Avian Studies for the Proposed Sunshine Wind Park, Coconino County, Arizona. Prepared for Sunshine Arizona Wind Energy, LLC., Flagstaff, Arizona, by WEST, Cheyenne, Wyoming, and the CPRS. Ecological Monitoring and Assessment Program, Northern Arizona University, Flagstaff, Arizona. May 2006.

Western EcoSystems Technology, Inc. (WEST). 2009. Wildlife Baseline Studies for the Antelope Ridge Wind Resource Area, Union County, Oregon. August 28, 2008 - August 12, 2009. Draft final report prepared for Horizon Wind Energy, Houston, Texas. Prepared by WEST, Cheyenne, Wyoming.

Young, D.P., Jr., W. P. Erickson, K. Bay, and R. Good. 2002. Baseline Avian Studies for the Proposed Maiden Wind Farm, Yakima and Benton Counties, Washington. Final Report, April 2001-April 2002. Prepared for Bonneville Power Administration, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. November 20, 2002. Available online: http://west-inc.com/reports/maiden_final_technical.pdf

Young, D.P., Jr., W. P. Erickson, J. Jeffrey, K. Bay, R. E. Good, and E. G. Lack. 2003a. Avian and Sensitive Species Baseline Study Plan and Final Report. Eurus Combine Hills Turbine Ranch, Umatilla County, Oregon. Technical report prepared for Eurus Energy America Corporation, San Diego, California and Aeropower Services, Inc., Portland, Oregon, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 10, 2003.

Young, D.P., Jr., W. P. Erickson, K. Bay, J. Jeffrey, E. G. Lack, and H. H. Sawyer. 2003b. Baseline Avian Studies for the Proposed Desert Claim Wind Power Project, Kittitas County, Washington. Final Report. Prepared for Desert Claim Wind Power, LLC, Ellensburg, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 2003.

Young, D.P., Jr., W. P. Erickson, K. Bay, J. Jeffrey, E. G. Lack, R. E. Good, and H. H. Sawyer. 2003c. Baseline Avian Studies for the Proposed Hopkins Ridge Wind Project, Columbia County, Washington. Final Report: March 2002 - March 2003. Prepared for RES North America, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. April 30, 2003. Available online at: http://wind.nrel.gov/public/library/young5.pdf

Young, D.P., Jr., V. K. Poulton, and K. Bay. 2007a. Ecological Baseline Studies Report. Proposed Dry Lake Wind Project, Navajo County, Arizona. Prepared for PPM Energy, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 1, 2007. Available online at: http://www.blm.gov/style/medialib/blm/az/pdfs/energy/dry-lake.Par.83529.File.dat/AppC-eco_baseline_study.pdf

Young, D.P., Jr., G. D. Johnson, V. K. Poulton, and K. Bay. 2007b. Ecological Baseline Studies for the Hatchet Ridge Wind Energy Project, Shasta County, California. Prepared for Hatchet Ridge Wind, LLC, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 31, 2007. Available online from: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=41939

Appendix A. All Bird Types and Species Observed During the Fixed-Point Bird Use Surveys Conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017

Appendix A. Summary of individuals and groups, by bird type and species, observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Type/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.
Waterbirds		**18**	**1,024**	**7**	**14**	**11**	**208**	**0**	**0**	**36**	**1,246**
American white pelican	*Pelecanus erythrorhynchos*	0	0	0	0	1	140	0	0	1	140
double-crested cormorant	*Phalacrocorax auritus*	0	0	6	13	1	7	0	0	7	20
great blue heron	*Ardea herodias*	0	0	1	1	6	7	0	0	7	8
sandhill crane	*Grus canadensis*	18	1024	0	0	3	54	0	0	21	1078
Waterfowl		**82**	**487**	**11**	**72**	**47**	**2,702**	**1**	**50**	**141**	**3,311**
blue-winged teal	*Anas discors*	8	39	1	3	0	0	0	0	9	42
Canada goose	*Branta canadensis*	12	185	2	4	25	1,016	0	0	39	1,205
canvasback	*Aythya valisineria*	1	2	0	0	0	0	0	0	1	2
green-winged teal	*Anas crecca*	3	14	0	0	0	0	0	0	3	14
lesser scaup	*Aythya affinis*	1	2	0	0	0	0	0	0	1	2
mallard	*Anas platyrhynchos*	21	63	6	11	9	733	0	0	36	807
northern pintail	*Anas acuta*	23	52	0	0	0	0	0	0	23	52
northern shoveler	*Anas clypeata*	12	124	0	0	0	0	0	0	12	124
redhead	*Aythya americana*	1	6	0	0	0	0	0	0	1	6
snow goose	*Chen caerulescens*	0	0	0	0	7	590	0	0	7	590
unidentified duck		0	0	1	52	3	82	1	50	5	184
unidentified goose		0	0	0	0	1	20	0	0	1	20
unidentified waterfowl		0	0	1	2	2	261	0	0	3	263
Shorebirds		**20**	**117**	**11**	**46**	**16**	**477**	**0**	**0**	**47**	**640**
American avocet	*Recurvirostra americana*	1	2	0	0	0	0	0	0	1	2
black-bellied plover	*Pluvialis squatarola*	1	82	0	0	0	0	0	0	1	82
Common snipe	*Gallinago gallinago*	1	1	0	0	0	0	0	0	1	1
killdeer	*Charadrius vociferus*	13	23	6	41	2	4	0	0	21	68
long-billed dowitcher	*Limnodromus scholopaceus*	0	0	0	0	3	27	0	0	3	27
marbled godwit	*Limosa fedoa*	2	5	1	1	0	0	0	0	3	6
unidentified sandpiper		0	0	0	0	9	326	0	0	9	326
unidentified shorebird		2	4	0	0	2	120	0	0	4	124
upland sandpiper	*Bartramia longicauda*	0	0	3	3	0	0	0	0	3	3
Wilson's snipe	*Gallinago delicata*	0	0	1	1	0	0	0	0	1	1
Gulls/Terns		**32**	**541**	**39**	**125**	**1**	**600**	**0**	**0**	**72**	**1,266**
Forster's tern	*Sterna forsteri*	1	8	0	0	0	0	0	0	1	8
Franklin's gull	*Leucophaeus pipixcan*	13	458	2	14	0	0	0	0	15	472
Herring gull	*Larus argentatus*	1	1	0	0	0	0	0	0	1	1
ring-billed gull	*Larus delawarensis*	7	22	37	111	0	0	0	0	44	133

Appendix A. Summary of individuals and groups, by bird type and species, observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Type/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.
unidentified gull		3	6	0	0	1	600	0	0	4	606
unidentified tern		7	46	0	0	0	0	0	0	7	46
Diurnal Raptors		**23**	**27**	**48**	**48**	**117**	**120**	**0**	**0**	**188**	**195**
Accipiters		*0*	*0*	*1*	*1*	*0*	*0*	*0*	*0*	*1*	*1*
Cooper's hawk	*Accipiter cooperii*	0	0	1	1	0	0	0	0	1	1
Buteos		*8*	*11*	*25*	*25*	*46*	*48*	*0*	*0*	*79*	*84*
ferruginous hawk	*Buteo regalis*	2	2	0	0	0	0	0	0	2	2
red-tailed hawk	*Buteo jamaicensis*	2	3	7	7	17	17	0	0	26	27
rough-legged hawk	*Buteo lagopus*	2	4	3	3	0	0	0	0	5	7
Swainson's hawk	*Buteo swainsoni*	2	2	15	15	13	13	0	0	30	30
unidentified buteo		0	0	0	0	16	18	0	0	16	18
Harriers		*10*	*11*	*10*	*10*	*53*	*54*	*0*	*0*	*73*	*75*
northern harrier	*Circus cyaneus*	10	11	10	10	53	54	0	0	73	75
Eagles		*1*	*1*	*0*	*0*	*2*	*2*	*0*	*0*	*3*	*3*
bald eagle	*Haliaeetus leucocephalus*	1	1	0	0	0	0	0	0	1	1
golden eagle	*Aquila chrysaetos*	0	0	0	0	2	2	0	0	2	2
Falcons		*3*	*3*	*1*	*1*	*1*	*1*	*0*	*0*	*5*	*5*
American kestrel	*Falco sparverius*	2	2	1	1	1	1	0	0	4	4
merlin	*Falco columbarius*	1	1	0	0	0	0	0	0	1	1
Other Raptors		*1*	*1*	*11*	*11*	*15*	*15*	*0*	*0*	*27*	*27*
unidentified hawk		0	0	11	11	9	9	0	0	20	20
unidentified raptor		1	1	0	0	6	6	0	0	7	7
Owls		**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**2**	**2**
barred owl	*Strix varia*	0	0	0	0	1	1	0	0	1	1
snowy owl	*Bubo scandiacus*	0	0	0	0	0	0	1	1	1	1
Upland Game Birds		**9**	**12**	**15**	**17**	**26**	**55**	**25**	**227**	**75**	**311**
gray partridge	*Perdix perdix*	0	0	0	0	0	0	2	6	2	6
ring-necked pheasant	*Phasianus colchicus*	9	12	15	17	23	48	12	183	59	260
sharp-tailed grouse	*Tympanuchus phasianellus*	0	0	0	0	3	7	11	38	14	45
Doves/Pigeons		**5**	**11**	**27**	**54**	**34**	**179**	**4**	**39**	**70**	**283**
mourning dove	*Zenaida macroura*	4	9	24	43	17	72	0	0	45	124
rock pigeon	*Columba livia*	1	2	3	11	17	107	4	39	25	159
Large Corvids		**2**	**3**	**1**	**7**	**2**	**2**	**3**	**3**	**8**	**15**
American crow	*Corvus brachyrhynchos*	2	3	0	0	0	0	1	1	3	4
black-billed magpie	*Pica hudsonia*	0	0	1	7	2	2	2	2	5	11

Appendix A. Summary of individuals and groups, by bird type and species, observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Type/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.	# Grps.	# Obs.
Passerines		**82**	**245**	**163**	**725**	**49**	**364**	**12**	**68**	**306**	**1,402**
American goldfinch	*Spinus tristis*	0	0	1	1	1	1	0	0	2	2
American robin	*Turdus migratorius*	6	9	3	3	0	0	0	0	9	12
barn swallow	*Hirundo rustica*	0	0	10	49	4	59	0	0	14	108
Brewer's blackbird	*Euphagus cyanocephalus*	0	0	5	183	1	65	0	0	6	248
brown-headed cowbird	*Molothrus ater*	0	0	3	4	1	50	0	0	4	54
clay-colored sparrow	*Spizella pallida*	0	0	6	6	0	0	0	0	6	6
cliff swallow	*Petrochelidon pyrrhonota*	0	0	3	50	0	0	0	0	3	50
common grackle	*Quiscalus quiscula*	0	0	7	20	0	0	0	0	7	20
dark-eyed junco	*Junco hyemalis*	0	0	0	0	1	15	0	0	1	15
eastern kingbird	*Tyrannus tyrannus*	0	0	14	19	0	0	0	0	14	19
horned lark	*Eremophila alpestris*	4	5	17	26	10	28	10	42	41	101
house sparrow	*Passer domesticus*	0	0	0	0	1	6	0	0	1	6
red-winged blackbird	*Agelaius phoeniceus*	20	70	46	295	0	0	0	0	66	365
Savannah sparrow	*Passerculus sandwichensis*	0	0	8	8	0	0	0	0	8	8
song sparrow	*Melospiza melodia*	15	21	0	0	0	0	0	0	15	21
unidentified blackbird		0	0	0	0	1	60	0	0	1	60
unidentified passerine		0	0	0	0	2	2	2	26	4	28
unidentified sparrow		3	65	2	2	11	43	0	0	16	110
vesper sparrow	*Pooecetes gramineus*	0	0	7	20	5	15	0	0	12	35
western kingbird	*Tyrannus verticalis*	0	0	1	2	0	0	0	0	1	2
western meadowlark	*Sturnella neglecta*	32	46	29	36	11	20	0	0	72	102
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	2	29	1	1	0	0	0	0	3	30
Woodpeckers		**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**2**	**2**
downy woodpecker	*Picoides pubescens*	0	0	0	0	1	1	0	0	1	1
unidentified woodpecker		0	0	0	0	0	0	1	1	1	1
Unidentified Birds		**2**	**21**	**0**	**0**	**1**	**5**	**3**	**3**	**6**	**29**
unidentified bird (small)		2	21	0	0	1	5	3	3	6	29
Overall	**65**	**275**	**2,488**	**322**	**1,108**	**306**	**4,714**	**50**	**392**	**953**	**8,702**

Grps. = Groups, Obs. = Observations

Appendix B. Mean Use, Percent of Use, and Frequency of Occurrence for Large and Small Birds Observed During the Fixed-Point Bird Use Surveys Conducted at the Aurora Wind Energy Project in Williams County, North Dakota,from May 24, 2016 – May 7, 2017

Appendix B1. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species, by season, observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Waterbirds	**19.55**	**0.15**	**2.10**	**0**	**49.8**	**3.7**	**4.9**	**0**	**12.6**	**6.2**	**9.1**	**0**
American white pelican	0	0	1.41	0	0	0	3.3	0	0	0	1.0	0
double-crested cormorant	0	0.14	0.07	0	0	3.4	0.2	0	0	5.2	1.0	0
great blue heron	0	0.01	0.07	0	0	0.3	0.2	0	0	1.0	6.1	0
sandhill crane	19.55	0	0.55	0	49.8	0	1.3	0	12.6	0	1.0	0
Waterfowl	**8.68**	**0.75**	**25.94**	**0.42**	**22.1**	**18.9**	**61.1**	**12.1**	**57.6**	**10.3**	**23.2**	**0.8**
blue-winged teal	0.59	0.03	0	0	1.5	0.8	0	0	12.1	1.0	0	0
Canada goose	3.51	0.04	9.84	0	8.9	1.0	23.2	0	16.1	2.0	17.2	0
canvasback	0.03	0	0	0	<0.1	0	0	0	1.5	0	0	0
green-winged teal	0.24	0	0	0	0.6	0	0	0	3.4	0	0	0
lesser scaup	0.04	0	0	0	<0.1	0	0	0	1.9	0	0	0
mallard	1.06	0.11	7.40	0	2.7	2.9	17.4	0	28.6	6.2	4.0	0
northern pintail	0.84	0	0	0	2.1	0	0	0	26.3	0	0	0
northern shoveler	2.25	0	0	0	5.7	0	0	0	18.7	0	0	0
redhead	0.12	0	0	0	0.3	0	0	0	1.9	0	0	0
snow goose	0	0	5.81	0	0	0	13.7	0	0	0	4.0	0
unidentified duck	0	0.54	0.25	0.42	0	13.7	0.6	12.1	0	1.0	1.0	0.8
unidentified waterfowl	0	0.02	2.64	0	0	0.5	6.2	0	0	1.0	2.0	0
Shorebirds	**1.84**	**0.48**	**4.82**	**0**	**4.7**	**12.1**	**11.3**	**0**	**27.9**	**9.3**	**7.1**	**0**
American avocet	0.03	0	0	0	<0.1	0	0	0	1.5	0	0	0
black-bellied plover	1.24	0	0	0	3.2	0	0	0	1.5	0	0	0
common snipe	0.02	0	0	0	<0.1	0	0	0	1.5	0	0	0
killdeer	0.40	0.43	0.04	0	1.0	10.7	<0.1	0	22.6	4.1	2.0	0
long-billed dowitcher	0	0	0.27	0	0	0	0.6	0	0	0	2.0	0
marbled godwit	0.08	0.01	0	0	0.2	0.3	0	0	3.0	1.0	0	0
unidentified sandpiper	0	0	3.29	0	0	0	7.8	0	0	0	3.0	0
unidentified shorebird	0.08	0	1.21	0	0.2	0	2.9	0	3.8	0	2.0	0
upland sandpiper	0	0.03	0	0	0	0.8	0	0	0	3.1	0	0
Wilson's snipe	0	0.01	0	0	0	0.3	0	0	0	1.0	0	0
Gulls/Terns	**8.32**	**1.3**	**6.06**	**0**	**21.2**	**32.9**	**14.3**	**0**	**41.1**	**18.8**	**1.0**	**0**
Forster's tern	0.12	0	0	0	0.3	0	0	0	1.5	0	0	0
Franklin's gull	6.94	0.15	0	0	17.7	3.7	0	0	18.2	1.0	0	0
Herring gull	0.02	0	0	0	<0.1	0	0	0	1.9	0	0	0

Appendix B1. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species, by season, observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
ring-billed gull	0.42	1.16	0	0	1.1	29.2	0	0	11.5	18.8	0	0
unidentified gull	0.12	0	6.06	0	0.3	0	14.3	0	3.8	0	1.0	0
unidentified tern	0.70	0	0	0	1.8	0	0	0	10.6	0	0	0
Diurnal Raptors	**0.46**	**0.49**	**1.14**	**0**	**1.2**	**12.4**	**2.7**	**0**	**32.5**	**32.9**	**54.5**	**0**
Accipiters	*0*	*0.01*	*0*	*0*	*0*	*0.3*	*0*	*0*	*0*	*1.0*	*0*	*0*
Cooper's hawk	0	0.01	0	0	0	0.3	0	0	0	1.0	0	0
Buteos	*0.18*	*0.26*	*0.42*	*0*	*0.5*	*6.5*	*1.0*	*0*	*13.3*	*19.6*	*25.3*	*0*
ferruginous hawk	0.03	0	0	0	<0.1	0	0	0	3.0	0	0	0
red-tailed hawk	0.06	0.07	0.17	0	0.1	1.8	0.4	0	3.8	5.2	12.1	0
rough-legged hawk	0.06	0.03	0	0	0.2	0.8	0	0	3.4	2.0	0	0
Swainson's hawk	0.03	0.15	0.13	0	<0.1	3.9	0.3	0	3.0	12.4	10.1	0
unidentified buteo	0	0	0.12	0	0	0	0.3	0	0	0	8.1	0
Harriers	*0.19*	*0.10*	*0.55*	*0*	*0.5*	*2.6*	*1.3*	*0*	*17.2*	*10.3*	*31.3*	*0*
northern harrier	0.19	0.10	0.55	0	0.5	2.6	1.3	0	17.2	10.3	31.3	0
Eagles	*0.02*	*0*	*0.02*	*0*	*<0.1*	*0*	*<0.1*	*0*	*1.9*	*0*	*2.0*	*0*
bald eagle	0.02	0	0	0	<0.1	0	0	0	1.9	0	0	0
golden eagle	0	0	0.02	0	0	0	<0.1	0	0	0	2.0	0
Falcons	*0.05*	*0.01*	*0.01*	*0*	*0.1*	*0.3*	*<0.1*	*0*	*5.0*	*1.0*	*1.0*	*0*
American kestrel	0.03	0.01	0.01	0	<0.1	0.3	<0.1	0	3.4	1.0	1.0	0
merlin	0.02	0	0	0	<0.1	0	0	0	1.5	0	0	0
Other Raptors	*0.02*	*0.11*	*0.14*	*0*	*<0.1*	*2.8*	*0.3*	*0*	*1.5*	*6.1*	*13.1*	*0*
unidentified hawk	0	0.11	0.09	0	0	2.8	0.2	0	0	6.1	8.1	0
unidentified raptor	0.02	0	0.05	0	<0.1	0	0.1	0	1.5	0	5.1	0
Owls	**0**	**0**	**0.01**	**0.01**	**0**	**0**	**<0.1**	**0.3**	**0**	**0**	**1.0**	**1.2**
barred owl	0	0	0.01	0	0	0	<0.1	0	0	0	1.0	0
snowy owl	0	0	0	0.01	0	0	0	0.3	0	0	0	1.2
Upland Game Birds	**0.21**	**0.17**	**0.56**	**2.59**	**0.5**	**4.4**	**1.3**	**75.3**	**14.9**	**12.3**	**17.2**	**17.5**
gray partridge	0	0	0	0.07	0	0	0	2.1	0	0	0	1.2
ring-necked pheasant	0.21	0.17	0.48	2.06	0.5	4.4	1.1	60.1	14.9	12.3	17.2	10.4
sharp-tailed grouse	0	0	0.07	0.45	0	0	0.2	13.1	0	0	1.0	8.2
Doves/Pigeons	**0.19**	**0.55**	**1.81**	**0.39**	**0.5**	**13.9**	**4.3**	**11.4**	**8.4**	**21.5**	**26.3**	**4.4**
mourning dove	0.15	0.44	0.73	0	0.4	11.1	1.7	0	6.5	20.5	15.2	0
rock pigeon	0.04	0.11	1.08	0.39	<0.1	2.8	2.5	11.4	1.9	3.1	15.2	4.4

Appendix B1. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species, by season, observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Large Corvids	**0.05**	**0.07**	**0.02**	**0.03**	**0.1**	**1.8**	**<0.1**	**0.8**	**3.4**	**1.0**	**2.0**	**2.9**
American crow	0.05	0	0	<0.01	0.1	0	0	0.2	3.4	0	0	0.8
black-billed magpie	0	0.07	0.02	0.02	0	1.8	<0.1	0.6	0	1.0	2.0	2.0
Overall	**39.28**	**3.96**	**42.45**	**3.44**	**100**	**100**	**100**	**100**				

Appendix B2. Mean small bird use (number of small birds/100-meter plot/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type and species, by season, observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

	Mean Use				% of Use				% Frequency			
Type/Species	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Passerines	**4.22**	**6.22**	**2.96**	**0.64**	**91.3**	**100**	**98**	**93.4**	**66.3**	**84.6**	**35.4**	**8.5**
American goldfinch	0	0.01	0.01	0	0	0.2	0.3	0	0	1.0	1.0	0
American robin	0.16	0.03	0	0	3.5	0.5	0	0	10.3	3.1	0	0
barn swallow	0	0.51	0.56	0	0	8.2	18.4	0	0	10.3	3.0	0
Brewer's blackbird	0	1.85	0	0	0	29.7	0	0	0	4.0	0	0
brown-headed cowbird	0	0.04	0.51	0	0	0.7	16.7	0	0	3.1	1.0	0
clay-colored sparrow	0	0.06	0	0	0	1.0	0	0	0	6.2	0	0
cliff swallow	0	0.52	0	0	0	8.4	0	0	0	3.1	0	0
common grackle	0	0.21	0	0	0	3.4	0	0	0	7.3	0	0
dark-eyed junco	0	0	0.15	0	0	0	5	0	0	0	1.0	0
eastern kingbird	0	0.19	0	0	0	3.1	0	0	0	12.2	0	0
horned lark	0.10	0.27	0.28	0.43	2.1	4.3	9.4	62.0	7.7	17.6	10.1	7.7
house sparrow	0	0	0.06	0	0	0	2.0	0	0	0	1.0	0
red-winged blackbird	1.19	1.82	0	0	25.7	29.2	0	0	32.3	36.3	0	0
Savannah sparrow	0	0.08	0	0	0	1.3	0	0	0	8.3	0	0
song sparrow	0.32	0	0	0	6.9	0	0	0	21.2	0	0	0
unidentified blackbird	0	0	0.61	0	0	0	20.1	0	0	0	1.0	0
unidentified passerine	0	0	0.02	0.22	0	0	0.7	31.4	0	0	2.0	1.7
unidentified sparrow	1.23	0.02	0.43	0	26.6	0.3	14.4	0	5.0	2.1	9.1	0
vesper sparrow	0	0.20	0.15	0	0	3.3	5.0	0	0	7.2	4.0	0
western kingbird	0	0.02	0	0	0	0.3	0	0	0	1.0	0	0
western meadowlark	0.79	0.37	0.18	0	17	5.9	6.0	0	47.3	26.6	9.1	0
yellow-headed blackbird	0.44	0.01	0	0	9.5	0.2	0	0	3.0	1.0	0	0
Woodpeckers	0	0	0.01	0.01	0	0	0.3	1.9	0	0	1.0	1.3
downy woodpecker	0	0	0.01	0	0	0	0.3	0	0	0	1.0	0
unidentified woodpecker	0	0	0	0.01	0	0	0	1.9	0	0	0	1.3
Unidentified Birds	**0.40**	**0**	**0.05**	**0.03**	**8.7**	**0**	**1.7**	**4.7**	**3.8**	**0**	**1.0**	**3.2**
unidentified bird (small)	0.40	0	0.05	0.03	8.7	0	1.7	4.7	3.8	0	1.0	3.2
Overall	**4.62**	**6.22**	**3.02**	**0.69**	**100**	**100**	**100**	**100**				

Appendix C. Flight Height Characteristics for Large and Small Birds Observed During the Fixed-Point Bird Use Surveys Conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017

Appendix C1. Flight height characteristics for each large bird species observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Species	# Groups Flying	Overall Mean Use	% Obs. Flying	% Flying within RSH based on initial Obs.	% Within RSH at anytime
sandhill crane	19	4.13	93.4	47.7	47.7
unidentified gull	3	1.30	99.7	100	100
Franklin's gull	13	1.47	68.6	42.3	48.5
Canada goose	24	2.81	84.5	16.1	21.2
American white pelican	1	0.30	100	100	100
unidentified sandpiper	8	0.69	50.9	55.4	55.4
northern shoveler	4	0.46	53.2	72.7	72.7
ring-billed gull	41	0.40	85.0	21.2	26.5
Swainson's hawk	25	0.08	83.3	76.0	80.0
red-tailed hawk	26	0.07	100	70.4	85.2
long-billed dowitcher	2	0.06	77.8	95.2	100
mallard	23	1.81	94.5	1.7	47.6
rock pigeon	18	0.39	70.4	8.9	8.9
unidentified waterfowl	2	0.56	4.9	84.6	84.6
double-crested cormorant	7	0.05	100	45.0	45.0
unidentified tern	6	0.14	95.7	13.6	13.6
unidentified buteo	12	0.03	100	58.3	58.3
great blue heron	7	0.02	100	75.0	75.0
unidentified hawk	9	0.05	45.0	55.6	55.6
northern harrier	72	0.18	98.7	6.8	9.5
unidentified raptor	6	0.01	100	66.7	83.3
ferruginous hawk	2	<0.01	100	100	100
rough-legged hawk	5	0.02	100	14.3	57.1
marbled godwit	2	0.02	50.0	33.3	33.3
black-billed magpie	4	0.03	90.9	10.0	10
snow goose	5	1.23	47.8	0	0
ring-necked pheasant	12	0.83	45.0	0	0
unidentified duck	2	0.33	80.3	0	0
mourning dove	24	0.30	46.0	0	0
unidentified shorebird	0	0.27	0	0	0
black-bellied plover	1	0.26	100	0	0
killdeer	5	0.21	16.2	0	0
northern pintail	10	0.17	40.4	0	23.8
sharp-tailed grouse	8	0.15	33.3	0	0
blue-winged teal	4	0.13	35.7	0	0
green-winged teal	1	0.05	42.9	0	0
Forster's tern	0	0.02	0	0	0
redhead	0	0.02	0	0	0
gray partridge	1	0.02	33.3	0	0
American crow	2	0.01	50.0	0	0
American kestrel	2	0.01	50.0	0	0
upland sandpiper	3	<0.01	100	0	0
lesser scaup	0	<0.01	0	0	0
canvasback	1	<0.01	100	0	0
American avocet	0	<0.01	0	0	0
golden eagle	2	<0.01	100	0	0
Herring gull	1	<0.01	100	0	100
bald eagle	1	<0.01	100	0	0
snowy owl	1	<0.01	100	0	0

Appendix C1. Flight height characteristics for each large bird species observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Species	# Groups Flying	Overall Mean Use	% Obs. Flying	% Flying within RSH based on initial Obs.	% Within RSH at anytime
merlin	1	<0.01	100	0	0
common snipe	0	<0.01	0	0	0
Wilson's snipe	0	<0.01	0	0	0
Cooper's hawk	1	<0.01	100	0	0
barred owl	1	<0.01	100	0	0

Obs. = Observations, RSH = Rotor-Swept Height (25 - 150 meters [82 - 492 feet] above ground level).

Appendix C2. Flight height characteristics for each small bird species observed during the fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Species	# Groups Flying	Overall Mean Use	% Obs. Flying	% Flying within RSH based on initial Obs.	% Within RSH at anytime
unidentified blackbird	1	0.13	100	100	100
unidentified sparrow	14	0.35	98.2	5.6	18.5
barn swallow	13	0.26	100	1	49
red-winged blackbird	32	0.74	72.2	0	0
Brewer's blackbird	2	0.51	12.6	0	0
western meadowlark	28	0.30	46.0	0	0
horned lark	33	0.29	81.2	0	0
cliff swallow	3	0.14	100	0	0
brown-headed cowbird	2	0.12	3.7	0	0
unidentified bird (small)	3	0.10	75.9	0	68.2
yellow-headed blackbird	3	0.09	100	0	0
vesper sparrow	7	0.09	68.6	0	0
unidentified passerine	4	0.07	100	0	0
song sparrow	7	0.07	57.1	0	0
common grackle	5	0.06	85.0	0	0
eastern kingbird	4	0.05	26.3	0	0
American robin	5	0.04	58.3	0	0
dark-eyed junco	1	0.03	100	0	0
Savannah sparrow	0	0.02	0	0	0
clay-colored sparrow	0	0.02	0	0	0
house sparrow	1	0.01	100	0	0
western kingbird	1	<0.01	100	0	0
American goldfinch	0	<0.01	0	0	0
unidentified woodpecker	0	<0.01	0	0	0
downy woodpecker	1	<0.01	100	0	0

Obs. = Observations, RSH = Rotor-Swept Height (25 - 150 meters [82 - 492 feet] above ground level).

Appendix D. Mean Use by Point for All Birds, Major Bird Types, and Diurnal Raptor Subtypes During the Fixed-Point Bird Use Surveys Conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017

Appendix D1. Mean use (number of birds/plot[a]/survey[b]) by point for all birds, major bird types, and diurnal raptor subtypes observed during fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 - May 7, 2017.

	Survey Point										
Bird Type/Raptor Subtype	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Waterbirds	**3.25**	**0.25**	**0.09**	**0.55**	**0.17**	**0.17**	**0.12**	**0**	**4.58**	**3.83**	**0**
Waterfowl	**1.25**	**20.00**	**70.82**	**8.18**	**4.25**	**41.42**	**2.00**	**12.50**	**1.42**	**10.33**	**0**
Shorebirds	**0**	**2.17**	**0.27**	**9.36**	**0.08**	**0**	**4.62**	**0**	**0**	**0.08**	**0**
Gulls/Terns	**0**	**1.75**	**0.55**	**2.00**	**1.67**	**1.08**	**1.50**	**0.12**	**1.92**	**0.83**	**0.12**
Diurnal Raptors	**0.75**	**0.08**	**0.64**	**0.64**	**0.75**	**0.50**	**1.50**	**0.50**	**0.33**	**0.50**	**1.12**
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.12*	*0.08*	*0.27*	*0.55*	*0.33*	*0.17*	*1.12*	*0.25*	*0.17*	*0.25*	*0.50*
Harriers	*0.38*	*0*	*0.27*	*0.09*	*0.33*	*0.08*	*0.12*	*0.25*	*0.17*	*0.25*	*0.50*
Eagles	*0*	*0*	*0.09*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0.12*	*0*	*0*	*0*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*
Other Raptors	*0.12*	*0*	*0*	*0*	*0.08*	*0.17*	*0.25*	*0*	*0*	*0*	*0.12*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.12**	**0**	**0**	**0**
Upland Game Birds	**0.12**	**1.75**	**0.18**	**3.27**	**3.42**	**0.50**	**0**	**0.12**	**0.42**	**0.17**	**0.25**
Doves/Pigeons	**0.38**	**1.50**	**0.64**	**0.09**	**0.42**	**0.58**	**0**	**0.38**	**1.00**	**0.33**	**0**
Large Corvids	**0**	**0**	**0**	**0.09**	**0**	**0**	**0**	**0.25**	**0**	**0**	**0.12**
All Large Birds	**5.75**	**27.5**	**73.18**	**24.18**	**10.75**	**44.25**	**9.75**	**14.00**	**9.67**	**16.08**	**1.62**
Passerines	2.00	1.83	1.82	0.82	2.33	3.00	7.50	3.75	1.92	6.00	9.00
Woodpeckers	0	0	0.09	0	0	0	0	0	0	0	0
Unidentified Birds	0.12	0	0	0	1.25	0	0	0	0.08	0	0
All Small Birds	**2.12**	**1.83**	**1.91**	**0.82**	**3.58**	**3.00**	**7.50**	**3.75**	**2.00**	**6.00**	**9.00**

[a.] 800-meter (m; 2,625-foot [ft]) radius plot for large birds and 100-m (328-ft) radius plot for small birds.

[b.] 60-minute (min) surveys for large birds, 10-min surveys for small birds.

Appendix D1 (*continued*). Mean use (number of birds/plot[a]/survey[b]) by point for all birds, major bird types, and diurnal raptor subtypes observed during fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

	Survey Point										
Bird Type/Raptor Subtype	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Waterbirds	**0**	**1.00**	**4.75**	**0**	**0**	**11.67**	**0**	**0**	**0**	**0**	**0.08**
Waterfowl	**15.50**	**2.00**	**0**	**8.42**	**3.17**	**2.42**	**53.78**	**3.50**	**12.55**	**0**	**0**
Shorebirds	**0.08**	**10.62**	**0.25**	**0.25**	**0.33**	**0.5**	**0**	**0**	**0.18**	**0.12**	**0.08**
Gulls/Terns	**0.08**	**0**	**0.38**	**1.00**	**0**	**5.00**	**1.89**	**3.08**	**0**	**0.75**	**0**
Diurnal Raptors	**0.50**	**0.50**	**0.88**	**1.17**	**0.25**	**0.58**	**0.56**	**0.42**	**0.18**	**0.25**	**0.50**
Accipiters	*0*	*0*	*0*	*0*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.25*	*0.12*	*0*	*0.67*	*0*	*0.17*	*0.22*	*0.08*	*0.09*	*0.12*	*0.08*
Harriers	*0.17*	*0*	*0.88*	*0.33*	*0.17*	*0.17*	*0.22*	*0*	*0*	*0*	*0.42*
Eagles	*0*	*0*	*0*	*0.08*	*0*	*0*	*0*	*0*	*0*	*0.12*	*0*
Falcons	*0*	*0*	*0*	*0*	*0*	*0*	*0.11*	*0*	*0.09*	*0*	*0*
Other Raptors	*0.08*	*0.38*	*0*	*0.08*	*0.08*	*0.17*	*0*	*0.33*	*0*	*0*	*0*
Owls	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Upland Game Birds	**0**	**0.12**	**1.00**	**6.08**	**0**	**0.08**	**0**	**1.17**	**0.18**	**0.25**	**0**
Doves/Pigeons	**0.5**	**0.62**	**0.38**	**0.67**	**1.08**	**0.17**	**0.78**	**1.33**	**3.91**	**0.12**	**0.33**
Large Corvids	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.17**	**0**	**0**	**0**
All Large Birds	**16.67**	**14.88**	**7.62**	**17.58**	**4.83**	**20.42**	**57**	**9.67**	**17.00**	**1.50**	**1.00**
Passerines	5.92	7.12	1.50	1.33	5.75	16.92	4.56	3.33	1.45	7.38	0.58
Woodpeckers	0	0	0	0	0	0	0	0	0	0	0.08
Unidentified Birds	0	0	0	0	0.42	0	0	0.08	0	0	0
All Small Birds	**5.92**	**7.12**	**1.50**	**1.33**	**6.17**	**16.92**	**4.56**	**3.42**	**1.45**	**7.38**	**0.67**

[a.] 800-meter (m; 2,625-foot [ft]) radius plot for large birds and 100-m (328-ft) radius plot for small birds.

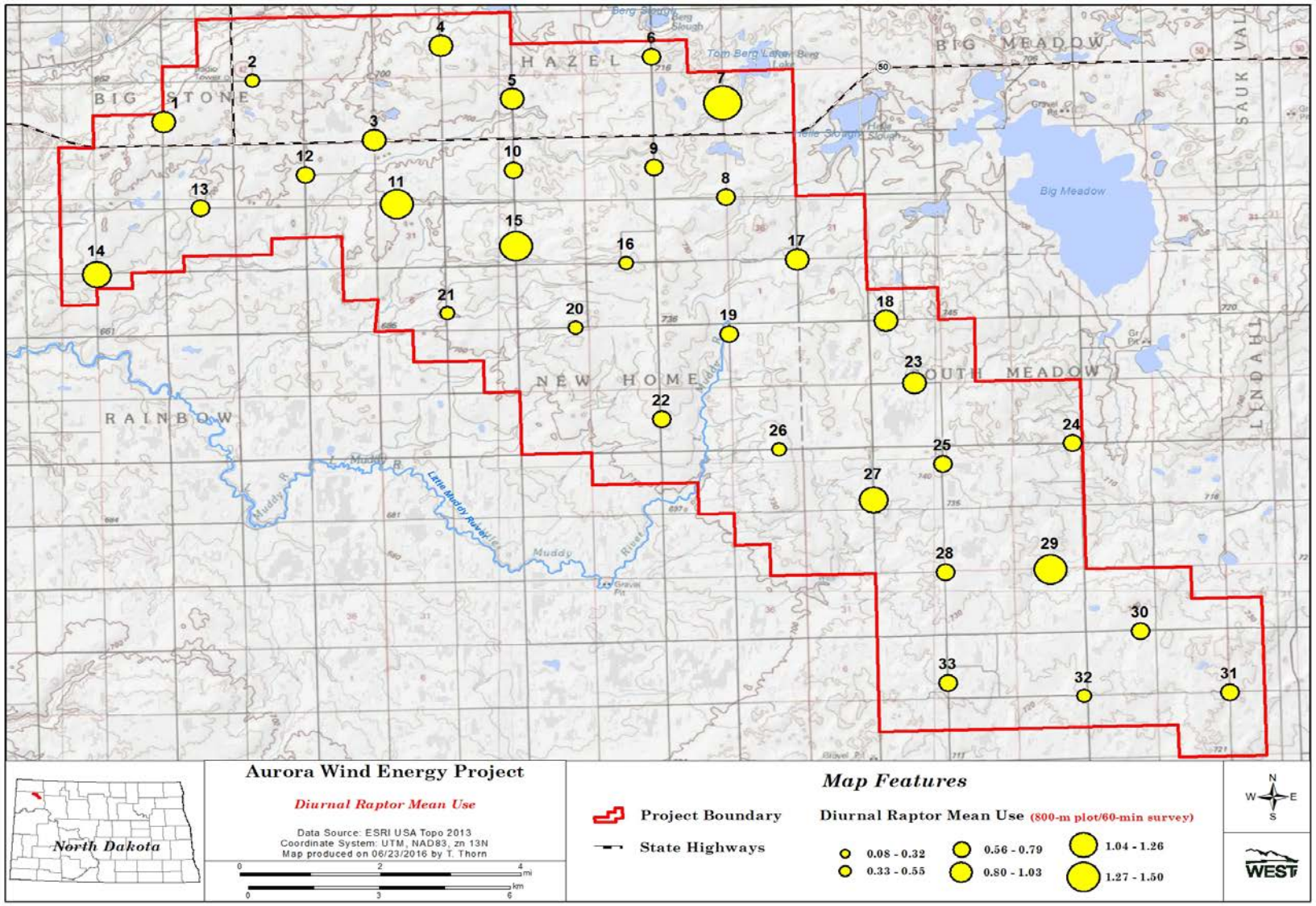
[b.] 60-minute (min) surveys for large birds, 10-min surveys for small birds.

Appendix D1 (*continued*). Mean use (number of birds/plot[a]/survey[b]) by point for all birds, major bird types, and diurnal raptor subtypes observed during fixed-point bird use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 - May 7, 2017.

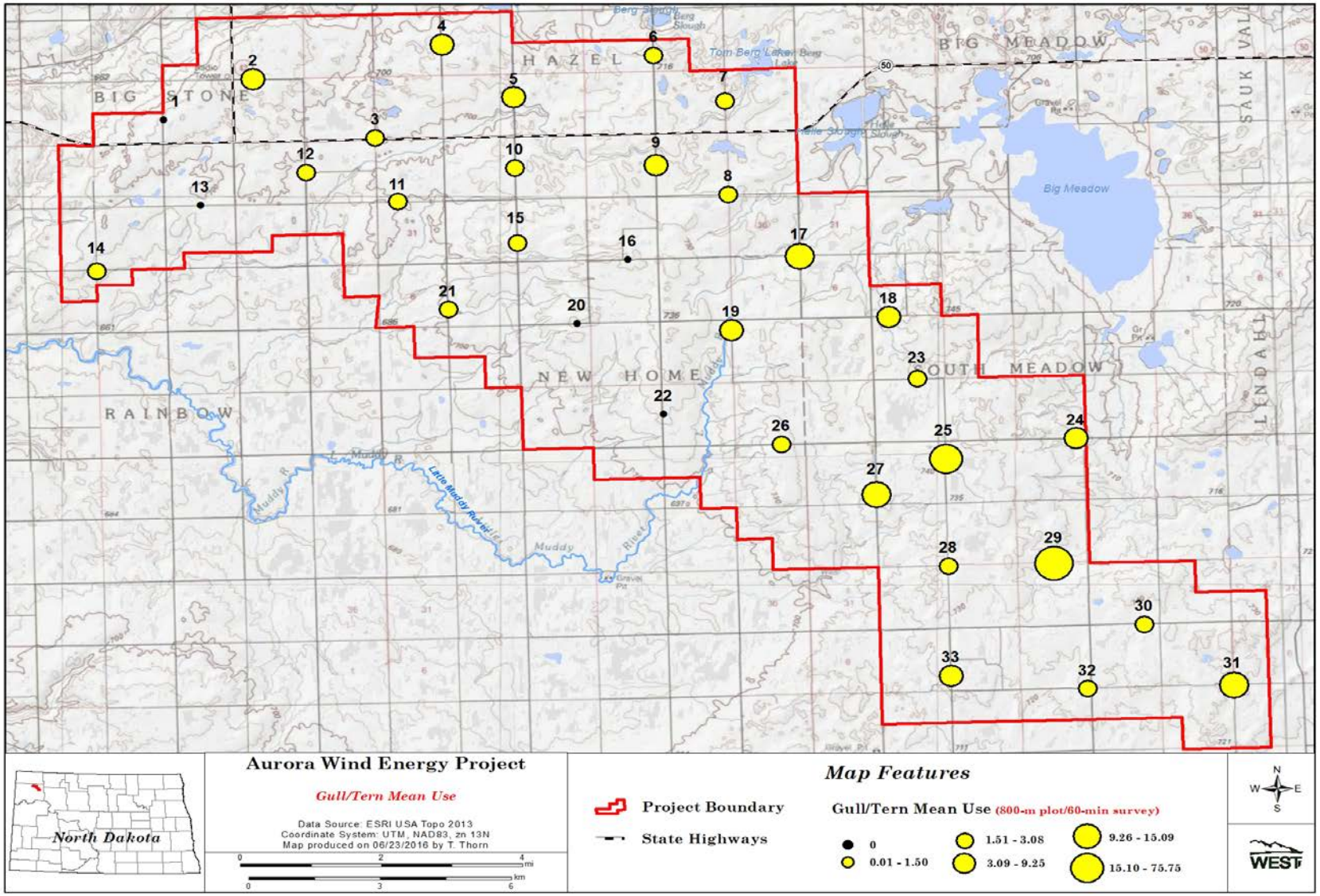
	Survey Point										
Bird Type/Raptor Subtype	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Waterbirds	0	0.08	0	0	0	21.38	0	40.25	0.88	21.17	0.08
Waterfowl	0	0	0.18	4.55	0	1.00	0	2.67	4.88	6.33	1.00
Shorebirds	8.78	0	17.00	0.18	7.25	0	0.50	0.17	0	0.25	0
Gulls/Terns	0.22	1.92	15.09	0.09	9.25	0.38	75.75	0.25	6.12	0.08	3.00
Diurnal Raptors	0.56	0.42	0.45	0.27	0.83	0.50	1.25	0.33	0.38	0.17	0.42
Accipiters	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Buteos	*0.22*	*0*	*0.09*	*0.18*	*0.42*	*0.12*	*0.25*	*0.25*	*0.12*	*0.08*	*0.25*
Harriers	*0.22*	*0.33*	*0.36*	*0.09*	*0.17*	*0.25*	*1*	*0*	*0.25*	*0.08*	*0.08*
Eagles	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Falcons	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.08*
Other Raptors	*0.11*	*0.08*	*0*	*0*	*0.25*	*0.12*	*0*	*0.08*	*0*	*0*	*0*
Owls	0	0	0	0	0.08	0	0	0	0	0	0
Upland Game Birds	0	3.17	0.36	0.18	0	0.38	2.12	0.83	0	0.92	0.67
Doves/Pigeons	2.44	3.25	0	1.27	0	0.38	0.75	0.17	0.62	1.83	0.17
Large Corvids	0	0	0	0	0	0	0	0.67	0.12	0	0
All Large Birds	**12.00**	**8.83**	**33.09**	**6.55**	**17.42**	**24.00**	**80.38**	**45.33**	**13.00**	**30.75**	**5.33**
Passerines	1.56	1.83	1.09	0.45	1.00	12.75	0.50	1.67	2.50	1.00	0.75
Woodpeckers	0	0	0	0	0	0	0	0	0	0	0
Unidentified Birds	0.67	0	0	0	0	0	0	0	0	0	0
All Small Birds	**2.22**	**1.83**	**1.09**	**0.45**	**1.00**	**12.75**	**0.50**	**1.67**	**2.50**	**1.00**	**0.75**

[a.] 800-meter (m; 2,625-foot [ft]) radius plot for large birds and 100-m (328-ft) radius plot for small birds.

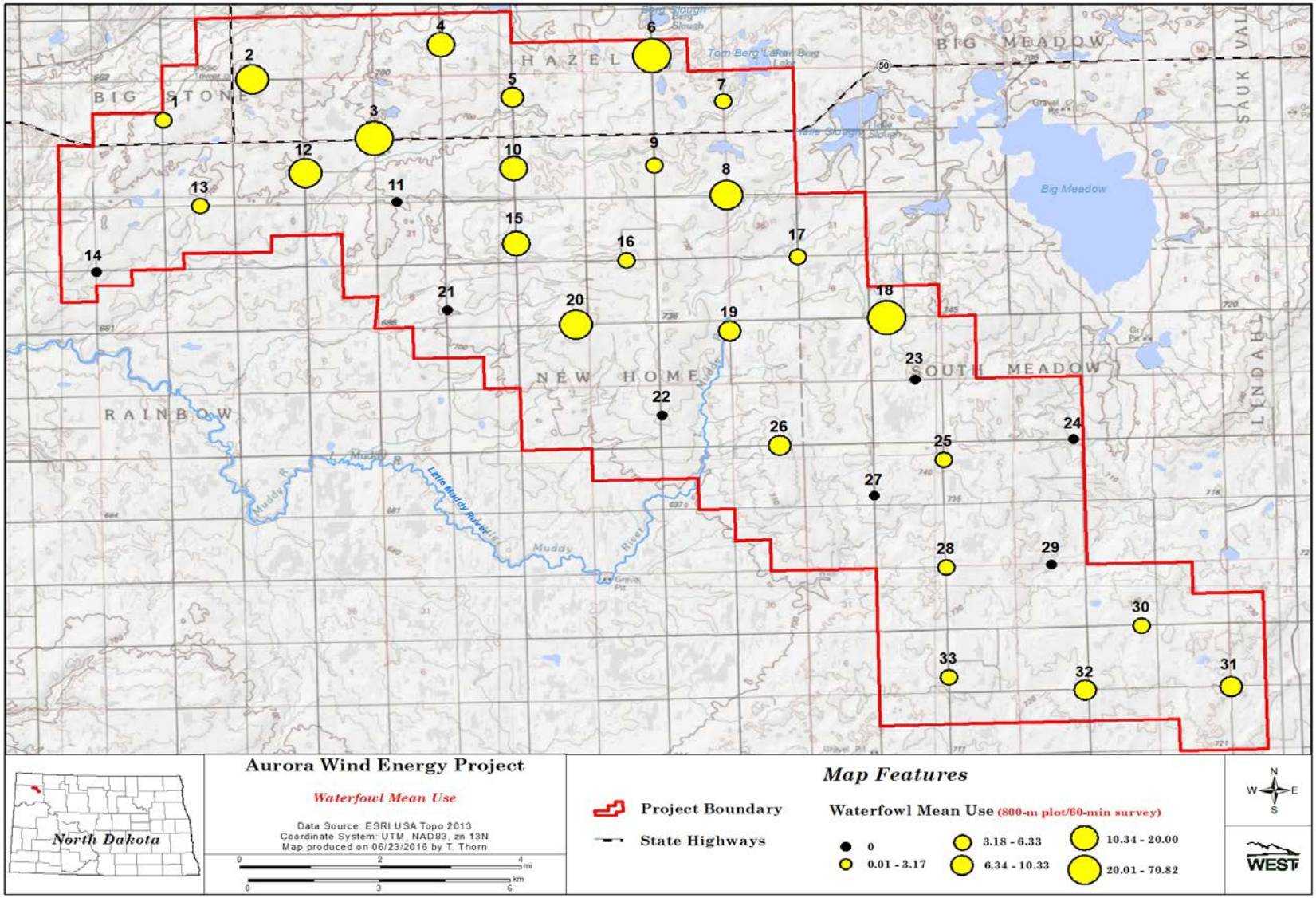
[b.] 60-minute (min) surveys for large birds, 10-min surveys for small birds.



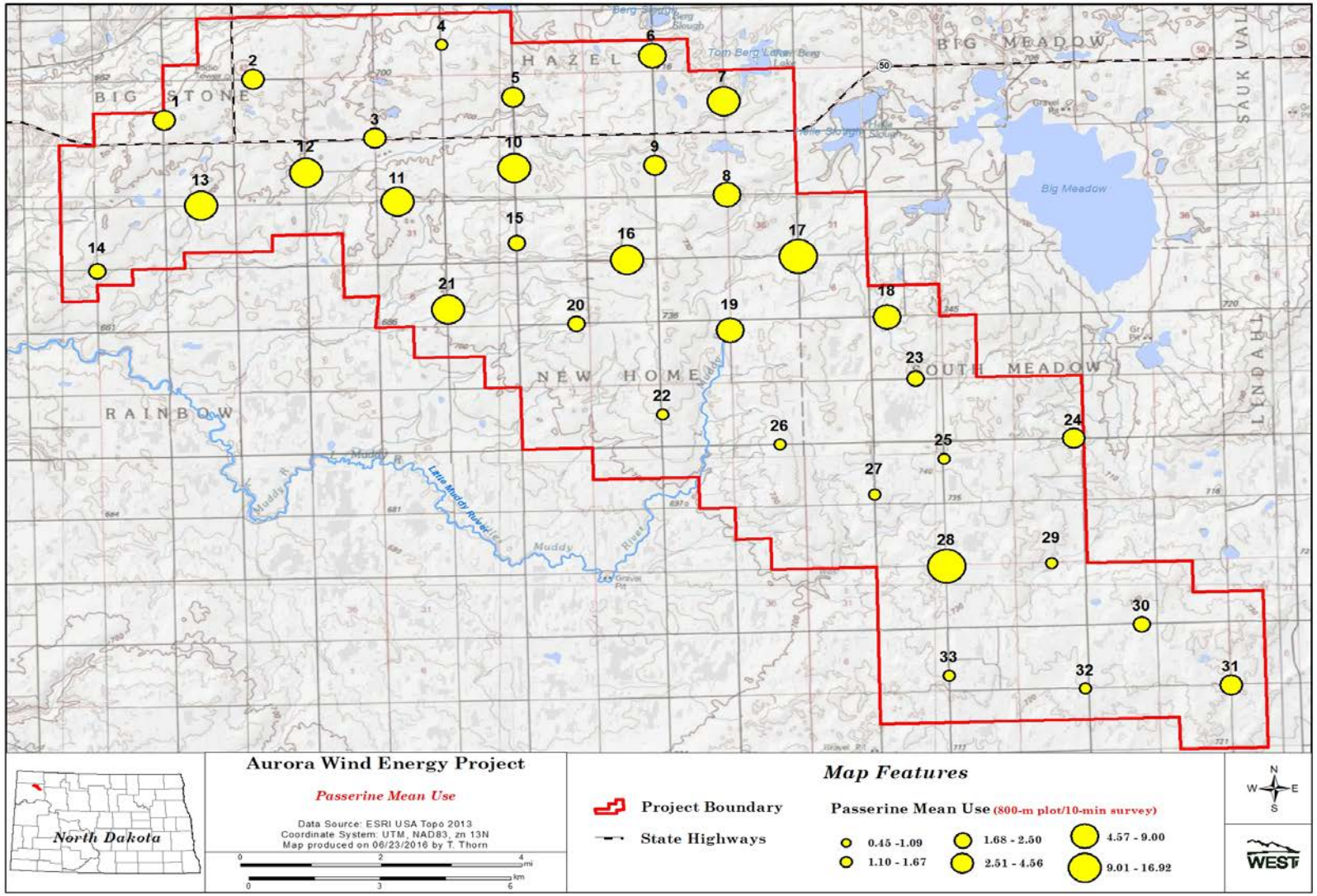
Appendix D2. Mean diurnal raptor use by survey point determined from fixed-point avian use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.



Appendix D2 (*continued*). Mean gulls/terns use by survey point determined from fixed-point avian use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.



Appendix D2 (*continued*). Mean waterfowl use by survey point determined from fixed-point avian use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.



Appendix D2 (*continued*). Mean passerine use by survey point determined from fixed-point avian use surveys conducted at the Aurora Wind Energy Project in Williams County, North Dakota, from May 24, 2016 – May 7, 2017.

Appendix E. North American Fatality Summary Tables

Appendix E. Fatality estimates for North American wind energy facilities.

Project Name	Bird fatalities (birds/MW/year)	Raptor fatalities (raptors/MW/year)	Predominant Habitat Type	Citation
Barton I & II, IA (2010-2011)	5.5	0	agriculture	Derby et al. 2011b
Big Blue, MN (2013)	0.6	0	agriculture	Fagen Engineering 2014
Big Blue, MN (2014)	0.37	0	agriculture	Fagen Engineering 2015
Blue Sky Green Field, WI (2008; 2009)	7.17	0	agriculture	Gruver et al. 2009
Buffalo Ridge I, SD (2009-2010)	5.06	0.2	agriculture/grassland	Derby et al. 2010e
Buffalo Ridge II, SD (2011-2012)	1.99	0	agriculture, grassland	Derby et al. 2012a
Buffalo Ridge, MN (Phase I; 1996)	4.14	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1997)	2.51	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1998)	3.14	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1999)	1.43	0.47	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1998)	2.47	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1999)	3.57	0	agriculture	Johnson et al. 2000a
Buffalo Ridge, MN (Phase III; 1999)	5.93	0	agriculture	Johnson et al. 2000a
Cedar Ridge, WI (2009)	6.55	0.18	agriculture	BHE Environmental 2010
Cedar Ridge, WI (2010)	3.72	0.13	agriculture	BHE Environmental 2011
Elm Creek II, MN (2011-2012)	3.64	0	agriculture, grassland	Derby et al. 2012b
Elm Creek, MN (2009-2010)	1.55	0	agriculture	Derby et al. 2010f
Fowler I, IN (2009)	2.83	0	agriculture	Johnson et al. 2010
Grand Ridge I, IL (2009-2010)	0.48	0	agriculture	Derby et al. 2010a
Heritage Garden I, MI (2012-2014)	1.3	NA	agriculture	Kerlinger et al. 2014
Kewaunee County, WI (1999-2001)	1.95	0	agriculture	Howe et al. 2002
Moraine II, MN (2009)	5.59	0.37	agriculture/grassland	Derby et al. 2010g
NPPD Ainsworth, NE (2006)	1.63	0.06	agriculture/grassland	Derby et al. 2007
Pioneer Prairie II, IA (2011-2012)	0.27	0	agriculture, grassland	Chodachek et al. 2012
PrairieWinds ND1 (Minot), ND (2010)	1.48	0.05	agriculture	Derby et al. 2011d
PrairieWinds ND1 (Minot), ND (2011)	1.56	0.05	agriculture, grassland	Derby et al. 2012d
PrairieWinds SD1, SD (2011-2012)	1.41	0	grassland	Derby et al. 2012c
PrairieWinds SD1, SD (2012-2013)	2.01	0.03	grassland	Derby et al. 2013
PrairieWinds SD1, SD (2013-2014)	1.66	0.17	grassland	Derby et al. 2014
Rail Splitter, IL (2012-2013)	0.84	0	agriculture	Good et al. 2013a
Ripley, Ont (2008)	3.09	0.1	agriculture	Jacques Whitford 2009
Rugby, ND (2010-2011)	3.82	0.06	agriculture	Derby et al. 2011c
Top Crop I & II (2012-2013)	1.35	NA	agriculture	Good et al. 2013b
Top of Iowa, IA (2003)	0.42	0	agriculture	Jain 2005
Top of Iowa, IA (2004)	0.81	0.17	agriculture	Jain 2005

Appendix E. Fatality estimates for North American wind energy facilities.

Project Name	Bird fatalities (birds/MW/year)	Raptor fatalities (raptors/MW/year)	Predominant Habitat Type	Citation
Wessington Springs, SD (2009)	8.25	0.06	grassland	Derby et al. 2010d
Wessington Springs, SD (2010)	0.89	0.07	grassland	Derby et al. 2011a
Winnebago, IA (2009-2010)	3.88	0.27	agriculture/grassland	Derby et al. 2010h

2017 Raptor Nest Survey
Aurora Wind Energy Project
Williams County, North Dakota

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REPORT REFERENCE

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1.0 INTRODUCTION

Aurora Wind Project, LLC (Aurora) is considering development of the Aurora Wind Energy Project (Project) in Williams County, North Dakota (Figure 1). Aurora contracted Western EcoSystems Technology, Inc. (WEST) to conduct an aerial raptor nest survey in the Project area and surrounding 1-mile (mi; 1.6 kilometers [km]) and 10-mi (16.1-km) buffers, with emphasis on bald eagle (*Haliaeetus leucocephalus*) nests. The aerial survey was conducted following the guidance provided in the U.S. Fish and Wildlife Service (USFWS) *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2* (ECPG; USFWS 2013), and the USFWS Interim Golden Eagle Inventory and Monitoring Protocols (Pagel et al. 2010).

2.0 STUDY AREA

The Project, located approximately four mi (6.4 km) northwest of the Town on Tioga, in Williams County, northwestern North Dakota, falls mostly within the Missouri Coteau Slope Level IV Ecoregion and partially within the Glaciated Dark Brown Prairie Level IV Ecoregion, in the Northwestern Glaciated Plains Level III Ecoregion (USEPA 2016). The Missouri Coteau Slope Level IV Ecoregion slopes westward toward the Missouri River and contains a number of small wetlands; farming most often occurs on the level to rolling topography while cattle graze on steeper areas along drainages. The Glaciated Dark Brown Prairie Level IV Ecoregion, a mosaic of croplands and rangelands, is a transition to drier conditions and contains fewer wetlands than the Missouri Coteau Slope. Topography is flat to rolling and is characterized by moraines created during the glacial period.

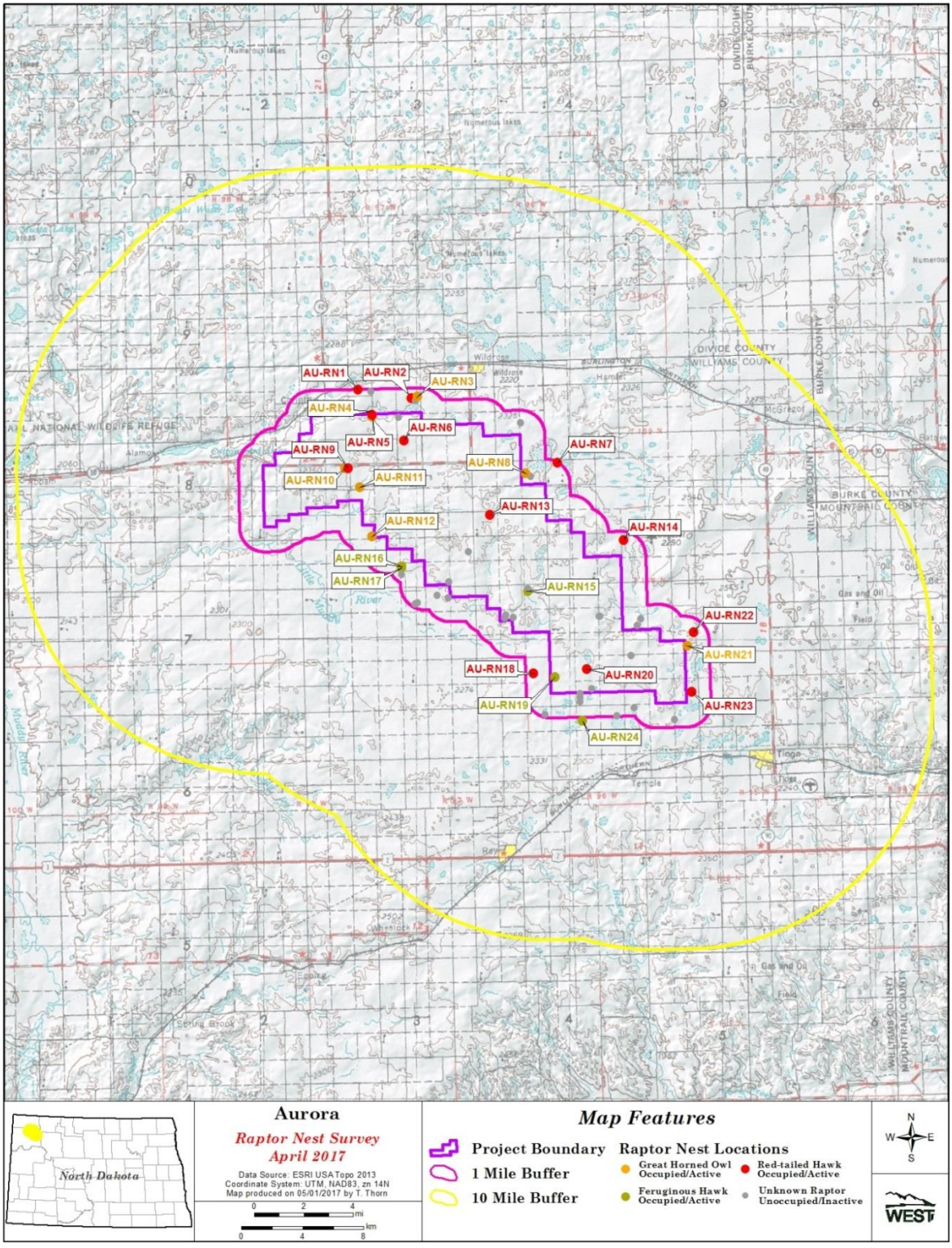

Figure 1. Overview of the proposed Aurora Wind Energy Project and associated buffers, in Williams County, North Dakota, and location of raptor nests* recorded in the study area during aerial surveys conducted on April 20 – 21, 2017.

* Nest IDs for unoccupied/inactive raptor species (grey circles) are not shown.

3.0 METHODS

An aerial survey was conducted from a Robinson R44 helicopter by a qualified biologist and experienced pilot on April 20 – 21, 2017. The goal of the survey was to document raptor nests within the Project area and associated buffers, with emphasis on eagle nests. The survey was timed to coincide with the period prior to leaf out conditions when bald eagles were likely incubating eggs or tending young in the region (USFWS 2007), and when other raptor species were likely to be nesting as well. Raptors are defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls; however, the main focus of the survey was to identify bald eagle nests.

Pre-flight planning included the creation of field maps and mobile Geographic Information System files and review of relevant background information, such as previously recorded nest locations, topographic maps, and aerial photographs. A survey route was planned using aerial imagery and the U.S. Geological Survey (USGS) National Land Cover Database (NLCD; Homer et al. 2015, USGS 2013) to cover all suitable bald eagle and raptor nesting habitat within 10-mi (16.1-km) of the Project. Suitable nesting habitat included wooded areas, riparian corridors, and forested margins of waterbodies. The locations of all potential and confirmed raptor nests, regardless of their activity status, were recorded using a hand-held Global Positioning System (GPS) unit; coordinates were set at Universal Transverse Mercator (UTMs) North American Datum (NAD) 83 unit.

All raptor nests found within the Project area and 1-mi (1.6-km) buffer were recorded; all eagle nests found within the Project area and associated 1- and 10-mi (16.1-km) buffers were recorded. Within the Project area and 1-mi (1.6-km) buffer, transects were flown approximately 0.5-mi (0.8-km) apart to provide complete coverage of all areas where construction impacts may occur. Within the 10-mi (16-km) buffer, transects were flown approximately 1-mi (1.6-km) apart. The survey track was recorded using a handheld GPS unit to ensure that all areas were adequately covered. The helicopter was positioned to allow a full visual inspection of the habitat and to provide a view of the tops of the tallest dominant trees where bald eagles generally prefer to nest (Buehler 2000). During the survey, the helicopter was flown approximately 150 to 200 feet (ft; 46 to 61 meters [m]) above ground level at approximately 75 mi (121 km) per hour.

Data recorded for each observed nest site included:

Nest Identification (ID) - WEST assigned a unique nest identification number for each occupied/active nest documented.

Species - A species was assigned to each nest when possible; otherwise, it was classified as an unknown raptor species nest. Unknown raptor species nests are defined here as any stick nest that did not have an occupant associated with it at the time of the survey. Unknown raptor species nests, including old nests or nests that could become suitable for raptors, were

documented in order to create a nest database for use during future surveys to identify all potentially suitable nest sites.

Nest Status - WEST categorizes basic nest use consistent with definitions from the USFWS ECPG (USFWS 2013). Nests were classified as "occupied" if any of the following were observed at the nest structure: (1) an adult in an incubating position; (2) eggs; (3) nestlings or fledglings; (4) occurrence of a pair of adults or sub-adults; (5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season; or (6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings, and/or molted feathers on its rim or underneath. Occupied nests were further classified as "active" if an adult in an incubating or brooding position, an egg or eggs, and/or nestlings/fledglings were observed, or "inactive" if no eggs or chicks were present. Nests that did not meet the above criteria for "occupied" were classified as "unoccupied".

Nest Condition - Nest condition was categorized using descriptions ranging from poor to excellent. While this designation varies between observers, it gives a general sense of when a nest or nest site may have last been used. Nests in fair to poor condition are characterized by varying degrees of disrepair, sloughing, or sagging heavily, and would require some level of effort to rebuild in order to be suitable for successful nesting. Nests in good to excellent condition are those that appear to have been well maintained, have a well-defined bowl shape, are not sagging or sloughing, and appear to be suitable for nesting.

Nest Substrate - The substrate in which a nest was observed was recorded to provide observers a visual reference. Substrates range from manmade structures (such as power lines, nest platforms, and dock hoists) to biological and physical structures (conifer and deciduous tree species, cliff faces, and rock outcrops).

4.0 RESULTS

No bald eagle nests were observed within the Project area or associated buffers. Twenty-four occupied/active raptor nests representing three raptor species were identified during aerial surveys conducted in 2017, 10 within the Project area and 14 within the 1-mi buffer (Figure 1; Table 1). These nests were classified as follows: 12 occupied/active red-tailed hawk (*Buteo jamaicensis*) nests, seven occupied/active great horned owl (*Bubo virginianus*) nests, and five occupied/active ferruginous hawk (*Buteo regalis*) nests.

Twenty-nine unoccupied/inactive unknown raptor nests were documented during the aerial raptor nest survey (Figure 1; Table 1). Eleven of the unoccupied/inactive unknown raptor species nests were located within the Project area, of which only three were considered to be in good condition and could be used as future nest sites. None of the nests were consistent with the size and structure of bald eagle nests.

No federally listed raptor species were observed nesting within the Project area or associated buffers during surveys conducted in 2017; however, the ferruginous hawk, a Level I Species of Conservation Priority in North Dakota (Dyke et al. 2015), was recorded nesting within the Project area and 1-mi (1.6-km) buffer (Figure 1; Table 1). Level I species have a high conservation priority due to declining populations across North Dakota and/or their range (Dyke et al. 2015).

Table 1. Summary of raptor nests identified during the aerial raptor nest survey conducted on April 20 – 21, 2017 for the proposed Aurora Wind Energy Project, Williams County, North Dakota.

Nest ID	Species[1]	Nest Status	Nest Condition	Nest Substrate	Within Project Boundary?	Comments
AU-RN1	RTHA	occupied/active	good	tree	no	Incubating
AU-RN2	RTHA	occupied/active	good	tree	no	Incubating
AU-RN3	GHOW	occupied/active	good	tree	no	Incubating
AU-RN4	GHOW	occupied/active	good	tree	yes	Incubating
AU-RN5	RTHA	occupied/active	good	tree	yes	Incubating
AU-RN6	RTHA	occupied/active	good	tree	yes	Incubating
AU-RN7	RTHA	occupied/active	good	tree	no	Incubating
AU-RN8	GHOW	occupied/active	good	tree	no	Incubating
AU-RN9	RTHA	occupied/active	good	tree	yes	
AU-RN10	GHOW	occupied/active	good	tree	yes	Incubating
AU-RN11	GHOW	occupied/active	good	tree	yes	Incubating
AU-RN12	GHOW	occupied/active	good	tree	no	Incubating
AU-RN13	RTHA	occupied/active	good	tree	yes	Incubating
AU-RN14	RTHA	occupied/active	good	tree	no	Incubating
AU-RN15	FEHA	occupied/active	good	tree	yes	Incubating
AU-RN16	FEHA	occupied/active	good	tree	no	Incubating
AU-RN17	FEHA	occupied/active	good	tree	no	Incubating
AU-RN18	RTHA	occupied/active	good	tree	no	
AU-RN19	FEHA	occupied/active	good	tree	yes	Incubating
AU-RN20	RTHA	occupied/active	good	tree	yes	Incubating
AU-RN21	GHOW	occupied/active	good	tree	no	Incubating
AU-RN22	RTHA	occupied/active	good	tree	no	
AU-RN23	RTHA	occupied/active	good	tree	no	
AU-RN24	FEHA	occupied/active	good	tree	no	Incubating
AU-UNK1	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK2	UNKN	unoccupied/inactive	disrepair	tree	Yes	
AU-UNK3	UNKN	unoccupied/inactive	good	tree	no	
AU-UNK4	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK5	UNKN	unoccupied/inactive	good	tree	no	
AU-UNK6	UNKN	unoccupied/inactive	disrepair	tree	yes	
AU-UNK7	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK8	UNKN	unoccupied/inactive	good	tree	no	
AU-UNK9	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK10	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK11	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK12	UNKN	unoccupied/inactive	disrepair	tree	yes	
AU-UNK13	UNKN	unoccupied/inactive	disrepair	tree	yes	
AU-UNK14	UNKN	unoccupied/inactive	disrepair	tree	yes	
AU-UNK15	UNKN	unoccupied/inactive	good	tree	yes	
AU-UNK16	UNKN	unoccupied/inactive	good	tree	yes	
AU-UNK17	UNKN	unoccupied/inactive	good	tree	yes	

Table 1. Summary of raptor nests identified during the aerial raptor nest survey conducted on April 20 – 21, 2017 for the proposed Aurora Wind Energy Project, Williams County, North Dakota.

Nest ID	Species[1]	Nest Status	Nest Condition	Nest Substrate	Within Project Boundary?	Comments
AU-UNK18	UNKN	unoccupied/inactive	disrepair	Tree	yes	
AU-UNK19	UNKN	unoccupied/inactive	good	tree	no	
AU-UNK20	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK21	UNKN	unoccupied/inactive	disrepair	tree	yes	
AU-UNK22	UNKN	unoccupied/inactive	disrepair	tree	yes	
AU-UNK23	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK24	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK25	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK26	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK27	UNKN	unoccupied/inactive	good	tree	no	
AU-UNK28	UNKN	unoccupied/inactive	disrepair	tree	no	
AU-UNK29	UNKN	unoccupied/inactive	good	tree	no	

[1] RTHA = red-tailed hawk; GHOW = great horned owl; FEHA = ferruginous hawk; UNKN = Unknown raptor species

5.0 DISCUSSION

The aerial raptor nest survey provided information on raptor and eagle nesting activity within and near the Project area. Red-tailed hawks and great horned owls, common and wide spread nesting species throughout North Dakota, were the most common species with occupied/active nests. No bald eagle nests were observed during the 2017 aerial survey. The Project is located in an area dominated by crop lands and hayfields/pastures with relatively little forest cover and no large lakes that would provide suitable foraging and nesting habitat for bald eagles. Although no eagle nests were found during the aerial survey, eagle use within the Project area could be influenced by suitable nesting and foraging habitat for eagles associated with large waterbodies to the north and east of the Project area (Tom Berg Lake, Helle Slough, Cottonwood Lake, and Alkali Lake).

The ferruginous hawk, a Level I State Species of Conservation Priority (Dyke et al. 2015), was observed nesting within the Project area and associated buffers. Research in North Dakota suggested that ferruginous hawks, a grassland-adapted species, were negatively affected by increases in fragmentation, cropland, and woodland, and decreases in colonial mammal prey (McCarthy 2006).

6.0 REFERENCES

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). A. Poole, ed. The Birds of North America Online. Cornell Lab of Ornithology. Ithaca, New York. Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/506

Dyke, S.R., S.K. Johnson, and P.T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department, Bismarck, North Dakota.

ESRI. 2013. Geographic Information System (GIS) Online Topographic Base Map. ESRI, producers of ArcGIS software. Redlands, California.

Homer, C.G., J.A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulston, N.D. Herold, J.D. Wickham, and K. Megown. 2015. Completion of the 2011 National Land Cover Database for the Conterminous United States-Representing a Decade of Land Cover Change Information. Photogrammetric Engineering and Remote Sensing 81(5): 345-354. Available online from: http://www.mrlc.gov/nlcd2011.php

McCarthy, C.M. 2006. Habitat use of large raptors at two spatial scales in North Dakota. Thesis, St. Cloud State University, St. Cloud, Minnesota.

North American Datum (NAD). 1983. Nad83 Geodetic Datum.

Pagel, J.E., D.M. Whittington, and G.T. Allen. 2010. Interim Golden Eagle inventory and monitoring protocols; and other recommendations. Division of Migratory Bird Management, U.S. Fish and Wildlife Service.

U.S. Environmental Protection Agency (USEPA). 2016. Level III and Level IV Ecoregions of the Continental United States. Information available online at: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

U.S. Fish and Wildlife Service (USFWS). 2007. National Bald Eagle Management Guidelines. May 2007. Available online at: http://www.fws.gov/northeast/EcologicalServices/pdf/NationalBaldEagle ManagementGuidelines.pdf

U.S. Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Executive Summary and frontmatter + 103 pp.

U.S. Geological Survey (USGS). 2011. National Land Cover Database 2011 (NLCD 2011). Multi-Resolution Land Characteristics Consortium (MRLC), National Land Cover Database (NLCD). USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. Information available online at: http://www.mrlc.gov/nlcd2011.php; Legend information available at: http://www.mrlc.gov/nlcd11_leg.php

2018 Raptor Nest Survey Report
Aurora Wind Energy Project
Williams County, North Dakota

Final Report

April 22, 2018

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Figure 1. Raptor nests* recorded during aerial raptor nest surveys conducted on April 22, 2018 for the Aurora Wind Energy Project in Williams County, North Dakota, and associated buffers. 6

INTRODUCTION

Aurora Wind Project, LLC (Aurora), is considering the development of the Aurora Wind Energy Project (Project) in northwest North Dakota. Aurora contracted Western EcoSystems Technology, Inc. (WEST) to conduct diurnal raptor nest surveys within the Project area and surroundings to estimate the impacts of construction on nesting raptors.

The principal objectives of this study were to: 1) identify the species of nesting raptors in the survey area; and 2) provide data on nest locations that could be useful in Project planning. The following report contains the results of the raptor nest surveys conducted for the proposed Project in the spring of 2018.

STUDY AREA

The proposed Project, located approximately 5 miles (mi; 8.0 kilometers [km]) northwest of the city of Tioga in Williams County, North Dakota (Figure 1), falls within the Glaciated Dark Brown Prairie Level IV Ecoregion (US Environmental Protection Agency 2016), in an area of nearly flat to gently rolling topography (US Geological Survey 2013). This ecoregion, previously dominated by short- and mixed- grass prairies, has extensively been converted to agricultural and livestock production lands, with oil and gas extraction constituting additional important activities (Bryce et al. 1996, US Environmental Protection Agency 2017). As defined in April of 2018 for nest surveys the Project encompassed and area of 55,549.8 acres (22,480.2 hectares).

Figure 1. Location of the Aurora Wind Energy Project in Williams County, North Dakota.

METHODS

One aerial raptor nest survey was conducted for the Project area, as defined in April of 2018, in accordance with the protocol described in the United States Fish and Wildlife Service (USFWS) *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2* (ECPG) and new eagle rule (USFWS 2013, 2016), and the USFWS Interim Golden Eagle Inventory and Monitoring Protocols (Pagel et al. 2010).

The survey, conducted on April 22, 2018, was timed to coincide with the period prior to leaf out conditions when bald eagles (*Haliaeetus leucocephalus*) are likely incubating eggs or tending young in the region (USFWS 2007), and when other raptor species are likely to be nesting as well. Raptors are defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls; however, the main focus of the survey was to identify eagle nests, focusing on locating eyries (i.e., large, stick nest structures) in suitable eagle nesting substrates (e.g., trees, transmission lines, cliff faces) within the proposed Project and associated buffers.

Pre-flight planning included the creation of field maps and mobile Geographic Information System (GIS) files and review of relevant background information, such as previously recorded nest locations, topographic maps, and aerial photographs to cover all suitable bald eagle and raptor nesting habitat within 10.0 miles (mi; 16.1 kilometers [km]) of the Project. In addition, a shapefile of known eagle nest locations within the Project and 10-mile buffer was requested from the North Dakota Game and Fish Department in January 2018. One experienced raptor ecologists and a skilled helicopter pilot conducted the raptor nest survey which involved a comprehensive search of suitable nesting areas and substrates (e.g., isolated trees, open woodlands, riparian corridors, savannas, rock outcrops, cliffs, and artificial nest structures such as power poles and transmission towers) within the proposed Project and buffers. The aerial survey efforts included surveys for all raptor nests within the Project area and 1.0-mi (1.6 km) buffer, and only eagle nests within the 10-mi buffer.

In general, all potential raptor nesting habitat was surveyed by flying meandering transects located 0.25–0.5 mi (0.4–0.8 km) apart, flying at speeds of 60–75 mi per hour throughout the proposed Project and associated buffers. Surveys were conducted daylight hours. Data recorded for each observed nest site are described below.

Nest Identification (ID) - WEST assigned a unique nest ID number for each nest documented.

Nest Location: The location of all raptor nests, including all confirmed and potential nests regardless of their activity status, was recorded using a hand-held Global Positioning System unit (commonly, GPS); coordinates were set at Universal Transverse Mercator (commonly, UTM) North American Datum (NAD) 1983 unit.

Bird Species: To the extent possible, a species was assigned to each observed nest; otherwise, the nest was classified as an unknown raptor species nest. Unknown raptor species nests are defined here as any stick nest that did not have an occupant associated with it at the time of the survey. Unknown raptor species nests, including old nests or nests that could become suitable for nesting raptors, were documented in order to create a nest database for use during future surveys to identify all potentially suitable nest sites.

Nest Status: Nest status was categorized consistent with definitions in the USFWS ECPG (USFWS 2013). Nests were classified as "occupied" if any of the following were observed at the nest structure: 1) an adult in an incubating position; 2) eggs; 3) nestlings or fledglings; 4) occurrence of a pair of adults or sub-adults; 5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season; or 6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. "Occupied" nests were further classified as "active" or "inactive". If an adult in an incubating or brooding position, an egg or eggs, and/or nestlings/fledglings were observed, the nest was classified as "active"; if no eggs, nestlings, fledglings, or adults in an incubating/brooding position were observed, the nest was classified as "inactive". A nest that did not meet the above criteria for "occupied" was classified as "unoccupied".

Nest Condition: Nest condition was categorized using descriptions ranging from poor to excellent. While this designation is qualitative, it gives a general sense of when a nest or nest site may have last been used. Nests in fair to poor condition were characterized by varying degrees of disrepair, sloughing, or heavy sagging, and would require some level of effort to rebuild in order to be suitable for successful nesting. Nests in good to excellent condition were those that appeared to have been well maintained, have a well-defined bowl shape, were not sagging or sloughing, and appeared to be suitable for nesting.

Nest Substrate: Substrates ranged from man-made structures such as power lines, nest platforms, and dock hoists, to biological and physical structures such as conifer and deciduous tree species, cliff faces, and rock outcrops.

Efforts were made to minimize disturbance to breeding raptors; the greatest possible distance at which the species and status could be determined was maintained, with distances varying depending upon nest location and weather conditions. Additional data recorded included whether or not the nest size and location was consistent with an eagle nest (Buehler 2000, Pagel et al. 2010), and to the extent possible, photographs.

RESULTS

A total of 63 nest structures representing three raptor species were recorded during the aerial survey conducted for the Project in the spring of 2018 (Table 1). No eagle nests or potential eagles nests were observed within the Project area or associated buffers and no eagle nests

were identified in the North Dakota Game and Fish data request. All raptor nests recorded during this survey were located within the Project area and 1.0-mi buffer (Figure 1).

The raptor nests recorded in 2018 were classified as follows: one occupied active ferruginous hawk (*Buteo regalis*) nest, seven occupied active great-horned owl (*Bubo virginianus*) nests, seven occupied active red-tailed hawk (*Buteo jamaicensis*) nests, one occupied active unknown raptor nest, and 47 unoccupied inactive unknown raptor nests (Table 1). No federally listed threatened or endangered raptor species with potential to occur in the Project area were observed nesting during the aerial raptor nest survey conducted in 2018. All species observed were to be expected for this geographic region and time of year.

The state of North Dakota does not designate species as endangered or threatened but uses a three level system to categorize species of conservation priority based on their conservation need (Dyke et al. 2015). The ferruginous hawk, a Level I Species of Conservation Priority in the State, was recorded nesting within the Project area (Figure 1). Level I species have a high conservation priority due to declining populations across North Dakota and/or their range (Dyke et al. 2015).

Table 1. Raptor nest locations (UTM NAD 83, Zone 13 N) and features identified during aerial surveys conducted on April 22, 2018 for the Aurora Wind Energy Project, in Williams County, North Dakota, and associated buffers[1].

Nest ID	Easting	Northing	Raptor Species	Status	Condition	Substrate	Comments
R1	626110	5386457	Great horned owl	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R2	626958	5386343	Great horned owl	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R3	629608	5385909	Great horned owl	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R4	629790	5385905	Red-tailed Hawk	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R5	627015	5384827	Red-tailed Hawk	Occupied/Active	Good	Deciduous Tree	1 adult; perched
R6	627034	5384699	Unknown	Occupied/Active	Good	Deciduous Tree	2 eggs; no adults in vicinity
R7	641659	5379584	Red-tailed Hawk	Occupied/Active	Good	Deciduous Tree	1 adult; perched
R8	634736	5378291	Great horned owl	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R9	628944	5374418	Red-tailed Hawk	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R10	647664	5369739	Great horned owl	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R11	641069	5368223	Great horned owl	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R12	638977	5367698	Ferruginous Hawk	Occupied/Active	Good	Deciduous Tree	1 adult; perched
R13	637572	5367957	Red-tailed Hawk	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R14	649027	5366849	Great horned owl	Occupied/Active	Good	Deciduous Tree	1 adult; 2 nestlings
R15	652570	5366855	Red-tailed Hawk	Occupied/Active	Good	Deciduous Tree	1 adult; incubating
R16	652184	5364689	Red-tailed Hawk	Occupied/Active	Good	Deciduous Tree	2 adults; perched
R17	630014	5386029	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R18	629866	5385764	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R19	629136	5383142	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R20	625452	5381339	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R21	625442	5381348	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R22	625269	5381350	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R23	626238	5380088	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R24	627033	5376904	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R25	633341	5375889	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R26	643484	5376637	Unknown	Unoccupied/Inactive	Excellent	Deciduous Tree	---
R27	637229	5373493	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R28	637229	5373493	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R29	637232	5373307	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R30	637220	5373288	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R31	635427	5374020	Unknown	Unoccupied/Inactive	Fair	Deciduous Tree	---
R32	632052	5373939	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R33	628938	5375136	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R34	628960	5374925	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R35	628939	5374841	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R36	629821	5372488	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R37	629807	5372446	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---

Table 1. Raptor nest locations (UTM NAD 83, Zone 13 N) and features identified during aerial surveys conducted on April 22, 2018 for the Aurora Wind Energy Project, in Williams County, North Dakota, and associated buffers[1].

Nest ID	Easting	Northing	Raptor Species	Status	Condition	Substrate	Comments
R38	631303	5373024	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R39	632017	5372892	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R40	635693	5371559	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R41	635783	5371760	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R42	636113	5371789	Unknown	Unoccupied/Inactive	Fair	Deciduous Tree	---
R43	636265	5371597	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R44	641857	5371663	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R45	644598	5371525	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R46	648041	5370627	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R47	643968	5369108	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R48	641191	5367059	Unknown	Unoccupied/Inactive	Fair	Deciduous Tree	---
R49	641405	5366940	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R50	640630	5366618	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R51	640627	5366385	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R52	640638	5366120	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R53	638327	5365251	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R54	638347	5365249	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R55	640770	5364880	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R56	643022	5365183	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R57	644164	5365704	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R58	647948	5366752	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R59	652566	5366855	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R60	660094	5364484	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R61	660781	5364286	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R62	661176	5363297	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---
R63	658192	5362496	Unknown	Unoccupied/Inactive	Good	Deciduous Tree	---

[1.] 1.0-mile (mi; 1.6-kilometer [km]) buffer for all raptor nests; 10.0-mi (16.1-km) buffer for eagle nests only.

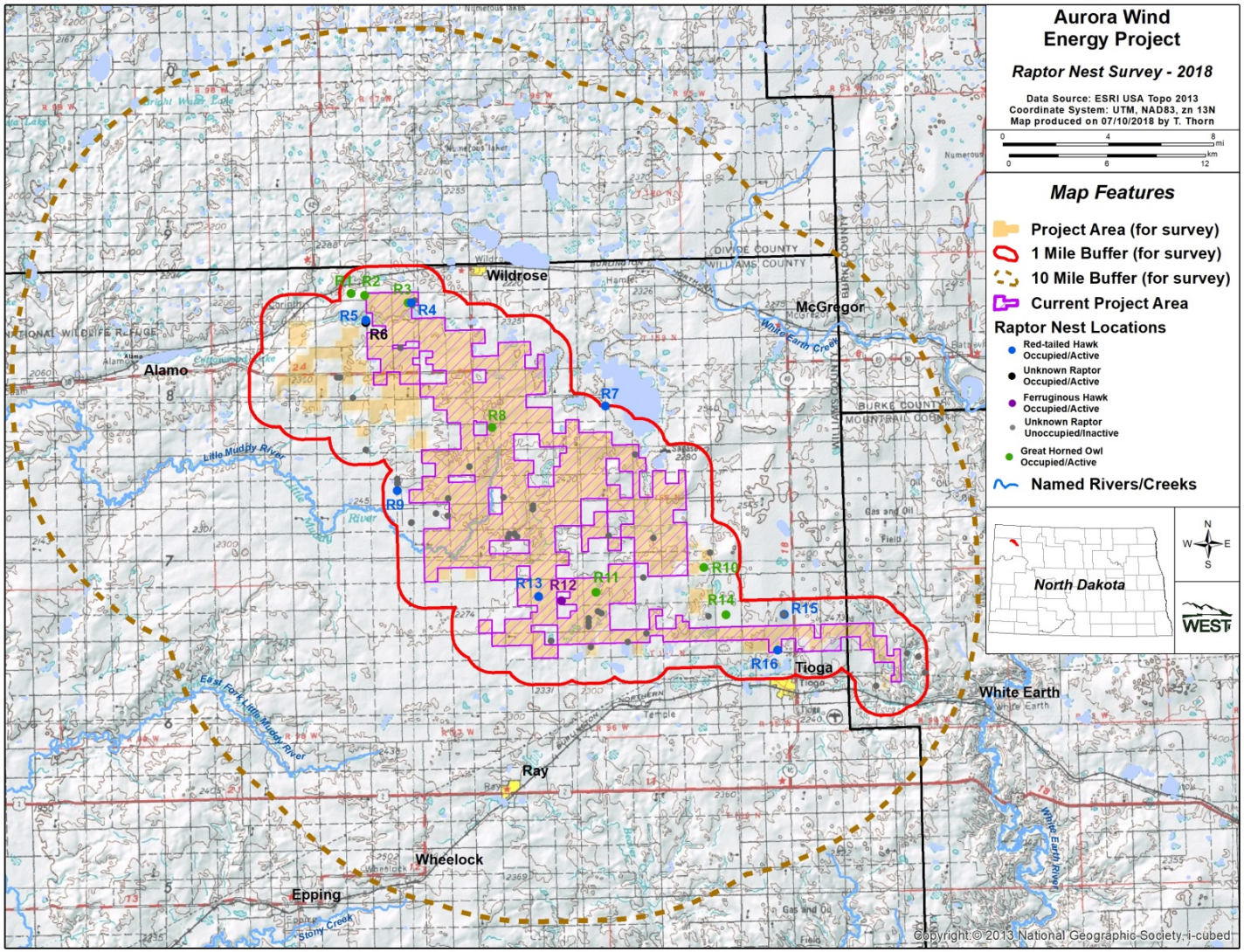

Figure 1. Raptor nests* recorded during aerial raptor nest surveys conducted on April 22, 2018 for the Aurora Wind Energy Project in Williams County, North Dakota, and associated buffers.

* Nest IDs for unknown raptor species (grey and black circles) are not shown.

REFERENCES

Bryce, S. A., J. M. Omernik, D. A. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S. H. Azevedo. 1996. Ecoregions of North Dakota and South Dakota. (Color poster with map, descriptive text, summary tables, and photographs.) US Geological Survey (USGS) map (map scale 1:1,500,000). USGS, Reston, Virginia. US Environmental Protection Agency (USEPA). Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-39

Buehler, D. A. 2000. Bald Eagle (*Haliaeetus Leucocephalus*), Version 2.0. P. G. Rodewald, ed. *In:* The Birds of North America Online. Cornell Lab of Ornithology, Ithaca, New York. Retrieved from the Birds of North America Online: https://birdsna.org/Species-Account/bna/species/baleag

Dyke, S. R., S. K. Johnson, and P. T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department, Bismarck, North Dakota. Available online: https://gf.nd.gov/wildlife/swap

North American Datum (NAD). 1983. Nad83 Geodetic Datum.

Pagel, J. E., D. M. Whittington, and G. T. Allen. 2010. Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. US Fish and Wildlife Service (USFWS). February 2010. Available online: http://steinadlerschutz.lbv.de/fileadmin/www.steinadlerschutz.de/terimGoldenEagleTechnicalGuidanceProtocols25March2010_1_.pdf

US Environmental Protection Agency (USEPA). 2017. Level Iii and Level Iv Ecoregions of the Continental United States. Ecosystems Research, USEPA. Last updated February 8, 2017. Information and maps online: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Executive Summary and frontmatter + 103 pp. Available online: https://www.fws.gov/migratorybirds/pdf/management/eagleconservationplanguidance.pdf

US Fish and Wildlife Service (USFWS). 2016. Programmatic Environmental Impact Statement for the Eagle Rule Revision. December 2016. Available online: https://www.fws.gov/migratorybirds/pdf/management/FINAL-PEIS-Permits-to-Incidentally-Take-Eagles.pdf

US Geological Survey (USGS). 2013. The National Map/Us Topo. Last updated January 2, 2013. Homepage available at: http://nationalmap.gov/ustopo/index.html

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Stage 1 Initial Site Assessment of Eagle Use/Risk
Aurora Wind Energy Project
Williams County, North Dakota

Prepared for:

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January 17, 2018

INTRODUCTION

Aurora Wind, LLC (Aurora Wind) is considering the development of the Aurora Wind Energy Project (Project) in Williams County, North Dakota (Figure 1). Aurora Wind requested that Western Ecosystems Technology, Inc. (WEST) develop an initial site assessment for eagles, which determines the relative importance of the Project (defined as the project boundary as currently determined by Aurora Wind and portrayed in figures below) to resident breeding and non-breeding eagles and migrant and wintering eagles. This report is intended to meet the requirements of a Stage 1 Initial Site Assessment as described in the US Fish and Wildlife Service's (USFWS) *Eagle Conservation Plan Guidance: Module 1 – Land-Based Wind Energy, Version 2* (ECPG; USFWS 2013).

The principal objective of this Stage 1 Assessment for the Project is to assess whether the Project is within areas known to or likely to be used by eagles, and if it is, to determine the expected extent and type of eagle use of the Project.

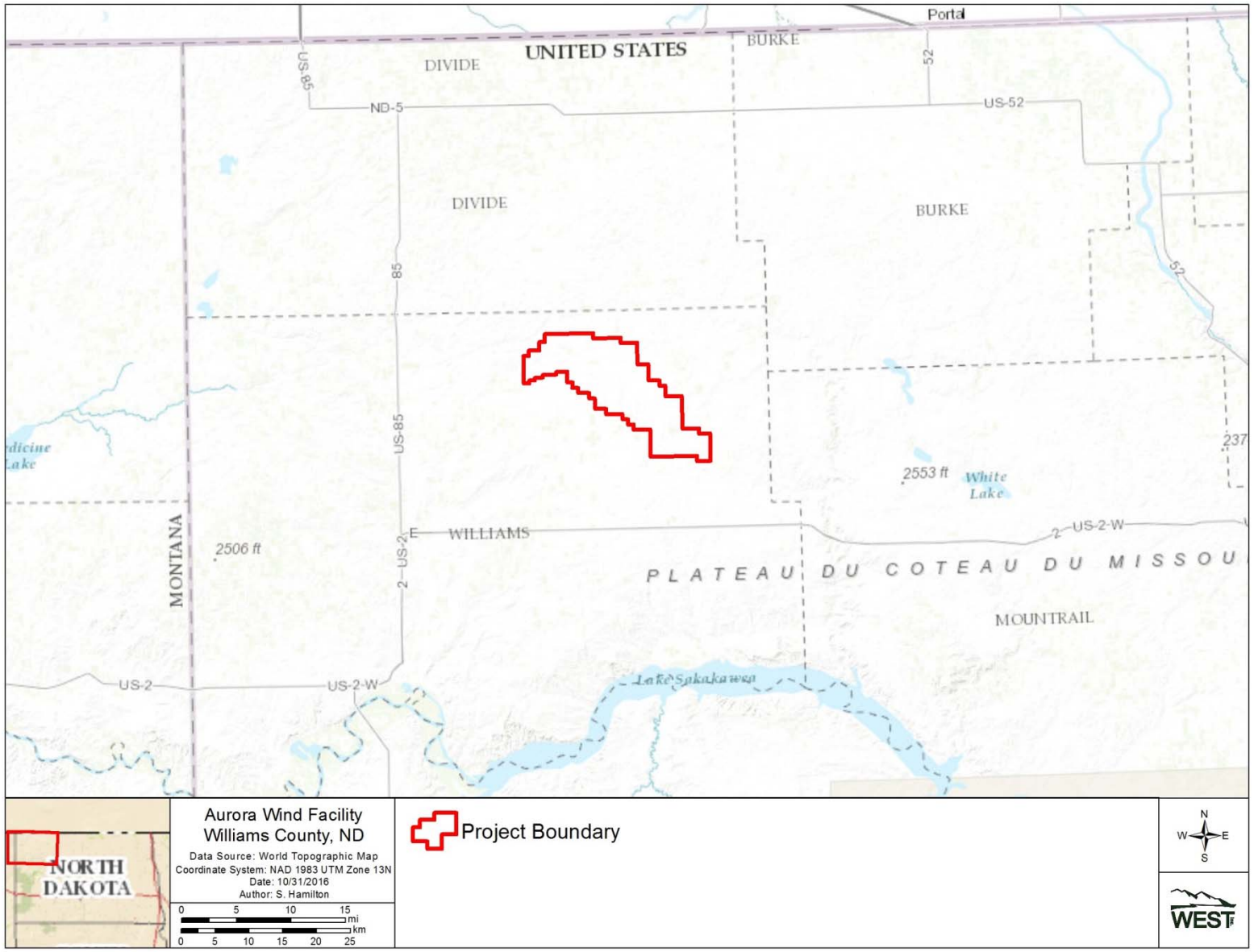

Figure 1. Location of the Aurora Wind Facility in Williams County, North Dakota.

Study Area

The Project encompasses approximately 54,316 acres (ac; 21,981 hectares [ha]) in Williams County, North Dakota (Figure 1). The Project falls within the Northwestern Glaciated Plains Level III Ecoregion and the Glaciated Dark Brown Prairie Level IV Ecoregion and the Missouri Coteau Slope Level IV Ecoregion (USEPA 2010). Much of the Northern Glaciated Plains region, which stretches from Saskatoon, Canada in the north, along the Missouri River through the Dakotas, and south to northern Nebraska, was originally characterized by fescue grasslands, tall and short-grass prairie, trembling aspen (*Populus tremuloides*), oak groves, mixed tall shrubs, and seasonal wetlands, but is now primarily farmland (Griffith 2010). The Northern Glaciated Plains region is a productive agricultural area with a variety of crops including spring wheat, flax (*Linum usitatissimum*), rye (*Secale cereal*), barley (*Hordeum vulgare*), oats (*Avena sativa*), corn (*Zea mays*), soybeans (*Glycine max*), and sunflowers (*Helianthus*; Griffith 2010). The majority of the land use/land cover within the Project is cultivated crops, herbaceous grassland, developed open space, and emergent herbaceous wetlands (US Geological Service [USGS] National Land Cover Database [NLCD] 2011). Though most of the Project is composed of cultivated cropland, there is some open water (<1%), shrub/scrub (<1%), woody wetlands (<1%), deciduous forest (<1%), and low intensity developed areas (<1%). Medium intensity developed areas and mixed forest are also present within the Project. Tom Berg Lake is within the Project (Figure 4), and several larger lakes are within two miles (mi; 3.2 kilometers [km]) of the Project. The topography of the Project is gently rolling hills (Figure 2) with the elevation ranging from approximately 669 – 755 meters (m; 2,195 – 2,477 feet [ft]; Figure 3).

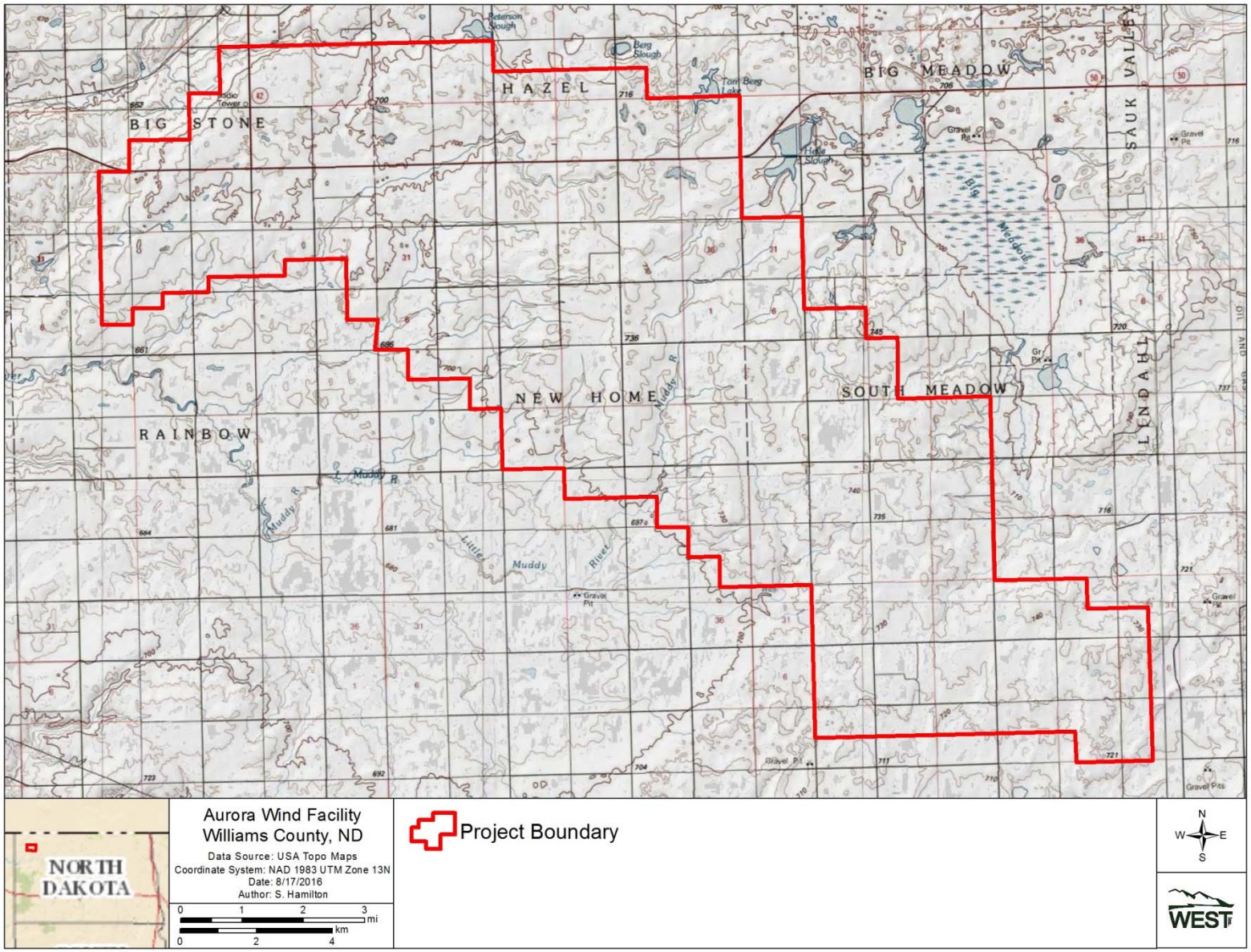

Figure 2. Topographic map of the Aurora Wind Facility.

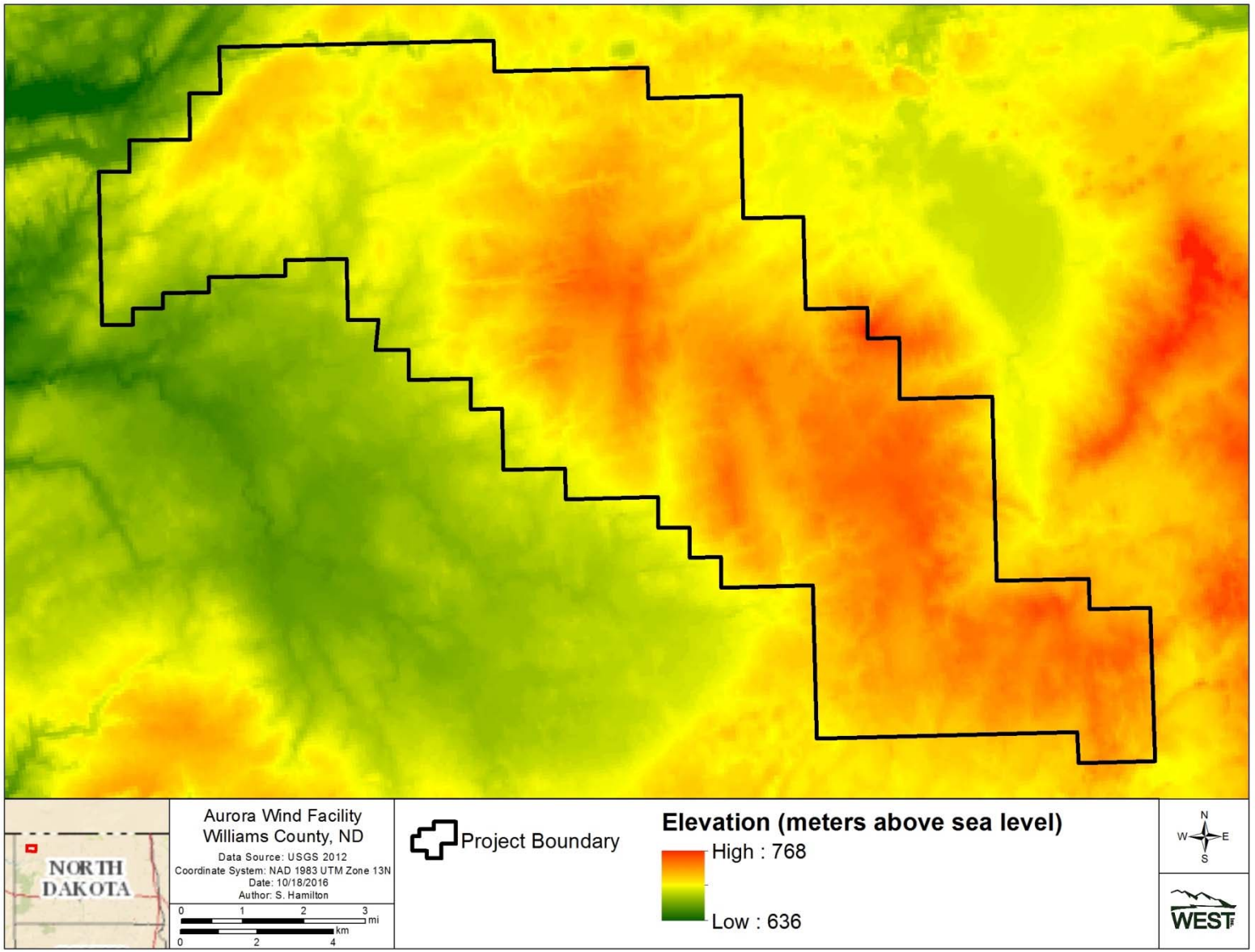

Figure 3. Elevation at Aurora Wind Facility (USGS 2012).

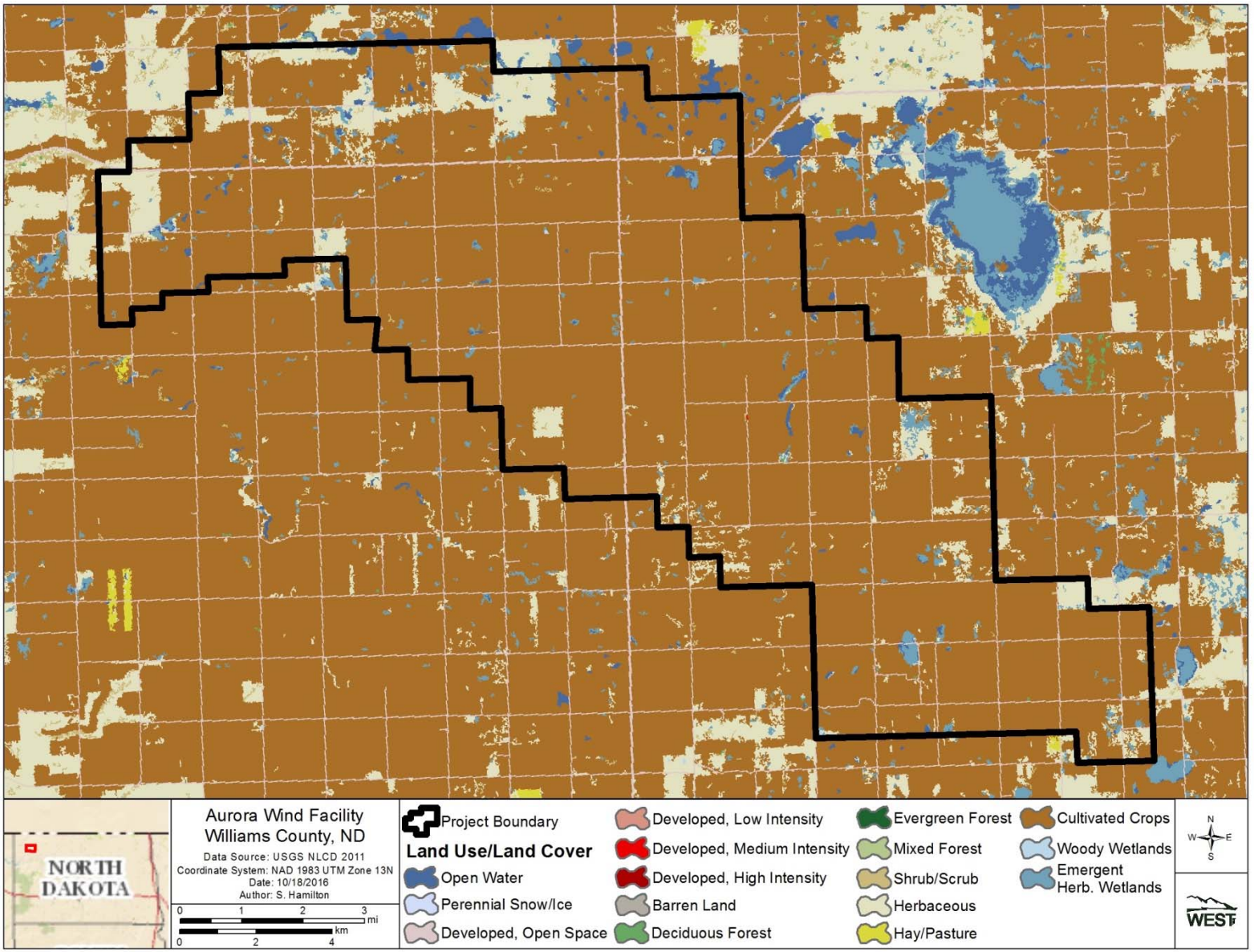

Figure 4. Land use/land cover in the Aurora Wind Facility (USGS NLCD 2011).

METHODS

This Stage 1 Assessment describes existing information from publicly available literature, databases, and other sources to evaluate the appropriateness of the Project for development as it relates to potential risk to eagles. Several sources of available data were used to identify biological resources within the Project. These sources included publicly available reports, publications, geographic information system (GIS) maps, agency reports, species experts, and online databases. Per the ECPG (USFWS 2013), areas of focus for this Stage 1 Assessment include:

- recent or historical nesting and seasonal occurrence data for eagles at the prospective area;
- migration or other regular movement by eagles through the area or surrounding landscape;
- seasonal concentration areas, such as a communal roost site in a mature riparian woodland, or waterfowl concentration serving as a major forage base; and
- physical features of the landscape, especially topography, that may attract or concentrate eagles.

PROJECT SITE CHARACTERISTICS

Land Use/Land Cover

Approximately 87% of the Project is cultivated crop. Herbaceous grasslands compose about 7% of the Project, and may contain some native grassland (USGS GAP 2014). Developed open space makes up approximately 4% of the Project. Emergent herbaceous wetlands cover about (2%) of the Project, while open water makes up nearly 1% of the Project (Table 1, Figure 4).

Table 1. Land use/cover types present within the Aurora Wind Facility (USGS NLCD 2011).

Land Use/Cover	Acres	Percent Composition
Cultivated Crop	47,105.8	86.7
Herbaceous	3,555.7	6.5
Developed, Open Space	2,034.0	3.7
Emergent Herbaceous Wetlands	844.9	1.6
Open Water	488.8	<1
Shrub/Scrub	211.5	<1
Woody Wetlands	33.7	<1
Deciduous Forest	19.7	<1
Developed, Low Intensity	19.7	<1
Developed, Medium Intensity	1.1	<1
Mixed Forest	1.1	<1
Total	**54,316.1**	**100**

Wetlands

Based on National Wetland Inventory (NWI) polygon data (USFWS NWI 2014), there are approximately 1,401.5 ac (567.1 ha) of wetlands found in the Project (Table 2, Figure 5). Freshwater emergent wetlands account for 1,281.5 acres (518.6 ha); followed by lakes that make up 59.8 ac (21.0 ha; Table 2). There is one named river, the Little Muddy River, that flows west from within the Project.

Table 2. National Wetland Inventory polygon types present within the Aurora Wind Facility (USFWS NWI 2014).

Wetland Type	Acres	Percent Composition
Freshwater Emergent Wetland	1,281.5	91.4
Lake	59.8	4.3
Freshwater Pond	51.6	3.7
Freshwater Forested/Shrub Wetland	4.9	0.3
Other	3.7	0.3
Total	**1,401.5**	**100**

Protected Areas

A review of the Protected Areas Database (PADUS 2012) from USGS shows that there are seven parcels of North Dakota State protected areas within the Project (Figure 6). Within 10 mi of the Project, there are four federally protected Waterfowl Production Areas (WPA) and three state protected areas with a total of 55 parcels dispersed throughout the 10 mi area. All protected areas within 10 mi of the Project have a total area of approximately 19,499 ac (7,891 ha). Protected areas within 10 miles of the Project are largely composed of herbaceous grassland, emergent herbaceous wetlands, and open water that may provide suitable foraging opportunities for eagles (USGS NLCD 2011).

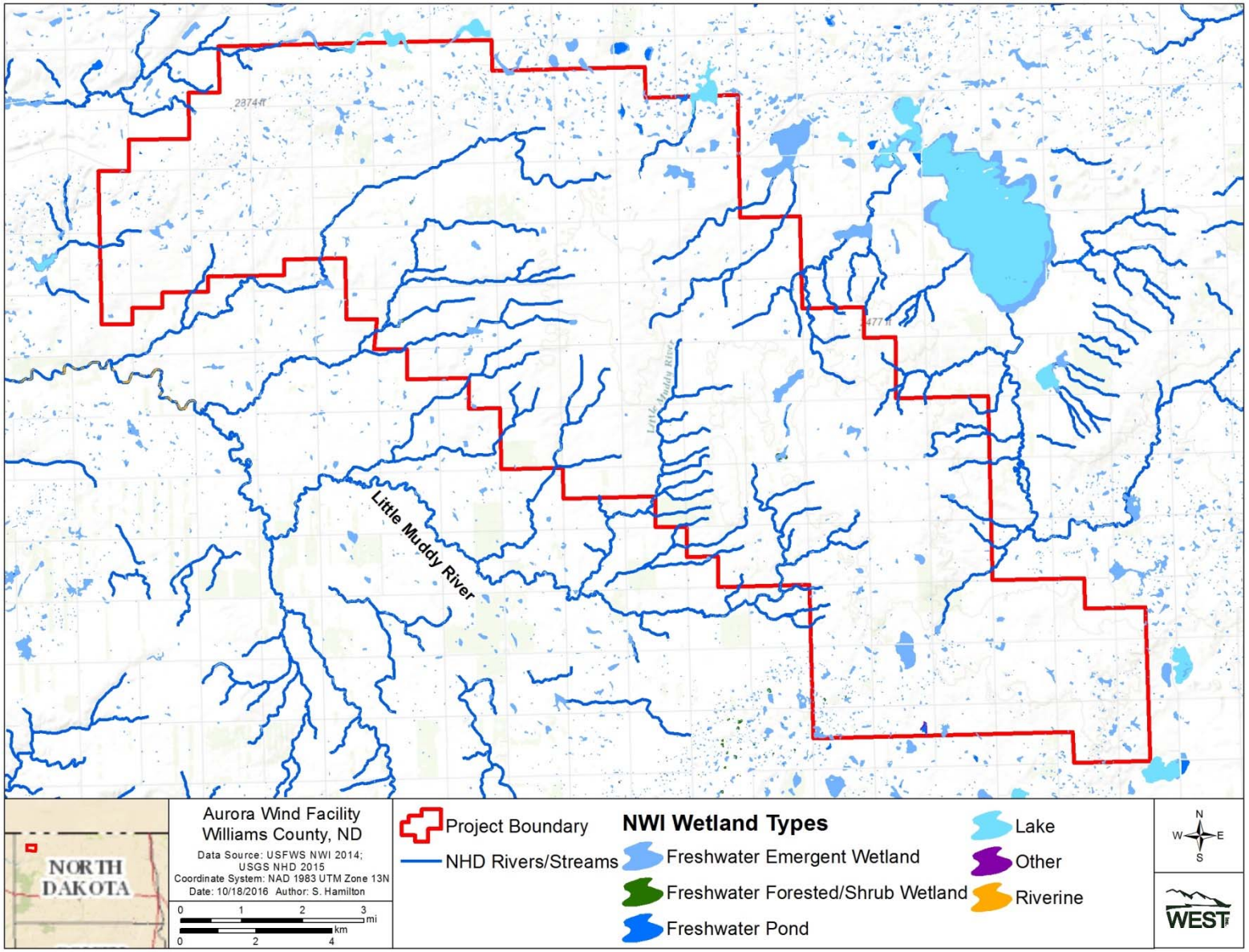

Figure 5. Wetlands, rivers, and streams in the Aurora Wind Facility (USFWS NWI 2014, USGS 2015).

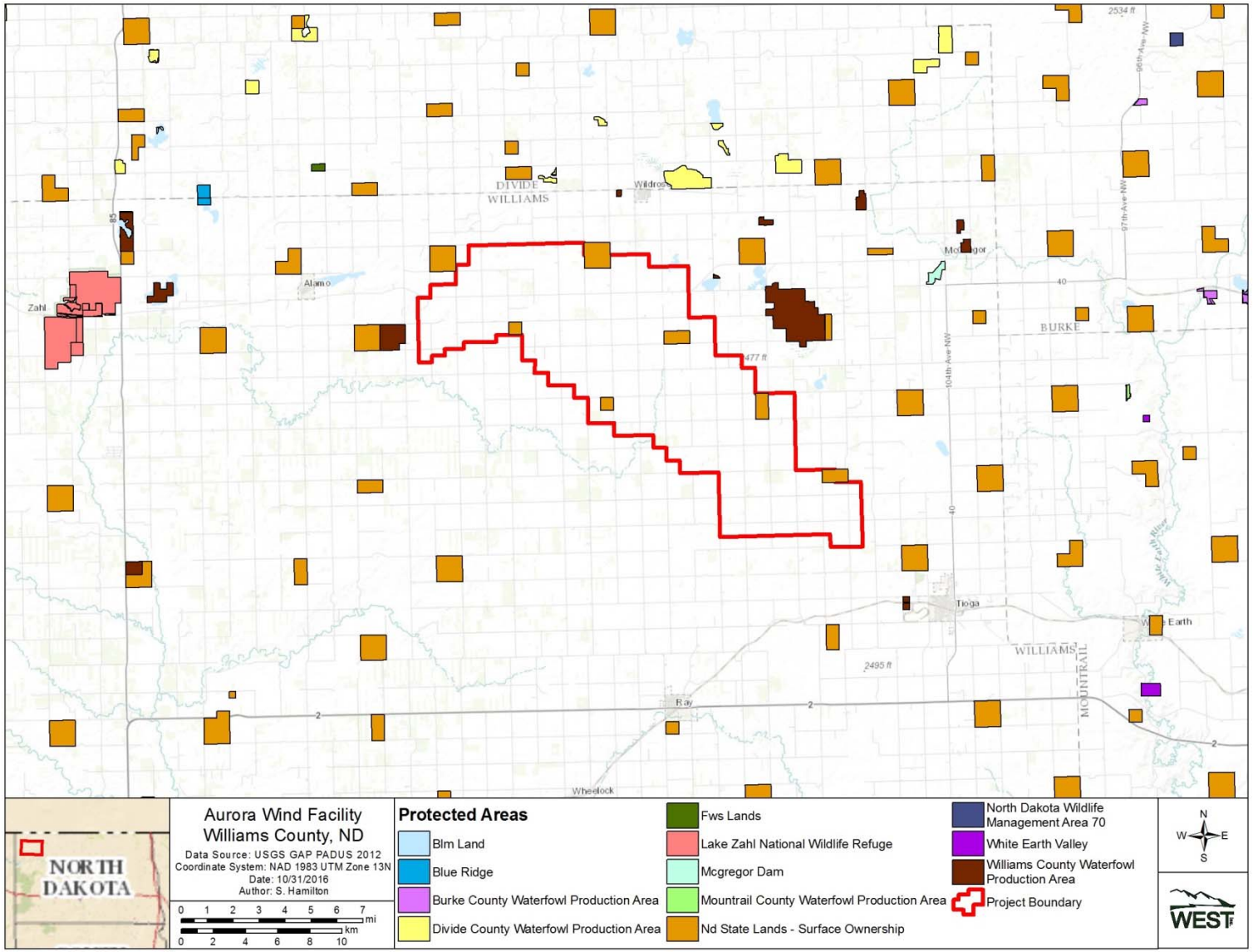

Figure 6. Protected Areas near the Aurora Wind Facility (PADUS 2012).

Important Bird Areas

The National Audubon Society (Audubon) has identified Important Bird Areas (IBAs) that provide essential habitat for one or more bird species (Audubon 2015). There are no IBAs within the Project. The closest IBA to the Project is Lostwood National Wildlife Refuge (NWR), a Globally Important Bird Area located approximately 23 miles (mi, 37.0 kilometers [km]) east of the Project in Burke and Mountrail Counties. This Globally Important Bird Area encompasses 63,992.2 ac (25,896.7 ha) and contains mixed-grass prairie, wetland, and open water habitat that is used by a variety of bird species, particularly breeding waterfowl and shorebirds (USFWS 2016a). The next closest IBA, Medicine Lake NWR, is a Globally Important Bird area that is located approximately 37.0 mi (59.5 km) west of the Project. This IBA encompasses 33,491 ac (13,553.3 ha) in Sheridan and Roosevelt Counties, Montana. Like Lostwood NWR, Medicine Lake NWR contains open water, native prairie, and marsh that provide migratory and breeding habitat for a number of avian species (USFWS 2016b).

EAGLE OCCURRENCE IN THE PROJECT

Golden Eagle

Golden eagles (*Aquila chrysaetos*) are typically considered more susceptible to wind turbine collision than bald eagles (*Haliaeetus leucocephalus*), as evidenced by higher mortality rates throughout their range (Allison 2012). While the North Dakota Game and Fish Department (NDGFD) classify the golden eagle as “uncommon” throughout North Dakota (NDGFD 2012), this species is reported more frequently in the western half of the state as western North Dakota is within the breeding range of the golden eagle (Figure 7). There is one eBird observation of a golden eagle within the Project in 2015, and there are multiple golden eagle observations recorded around the Project (eBird 2016e; Figure 7). It should be noted that eBird data is a citizen-science database and is composed of reported observations collected without a systematic sampling structure. These data should be interpreted with caution as observation locations are often skewed toward birding hotspots and accessible areas. However, these data are useful for the investigation of broad spatial and temporal trends. Given the Project is located largely outside of the breeding range of the species, this report focuses largely on bald eagles (see below sections).

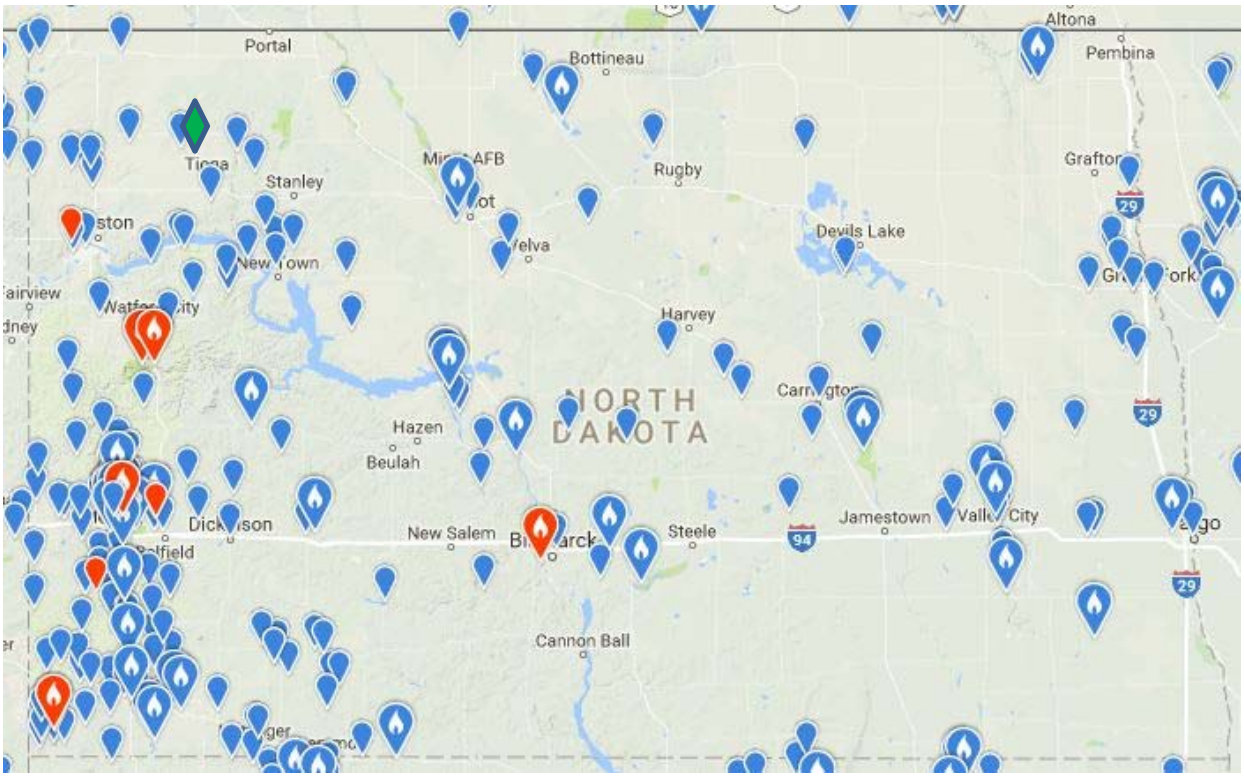

Figure 7. eBird data of golden eagle occurrences observed during all seasons in North Dakota (ebird 2016e). The green diamond represents the approximate location of Aurora Wind Facility. Blue markers indicate golden eagle observations from 1900-2016 and red markers indicate observations less than 30 days old (data from August 18, 2016). Each blue marker can represent one golden eagle observation or multiple golden eagle observations in the same location.

Bald Eagle

In the 1800s, bald eagles were common breeders along North Dakota's major rivers and lakes, such as the Missouri River, Red River, and Devils Lake (Johnson 2010). By the 19th century, however, a significant decline in their numbers occurred due to environmental contaminants and loss of habitat (USFWS 2015). This drop in numbers led to the enactment of the Bald and Golden Eagle Protection Act (BGEPA) in 1940 (BGEPA 1940). In 1978, the bald eagle was listed as an endangered species (Johnson 2010). Nationwide conservation efforts led to the recovery of bald eagles, and the bald eagle was removed from the federal list of endangered and threatened wildlife and plants in 2007 (USFWS 2007b, Johnson 2010).

Bald eagles prefer nesting, roosting, and foraging in areas with mature trees near permanent water bodies in undisturbed areas with abundant prey resources, such as fish and waterfowl (Swenson et al. 1986; Mojica et al. 2008). Though North Dakota has experienced a large increase in the number of nesting bald eagles over the past four decades, challenges and threats to bald eagles remain. Threats to bald eagles include loss or alteration of nesting and roosting habitat, exposure to poisons and environmental contaminants (e.g., lead, pesticides, pollution), electrocution and collision with power lines, and collision with wind turbines (Kochert and Steenhof 2002). Potential impacts to bald eagles from wind energy development and

operations include collision with wind turbines and associated transmission lines, as well as disturbance of nests, roosting sites, and foraging areas.

A review of all years (1900 – 2016) of bald eagle year-round data in the eBird database for a 5-county region (Williams County and the surrounding North Dakota counties [Burke, Divide, McKenzie, and Mountrail Counties]) indicates a strong seasonal trend, with eagle occurrence peaking in March with some smaller peaks in observations occurring in January, mid-April to mid-May, and November (Figures 8), essentially the migration and winter periods. Bald eagle observations within Williams County peak in March with a few additional increases in observations occurring between January-April and again in November (Figure 9). The bald eagle observations from this region are primarily concentrated along the Missouri River and in Lostwood NWR, approximately 17.8-mi (28.6 km) south and 23-mi (37.0 km) west of the Project, respectively. Bald eagle sightings are dispersed throughout the landscape in lower densities in this region of North Dakota, typically where suitable habitat exists (Figure 10).

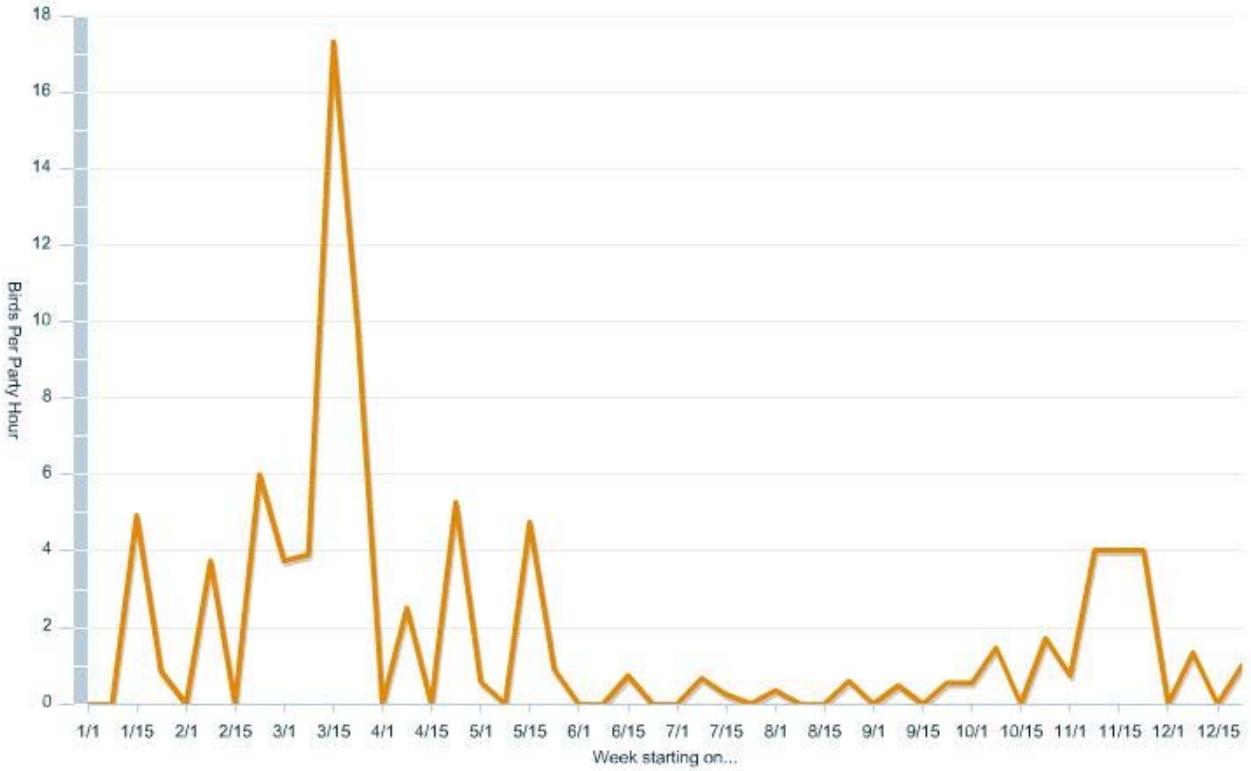

Figure 8. eBird data of bald eagles observed per hour of observation within the 5-county region in North Dakota where Aurora Wind Facility is located (Williams County and the surrounding North Dakota counties Burke, Divide, McKenzie, and Mountrail Counties; eBird 2016b). Birds per hour is the average number of bald eagles seen per hour spent birding within a specified date range and region. Dates range from January 1, 1900, to August 19, 2016.

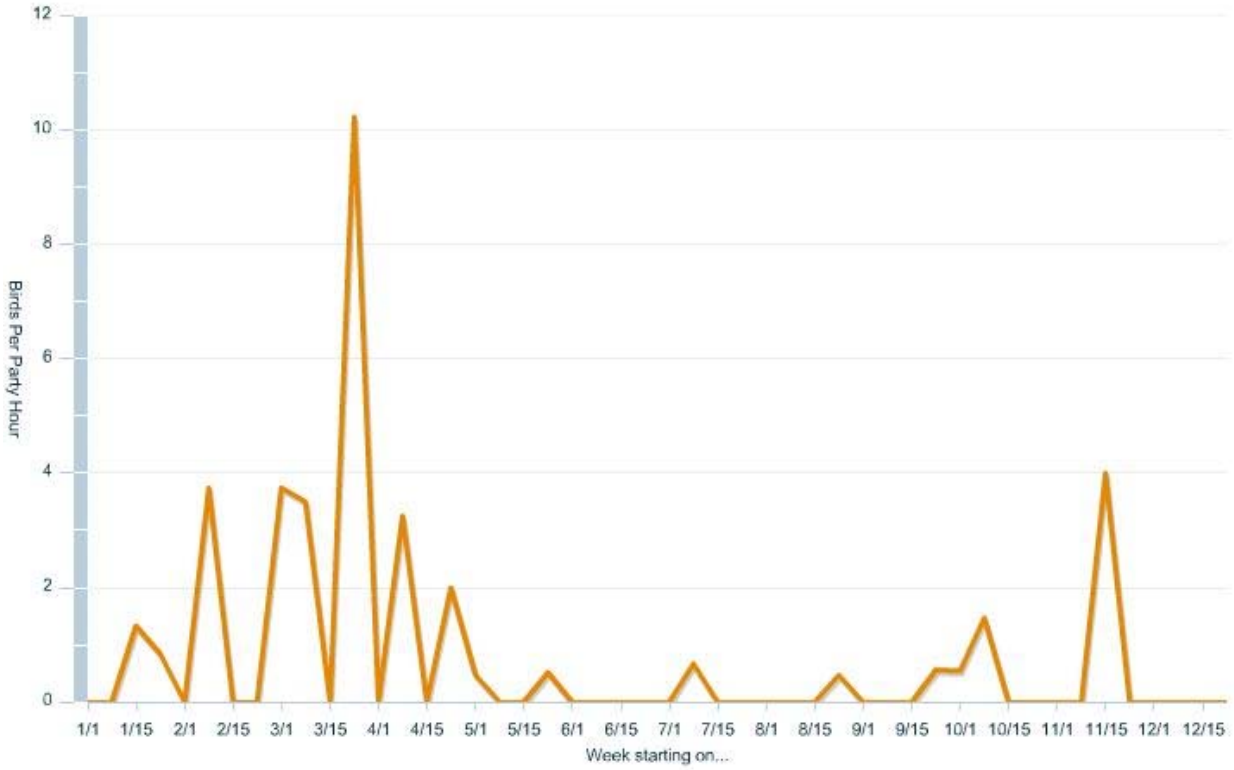

Figure 9. eBird data of bald eagles observed per hour of observation in Williams County, North Dakota (eBird 2016d). Birds per hour is the average number of bald eagles seen per hour spent birding within a specified date range and region. Dates range from January 1, 1900, to August 19, 2016.

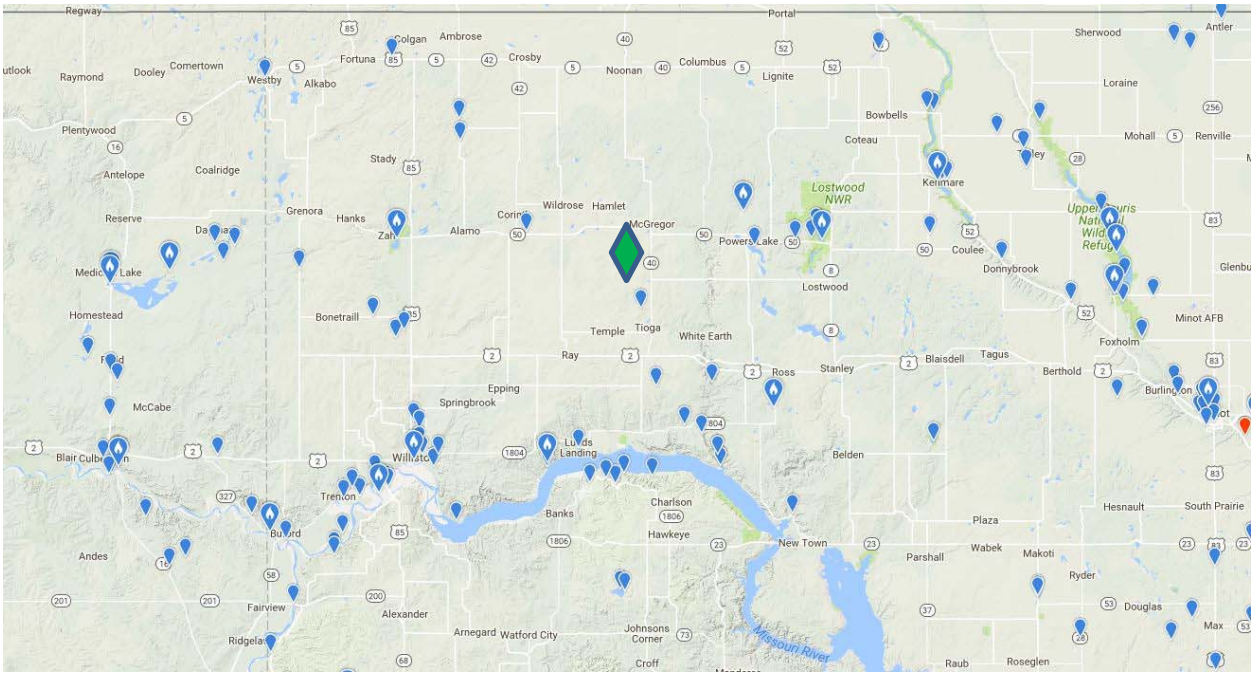

Figure 10. eBird data of bald eagle observations within the region where Aurora Wind Facility is located (eBird 2016a). Observation data are from all months. The green diamond indicates the approximate location of Aurora Wind Facility. Blue markers indicate all year- round observations from 1900-2016 that are more than 30 days old. Red markers indicate data from the last 30 days (data from August 19, 2016). Each blue marker can represent one bald eagle observation or multiple bald eagle observations in the same location.

Resident Breeding and Non-Breeding Eagles

During the breeding season, bald eagles typically breed in forested areas adjacent to large bodies of water. They usually nest in large mature deciduous or coniferous trees in forest tracts that have relatively open canopies or foliage-height diversity that allow for access to nest trees (Anthony and Isaacs 1989, Buehler 2000, Wood et al. 1989). The distance from nest to water varies depending on the population, and occasionally, distance to water appears to be less important than the presence of quality foraging areas (defined by diversity, abundance, and availability of prey [MacDonald and Austin-Smith 1989]), and absence of human disturbance (McGarigal et al. 1991). Perch trees encompass a wider range of tree species and sizes than nest or roost-trees as bald eagles use both coniferous and deciduous trees for perching (Buehler 2000; Stalmaster 1987).

In 2009, the NDGFD reported 66 pairs of bald eagles nesting in 29 counties in the state (Johnson 2010). Johnson (2010) reported two potential bald eagle nests in northwestern Mountrail County and south central Burke County, within approximately 25.0 mi (40.2 km) of the Project (Figure 11). Nesting bald eagle numbers are increasing, as the NDGFD estimated 140 active bald eagle nests in North Dakota in 2015 (Kessler 2015). An increase in migrating bald eagles has also been observed throughout the state as bald eagles migrate through grassland areas in the fall and spring (Kessler 2015). The NDGFD reports that there are no known bald or golden eagle nests within 10-miles of the Project (NDGFD pers. comm.). It should be noted that the NDGFD eagle nests database contains nests reported by the public and nests found during the NDGFD raptor surveys (NDGFD pers. comm.). The NDGFD does not implement a state-wide eagle nest survey using a systematic sampling structure. Therefore, eagle nests may be within 10 miles of the Project, but have yet to be reported to the NDGFD.

Nesting eagles could also pass through the Project or forage within the Project. While the Project land use and land cover is primarily cultivated crops, the herbaceous grassland areas that exist within the Project are likely to provide habitat for eagles (USGS NLCD 2011). Also within and near the Project, there are some large wetland complexes and open water with nearby trees that provide suitable foraging habitat for bald eagles. If bald eagles are found within or near the Project, they will likely be near these lakes. However, there is no reason to believe that the Project landscape is more attractive to eagles than habitat outside of the Project (e.g., more attractive habitat is likely found along the Missouri River, Williams County WPA to the east, and Medicine Lake to the west).

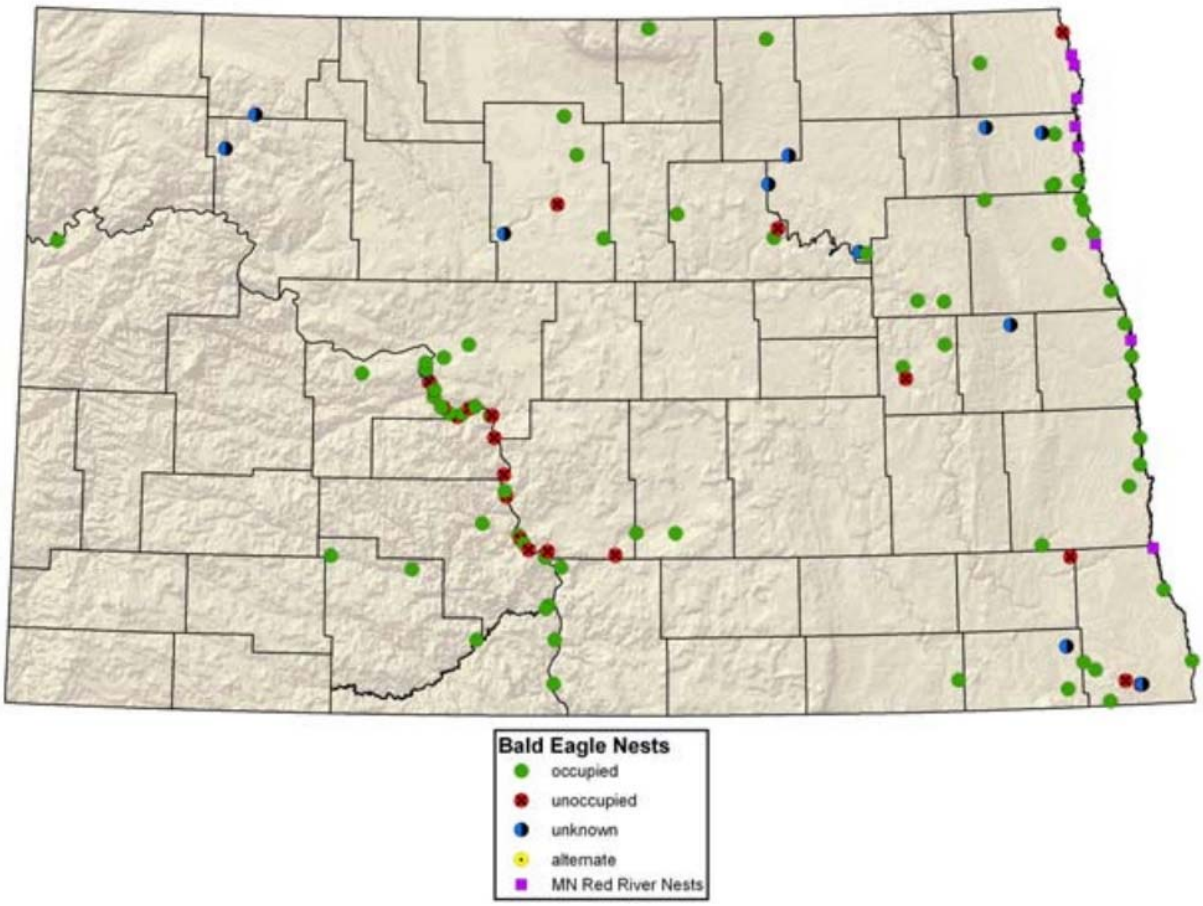

Figure 11. Spatial distribution of bald eagle nests in North Dakota in 2009 (Johnson 2010).

Breeding Bird Surveys

One USGS Breeding Bird Survey (BBS) route, the Wild Rose BBS route, runs through the Project. The next closest route is the Powers Lake Route, located approximately 15.5 mi (24.9 km) east of the Project. Routes are typically 24.5 mi (39.4 km) long and consist of 50 3-minute counts along the length of the route (USGS 2014). Information gathered from the survey provides information about what species may occur in the Project, either transiently or during the breeding season.

Between 2012 and 2015, 86 species were observed along the Wild Rose BBS route, including three raptor species: red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), and Swainson's hawk (*Buteo swainsoni;* Pardieck et al. 2016). No bald or golden eagles were observed along the Wild Rose BBS routes during these years (Pardieck et al. 2016). Between 2012 and 2015, 81 species were observed along the Powers Lake BBS route, including three raptor species: red-tailed hawk, northern harrier, and Cooper's hawk (*Accipiter cooperii;* Pardieck et al. 2016). Two owl species, great horned owl (*Bubo virginianus*) and short-eared owl (*Asio flammeus*), were also observed along the Powers Lake BBS route (Pardieck et al. 2016). No bald or golden eagles were observed along the Powers Lake BBS routes during these years (Pardieck et al. 2016).

Wintering Eagles

Bald eagles may congregate in communal roosts in winter to conserve energy, exploit protective microclimates, and reduce foraging costs (USFWS 2010). Roost sites are typically in mature trees where eagles are sheltered from the wind and inclement weather (USFWS 2007a). Buehler et al. (1991) found that winter communal roosts were more often located close to water sources and away from human development than at random sites. Perching habitat during the winter is similar to other times of the year and is characterized by tall trees located adjacent to foraging areas (Buehler et al. 1992; Chandler et al. 1995).

Bald eagles prefer to forage on fish, so they are often attracted to aquatic habitats (DeLong 1990). However, they are opportunistic foragers and may rely heavily on carrion of fish, birds, and mammals as a primary food source during the winter months (Buehler 2000; Mersmann 1989). Bald eagles also forage at waterfowl concentration areas during the winter where mortality due to hunting provides a reliable supply of waterfowl carcasses for scavenging (Griffin et al. 1982).

Bald eagles are present during the winter in North Dakota, especially near rivers and reservoirs (Kessler 2015). In 2015, bald eagles were reported during 17 of the 20 Christmas Bird Counts that took place throughout the state of North Dakota, with 142 bald eagles observed statewide (Audubon 2016). The Project does not contain significant habitat features that would be attractive to wintering eagles (i.e., open water sources). However, if waterfowl are present during open water periods in late fall and early spring, the herbaceous areas and open water/wetland complexes within the Project and the WPAs or Wildlife Management Areas adjacent to the Project could attract eagles (All About Birds 2015). Bald eagles may occur within the Project during the winter; however, larger bodies of water that are free of ice longer, such as the lake and freshwater emergent wetlands within Williams County WPA to the east and Medicine Lake to the west, are expected to provide better winter habitat. The Project also contains herbaceous areas where carrion (e.g., deer carcasses, road kill) or small game may be present and could be an attractant for bald eagles.

Bald Eagle Migration or Other Regular Movement

Bald eagle migration is not as regular as other migratory birds, as movements are often opportunistic, somewhat unpredictable, and widely dispersed in time (Buehler 2000). Bald eagle migration patterns depend primarily on the age of the bird (immature or adult), location of the breeding site, breeding site climate, and food availability (Buehler 2000). Bald eagles typically do not migrate in kettles or flocks, but concentrations of migrants may occur at communal feeding and roost sites during migration (Buehler 2000). Migration occurs during the day, when thermals provide opportunities to soar with limited energetic expense.

Fall migration peaks from mid-October to early December in North Dakota (Johnson 2009). Bald eagles often migrate along major river systems in search of food (Buehler et al. 1991). In the spring, bald eagles may return to their breeding grounds as soon as the weather improves and

food is available, again often using major river valleys as migration corridors. The spring migratory period peaks from mid-March to mid-April in North Dakota (Johnson 2009).

Little information is available regarding the characteristics of stopover habitat used during migration. It is likely that the suitability of stopover habitat is most related to food availability rather than vegetative composition or structural characteristics. Stopover sites are usually areas with consistent fish-kills, concentrations of fish and waterfowl, or the presence of large mammals as carrion (McClelland et al. 1996). Roosts that most commonly see repeated use as stopover sites consist of clumps of mature deciduous trees in riparian areas protected from human disturbance and close to foraging opportunities. Locations within the Project that may serve as stopover sites for eagles are limited to small wooded patches and lakes with opportunities for foraging. Grasslands and other areas within the Project may attract migrating bald eagles if carrion or small game is present. Therefore, it is possible that eagles will migrate through the Project. However, it is more likely that bald eagles will migrate through areas with more water and trees (e.g., Missouri River corridor) during the migratory period.

Seasonal Eagle Concentration Areas

The Project does not contain habitat or landscape features that would appear to lead to significant seasonal concentrations of bald or golden eagles. Most of the Project consists of cultivated cropland with some grassland and wetland habitat. There are a few wetland complexes within the Project that eagles could use during winter, migration, or during the breeding season. Ephemeral foraging opportunities in the form of carrion and road kill may temporarily attract eagles, especially during the winter.

Physical Landscape Features

Physical features of the landscape that may attract or concentrate eagles are limited within the Project. The general topography across the Project is gently rolling hills. It is likely that bald or golden eagles will migrate through the Project in a broad-front fashion as there are no prominent north-south ridges or valleys that would funnel migrants through the Project (HawkMountain 2016; Liguori 2005; Figures 2 and 3). The available trees and open water/wetland complexes may provide some stopover habitat for migrating eagles, but concentrated use is not expected within the Project since these features are limited within the Project.

CONCLUSIONS

The ECPG (USFWS 2013) suggests specific questions that should be considered to help place a prospective project site into an appropriate risk category. These questions are answered below based on the information compiled during the Stage 1 Initial Site Assessment.

1. *Does existing or historical information indicate that eagles or eagle habitat may be present within the geographic region under development consideration?*

Eagles have not been observed within the Project. There are no known bald or golden eagle nests within the Project or within 10 miles per communication with NDGFD. Bald eagle habitat

exists within the Project as there are open water/wetland complexes (<3%) and forest coverage (<1%; USGS NLCD 2011).

2. *Within a prospective project site, are there areas of habitat known to be or potentially valuable to eagles that would be destroyed or degraded due to the project?*

Overall the Project lacks significant eagle habitat. There is some potentially eagle habitat in the Project area, such as wetland complexes, open water, and herbaceous grasslands. Impacts to these areas should be minimized.

3. *Are there important eagle use areas or migration concentration sites documented or thought to occur in the project area?*

To date, no important eagle use areas or migration concentration sites have been documented or are thought to occur within the Project. The important bald eagle use areas and migration concentration sites are located approximately 17.8 mi (28.6 km) south of the Project along the Missouri River. No bald or golden eagle nests are known within the Project.

4. *Does existing or historical information indicate that habitat supporting abundant prey for eagles may be present within the geographic region under development consideration?*

Abundant prey for eagles is not expected to be present within the Project, but may be found in the larger geographic region. Some foraging opportunities may be present in the form of waterfowl, small game, and road-killed deer and other carrion within the Project.

5. *For a given prospective site, is there potential for significant adverse impacts to eagles based on answers to above questions and considering the design of the proposed project?*

Bald and golden eagles have the potential to occur in the Project during all seasons, but will likely occur in low numbers. Generally, bald eagles do not move broadly across the landscape during the nesting season. As such, the potential risk of bald and golden eagles interacting with wind turbines at this site could be greater during the migratory season; however, no migration concentration sites have been documented or are thought to occur within the Project. Based on available information, it is not likely that eagle populations will be significantly adversely impacted by development of the proposed Project.

REFERENCES

All About Birds. 2015. Bald Eagle. Cornell Lab of Ornithology. Accessed September 2016. Profile available online at: https://www.allaboutbirds.org/guide/bald_eagle/id

Allison, T. D. 2012. Eagles and Wind Energy: Identifying Research Priorities. American Wind Wildlife Institute, Washington, D.C. May 2012. Available online at: http://awwi.org/uploads/files/AWWI_White_Paper_Eagles_and_Wind_Energy_May_2012.pdf

Anthony, R. G. and F. B. Isaacs. 1989. Characteristics of Bald Eagle Nest Sites in Oregon. Journal of Wildlife Management 53: 148-159.

Audubon Society (National Audubon Society [Audubon]). 2015. The Important Bird Areas. Updated February 2015. IBAs by state available online at: http://www.audubon.org/bird/iba

Audubon Society (National Audubon Society [Audubon]). 2016. Christmas Bird Count. Current and Historical Bird Count Results. Audubon Christmas Bird Count online database. Homepage available online at: http://birds.audubon.org/christmas-bird-count

Bald and Golden Eagle Protection Act (BGEPA). 1940. 16 United States Code (USC) § 668-668d. Bald Eagle Protection Act of 1940, June 8, 1940, Chapter 278, § 2, 54 Statute (Stat.) 251; Expanded to include the related species of the golden eagle October 24, 1962, Public Law (P.L.) 87-884, 76 Stat. 1246. As amended: October 23, 1972, P.L. 92-535, § 2, 86 Stat. 1065; Nov. 8, 1978, P.L. 95-616, § 9, 92 Stat. 3114

Bryce, S. A., J. M. Omernik, D. A. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S. H. Azevedo. 1996. Ecoregions of North Dakota and South Dakota. (Color poster with map, descriptive text, summary tables, and photographs.) US Geological Survey (USGS) map (map scale 1:1,500,000). USGS, Reston, Virginia. US Environmental Protection Agency (USEPA). Ecoregion data and GIS shapefiles available online at: http://www.epa.gov/wed/pages/ ecoregions/ndsd_eco.htm#Please%20note

Buehler, D. A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). A. Poole, ed. The Birds of North America Online. Cornell Lab of Ornithology. Ithaca, New York. Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/506

Buehler, D. A., S. K. Chandler, T. J. Mersmann, J. D. Fraser, and J. K. D. Seegar. 1992. Nonbreeding Bald Eagle Perch Habitat on the Northern Chesapeake Bay. Wilson Bulletin 104: 540-545.

Buehler, D. A., T. J. Mersmann, J. D. Fraser, and J. K. D. Seegar. 1991. Nonbreeding Bald Eagle Communal and Solitary Roosting Behavior and Roost Habitat on the Northern Chesapeake Bay. Journal of Wildlife Management 55(2): 273-281.

Chandler, S. K., J. D. Fraser, D. A. Buehler, and J. K. D. Seegar. 1995. Perch Trees and Shoreline Development as Predictors of Bald Eagle Distribution on Chesapeake Bay. Journal of Wildlife Management 59: 325-333.

DeLong, D. C. Jr. 1990. Effects of Food on Bald Eagle Distribution and Abundance on the Northern Chesapeake Bay: An Experimental Approach. Master's Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Derby, C. 2016. Glacier Ridge Wind Farm Land Cover Mapping. Technical memo prepared for Glacier Ridge Wind Farm, LLC.

eBird. 2016b. Bald Eagles Per Hour in Burke, Divide, McKenzie, Mountrail, and Williams Counties, North Dakota, from January 1, 1900 - August 19, 2016. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Chart available online at: http://ebird.org/ebird/GuideMe?step=saveChoices&getLocations=counties&parentState=US-ND&speciesCodes=baleag&bMonth=01&bYear=1900&eMonth=12&eYear=2016&reportType=species&counties=US-ND-013&counties=US-ND-023&counties=US-ND-053&counties=US-ND-061&counties=US-ND-105&continue.x=47&continue.y=3&continue=Continue

eBird. 2016d. Bald Eagles Per Hour in Williams County, North Dakota, from January 1, 1900 - August 19, 2016. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Chart available online at: http://ebird.org/ebird/GuideMe?step=saveChoices&getLocations=counties&parentState=US-ND&speciesCodes=baleag&bMonth=01&bYear=1900&eMonth=12&eYear=2016&reportType=species&counties=US-ND-105&continue.x=41&continue.y=11&continue=Continue

eBird. 2016e. Golden Eagle Sightings in North Dakota. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Golden eagle sightings in North Dakota available online at: http://ebird.org/ebird/map/goleag?neg=true&env.minX=&env.minY=&env.maxX=&env.maxY=&zh=false&gp=false&ev=Z&mr=1-12&bmo=1&emo=12&yr=all&byr=1900&eyr=2016

Frenzel, R. W. 1984. Environmental contaminants and ecology of Bald Eagles in southcentral Oregon. Phd Thesis. Oregon State Univ. Corvallis.

Garrett, M. G., J. W. Watson, and R. G. Anthony. 1993. Bald Eagle home range and habitat use in the Columbia River estuary. J. Wildl. Manage. 57:19-27.

Gerrard, P.N., G.R. Gerrard, and E.H. Dzus. 1992. A 24-year study of Bald Eagles on Besnard Lake, Saskatchewan. Journal of Raptor Research 26:159–166

Griffin, C.R. and R.S. Baskett. 1985. Food availability and winter range sizes of immature and adult Bald Eagles. J. Wildl. Manage. 49:592-594.

Griffin, C. R., T. S. Baskett, and R. D. Sparrowe. 1982. Food Availability and Winter Range Size of Immature and Adult Bald Eagle. Journal of Wildlife Management 49: 592-594.

Griffith, G. 2010. Level III North American Terrestrial Ecoregions: United Stated Descriptions. Prepared for North American Commission for Environmental Cooperation.

Hawk Mountain. 2016. Migration Path. Hawk Mountain Sanctuary, Kempton, Pennsylvania. Accessed January 17, 2018. Available online at: http://www.hawkmountain.org/raptorpedia/migration-path/page.aspx?id=352.

Hodges, J.I. and F.C. Robards. 1982. Observations of 3,850 Bald Eagle nests in Southeast Alaska. Pages 37-54. In: W. N. Ladd and P F. Schempf, eds. Proc. of a symposium and workshop on raptor management and biology in Alaska and Western Canada, 17-20 February 1981, Anchorage, Alas. U.S. Dept. Inter., Fish Wildl. Serv., Anchorage, Alas. 335pp.

Johnson, S. 2010. Nesting in Numbers: Active Bald Eagle Nests up in North Dakota. North Dakota Outdoors Magazine February 2010: 14-17.

Johnson, S. 2009. North Dakota Bald Eagle Nest Summary. National Resources Conservation Service. North Dakota Field Office Technical Guide.

Kessler, A. 2015. "Bald Eagles on the Rise in North Dakota: Game and Fish Estimates State Has 140 Active Nests " *The Dickinson Press*, March 7, 2015. Available online at: http://www.thedickinsonpress.com/news/local/3695276-bald-eagles-rise-north-dakota-game-and-fish-estimates-state-has-140-active-nests

Kochert, M. N. and K. Steenhof. 2002. Golden Eagles in the U.S. And Canada: Status, Trends, and Conservation Challenges. Journal of Raptor Research 36: 32-40.

Liguori, J. 2005. Hawks from Every Angle: How to Identify Raptors in Flight. Princeton University Press, Princeton, New Jersey.

MacDonald, P. R. N. and P. J. Austin-Smith. 1989. Bald Eagle, *Haliaeetus leucocephalus*; Nest Distribution in Cape Breton Island, Nova Scotia. Canadian Field-Naturalist 103: 293-296.

McClelland, B. R., P. T. McClelland, R. E. Yates, E. L. Caton, and M. E. McFadzen. 1996. Fledging and Migration of Juvenile Bald Eagles from Glacier National Park, Montana. Journal of Raptor Research 30: 79-89.

McGarigal, K., R. G. Anthony, and F. B. Isaacs. 1991. Interactions of Humans and Bald Eagles on the Columbia River Estuary. Wildlife Monographs 115: 3-47.

Mersmann, T. J. 1989. Foraging Ecology of Bald Eagles on the Northern Chesapeake Bay with an Examination of Techniques Used in the Study of Bald Eagle Food Habits. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Mojica, E. K., J. M. Meyers, B. A. Millsap, and K. L. Haley. 2008. Migration of Florida Sub-Adult Bald Eagles. Wilson Journal of Ornithology 120(2): 304-310.

National Geographic Society (National Geographic). 2013. TOPO! Digital Topographic Map.

North Dakota Game and Fish Department (NDGFD). 2012. Golden Eagle. Species Identification, North Dakota Birds of Prey. NDGFD, Bismarck, North Dakota. Available online at: http://gf.nd.gov/wildlife/fish-wildlife/id/birds/birds-of-prey/g-eagle

Pardieck, K.L., D.J. Ziolkowski Jr., M.-A.R. Hudson, and K. Campbell. 2016. North American Breeding Bird Survey Dataset 1966 - 2015, version 2015.1. U.S. Geological Survey, Patuxent Wildlife Research Center. www.pwrc.usgs.gov/BBS/RawData/; doi:10.5066/F7C53HZN.

Protected Areas Data - United States (PADUS). 2012. Protected Areas Viewer. US Geological Survey (USGS), USGS National Gap Analysis Program. PADUS version 1.3. November 2012. Data available online at: http://gapanalysis.usgs.gov/padus/data/

Stalmaster, M. V. 1987. The Bald Eagle. Universe Books, New York, New York.

Sullivan, B. L., C. L. Wood, M. J. Iliff, R. E. Bonney, D. Fink, and S. Kelling. 2009. eBird: A Citizen-Based Bird Observation Network in the Biological Sciences. Biological Conservation 142: 2282-2292.

Swenson, J. E., K. L. Alt, and R. L. Eng. 1986. Ecology of Bald Eagles in the Greater Yellowstone Ecosystem. Wildlife Mongraphs 94: 3-46.

US Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). 2012. NAIP Imagery and Status Maps. Last modified August 2012. http://www.fsa.usda.gov/FSA/ apfoapp?area=home&subject=prog&topic=nai

US Environmental Protection Agency (USEPA). 2013. Level III and IV Ecoregions of the Continental United States. Map scale 1:3,000,000. USEPA National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. Available online at: http://www.epa.gov/wed/ pages/ecoregions/level_iii_iv.htm

US Fish and Wildlife Service (USFWS). 2009. Final Environmental Assessment – Proposal to Permit Take as Provided Under the Bald and Golden Eagle Protection Act. Division of Migratory Bird Management.April,2009. http://www.fws.gov/migratorybirds/CurrentBirdIssues/BaldEagle/FEA_EagleTakePermit_Final.pdf

US Fish and Wildlife Service (USFWS). 2007a. National Bald Eagle Management Guidelines. May 2007. Available online at: http://www.fws.gov/northeast/EcologicalServices/pdf/NationalBaldEagleManagementGuidelines.pdf

US Fish and Wildlife Service (USFWS). 2007b. United States Fish and Wildlife Service, Department of the Interior. Part III. 50 CFR Parts 17 Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife; Final Rule; Endangered and Threatened Wildlife and Plants; Draft Post–Delisting and Monitoring Plan for the Bald Eagle (*Haliaeetus leucocephalus*) and Proposed Information Collection; Notice. 72 FR 170, 37346. July 9, 2007.

US Fish and Wildlife Service (USFWS). 2010. Disturbance of Bald Eagles at Winter Roosting/Foraging Areas and Effects of Overhead Utility Line at River Crossings on Bald Eagles. Review of current literature and overview of important eagle areas along the Minnesota River in Le Sueur, Sibley, Scott, and Nicollet Counties. USFWS Twin Cities Field Office, Minnesota. February 8, 2010.

US Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy, Version 2. US Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management. April 2013. Executive Summary and frontmatter + 103 pp. Available online at: http://www.fws.gov/migratorybirds/Eagle_Conservation_Plan_Guidance-Module%201.pdf

US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). 2014. Seamless Wetlands Data by State: North Dakota. USFWS NWI Data Mapper. USFWS NWI, Fort Snelling, Minnesota. Updated May 1, 2014. Geodatabase and Shapefile data available online at: http://www.fws.gov/wetlands/data/State-Downloads.html

US Fish and Wildlife Service (USFWS). 2015. Bald and Golden Eagle Information. Last Updated September 25, 2015. Accessed September 2016. Managed Species homepage: https://www.fws.gov/birds/management/managed-species/bald-and-golden-eagle-information.php

US Fish and Wildlife Service (USFWS). 2016a. Lostwood National Wildlife Refuge: Wildlife and Habitat. USFWS Refuge Profile. Accessed September 2016. Lostwood National Wildlife Refuge homepage: https://www.fws.gov/refuge/Lostwood/

US Fish and Wildlife Service (USFWS). 2016b. Medicine Lake National Wildlife Refuge: Wildlife and Habitat. USFWS Refuge Profile. Accessed September 2016. Medicine Lake National Wildlife Refuge homepage: https://www.fws.gov/refuge/Medicine_Lake/

US Geological Survey (USGS). 2011. National Land Cover Database 2011 (NLCD 2011). Multi-Resolution Land Characteristics Consortium (MRLC), National Land Cover Database (NLCD). USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. Information available online at: http://www.mrlc.gov/nlcd2011.php; Legend information available at: http://www.mrlc.gov/nlcd11_leg.php

US Geological Survey (USGS). 2012. The National Map/Us Topo. Last updated October 26, 2012. Homepage available at: http://nationalmap.gov/ustopo/index.html

US Geological Survey (USGS). 2014. Information on Routes. North American Breeding Bird Survey, Patuxent Wildlife Research Center, USGS. . Online at: https://www.pwrc.usgs.gov/BBS/RouteMap/Map.cfm#

US Geological Survey (USGS). 2015. National Hydrography Dataset (NHD). USGS NHD Extracts: North Dakota. Last accessed August 2016. Information available online at: http://nhd.usgs.gov/; State data available online at: ftp://nhdftp.usgs.gov/DataSets/Staged/States/FileGDB/HighResolution/

US Geological Survey (USGS) National Land Cover Data (NLCD). 2011. National Land Cover Database NLCD, Muti-Resolution Land Characteristics Consortium (MRLC). USGS Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota. Information available online at: http://www.mrlc.gov/nlcd11_leg.php

US Geological Survey (USGS) National GAP Analysis Program (GAP). 2014. Online Land Cover Data Viewer. Accessed January 17, 2018. http://gis1.usgs.gov/csas/gap/viewer/land_cover/Map.aspx

Wood, P. B., T. C. Edwards, and M. W. Collopy. 1989. Characteristics of Bald Eagle Nesting in Florida. Journal of Wildlife Management 53: 441-449.

Baseline Wildlife Studies
Aurora Wind Energy Project
Williams and Mountrail counties, North Dakota

2018 Sharp-Tailed Grouse Lek Surveys

Final Report

Prepared for:

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Bismarck, North Dakota 58501

August 3, 2018

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REPORT REFERENCE

Moratz, K., T. Thorn, and C. Derby. 2018. Baseline Wildlife Studies, Aurora Wind Energy Project, Williams and Mountrail counties, North Dakota. 2018 Sharp-Tailed Grouse Lek Surveys. Final Report. Prepared for Aurora Wind Project, LLC. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 3, 2018.

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INTRODUCTION

Aurora Wind Project, LLC (Aurora Wind) is proposing to construct the Aurora Wind Energy Project (Project) located in Williams and Mountrail counties, North Dakota. Aurora Wind contracted Western EcoSystems Technology, Inc. (WEST) to conduct sharp-tailed grouse (*Tympanuchus phasianellus*) lek surveys at larger grasslands areas within the Project area and along the proposed transmission line corridor. This report presents results of the ground-based lek surveys conducted during April and May of 2018.

STUDY AREA

The Project is located in Williams and Mountrail counties, approximately 1.0 mi north of the town of Tioga, in northwestern North Dakota (Figure 1). The Project encompasses an area of approximately 48,029.1 acres (ac; 19,436.6 hectares [ha]); however, when the sharp-tailed grouse lek surveys were initiated, the Project was approximately 55,949.8 ac (22,642.1 ha; Figure 2). The Project is within the Northwestern Glaciated Plains Level III Ecoregion, an area historically dominated by grasslands but extensively converted to agricultural use (e.g., row crops and livestock grazing; US Environmental Protection Agency 2017). The landscape within the Project is gently rolling to flat, with elevations ranging from 2,150.6 – 2483.6 feet (655.5 – 757.0 meters) above sea level (US Geological Survey 2017).

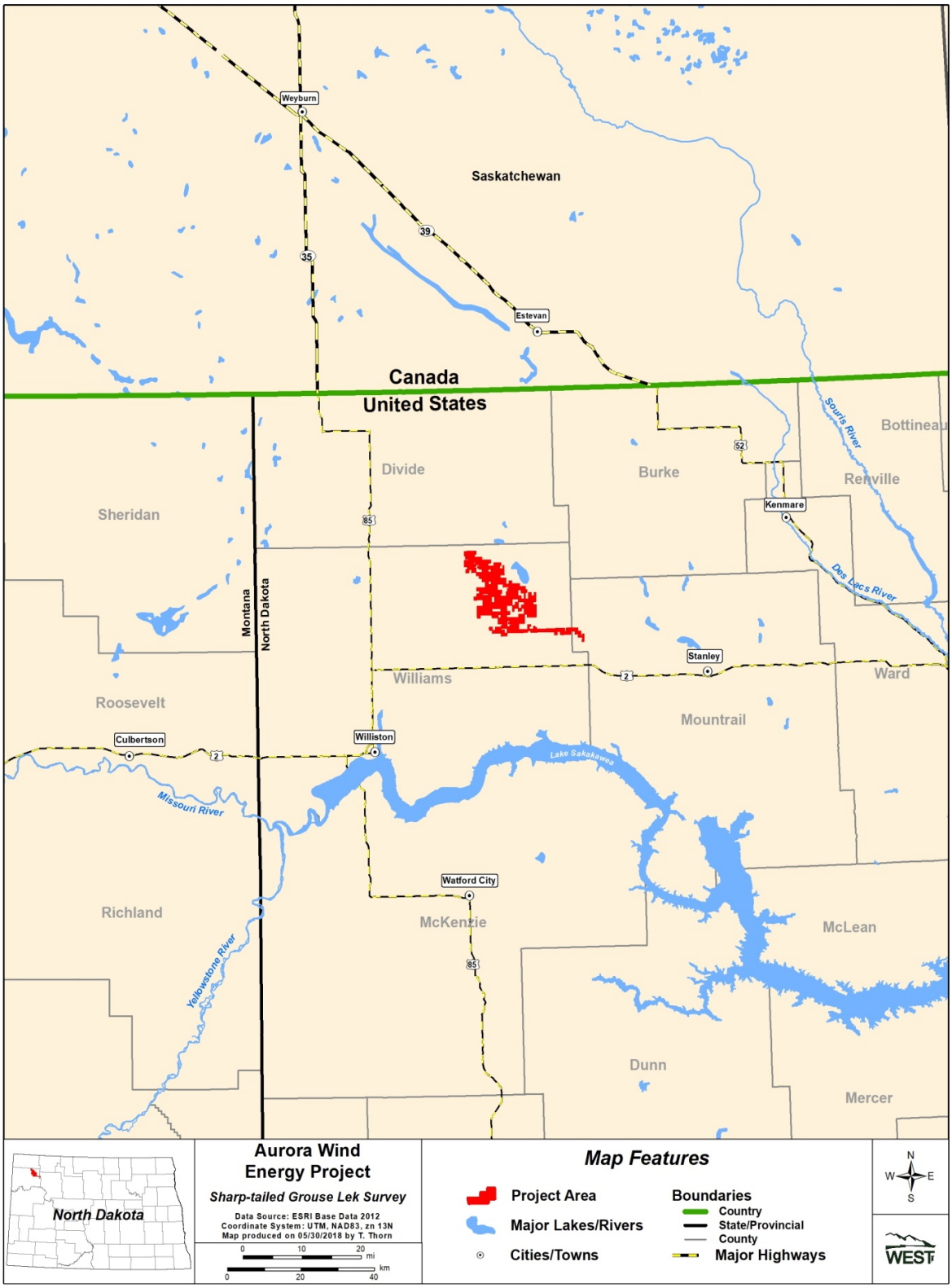


Figure 1. Location of the Aurora Wind Energy Project in Williams and Mountrail counties, North Dakota.

METHODS

Lek surveys were completed three times during the spring, from April 9 – May 11, 2018. Larger grassland tracts (e.g., 80.0 ac [32.4 ha] or larger) within the Project area (Figure 2), were selected for lek surveys as agreed upon in consultation with the North Dakota Game and Fish Department (NDGFD; Sandy Johnson pers. comm.). Fifty-two points, located along public roads and trails around those larger grasslands were selected for surveys. Survey methodology was modeled after the South Dakota Department of Game, Fish and Parks (SDGFP) Wildlife Survey Manual (SDGFP 2009), as a written methodology from North Dakota was not available.

Lek surveys were conducted from 30 minutes (min) prior to sunrise until approximately two hours after sunrise for approximately three to four days each survey period. During each survey period, observers visited each of the survey points from public roads or section lines for a minimum of five min to listen and look for displaying grouse. Leks were classified as "confirmed" if grouse males were engaged in lek attendance behavior (e.g., dancing, calling) at the same location during more than one survey. Leks were classified as "potential" when grouse males were observed in lek attendance behavior (e.g., dancing, calling) during only one survey. If a lek was located, the observer would then map the location from the road (to the best of their ability) and record the number of males, females, and birds of unknown sex attending the lek. Sharp-tailed grouse observed flying or engaging in other behavior (foraging) were also recorded at each point. Other information, such as weather conditions and vegetation/topography descriptions, was also recorded. When possible, surveys were completed on relatively calm mornings (winds less than 20.0 mi [32.2 km] per hour) with little to no rain.

RESULTS

Sharp-tailed grouse lek surveys were conducted within the Project during three survey periods: April 9 – 11, April 23 – 26, and May 8 – 11, 2018. Eighteen points were not visited during the first round of surveys (April 9 – 11) due to snow blocking roadways. No historical lek data was available from NDGFD prior to lek surveys.

Three leks were observed within grassland/hayland during the survey (Table 1; Figure 2). Two leks were confirmed lek locations, with grouse observed in courtship behavior on at least two visits, and one lek was identified as a potential lek as courtship behavior was only observed once during the three surveys. Sharp-tailed grouse were observed engaging in courtship behavior at AU01 during all three survey periods; however AU01 is not within the current Project boundary (Figure 2). Sharp-tailed grouse were observed engaging in courtship behavior at AU02 during the last two survey periods (April 23 – 26 and May 8 – 11, 2018). Grouse were only observed engaging in courtship behavior at AU03 during the second survey period (April 23 – 26, 2018). The average number of sharp-tailed grouse observed on a lek was 10.3 birds, and the maximum number of birds recorded on a lek was 17 birds (Lek AU01; Table 1).

Twenty-five other grouse individuals were also observed during surveys, but were flying, walking, or engaging in other behaviors (e.g., feeding). Six individuals were observed walking in an agricultural field at Point 20 during the first survey period. Eight individuals were observed during the second survey period at points 3, 7, 10, and 20. Eleven grouse were observed flying to and standing near survey point 52 during the last survey period (May 8 – 11, 2018); however no courtship behavior was observed.

Table 1. Summary of ground-based sharp-tailed grouse lek surveys conducted within the Aurora Wind Energy Project in Williams and Mountrail counties, North Dakota, from April 6 – May 11, 2018.

Lek ID	Date First Observed	Other Dates Observed	Highest Total
AU01	04/11/2018	04/26/2018, 05/11/2018	17
AU02	04/23/2018	05/08/2018	4
AU03	04/25/2018	-	10

CONCLUSION

Sharp-tailed grouse is designated as a Level II Species of Conservation Priority according to the North Dakota Wildlife Action Plan (Dyke et al. 2015). While North Dakota contains approximately one-third of the entire sharp-tailed grouse population, a decrease has been observed in the population range wide (Dyke et al. 2015). Data gathered from the lek surveys conducted within the Project can be used in Project siting as well as assessing impacts on prairie grouse from development and operation of the proposed project.

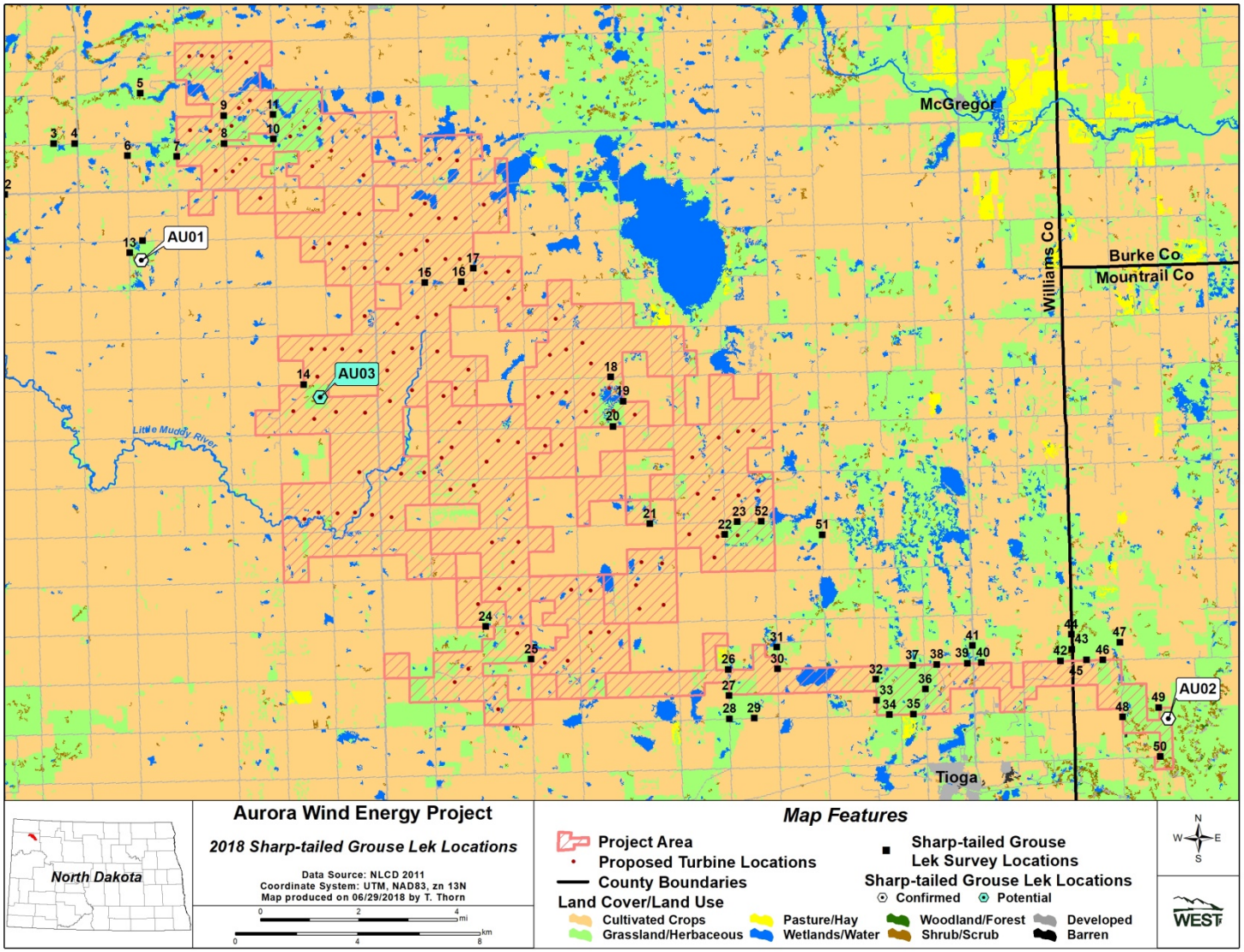


Figure 2. Location of survey points and sharp-tailed grouse leks observed during ground-based lek surveys conducted within the Aurora Wind Energy Project in Williams and Mountrail counties, North Dakota, from April 6 – May 11, 2018.

REFERENCES

Dyke, S. R., S. K. Johnson, and P. T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department, Bismarck, North Dakota. Available online: https://gf.nd.gov/wildlife/swap

North American Datum (NAD). 1983. Nad83 Geodetic Datum.

South Dakota Department of Game, Fish and Parks (SDGFP). 2009. Wildlife Survey Manual 2009-2015. Division of Wildlife, Pierre, South Dakota. 187 pages.

USA Topo. 2013. USA Topo Maps. US Geological Survey (USGS) topographical maps for the United States. ArcGIS. ESRI, producers of ArcGIS software. Redlands, California.

US Environmental Protection Agency (USEPA). 2017. Level Iii and Level IV Ecoregions of the Continental United States. Ecosystems Research, USEPA. Last updated February 8, 2017. Information and maps online: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

US Fish and Wildlife Service (USFWS). 2018. Wind Energy Development Information. USFWS Wind Energy website. Last updated May 2, 2018. Website at: http://www.fws.gov/windenergy/

US Geological Survey (USGS). 2017. USGS Topographic Maps. Last updated January 17, 2017. Homepage available at: https://nationalmap.gov/ustopo/index.html

Stantec Consulting Services Inc.
6800 College Boulevard Suite 750,
Overland Park KS 66211

December 12, 2017
File: 2017 Aurora Wind Project Acoustic Bat Summary

Attention: Jennifer Dean
Aurora Wind Project, LLC
16105 West 113th Street, Suite 105
Lenexa, KS 66219-2305

Reference: 2017 Acoustic Bat Monitoring Survey Summary for the Aurora Wind Project, Williams and Mountrail Counties, North Dakota

Dear Ms. Dean,

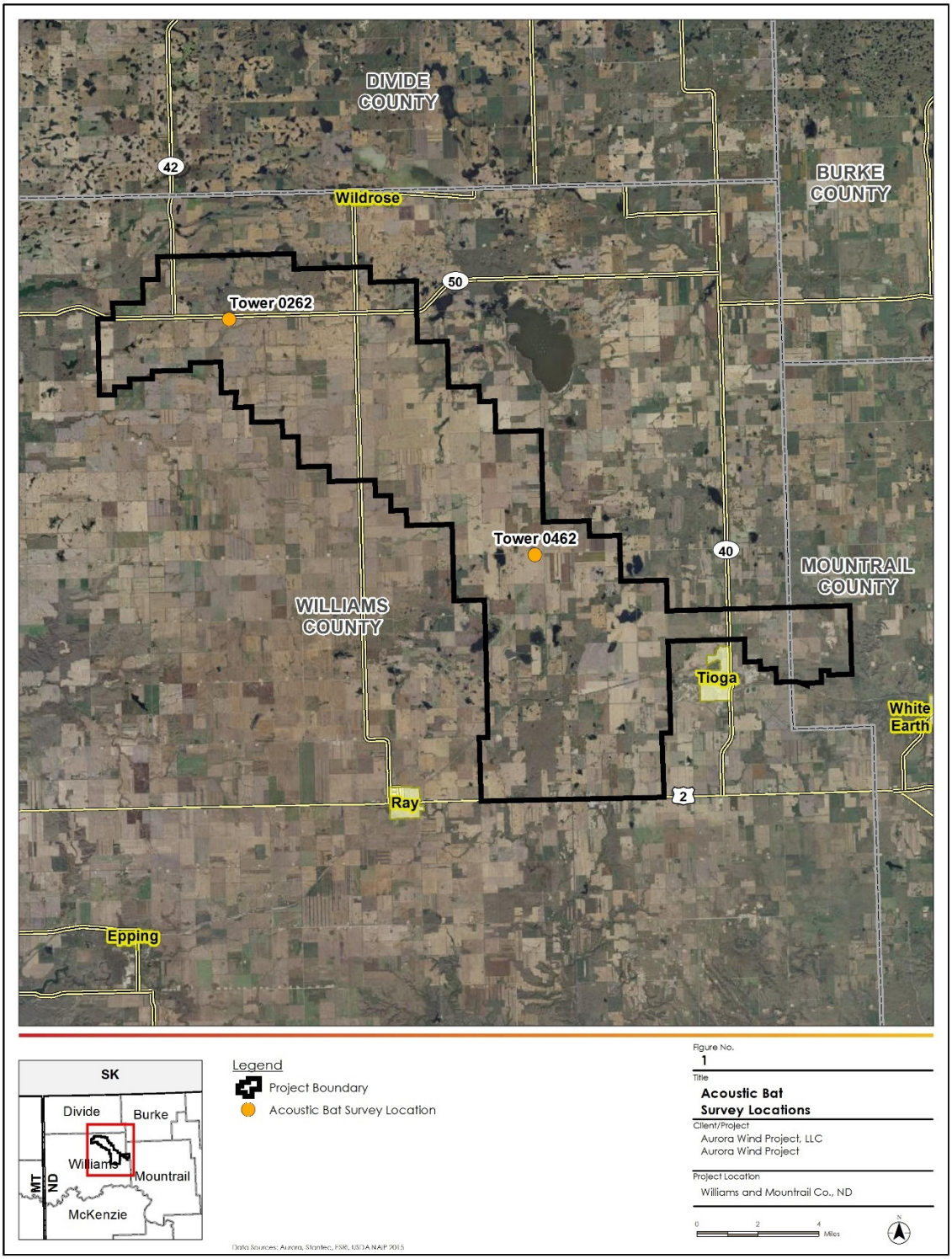
Aurora Wind Project, LLC (Aurora) contracted Stantec Consulting Services Inc. (Stantec) to conduct an acoustic survey utilizing meteorological (met) towers to document bat activity at the Aurora Wind Project (Project) in Williams and Mountrail counties, North Dakota, from April 18 through October 31, 2017. This memo summarizes the bat activity data recorded during the 2017 survey.

Acoustic bat monitoring equipment (Wildlife Acoustics SM3BAT full spectrum, dual-channel bat detectors) was installed on April 18 and 19, 2017 at two met towers (Tower 0262 and Tower 0462) within the Project. A map of the Project area with the locations of the two met towers outfitted with acoustic monitoring equipment is shown in Figure 1. The detectors were configured to monitor bat activity near ground level (3 meters [m] above ground level [agl]; "Low Microphone") and at heights within the proposed rotor-swept area (55 meters agl; "High Microphone"). Recording locations were named according to the tower number and the detector height (e.g., "0262 High" refers to the High Microphone at Tower 0262). The microphones were connected to a detector installed at the base of each tower and were programmed to record bat activity from 30 minutes prior to sunset to 30 minutes after sunrise each night of the survey. A detector night (DN) was defined as one microphone recording location sampled for an entire night.

The detector at Tower 0462 was installed on April 18, 2017. The detector on Tower 0262 was installed on April 19, 2017. Both detectors were demobilized on October 31, 2017. There was a potential for 195 detector nights at each microphone on Tower 0262 and 196 detector nights at each microphone on Tower 0462; therefore, the Project had 782 potential detector nights. All attempted detector nights were successful at both towers. A summary of survey effort at each monitoring location is presented in Table 1.

Table 1. Survey Effort

Microphone Location	Attempted Detector Nights	Successful Detector Nights	Success Rate
0262 High	195	195	**100%**
0262 Low	195	195	**100%**
0462 High	196	196	**100%**
0462 Low	196	196	**100%**
TOTAL	**782**	**782**	**100%**


DIVIDE COUNTY
BURKE COUNTY
MOUNTRAIL COUNTY
WILLIAMS COUNTY
Wildrose
Tower 0262
Tower 0462
Tioga
White Earth
Ray
Epping
42
50
40
2
SK
Divide
Burke
Williams
Mountrail
McKenzie
MT
ND
Legend
Project Boundary
Acoustic Bat Survey Location
Figure No.
1
Title
Acoustic Bat Survey Locations
Client/Project
Aurora Wind Project, LLC
Aurora Wind Project
Project Location
Williams and Mountrail Co., ND
0
2
4
Miles
N
Data Sources: Aurora, Stantec, ESRI, USDA NAIP 2015

Stantec conducted an analysis of the 2017 acoustic bat data collected at the Project. After the acoustic data files were downloaded, all files were filtered using Kaleidoscope Pro 4.3.2 (Wildlife Acoustics, Inc.) to eliminate noise (e.g., insects, rain, wind). The program parameters used when filtering data through Kaleidoscope Pro are available in Appendix A. A trained bat biologist visually reviewed the files in AnalookW (version 4.2n) to confirm they contained a Bat Pass (BP; i.e., at least 2 bat echolocation call pulses). Files that did not contain a BP were manually removed and not analyzed further.

Once each file was reviewed to verify it contained bat passes, files were assigned auto-identifications by Kaleidoscope Pro based on species potentially occurring in the Project (Table 2). Ten bat species could potentially occur within the Project based on historical ranges and North Dakota county records (Dyke et al. 2015, Harvey et al. 2011, Reid 2006). Of these species, four are state-listed Species of Conservation Priority (SCP) Level 1 (considered to be of declining status or the core of the species breeding range is in North Dakota) and three are SCP Level 3 (believed to be in the peripheral of the distribution or non-breeding in the state). These species are listed in the State Wildlife Action Plan which does not provide any regulatory protection, but identifies them for state conservation efforts. One of these SCP, the Northern Long-eared Bat (*Myotis septentrionalis*), is also federally-listed as threatened. Auto-identifications assigned by Kaleidoscope Pro were then sorted into species groups (defined below) by a trained bat biologist.

Bat species can often be identified by the differences in the frequencies of their echolocation calls. The minimum frequency of a bat pass (measured in kilohertz [kHz]) is a characteristic typically used to differentiate species or groups of species from one another. Bats with minimum echolocation pulse frequencies typically less than or equal to 30 kHz were placed into the Low Frequency Species Group (LFSG). Bats with minimum echolocation pulse frequencies typically higher than 30 kHz were sorted into the High Frequency Species Group (HFSG). These groups are also presented in Table 2.

Table 2. Bat Species Potentially Occurring in the Project Vicinity

Species	Scientific Name	Species Group	Federal Rank	State Rank
Big Brown Bat	*Eptesicus fuscus*	LFSG	-	SCP Level 1
Eastern Red Bat	*Lasiurus borealis*	HFSG	-	-
Hoary Bat	*Lasiurus cinereus*	LFSG	-	-
Little Brown Bat	*Myotis lucifugus*	HFSG	-	SCP Level 1
Long-eared Bat	*Myotis evotis*	HFSG	-	SCP Level 3
Long-legged Bat	*Myotis volans*	HFSG	-	SCP Level 3
Northern Long-eared Bat	*Myotis septentrionalis*	HFSG	Threatened	SCP Level 1
Silver-haired Bat	*Lasionycteris noctivigans*	LFSG	-	-
Townsend's Big-eared Bat	*Corynorhinus townsendii*	LFSG	-	SCP Level 1
Western Small-footed Bat	*Myotis ciliolabrum*	HFSG	-	SCP Level 3

Sources: Harvey et al. 2011, Dyke et al. 2015, Reid 2006 SCP: Species of Conservation Priority

A total of 1,836 BPs was recorded at the 2 met towers, with 912 BPs recorded at Tower 0262 (average of 2.3 BP/DN) and 924 bat passes recorded at Tower 0462 (average of 2.4 BP/DN). The average bat passage rate for each microphone and met tower location is presented in Table 3. The average bat passage rate for the Project was 2.3 BP/DN. Activity was nearly two times higher at the low microphones (1,228 bat passes; 3.1 BP/DN) than the high microphones (608 bat passes; 1.6 BP/DN). These passage rates are lower than the average number of bat passes per detector night (4.2 BP/DN) for the Great Plains Region (Hein et al. 2013). Bat activity for each microphone at Tower 0262 and Tower 0462 was graphed for the survey period and are shown in Figure 2 and Figure 3, respectively. Bat activity trends for the entire Project, based on microphone height, are shown in Figure 4.

Table 3. Summary of Bat Passes

Microphone Location	Bat Passes	Detector Nights	Average BP/DN
0262 High	303	195	1.6
0262 Low	609	195	3.1
0262 Total	**912**	**390**	**2.3**
0462 High	305	196	1.6
0462 Low	619	196	3.2
0462 Total	**924**	**392**	**2.4**
High Microphones Total	**608**	**391**	**1.6**
Low Microphones Total	**1228**	**391**	**3.1**
Grand Total	**1,836**	**782**	**2.3**

The first bat pass recorded at the Project occurred on April 20, 2017. Both towers experienced relatively low activity until mid-July. Activity at the Project peaked between late-July and mid-September with the highest monthly bat passage rate being in August (average of 7.9 BP/DN). This period coincides with timing of fall migration, known to occur from August to November (Cryan 2003). The highest bat activity night at the Project occurred on August 10, 2017 with 94 bat passes. From peak activity in early August, bat activity gradually decreased until early October. The increase in high microphone activity observed in early September may have resulted from a later migratory push. Bat activity decreased to an average of 0.1 BP/DN in October. Given the relatively high latitude of the Project, the early decrease in bat activity is expected. The last bat pass recorded for the Project occurred on October 17, 2017.

Of the 1,836 bat passes recorded, 1,409 (76.7%) were identified to a Species Group (LFSG or HFSG). The majority (59.2%) of classifiable bat passes were classified as LFSG (Figure 5). To compare bat frequency-group composition at ground level and in the rotor-swept zone, bat passes identified to species groups were totaled among the two microphone heights. Bat passes attributed to the LFSG were more prevalent at high microphone locations throughout the survey, contributing 86.3% of the bat passes identified. Bat passes attributed to the HFSG were more prevalent at low microphone locations, contributing 54.5% of the identified bats (Figure 5).

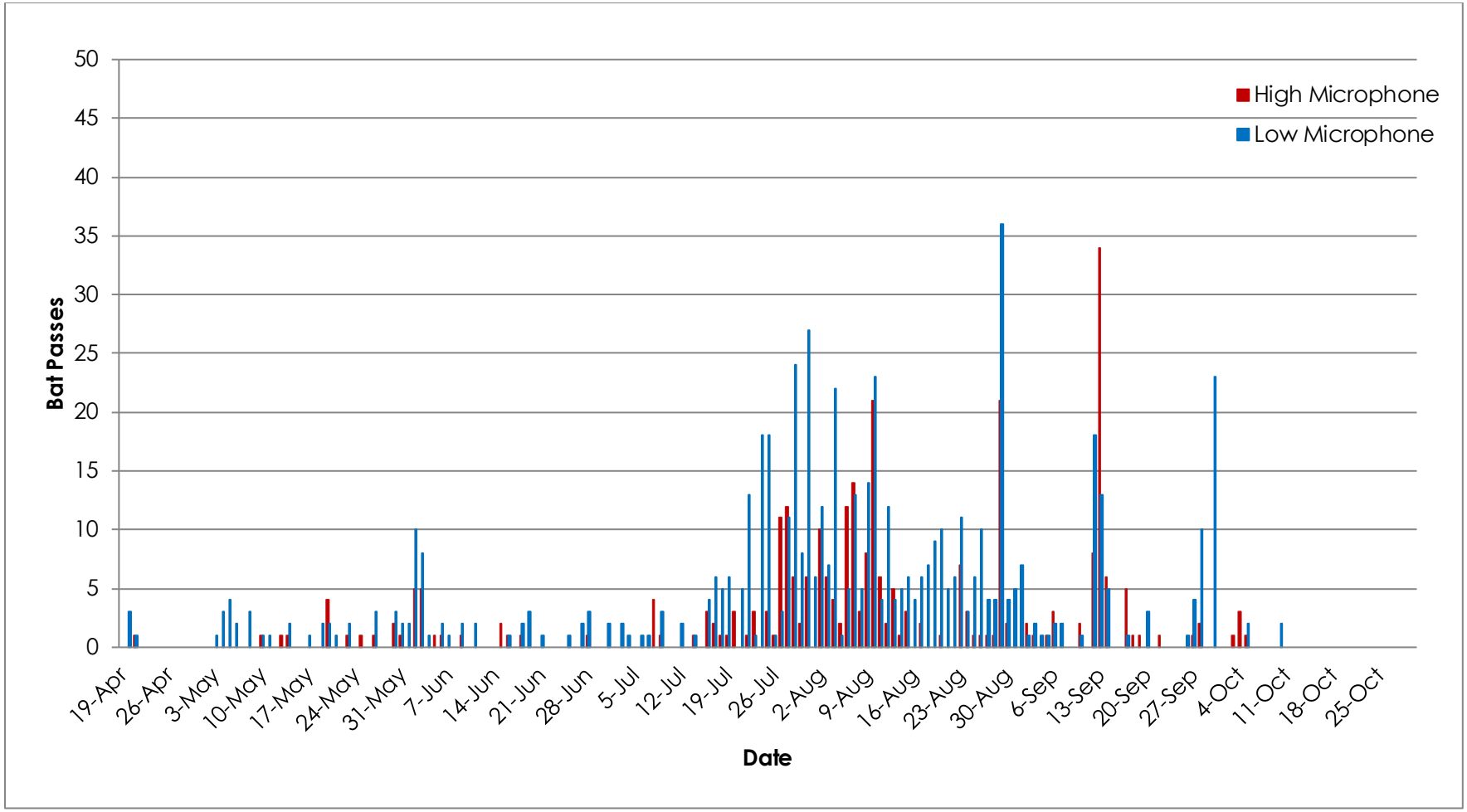


Figure 2. Nightly Bat Activity at Tower 0262

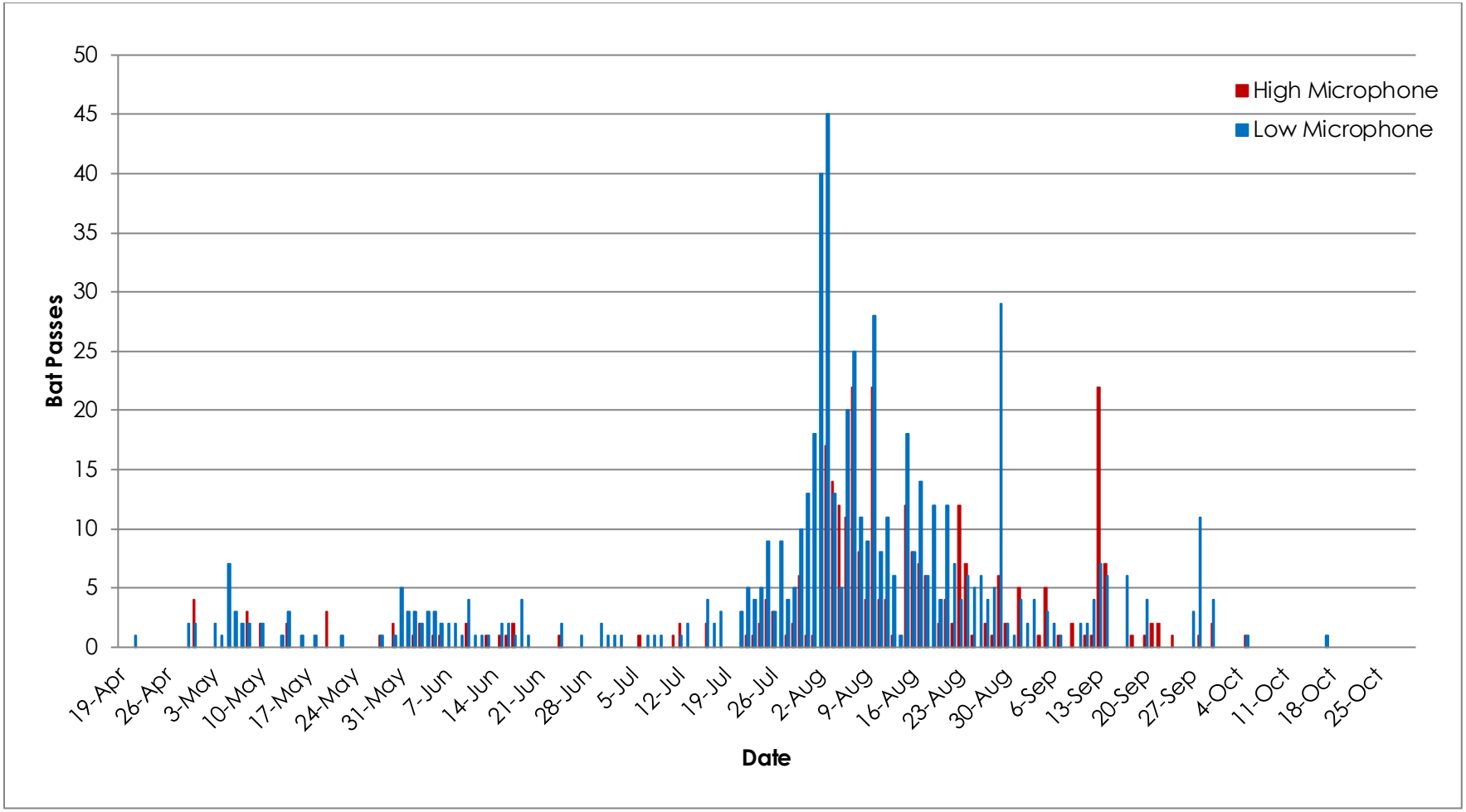


Figure 3. Nightly Bat Activity at Tower 0462

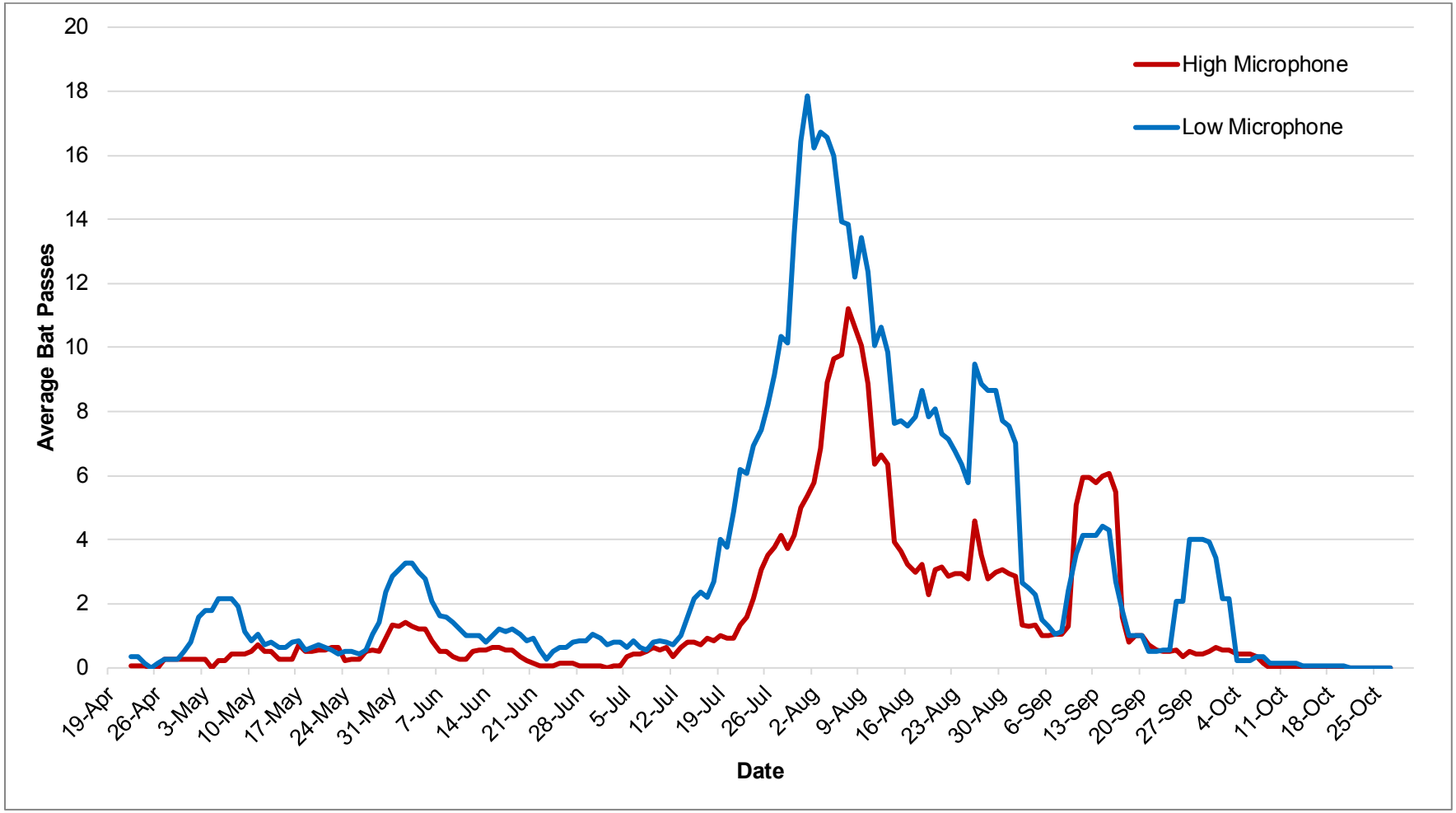


Figure 4. Average Nightly Bat Activity at High and Low Microphones
Values are the 7-day moving average of both towers averaged.

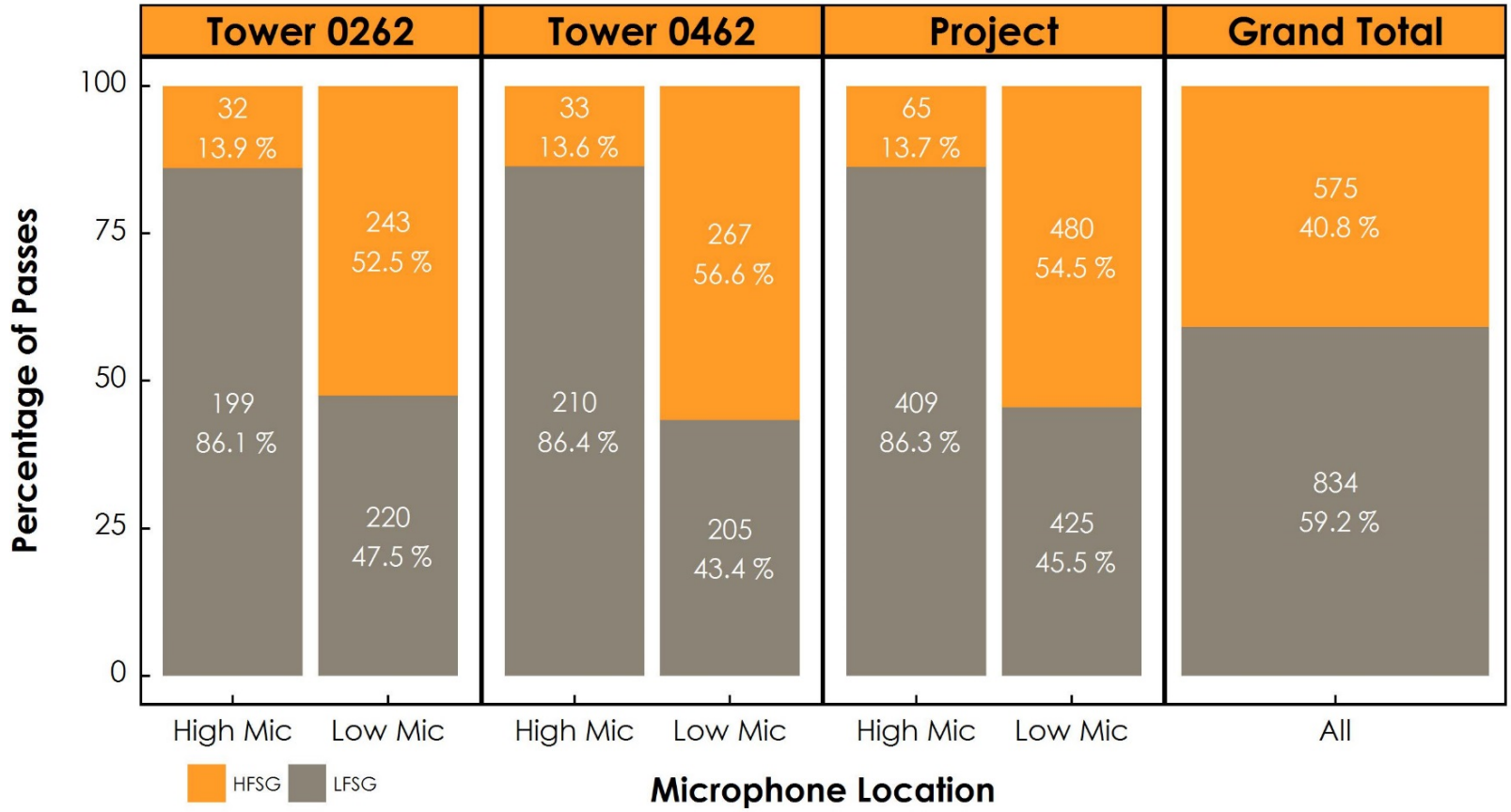


Figure 5. Bat Pass Frequency Group Percentage by Location

Passive long-term acoustic surveys are an acceptable method for documenting bat activity over time. Bat calls recorded on detectors can vary due to several biological and environmental factors. The bat's orientation, speed, and distance from the microphone all can influence how their calls are recorded (Limpens and McCracken 2002). Additionally, temperature, humidity, wind speed, environmental clutter, insect noise, and proximity to other bats also affect how echolocation calls are produced and recorded. These factors yield natural variation in a species' echolocation call repertoire. The type of bat detector, quality and calibration of microphones, and mode of data recording (full spectrum versus zero-crossing) also affect bat call recording. All equipment used in this survey was calibrated to factory specifications before and after the survey to ensure equipment was functioning properly. It is important to consider these factors when comparing activity rates across projects.

This survey documented the resident bat population at the Project during the spring migratory season, the summer maternity season, and fall migratory season. Based on the results of this survey, bat activity at the Project is lower than expected for the Great Plains region. Bat activity patterns are consistent with bat activity seen elsewhere in the United States with peak activity occurring between late July and mid-September, which coincides with fall migration (Hein et al. 2013). Finally, the low frequency species group represents most of the bats detected at the Project in 2017. Acoustic data are scheduled to be collected at the Project from spring through fall for the 2018 survey season.

Regards,

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REFERENCES

Cryan, P. M. 2003. Seasonal distribution of migratory tree bats (*Lasiurus* and *Lasionycteris*) in North America. USGS Staff – Published Research. Paper 119.

Dyke, S. R., S. K. Johnson, and P. T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department, Bismarck, ND.

Harvey, M. J., J. S. Altenbach, and T.L. Best. 2011. Bats of the United States and Canada. Baltimore: Johns Hopkins University Press.

Hein, C. D., J. Gruver, and E. B. Arnett. 2013. Relating pre-construction bat activity and post- construction bat fatality to predict risk at wind energy facilities: a synthesis.

Limpens, H. J. G. A. and G. F. McCracken. 2002. Choosing a bat detector: theoretical and practical aspects. Pp. 28-37. In: R. M. Brigham, E. K. V. Kalko, G. Jones, S. Parsons, and H. J. G. A. Limpens, eds. Bat Echolocation Research: Tools, Techniques, and Analysis. Bat Conservation International, Austin, Texas.

Reid, F. A. 2006. Mammals of North America. Mammals of North America. Boston: Houghton Mifflin Company.

APPENDIX A: KALEIDOSCOPE PARAMETERS

Parameter	Setting
Frequency Range	16 – 120 kHz
Pulse Length Range	1.5 – 35 milliseconds
Maximum Inter-Syllable Gap	500 milliseconds
Minimum Pulse Number	3
Advanced Signal Processing	Yes
Classifier Sensitivity	Balanced (Neutral)

Whooping Crane Habitat Analysis

Aurora Wind Energy Project

Williams County, North South Dakota

Final Report

Prepared for:

Aurora Wind Project, LLC

16105 W. 113th Street, Suite 105
Lenexa, Kansas 66219

Prepared by:

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August 22, 2018

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REPORT REFERENCE

Western EcoSystems Technology, Inc. (WEST). 2018. Whooping Crane Habitat Analysis, Aurora Wind Energy Project, Williams County, North Dakota. Final Report. Prepared for Aurora Wind Project, LLC, Lenexa, Kansas. Prepared by WEST, Bismarck, North Dakota. August 22, 2018.

Data disclaimer for the confirmed records of whooping crane:

This document or presentation includes Whooping Crane migration use data from the Central Flyway stretching from Canada to Texas, collected, managed and owned by the US Fish and Wildlife Service (USFWS). Data were provided to Western EcoSystems Technology, Inc. (WEST) as a courtesy for their use. The USFWS has not directed, reviewed, or endorsed any aspect of the use of these data. Any and all data analyses, interpretations, and conclusions from these data are solely those of the WEST.

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Figure 3. National Wetlands Inventory (NWI) wetlands, rivers, and streams within the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas (Source: US Fish and Wildlife Service NWI 2014)..... 9

Figure 4. Location of the Aurora Wind Energy Project in Williams County, North Dakota, and reference areas, in relation to whooping crane stopover site use intensity cells (Source: Pearse et al. 2015). 11

INTRODUCTION

Aurora Wind Project, LLC (Aurora) is proposing to develop the Aurora Wind Energy Project (Project) in Williams and Mountrail counties, North Dakota. While the overall Project includes a portion of the transmission line in Mountrail County, the Project area, as evaluated initially in 2016 and as included in this report, is limited to Williams County. Aurora requested that Western EcoSystems Technology, Inc. (WEST) implement a desktop review and analysis of potential whooping crane (*Grus americana*) habitat resources within the Project area and compare these resources to areas outside of the Project boundary to the north, south, east, and west. The whooping crane is federally endangered and protected under the Endangered Species Act (ESA; 16 United States Code [USC] Sections [§§] 1531–1544 1973). The Project is located within the migration corridor of the Aransas-Wood Buffalo whooping crane population (Figure 1) which migrates through North Dakota in the spring, from April through May, and in the fall, from mid-September through mid-November (US Fish and Wildlife Service [USFWS] 2013).

The habitat review and analysis presented in this report evaluated whether or not the proposed Project area represents the only unique whooping crane habitat compared to the surrounding landscape. The purpose of this analysis was to quantify the potential suitability of wetlands within the Project area for whooping cranes and to compare the suitability of these wetlands with preferred whooping crane stopover habitat. From this analysis all parties can then discuss what impacts there may be to whooping cranes from development of the Project. This analysis is part of the Project's Tier 2 Site Characterization assessments, in accordance with the USFWS's voluntary *Final Land-Based Wind Energy Guidelines* (WEG; USFWS 2012a).

Regulations and Guidelines

Endangered Species Act

The whooping crane is listed as endangered under the ESA, because it is in danger of extinction throughout all or a significant portion of its range. The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. The ESA makes it unlawful for a person to "take" a listed species without a permit. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct" (16 USC §§ 1531–1544 1973). Harm also includes significant habitat modification or degradation that results in death or injury to a whooping crane by significantly impairing essential behavioral patterns (50 Code of Federal Regulations § 17.3 1975).

The USFWS may also designate critical habitat for listed species under the ESA; federal agencies are required to avoid destruction or adverse modification of critical habitat. The Platte River bottoms between Lexington and Denman, Nebraska; Cheyenne Bottoms State Waterfowl Management Area and Quivira National Wildlife Refuge (NWR) in south-central Kansas; and Salt Plains NWR in north-central Oklahoma, are the designated critical habitats during migration for whooping cranes in the US (Canadian Wildlife Service and USFWS 2005). The Project is

approximately 550.0 miles (mi; 885.1 kilometers [km]) north of the Platte River bottoms, which is the closest designated critical habitat for the species.

Due to habitat loss and hunting pressure, the Aransas-Wood Buffalo population had been reduced to an estimated 15 individuals in 1941 (Harrell and Bidwell 2013). This prompted conservation efforts by United States and Canadian wildlife agencies, including captive breeding efforts and an emergency listing as "threatened with extinction" in the US in 1967 (32 Federal Register [FR] 48: 4001 1967). This listing was grandfathered into the Endangered Species Act, and whooping cranes are currently listed as federally endangered except where nonessential experimental populations exist (62 FR 139: 38932-38939 1997; 66 FR 123: 33903-33917 2001; see USFWS 2012b). As a result of joint recovery efforts by Canadian and US agencies, the Aransas-Wood Buffalo wintering population was estimated was estimated at 431 whooping cranes (95% confidence interval = 371.1–492.7; USFWS 2017).

Land-based Wind Energy Guidelines

The USFWS designed the WEG to provide a structured process for evaluating and addressing wildlife conservation concerns during all stages of land-based wind energy development (USFWS 2012). The WEG is voluntary and is meant to facilitate communication among wind energy developers and federal, state, and local conservation agencies. The WEG includes a five-tiered process for assessing potential adverse impacts to species of concern and their habitats. The first three tiers include pre-construction evaluations (Tier 1: Preliminary Site Evaluation, Tier 2: Site Characterization, and Tier 3: Pre-construction Field Studies); Tier 4 and Tier 5 involve post-construction monitoring and evaluations (USFWS 2012).

PROJECT AREA

The Project area is located approximately four mi (6.43 km) northwest of the City of Tioga in northwest North Dakota, (Figure 1) and covers an area of approximately 54,318.0 acres (ac; 21,981.7 hectares [ha]). The landscape within the Project area is flat to gently rolling, with elevations ranging from 2,190.4–2,479.1 feet (ft; 667.6 – 755.6 meters [m])) above sea level (US Geological Survey [USGS] 2016). Historically, the Project area was dominated by short- and mixed-grass prairies but has since been largely converted to agricultural use with crop production (mainly wheat [*Triticum* spp], corn [*Zea mays*], and soybeans (*Glycine max*) and livestock grazing being the primary practices (Griffith 2010, Sayler 2016). Trees and shrubs can be found around farmsteads, within planted shelter belts, and along/within drainages; wetlands are scattered throughout the Project area (WEST 2017).

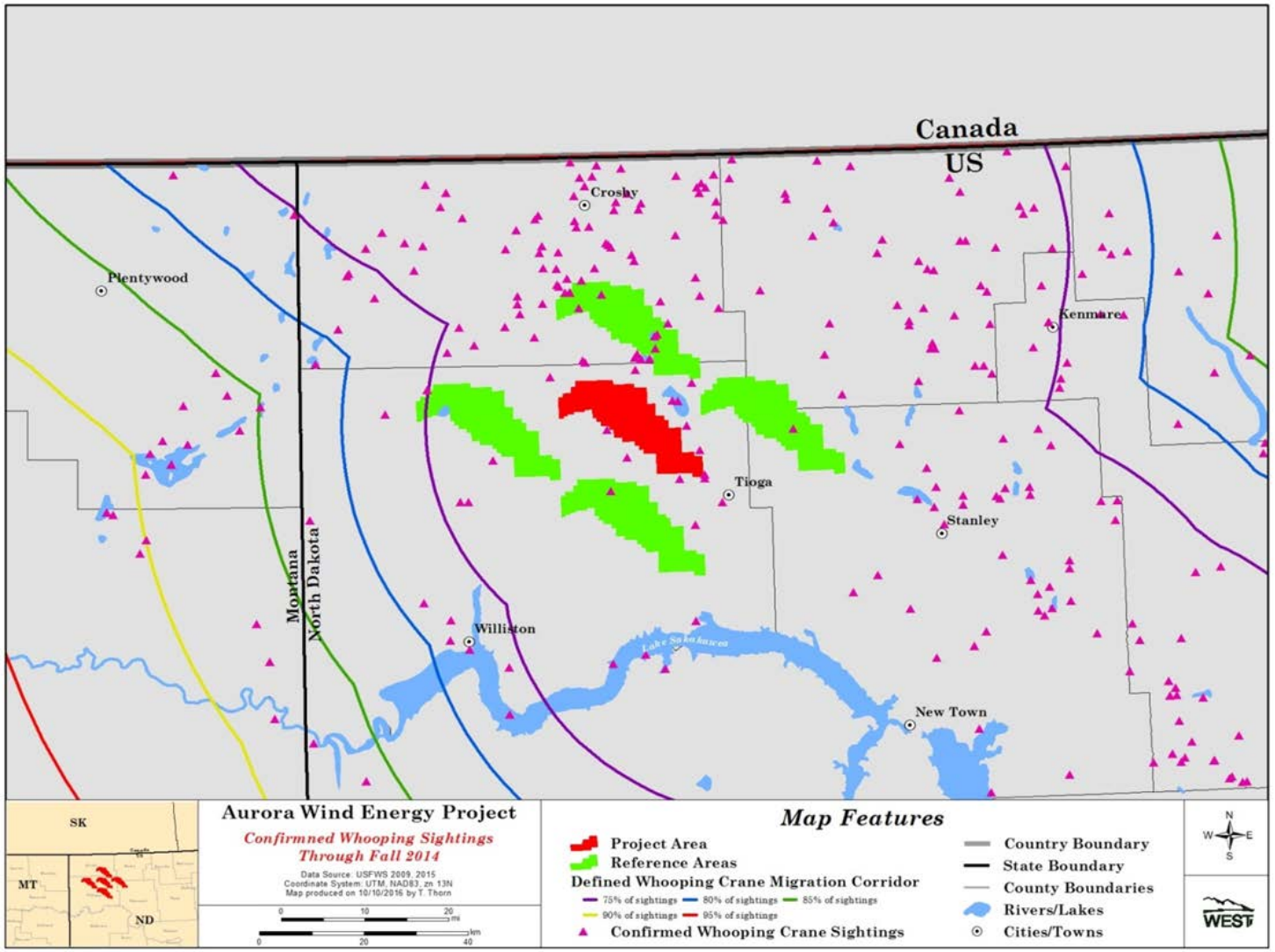

Figure 1. Location of the Aurora Wind Energy Project in Williams County, North Dakota, and reference areas, in relation to the whooping crane migration corridor and confirmed sightings through fall 2014.

METHODS

The whooping crane habitat analysis included a comparison of landscape features within the proposed Project area and four reference areas of the same dimensions located adjacent (based on the Project's boundary extent) to the Project boundary in the four cardinal directions. A desktop review was completed using ArcGIS ArcMap 10.3.1, land cover information from the USGS National Land Cover Database (NLCD; USGS NLCD 2011, Homer et al. 2015), wetland data from the USFWS National Wetland Inventory (NWI; USFWS NWI 2014), National Agricultural Imagery Program (NAIP) aerial imagery (US Department of Agriculture NAIP 2017), and the current Project boundary provided by Aurora. A site visit was not completed by WEST for this exercise specifically, but WEST has conducted other surveys at the Project and confirmed that the mapping generally agrees with current conditions.

An assessment of the suitability of whooping crane habitat in the Project area and the four reference areas was conducted using methodology developed by the Watershed Institute (2012). The assessment first screens all wetlands for minimum size, visual obstructions, and disturbances; wetlands that do not meet criteria are eliminated from analysis. Those wetlands left are then quantified by their size, density of wetlands around them, distance to food, whether they are natural or constructed, and their water regime as a means to quantify suitability. A habitat quality score is then assigned to the wetlands left in the analysis; a score of 12 or higher represents potentially suitable whooping crane migratory stopover habitat.

USGS and its partners recently determined whooping crane stopover sites and the intensity of use of these areas within the Great Plains using radio telemetry information of tagged whopping cranes from 2010 – 2014 (Pearse et al. 2015). Using a grid-based approach, Pearse et al. (2015) assessed occupied grid cells based on density of stopover sites and the amount of time whooping cranes spent in the area, resulting in four categories of stopover site use: unoccupied, low intensity, core intensity, and extended-use core intensity. This tool allows for the identification of landscapes that may be important for whooping crane use and potentially conservation.

RESULTS

Terrestrial Habitats

According to USGS NLCD, cultivated crops was the dominant land type, composing 86.7% of the Project area (47,091.1 ac [19,057.1 ha]; Table 1, Figure 2). Grass/herbaceous lands composed 6.6% of the Project area, while developed areas and water/wetlands composed another 3.8% and 2.5%, respectively; all other land types composed less than 1.0% of the Project area (Table 1, Figure 2).

The percentage of cultivated crops varied between the Project area and reference areas, with the Project area containing the highest percentage (86.7%) and the North reference area the

least (42.7%; Table 1, Figure 2); the percentage of cultivated crops in the remaining reference areas ranged from 50.6%–76.9% (Table 1). The percentage of grassland/herbaceous lands also varied between the Project and reference areas (Table 1, Figure 2). The North and East reference areas had the highest percentages (35.2% and 31.6%, respectively) while the Project area had the least percentage (6.6%); grassland /herbaceous lands composed 20.8% or less of the other reference areas (Table 1). Pasture/hay composed 10.8% of the North reference area and 0% of the Project area, ranging from 0.1%–4.2% in all other areas (Table 1). The percentage of developed lands was similar across areas, ranging from 3.0%– 4.7%; wetlands composed 8.1% of the North reference area, compared to 1.2% of the South reference area; all other land types composed 2.9% or less of all areas (Table 1).

Table 1. Land use/Land cover types, by acreage and percent of total coverage (%), within and in the vicinity of the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas, based on the US Geological Survey (USGS) National Land Cover Database (NLCD).

	Project		North		East		South		West	
Land Use/Land Cover	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Cultivated Crops	47,091.1	86.7	23,175.7	42.7	27,497.2	50.6	41,793.5	76.9	36,637.0	67.4
Grassland/Herbaceous	3,564.8	6.6	19,101.2	35.2	17,142.9	31.6	8,506.7	15.7	11,291.6	20.8
Pasture/Hay			5,854.2	10.8	2,260.3	4.2	36.5	0.1	385.1	0.7
Developed	2,074.4	3.8	1,648.7	3.0	2,202.7	4.1	2,538.3	4.7	2,469.8	4.5
Water/Wetlands	1,352.7	2.5	4,376.3	8.1	2,297.4	4.2	641.7	1.2	2,886.3	5.2
Forest	20.9	<0.1	40.7	0.1	1,593.4	2.9	83.2	0.2	47.3	0.1
Shrub/Scrub	214.1	0.4	114.7	0.2	1,308.9	2.4	715.1	1.3	595.8	1.1
Barren			7.1	<0.1	15.3	<0.1	3.0	<0.1	5.1	<0.1

Sources: USGS NLCD 2011, Homer et al. 2015.

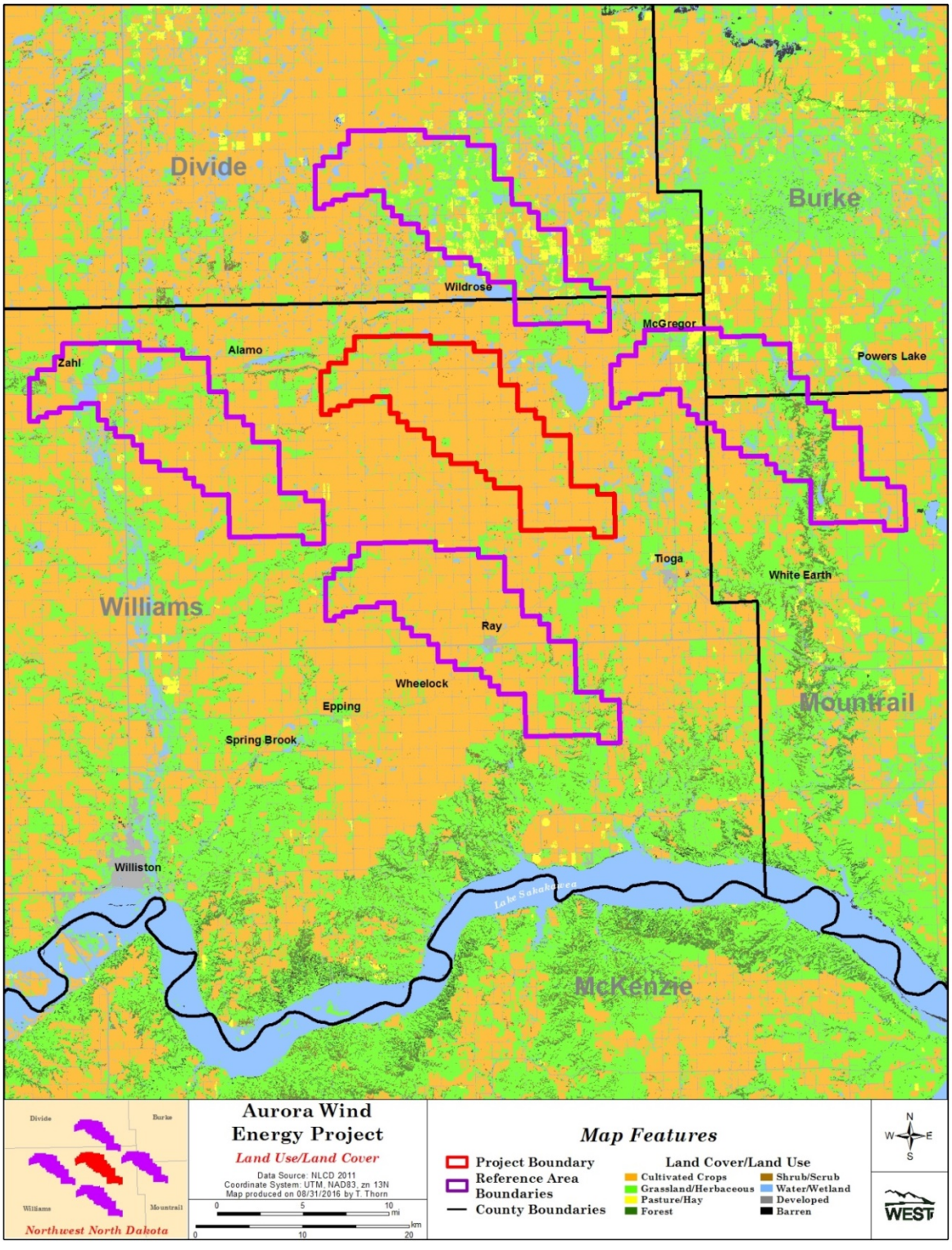

Figure 2. Land use/land cover types within and in the vicinity of the Aurora Wind Energy Project in Williams County, North Dakota, and the four reference areas (Sources: US Geological Survey National Land Cover Database [NLCD] 2011, Homer et al 2015).

Wetlands

For this analysis, it was assumed that all wetlands were potential whooping crane roosting areas under one water regime or another (e.g., drought, normal, or flood); USFWS NWI wetland data was used for this analysis because it represents wetland features to a higher degree than the USGS NLCD.

Based on the USFWS NWI (2014), the Project area had similar wetland basin statistics as the South reference area, with the least wetland acreages, smallest mean basin sizes, and narrowest basin size ranges (Table 2). The North reference area had by far the highest number of basins (2,620) and of total wetland acreage (5,930.1 ac [2,399.8 ha]), the second largest mean basin size (2.3 ac [0.9 ha]), and the third greatest basin size range (less than 0.1–373.8 ac [less than 0.04–151.3 ha]; Table 2). The West reference area had the fewest basins (1,063) but the second highest total wetland acreage (2,674.0 ac [1,082.1 ha]), the largest mean basin size (2.5 ac [1.0 ha]), and the greatest wetland size range (less than 0.1–616.4 ac [less than 0.04–249.4 ha]; Table 2); these characteristics were likely attributable to several large lakes in the northwest part of this reference area (Figure 3). The East reference area had a total of 1,620 wetland basins covering 2,117.8 ac (857.0 ha), a mean basin size of 1.3 ac (0.5 ha), and wetland sizes ranging from less than 0.1–3.80.3 ac (less than 0.04–153.9 ha).

Freshwater emergent wetlands composed the vast majority of wetlands in the Project area (91.4%) and the South reference area (93.0); coverage of freshwater emergent wetlands ranged from 50.4%–75.1% in the other reference areas (Table 3). Lakes composed 43.2%, 22.8%, and 19.0% of the West, North, and East reference areas, respectively, compared to only 4.3% and 2.9% of the total wetland acreage in the Project area and South reference area, respectively (Table 3). Freshwater ponds composed 11.6% of the North reference area, and ranged from 3.7%– 4.4% in the other areas.

To summarize, the Project and South reference area had similar wetland basin statistics and wetland types while the North reference area had the most basins and total acreages of wetlands. The West reference area had the least number of basins but the largest mean basin size and greatest size range, likely attributable to several large lakes present in this area

Table 2. Number and size characteristics of wetland basins present within the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas.

Area	Number of Basins	Acres (ac)	Mean Basin Size (ac)	Size Range (ac)
Project	1,315	1,515.1	1.1	<0.1–98.6
North	2,620	5,930.1	2.3	<0.1–373.8
East	1,620	2,117.8	1.3	<0.1–380.3
South	1,244	1,459.6	1.2	<0.1–101.1
West	1,063	2,674.0	2.5	<0.1–616.4

Source: US Fish and Wildlife Service National Wetland Inventory 2014.

Table 3. Wetland types, by acreage and percent (%) of total wetlands, within the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas.

	Project		North		East		South		West	
Wetland Type	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Freshwater Emergent Wetland	1,281.5	91.4	3,406.7	65.4	1,559.4	75.1	1,316.8	93	1,348.2	50.4
Freshwater Forested/Shrub Wetland	4.9	0.4	12.9	0.2	1	<0.1	1	0.1	2.8	0.1
Freshwater Pond	51.6	3.7	602.3	11.6	87	4.2	57.1	4	118.5	4.4
Lake	59.8	4.3	1,185.4	22.8	394.4	19	40.7	2.9	1,155.0	43.2
Other	3.7	0.3	0	0	0.9	<0.1	0	0	4.8	0.2
Riverine	0	0	0	0	32.9	1.6	0	0	45.1	1.7

Source: US Fish and Wildlife Service National Wetland Inventory 2014.

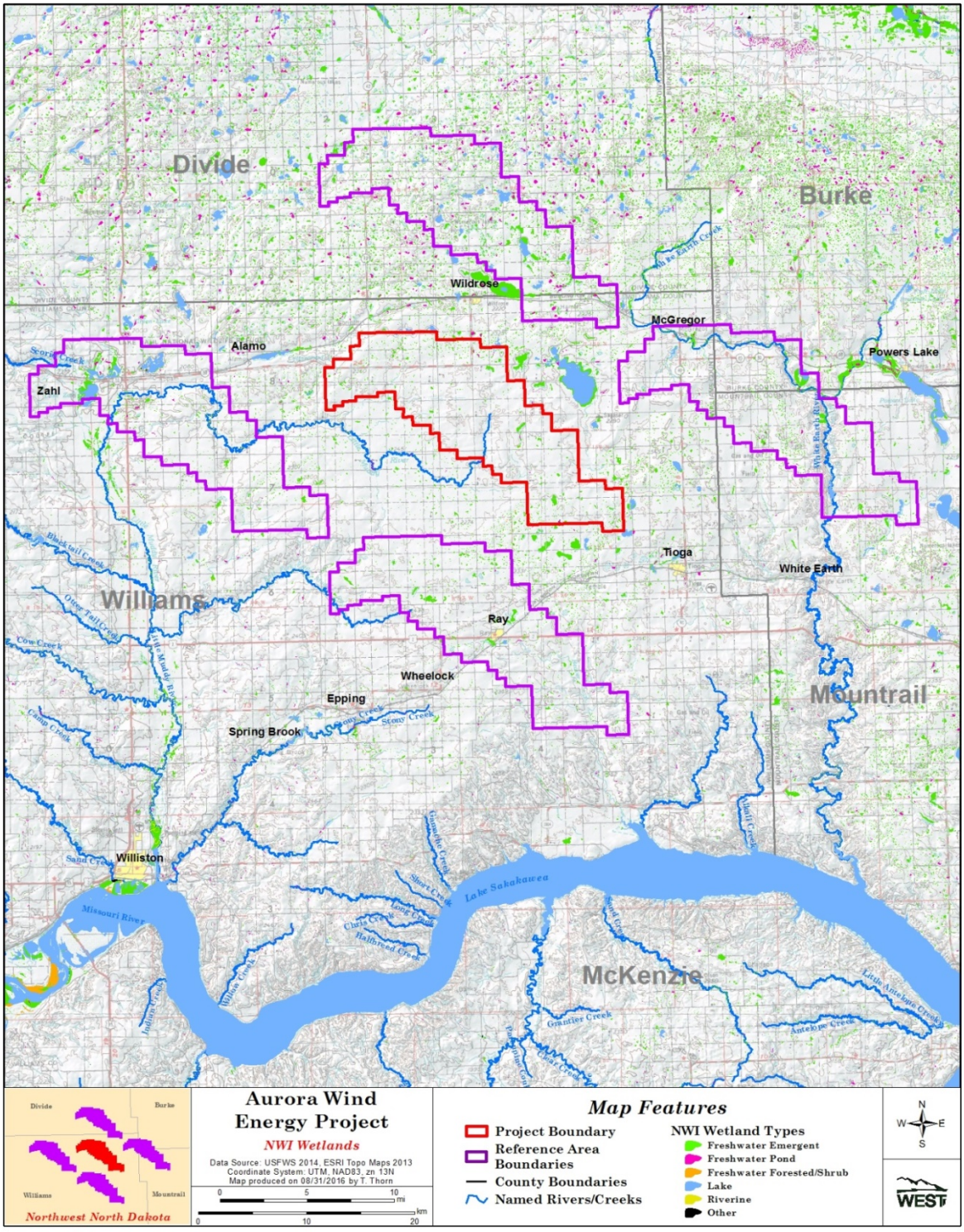

Figure 3. National Wetlands Inventory (NWI) wetlands, rivers, and streams within the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas (Source: US Fish and Wildlife Service NWI 2014).

Habitat Suitability Assessment

The habitat assessment identified 442 wetland basins totaling 865.5 ac (350.3 ha) within the Project area as potential whooping crane roosting habitat (Table 4). The mean suitability score for these wetlands was 11.9 with the scores ranging from seven–19. The north reference area had the highest number of potential suitable basins (935), the highest acreage of wetlands (3,697.0 ac [1,496.1 ha]), and the highest mean suitability score (12.0); scores ranged from 10.6–11.9 in all other areas (Table 4).

In Kansas, a wetland with a score of 12 or more was considered suitable potential whooping crane habitat (Watershed Institute 2012). If applied to the Project, 242 (54.8%) of the potential whooping crane habitat wetlands would be considered as such. The number of potential whooping crane habitat with a score of 12 or greater was highest in the North reference area (544) and ranged from 79–151 in all other reference areas.

Table 4. Number of wetland basins and mean size in acres and potential suitable whooping crane migration habitat within the Philip Wind Energy Project in Haakon County, South Dakota, and four reference areas.

Area	Number of Basins	Total Wetland Acres	Mean Score	Score Range
Project	442	865.5	11.9	7–19
North	935	3,697.0	12.0	5–19
East	344	646.3	10.6	6–18
South	367	1,042.8	10.9	6–16
West	290	1,921.8	10.7	7–16

Data derived from Potentially Suitable Habitat Assessment (Watershed Institute 2012).

Whooping Crane Stopover Site Use Intensity

The Project and the South and West reference areas fall within “unoccupied” grid cells while the East and North reference areas intersect both “core intensity” and “low intensity” cells (Pearse et al. 2015; Figure 4). The USGS describes an “unoccupied” cell as “lacking evidence of use”, “low intensity” cells show “evidence of use and low stopover site use intensity”, and a “core intensity” cell “contains density of stopovers identified as high use intensity and crane days of lower intensity” (Pearse et al. 2015).

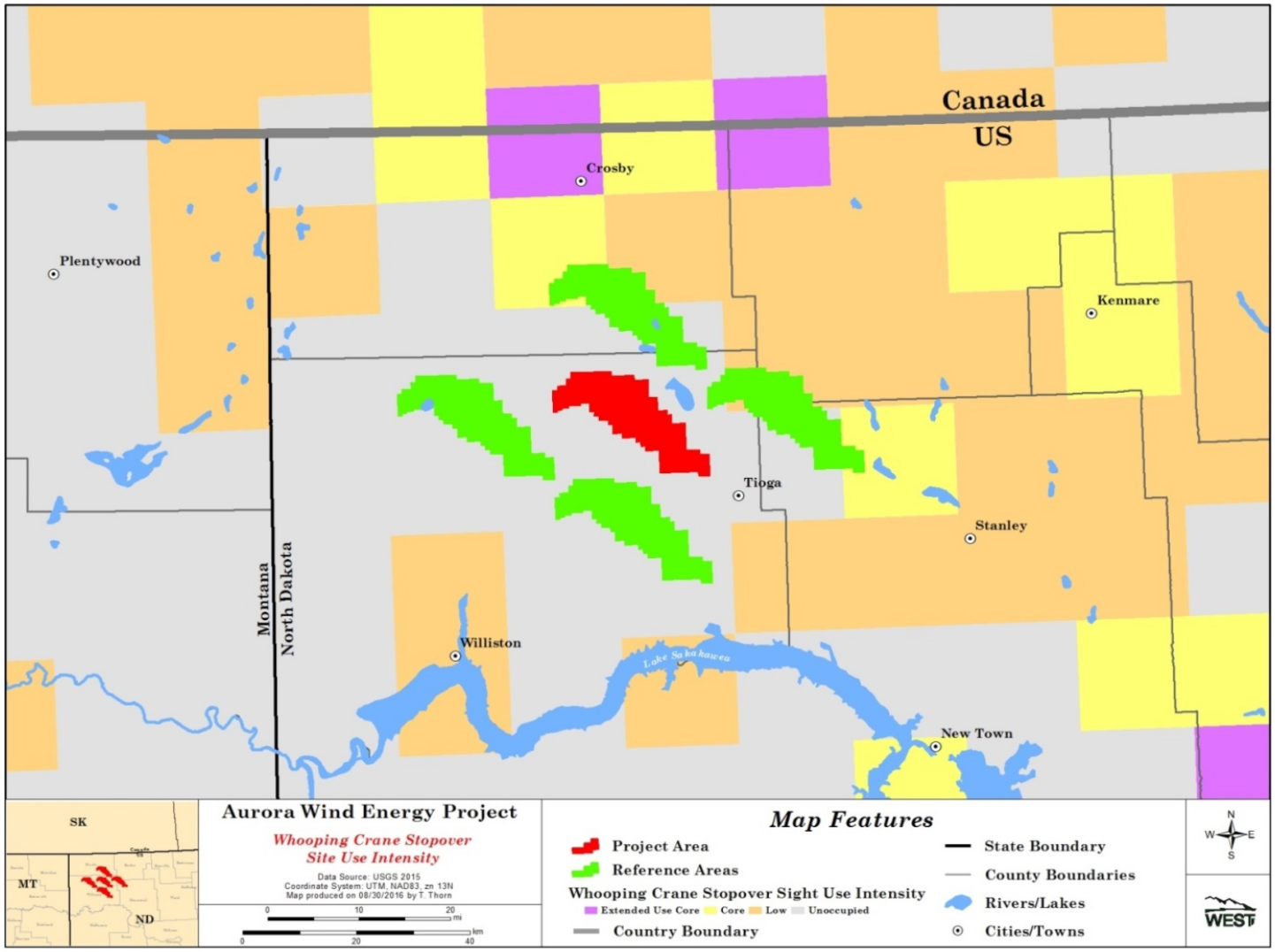

Figure 4. Location of the Aurora Wind Energy Project in Williams County, North Dakota, and reference areas, in relation to whooping crane stopover site use intensity cells (Source: Pearse et al. 2015).

Whooping Crane Migration Corridor and Confirmed Sightings

Stehn (2007) documented a 200.0-mi (321.9-km) wide migration corridor for whooping cranes based on the historical sightings of whooping cranes from the early 1960's through 2006. This 200-mi wide corridor (100.0 mi [160.9 km] on either side of the centerline) encompasses approximately 95% of the observations and a 100.0-mi wide corridor subset of this encompasses approximately 82.0% of the observations. The Project area and all four reference areas are located within the defined (95% of confirmed sightings) whooping crane migration corridor; however, no whooping cranes have been documented within the Project (Cooperative Whooping Crane Tracking Project 2009, USFWS 2015; Figure 1). There are, however, six confirmed sightings within one mi (1.6 km) of the Project's boundary; the North, South, and East reference areas each contain whooping crane sightings while at least one sighting has been reported within one mi of the West reference area (Figure 1). It should be noted that reported whooping crane observations are mostly random events by the public or focused around refuges and other areas of management interest and not the result of a systematic search. Therefore, a lack of documented whooping crane sightings in a particular area does necessarily mean that birds do not use the area.

DISCUSSION

Threats to whooping cranes include collisions with manmade objects (e.g., power lines, fences), shooting, predators, disease, habitat destruction, severe weather, and a genetic bottleneck caused by their severe decline prior to 1941 (USFWS 2012b). According to the USFWS (2009), direct mortality may occur when whooping cranes collide with turbines in bad weather or low light conditions at the beginning or end of migration flights, or when flying between roosts and foraging areas at stopover sites. Because individuals of this species are particularly vulnerable during migration, recovery activities have included providing opportunities for cranes to stop and rest (i.e., stopover) during their journey (Harrell and Bidwell 2013).

Whooping cranes have the potential to occur in the Project and reference areas due to their location relative to the migration corridor and confirmed sightings in the general region. Potential whooping crane habitat within the Project area was similar to the reference areas. The Project area and reference areas all had substantial amounts of cultivated croplands with lesser amounts of grassland/herbaceous. Additionally, all areas had some wetlands, although percent of the total area was low. These results verify that both roosting (i.e., wetlands) and foraging (i.e., croplands and grassland) habitats are available in the Project and reference areas.

Although developed for transmission line impacts on whooping crane habitat in Kansas, the Watershed Institute's (2012) potentially suitable habitat assessment for whooping cranes can help to quantify potential whooping crane habitat in and around proposed wind energy projects. According to this model, the range of scores and mean scores of wetlands within the Project area was similar to the four reference areas. Overall, the average score and the majority of the individual wetland scores were lower than the reference score of 12 developed for quality habitat at the Quivira National Wildlife Refuge. Use of the Watershed Institute's (2012) model as

a tool for assessing habitat suitability at Project suggests that whooping cranes are not likely to use the Project area for migratory stopovers.

No confirmed whooping crane sightings have been reported within the Project area through spring 2017 (USFW 2017); however, observations of whooping cranes within the vicinity of the Project have been recorded (Figure 1). As such, it is possible that whooping cranes could fly over or through the Project during migration. Whooping cranes generally migrate at 1,000.0–6,000.0 ft (304.5–1,828.8 m) altitude, well above turbine height (Stehn 2007), and thus for the most part are unlikely to collide with turbines. However, as whooping cranes ascend and descend during takeoff and landing, or migrate during inclement weather, they may fly at lower altitudes and may fly at altitudes corresponding to the rotor-swept areas of wind turbines. In summary, low altitude flight is generally of short duration in the morning and evenings with more time and distance covered at higher elevation during typical migration flight, reducing potential risk to whooping cranes.

To date, there have been no recorded instances of whooping cranes being killed or injured by wind turbines (National Wind Coordinating Collaborative 2004); however, one sandhill crane (*Antigone canadensis*) was reported killed at the Altamont wind energy facility in California (Smallwood and Karas 2009); it is unclear if this fatality was a result of turbine collision or collision with a power line. Additionally, two sandhill cranes struck turbines during a study of wintering cranes in Texas (Navarrete and Griffis-Kyle 2014). No sandhill cranes or whooping cranes have been found as fatalities at five wind facilities searched daily for crane mortalities during migration in North Dakota and South Dakota for up to three years (Derby et al. 2012).Thus, it appears that cranes are not particularly susceptible to collision with wind turbines given that large numbers of sandhill cranes and lesser numbers of whooping cranes that migrate biannually through the Great Plains region with no documented fatalities as a result of collision with wind turbines during migration.

According to the USGS stopover site use intensity (Pease et al. 2015), whooping crane use occurs directly to the north and east of the Project area with lesser use to the west and south. Although no whooping crane use was document for the birds carrying the telemetry units within the grid cells intersected by the Project area, it is possible that whooping cranes would fly over the Project area during migration and/or use wetlands and croplands within the Project area for roosting and foraging.

SUMMARY

In summary, there is potential whooping crane habitat within the Project area and the potential for whooping cranes to utilize suitable habitats within the Project while migrating. This analysis showed that both roosting (i.e., wetlands) and foraging (i.e., croplands) habitats are available in the Project and reference areas. Potential whooping crane habitat within the Project area appeared to be most similar to that in the North reference area and more suitable than that found in the other reference areas. Although according to the USGS's recent determination of whooping crane stopover use sites, the Project area did not intersected any occupied grid cells,

the reference areas adjacent to the proposed Project area had use. Given there is potential habitat and documented use in the region, whooping cranes will likely migrate over or through the Project area during migration. There is potential whooping habitat within the Project but this habitat is not unique compared to adjacent areas.

REFERENCES

16 United States Code (USC) §§ 1531-1544. 1973. Title 16 - Conservation; Chapter 35 - Endangered Species; Sections (§§) 1531-1544. 16 USC 1531-1544. Available online at: https://www.fws.gov/le/USStatutes/ESA.pdf

32 Federal Register (FR) 48: 4001. 1967. Native Fish and Wildlife: Endangered Species. Office of the Secretary. 32 FR 4001. March 11, 1967. Available online: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr32-4001.pdf

50 Code of Federal Regulations (CFR) § 17.3. 1975. Title 50 - Wildlife and Fisheries; Chapter I - United States Fish and Wildlife Service, Department of the Interior; Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 17 - Endangered and Threatened Wildlife and Plants; Subpart a - Introduction and General Provisions; Section (§)17.3. Definitions. 50 CFR 17.3 [40 Federal Register (FR) 44415, September 26, 1975, as amended at 42 FR 28056, June 1, 1977; 44 FR 54006, September 17, 1979; 46 FR 54750, November 4, 1981; 47 FR 31387, July 20, 1982; 50 FR 39687, September 30, 1985; 63 FR 8870, February 23, 1998; 63 FR 48639, September 11, 1998; 69 FR 24092, May 3, 2004; 71 FR 46870, August 15, 2006.].

62 Federal Register (FR) 139: 38932-38939. 1997. Endangered and Threatened Wildlife and Plants; Final Rule to Designate the Whooping Cranes of the Rocky Mountains as Experimental Nonessential and to Remove Whooping Crane Critical Habitat Designations from Four Locations. Final Rule. Department of the Interior, Fish and Wildlife Service. 62 FR 38932. July 21, 1997. Available online: https://www.gpo.gov/fdsys/pkg/FR-1997-07-21/pdf/97-19058.pdf

66 Federal Register (FR) 123: 33903-33917. 2001. Endangered and Threatened Wildlife and Plants; Establishment of a Nonessential Experimental Population of Whooping Cranes in the Eastern United States. Final Rule. Department of the Interior, US Fish and Wilife Service. 66 FR 33903. June 26, 2001. Available online: https://www.gpo.gov/fdsys/pkg/FR-2001-06-26/pdf/01-15791.pdf

Canadian Wildlife Service (CWS) and US Fish and Wildlife Service (USFWS). 2005. Draft Revised International Recovery Plan: Whooping Crane (Grus Americana). Recovery of Nationally Endangered Wildlife (RENEW), Ottowa, and USFWS, Albuquerque, New Mexico. January 2005. 196 pp. Available online: https://www.fws.gov/southwest/es/Documents/R2ES/Whooping_Crane_DRAFT_Revised_International_Recovery_Plan_2005.pdf

Cooperative Whooping Crane Tracking Project (CWCTP). 2009. Cwctp-Gis Data/ Whooping Crane Migration Corridor Data.

Derby, C., T. Thorn, and M. Wolfe. 2012. Whooping and Sandhill Crane Monitoring at Five Operating Wind Facilities in North and South Dakota. Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota, and Cheyenne, Wyoming. National Wind Coordinating Collaborative (NWCC) Wind Wildlife Research Meeting IX. November 27-30, 2012, Denver, Colorado.

Griffith, G. 2010. Level Iii North American Terrestrial Ecoregions: United Stated Descriptions. Prepared for North American Commission for Environmental Cooperation.

Harrell, W. and M. Bidwell. 2013. Report on Whooping Crane Recovery Activities (2012 Breeding Season - 2013 Spring Migration). US Fish and Wildlife Service (USFWS) and Canadian Wildlife Service (CWS). September 2013. Available online at: http://www.fws.gov/uploadedFiles/WCRecoveryActivitiesReport_Sept-April2013_24Sept2013_Sub_508%20%281%29.pdf

Homer, C. G., J. A. Dewitz, L. Yang, S. Jin, P. Danielson, G. Xian, J. Coulston, N. D. Herold, J. D. Wickham, and K. Megown. 2015. Completion of the 2011 National Land Cover Database for the Conterminous United States-Representing a Decade of Land Cover Change Information. Photogrammetric Engineering and Remote Sensing 81(5): 345-354. Available online: http://www.mrlc.gov/nlcd2011.php

National Wind Coordinating Collaborative (NWCC). 2004. Wind Turbine Interactions with Birds and Bats: A Summary of Research Results and Remaining Questions. Fact Sheet. 2nd Edition. November 2004. Available online: http://nationalwind.org/wp-content/uploads/assets/archive/Wind_Turbine_Interactions_with_Birds_and_Bats_-_A_Summary_of_Research_Results_and_Remaining_Questions__2004_.pdf

Navarrete, L. and K. L. Griffis-Kyle. 2014. Sandhill Crane Collisions with Wind Turbines in Texas. Proceedings of the North American Crane Workshop 12: 65-67.

North American Datum (NAD). 1983. Nad83 Geodetic Datum.

Pearse, A. T., D. A. Brandt, W. C. Harrell, K. L. Metzger, D. M. Baasch, and T. J. Hefley. 2015. Whooping Crane Stopover Site Use Intensity within the Great Plains. USGS Open-File Report 2015-1166. US Geological Survey (USGS). 12 pp. Available online: https://pubs.usgs.gov/of/2015/1166/ofr2015-1166.pdf

Sayler, K. 2016. Contemporary Land Cover Change in the Northwestern Great Plains Ecoregion. Page Last Modified July 7, 2016. US Geological Service (USGS) Earth Resources Observation and Science Center. Sioux Falls, South Dakota. Available: https://landcovertrends.usgs.gov/gp/eco43Report.html

Smallwood, K. S. and B. Karas. 2009. Avian and Bat Fatality Rates at Old-Generation and Repowered Wind Turbines in California. Journal of Wildlife Management 73(7): 1062-1071.

Stehn, T. 2007. Whooping Cranes and Wind Farms - Guidance for Assessment of Impacts. US Fish and Wildlife Services (USFWS) technical report.

US Department of Agriculture (USDA). 2017. Imagery Programs - National Agriculture Imagery Program (Naip). USDA, Farm Service Agency (FSA), Aerial Photography Field Office (APFO), Salt Lake City, Utah. Accessed November 2017. Information online: https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/index

US Fish and Wildlife Service (USFWS). 2009. Whooping Cranes and Wind Development - an Issue Paper. Regions 2 and 6, USFWS. April 2009. Available online: http://www.fws.gov/southwest/es/oklahoma/documents/te_species/wind%20power/whooping%20crane%20and%20wind%20development%20fws%20issue%20paper%20-%20final%20%20april%202009.pdf

US Fish and Wildlife Service (USFWS). 2012a. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online: http://www.fws.gov/cno/pdf/Energy/2012_Wind_Energy_Guidelines_final.pdf

US Fish and Wildlife Service (USFWS). 2012b. Whooping Crane (Grus Americana). 5-Year Review: Summary and Evaluation. USFWS, Aransas National Wildlife Refuge, Austwell, Texas, and Corpus Christi Ecological Service Field Office, Texas. Available online at: http://ecos.fws.gov/docs/five_year_review/doc3977.pdf

US Fish and Wildlife Service (USFWS). 2013. North Dakota Field Office. Whooping Crane (Grus americana). Accessed August 2018. Available Online: https://www.fws.gov/northdakotafieldoffice/endspecies/species/whooping_crane.htm

US Fish and Wildlife Service (USFWS). 2017. Whooping Crane Survey Results: Winter 2016–2017. Aransas National Wildlife Refuge (Texas): Whooping Crane Updates. Available online: https://www.fws.gov/uploadedFiles/Region_2/NWRS/Zone_1/Aransas-Matagorda_Island_Complex/Aransas/Sections/What_We_Do/Science/Whooping_Crane_Updates_2013/WHCR_Update_Winter_2016-2017.pdf

US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). 2014. Nwi Data Mapper. Updated May 1, 2014. Fort Snelling, Minnesota. Wetlands Mapper: http://www.fws.gov/wetlands/Data/Mapper.html

US Fish and Wildlife Service. 2015. Cooperative Whooping Crane Tracking Project (CWCTP) GIS Database (Cwctp-Gis). Whooping Crane Migration Corridor Gis Layer Created Based on Crane Observations through Fall 2014. GIS layers from CWCTP, US Fish and Wildlife Service (USFWS), Grand Island, Nebraska.

US Geological Survey (USGS). 2016. National Elevation Dataset (Ned). Raster digital data. USGS, Sioux Falls, South Dakota. Accessed October 2016. Information online: http://nationalmap.gov

US Geological Survey (USGS) National Land Cover Data (NLCD). 2011. National Land Cover Database Nlcd, Muti-Resolution Land Characteristics Consortium (Mrlc). Usgs Earth Resources Observation and Science (Eros) Center, Sioux Falls, South Dakota. Information available online at: http://www.mrlc.gov/nlcd11_leg.php

USA Topo. 2013. USA Topo Maps. US Geological Survey (USGS) topographical maps for the United States. ArcGIS. ESRI, producers of ArcGIS software. Redlands, California.

Watershed Institute. 2012. Potentially Suitable Habitat Assessment for the Whooping Crane (Grus Americana). The Watershed Institute, Topeka, Kansas.

Western Ecosystems Technology, Inc. (WEST). 2017. Site Characterization Study for the Aurora Wind Energy Project, Williams County, North Dakota. Prepared for Tradewind Energy, Inc., Lenexa, Kansas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. August 25, 2017.

Policy and Commitments

Tradewind takes a conservative and proactive approach to the environmental and permitting aspects of all its projects, making certain that all critical aspects and potential site-related issues have been addressed. This management effort includes ongoing correspondence and coordination with Federal, State, and local agencies including the USFWS and state natural resource agencies. Tradewind's environmental and permitting program voluntarily follows the USFWS's Land Based Wind Energy Guidelines for siting wind energy facilities and the USFWS Eagle Conservation Plan Guidance and we work to identify potential issues from other environmental stakeholders early on in project development. In addition, it is Tradewind's standard practice to prepare a Bird and Bat Conservation Strategy (BBCS) for all of its Projects, demonstrating the ongoing commitment to managing environmental resources throughout the life of a Project.