




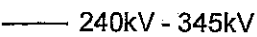






Dakota Range: Map of Easements

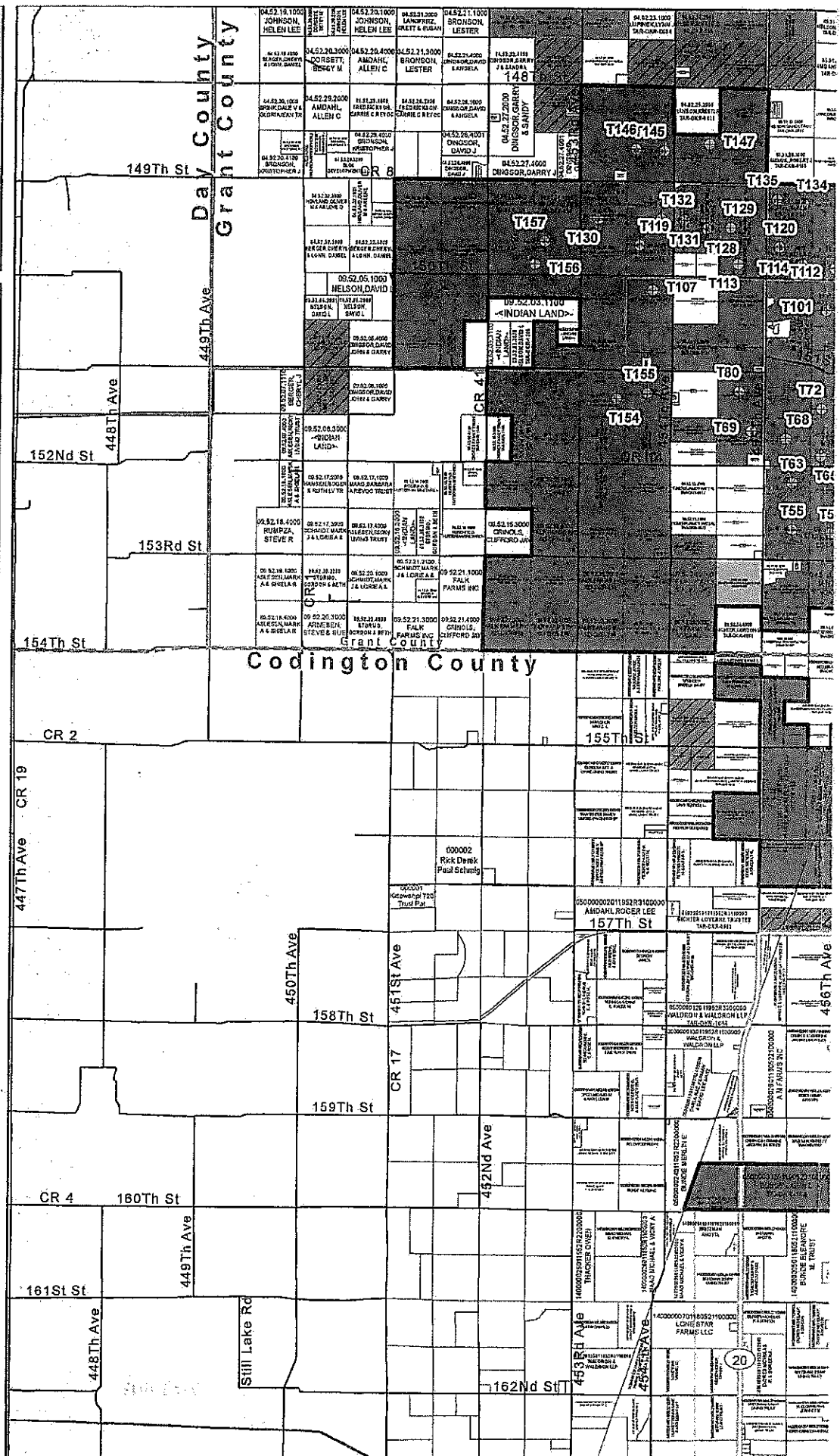
-  Project Boundary
-  County Boundary
-  Parcel Boundary
-  Proposed Turbine

Existing Transmission

-  34kV5 - 69kV
-  240kV - 345kV
-  100kV - 138kV

Lease Status

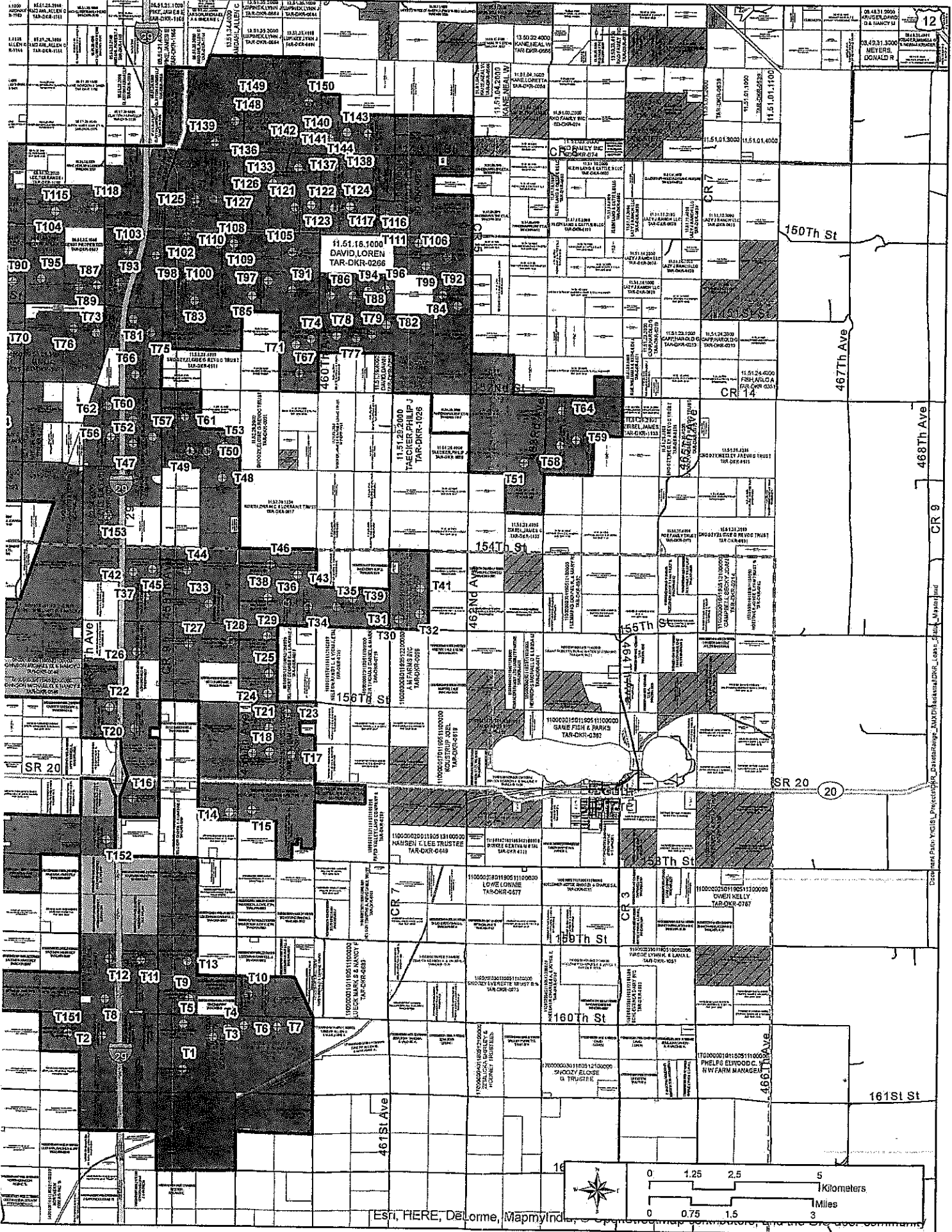
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-  Lease, Signed
-  UCE, Signed







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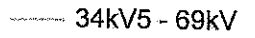








Dakota Range: Map of Easements

-  Project Boundary
-  County Boundary
-  Parcel Boundary
-  Proposed Turbine

Existing Transmission

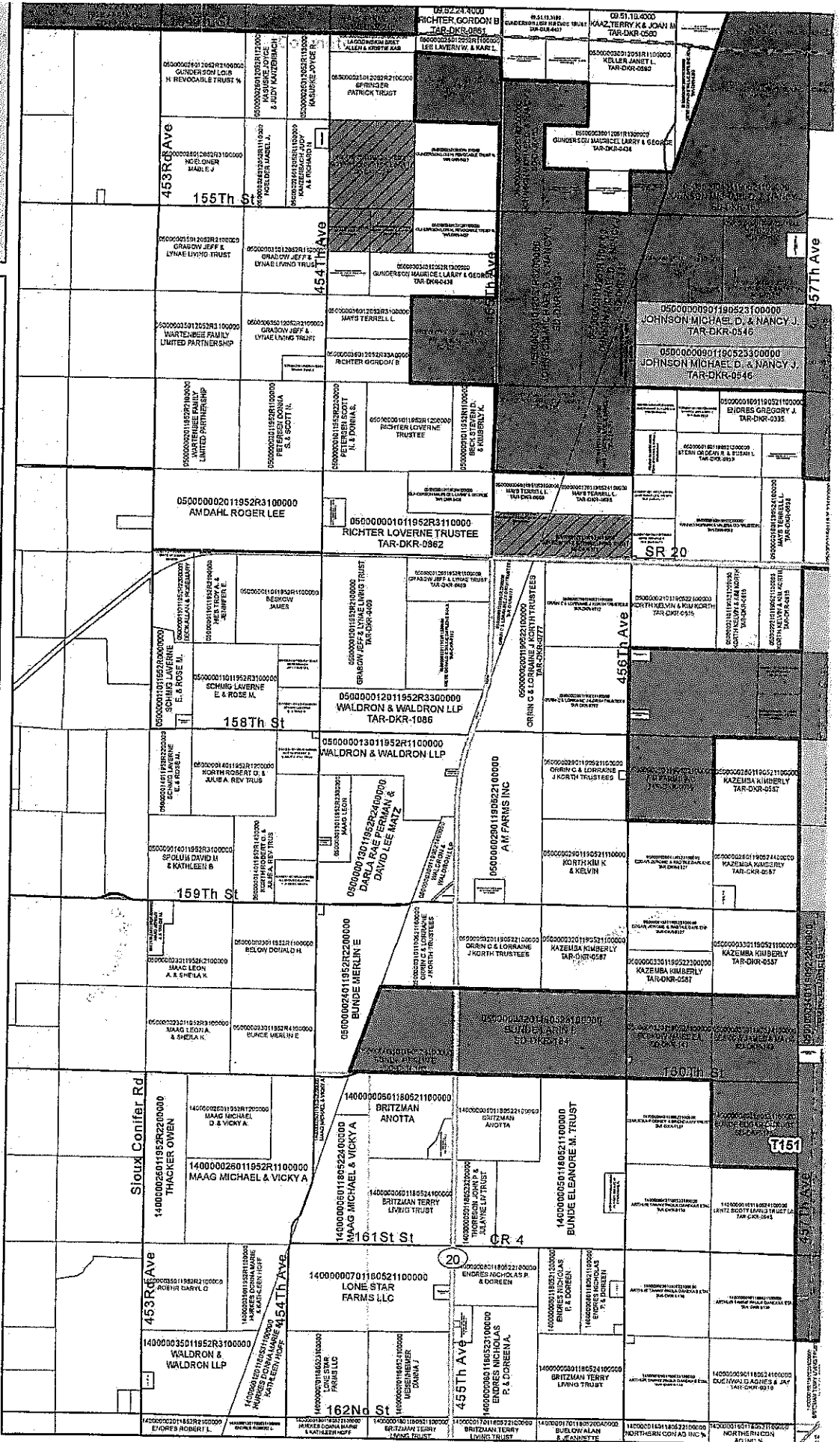
-  34kV5 - 69kV
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Use Status

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-  Lease, Signed
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5/2/2017 Author: MR CONFIDENTIAL

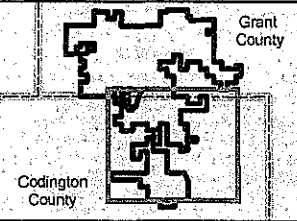
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 Projection: Mercator Auxiliary Sphere
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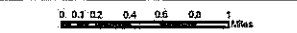
Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017

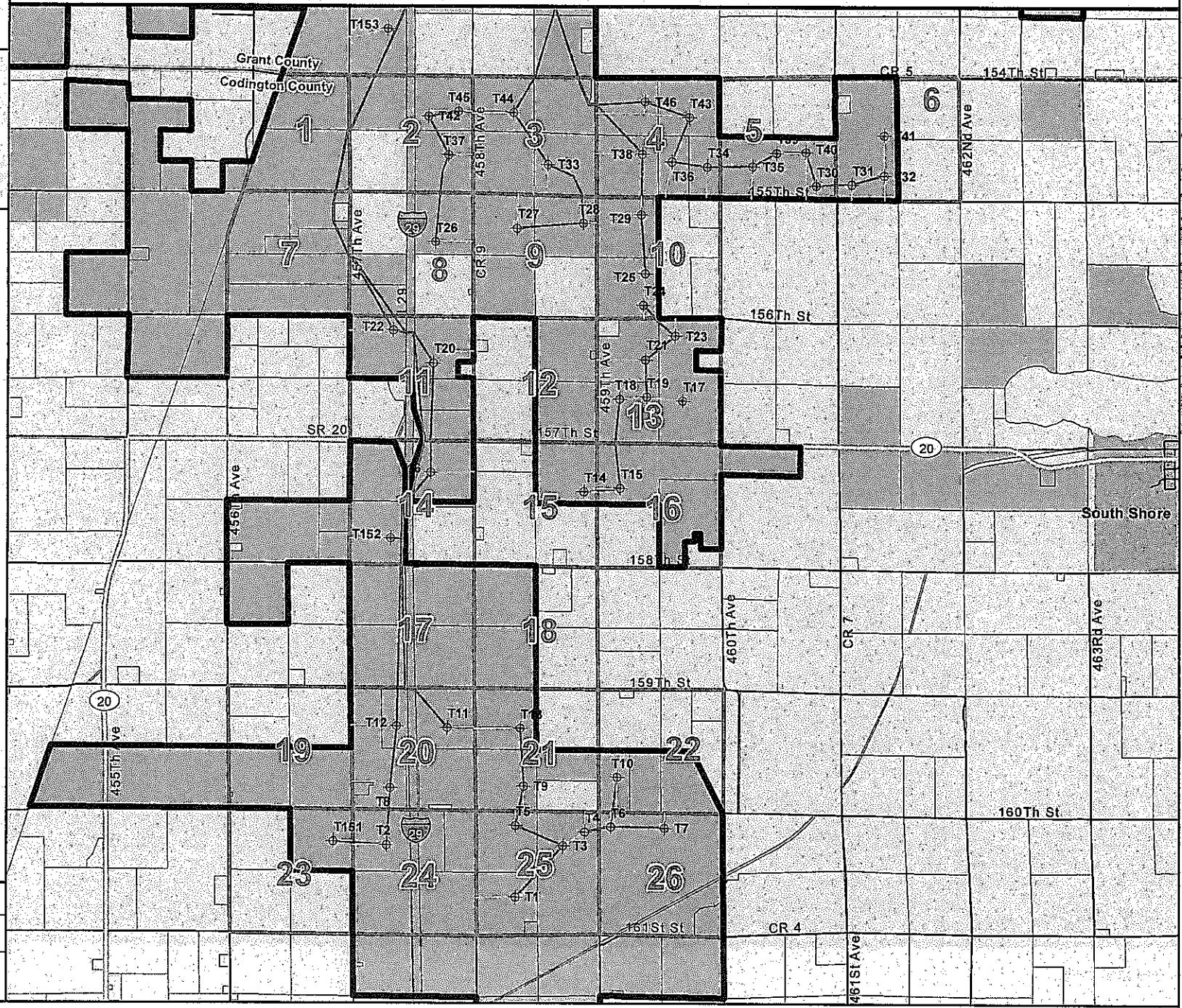


- Proposed Turbine
- Proposed Private Access Road
- Proposed Collection Line
- Parcel Boundary
- Map Page
- Project Boundary
- Participating Parcel

All locations of turbines, access roads, substations, transmission lines, and utility lines are approximate. Final locations depend on turbine model, federal and state permitting, and local micro-siting. All final turbine locations will adhere to applicable County and State requirements.



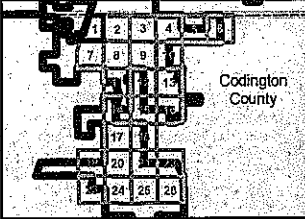
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Site Plan Mapbook: Dakota Range Wind Codington County

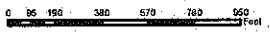
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- Proposed Turbine
- Proposed Private Access
- Proposed Collection Line
- Existing Public Road
- Parcel Boundary
- Occupied House Setback - 1,000 Ft
- Public Road Setback - 541 Ft
- Nonparticipating Parcel Setback - 541 Ft
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- Project Boundary

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Page: 1



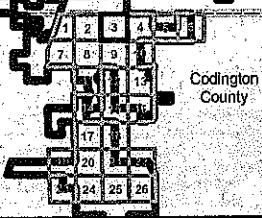
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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

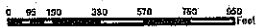
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- Proposed Turbine
- Proposed Private Access
- Proposed Collection Line
- Existing Public Road
- Parcel Boundary
- Occupied House Setback - 1,000 FT
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Page: 3



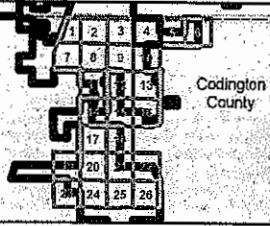
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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

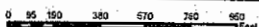
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- Proposed Turbine
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- Parcel Boundary
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Page: 4



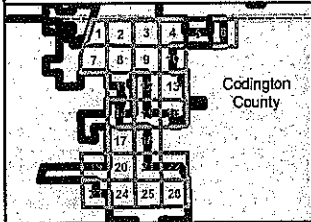
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Datum: North American 1983



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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

Date: 5/2/2017



- Proposed Turbine
- Proposed Private Access
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Page: 5



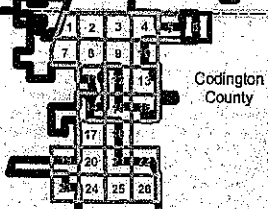
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Site Plan Mapbook: Dakota Range Wind Codington County

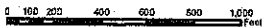
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- Proposed Turbine
- Proposed Private Access
- Proposed Collection Line
- Existing Public Road
- Parcel Boundary
- Occupied House Setback - 1,000 Ft
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Page: 6



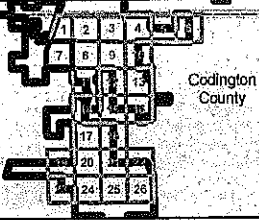
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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

Date: 5/2/2017



- Proposed Turbine
- Proposed Private Access
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Page: 7

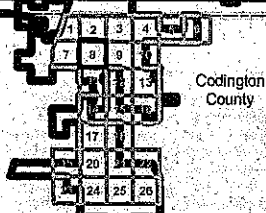


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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017



- Proposed Turbine
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Page: 8



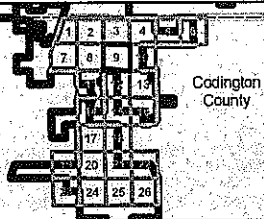
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Site Plan Mapbook: Dakota Range Wind Codington County

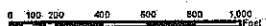
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- Proposed Turbine
- Proposed Private Access
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Page: 9



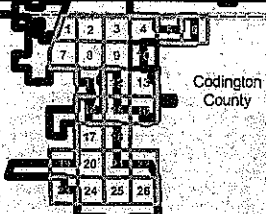
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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017

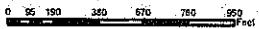


Codington
County

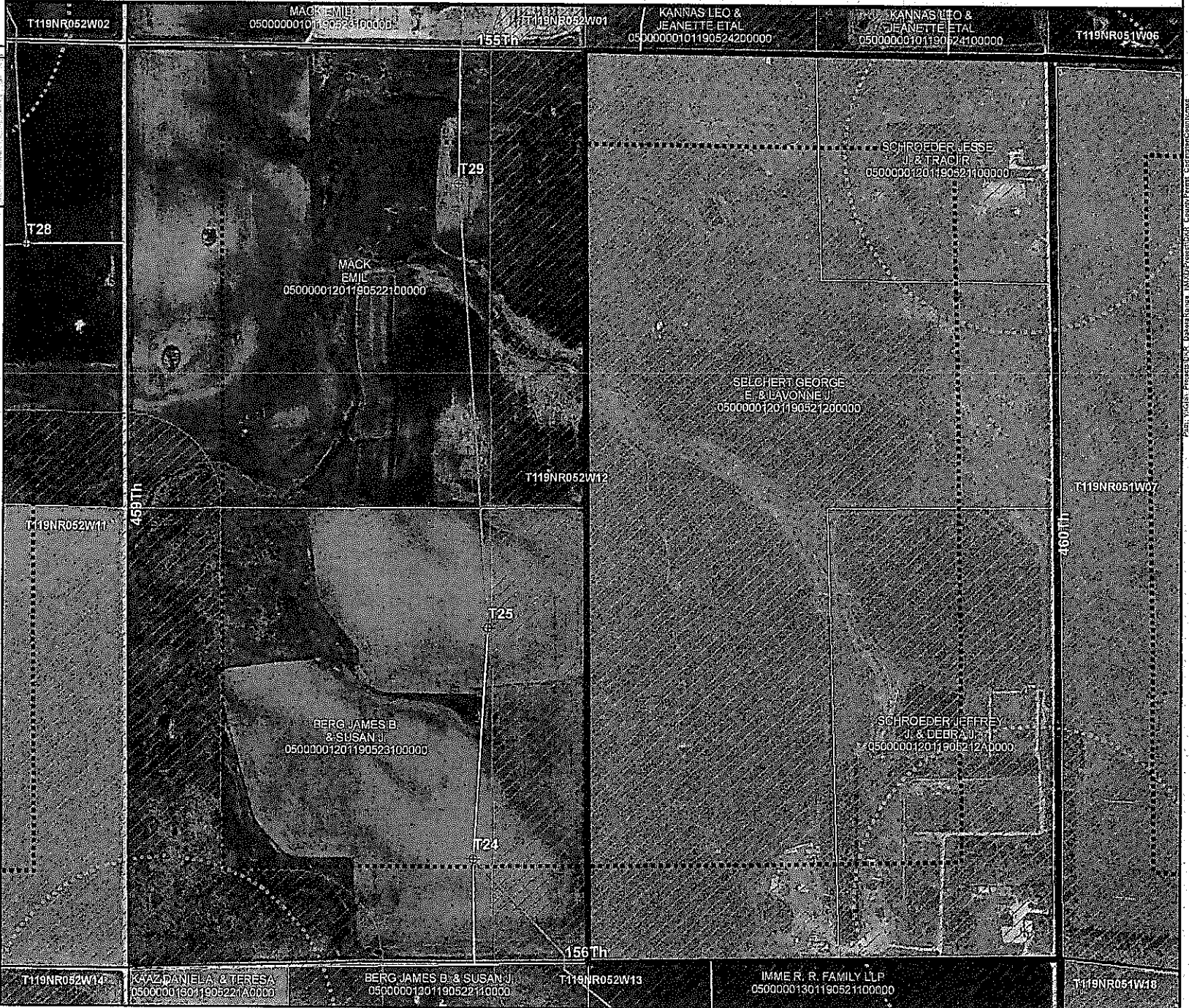
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- Proposed Collection Line
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- Occupied House Setback - 1,000 FT
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- Nonparticipating Parcel Setback - 541 FT
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Page: 10



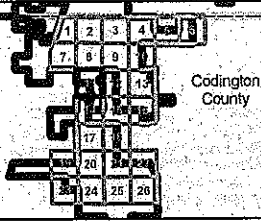
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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017



- Proposed Turbine
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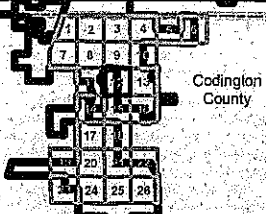


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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017



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Page: 12



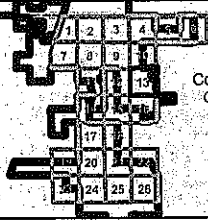
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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017

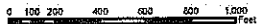


Codington
County

- Proposed Turbine
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Page: 13



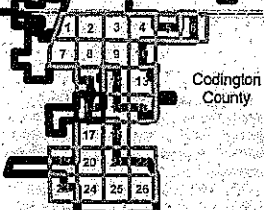
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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

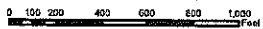
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Page: 14



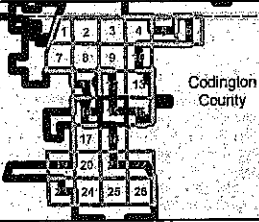
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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

Date: 5/2/2017



Codington
County

- Proposed Turbine
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Page: 15



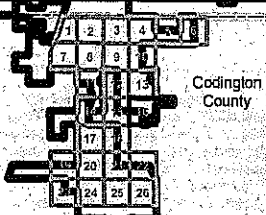
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Site Plan Mapbook: Dakota Range Wind Codington County

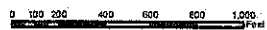
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- Proposed Turbine
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Page: 16



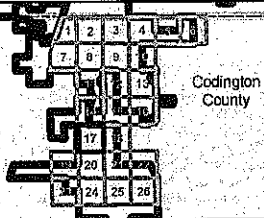
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Site Plan Mapbook: Dakota Range Wind Codington County

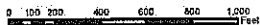
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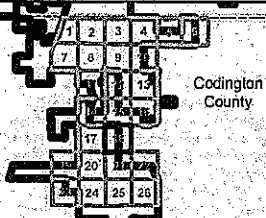
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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017



- Proposed Turbine
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- Occupied House Setback - 1,000 Ft
- Public Road Setback - 541 Ft
- Nonparticipating Parcel Setback - 541 Ft
- Nonparticipating Parcel
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All locations of turbines, access roads, substations, transmission lines, and utility lines are approximate. Final locations depend on turbine model, federal and state permitting, and local micro-siting. All final turbine locations will adhere to applicable County and State requirements.

Page: 18



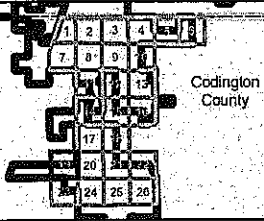
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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

Date: 5/2/2017



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- Proposed Private Access
- Proposed Collection Line
- Existing Public Road
- Parcel Boundary
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Page: 19



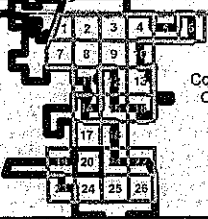
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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

Date: 5/2/2017



Codington
County

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Page: 20



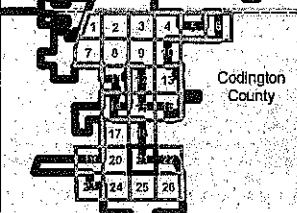
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Site Plan Mapbook: Dakota Range Wind Codington County

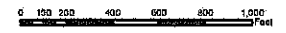
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Page: 21



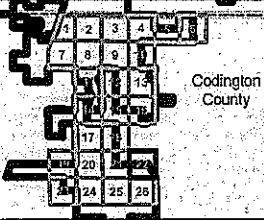
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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017



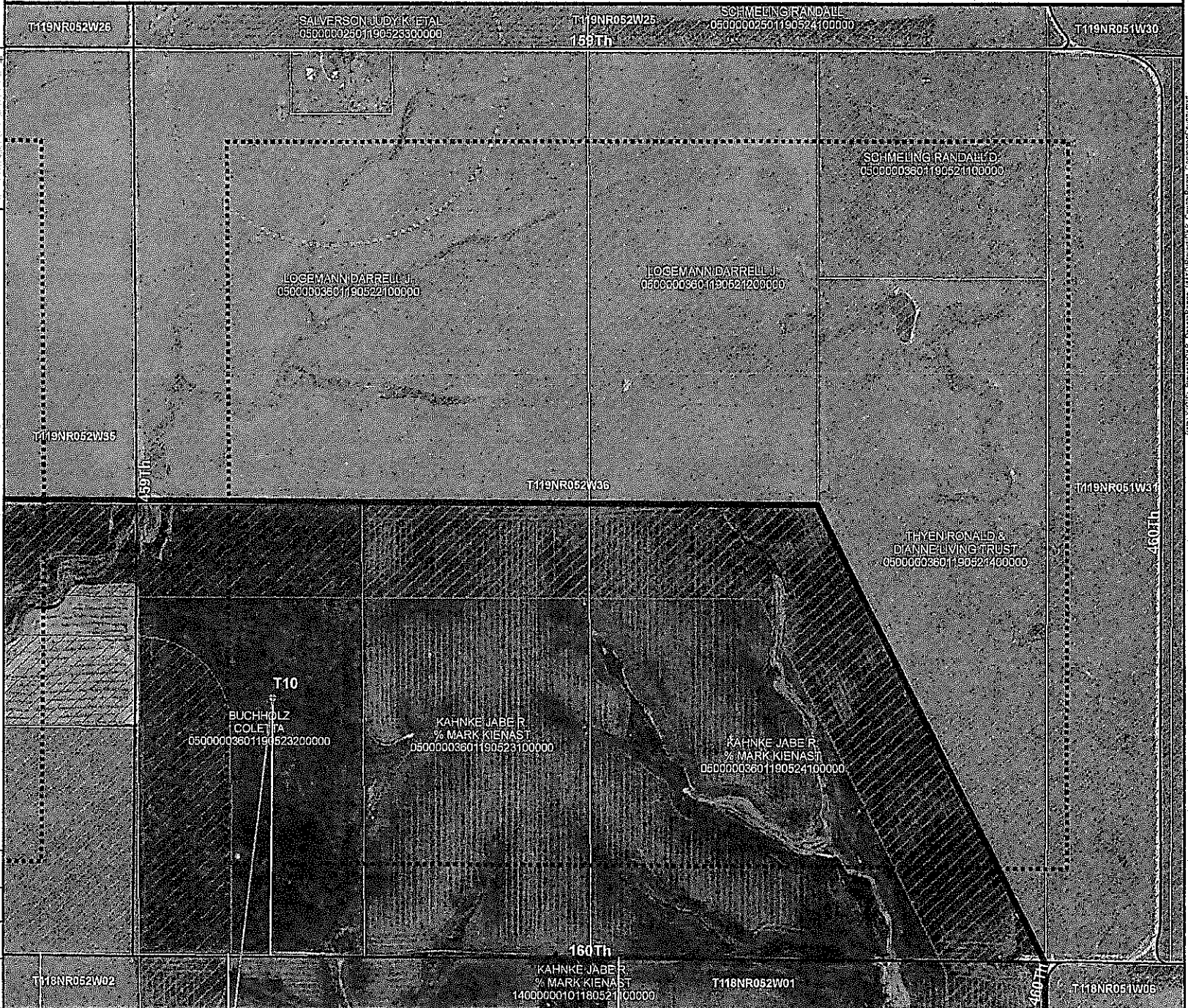
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Page: 22



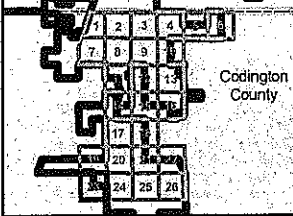
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**Site Plan Mapbook:
Dakota Range Wind
Codington County**

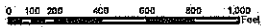
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Page: 23



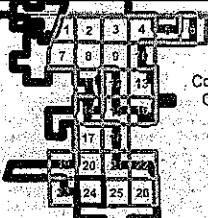
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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017



Codington County

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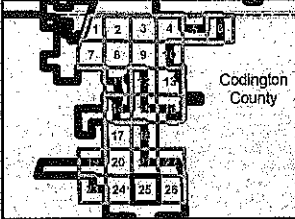
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Site Plan Mapbook: Dakota Range Wind Codington County

Date: 5/2/2017



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Page: 25



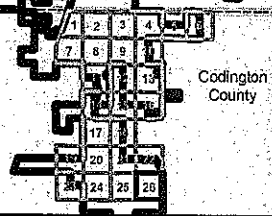
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**Site Plan Mapbook:
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Codington County**

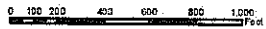
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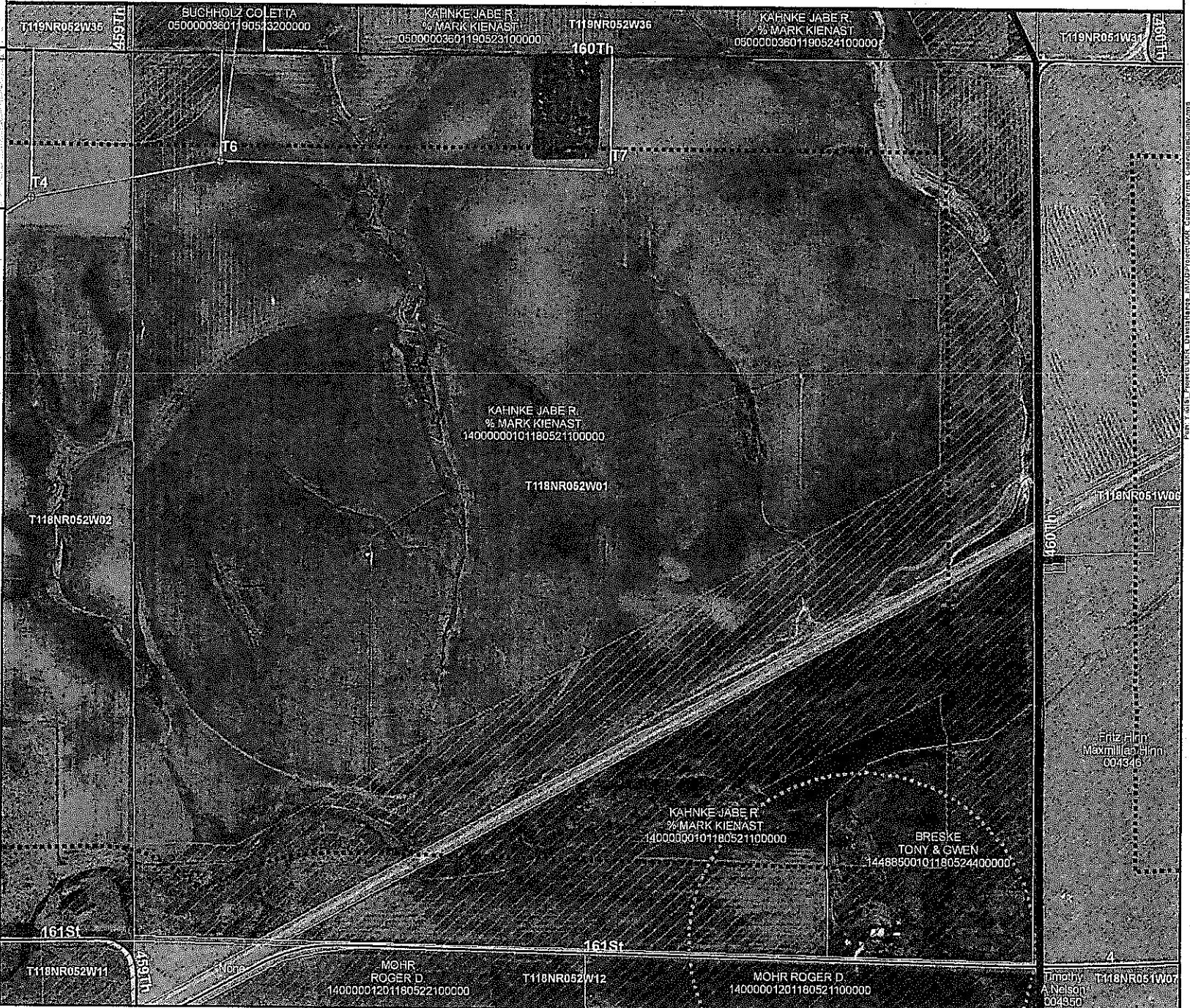
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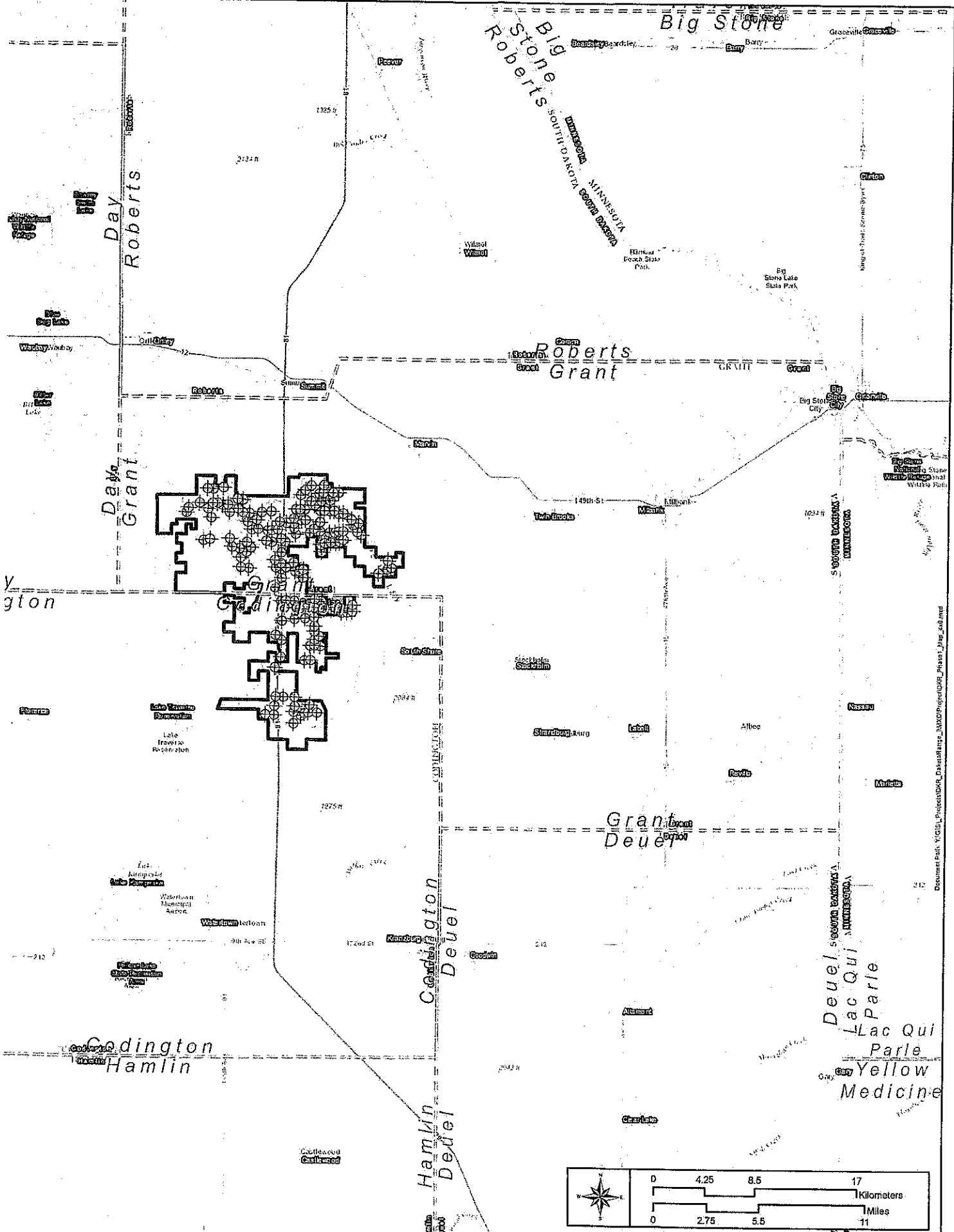
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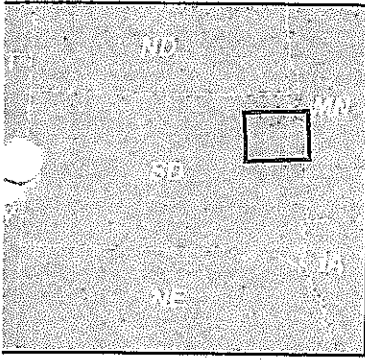
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


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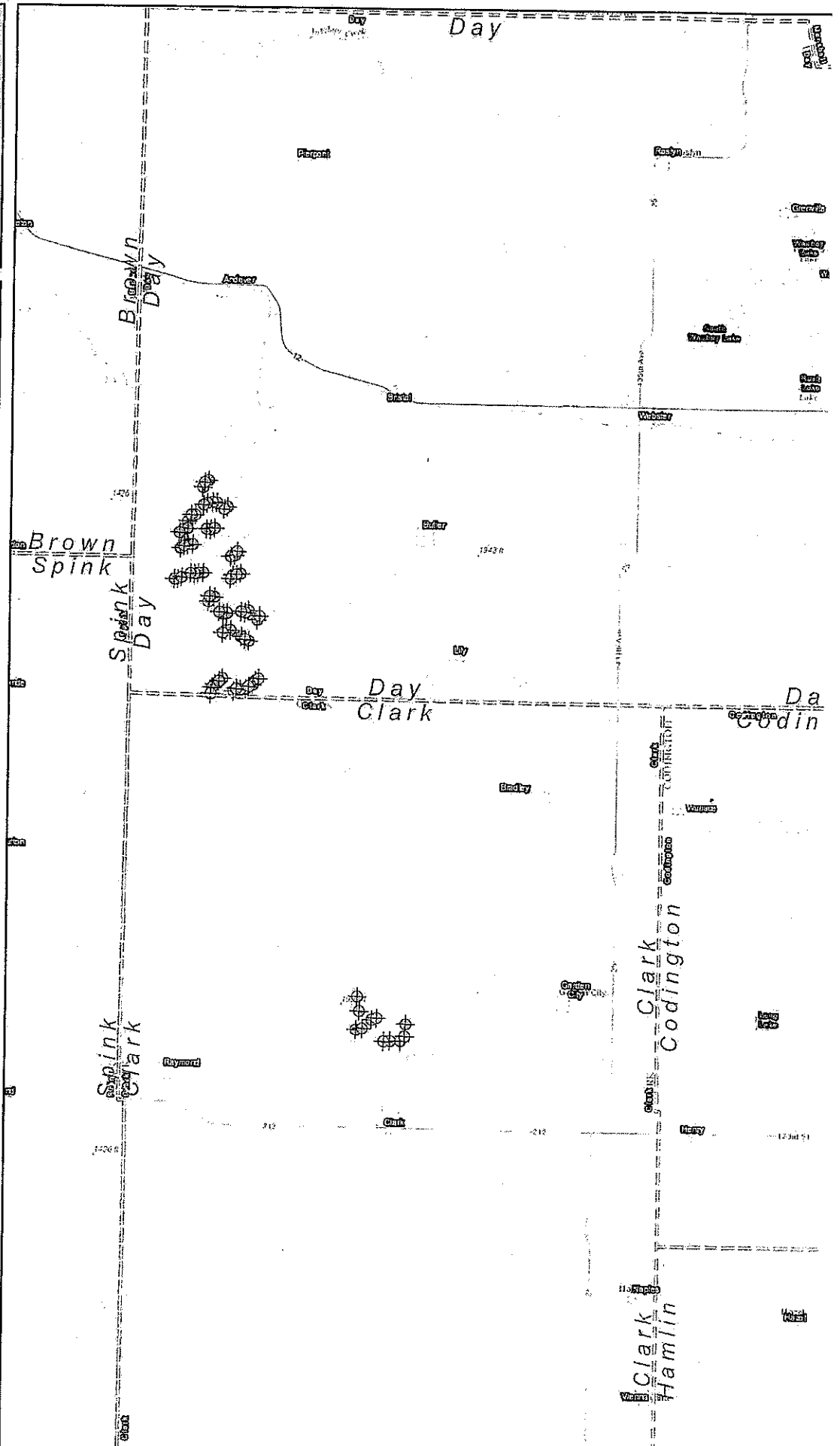


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Regional Built Turbines

-  Project Boundary
-  County Boundary
-  Proposed Turbine
-  Built Turbines



5/2/2017 Author: MR CONFIDENTIAL
 State System: NAD 1983 State Plane South Dakota North FIPS 4001 Feet
 datum: Lambert Conformal Conic
 spheroid: North American 1983
 units: Foot US



Dakota Range

Codington and Grant Counties, South Dakota

Project Schedule Dakota Range Wind Power Project

A variety of factors influence the timing of the Dakota Range Project Schedule. Below is a best estimate at this time of the schedule. The construction of the project could be delayed or accelerated depending on a number of factors, including permitting, financing, power offtake, turbine supply, and the construction of the Big Stone South-to-Ellendale transmission line that the project will interconnect to. Depending on the resolution of these factors, Dakota Range expects construction to be completed sometime between Q3 2018 and Q4 2019.

January, 2015 – April, 2017: Land leasing

December, 2015 – December 2017: Environmental studies

May, 2017 – June, 2017: Conditional Use Permit

July, 2017 – January, 2018: South Dakota Public Utility Commission Wind Energy Facility Siting Permit

August, 2018 – February, 2018: Pre-construction engineering

February, 2018: Finalize layout; apply for building permits. → ?

March, 2018 – September, 2018: Construction

c/o Apex Clean Energy, Inc.

310 4th Street NE, Suite 200 | Charlottesville, VA 22902

T 434.220.7595 | F 434.220.3712

apexcleanenergy.com

Dakota Range

Codington and Grant Counties, South Dakota

To: Conditional Use Permit Application Reviewers

From: Mark Mauersberger, Dakota Range

Date: May 3, 2017

RE: Third Party Reports

The Example Decommissioning Report (Tab 11), the Example Noise Impact Analysis (Tab 12), and the Example Shadow Flicker Analysis (Tab 13), will be provided to the Codington County Planner separately from the May 3 application submission. Dakota Range will provide these documents no later than two weeks before the scheduled Board of Adjustment meeting.



PREPARED FOR
APEX CLEAN ENERGY

TURBINE SOUND ANALYSIS

Ref. No.: 17-00671

DAKOTA RANGE I
Codington & Grant Counties
South Dakota

31 May 2017

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DOCUMENT CONTRIBUTORS

AUTHOR(S)	REVIEWER(S)	APPROVED BY
Stephanie Van Kempen Lead Renewable Energy Analyst	Jeff Long Senior Renewable Energy Analyst	Katrina Mayba Senior Project Manager

DOCUMENT HISTORY

Issue	Date	Summary
A	31 May 2017	Initial Report



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EXECUTIVE SUMMARY

AWS Truepower, LLC, a UL company, was retained by Apex Clean Energy to evaluate the turbine sound propagation of the proposed Dakota Range I wind project located in Codington and Grant Counties, South Dakota. The layout modeled in this analysis consists of 157 Vestas V110-2.0 MW turbines with a rotor diameter of 110 m and a hub height of 95 m. The turbines will be equipped with blades with the optional serrated trailing edge. This report presents the results of AWS Truepower's analysis and discusses the methods used to develop the turbine sound propagation estimates.

The zoning ordinances for both Codington and Grant Counties outline specific regulations for wind energy conversion systems. The zoning ordinances both specify that the average A-weighted sound pressure level shall not exceed 50 dB(A) at any existing off-site residences. They also specify that turbines shall be setback at least 1,000 feet from any off-site residences, and at least 500 feet from on-site residences. Although this is not specifically in reference to sound, siting turbines a considerable distance from occupied dwellings will help to reduce the impacts of sound.

The turbine sound propagation of the proposed Dakota Range I wind project was estimated using the Openwind software. Openwind was developed by AWS Truepower as an aid for the design, optimization, and assessment of wind power projects. The sound model in Openwind is based on ISO 9613-2, which is the international standard for the attenuation of sound during propagation outdoors. Various site-specific inputs, along with the sound power levels by octave band for the turbine, were input into the software. The octave band-spreading version of the model was used for this study to compare the output to the values in the Codington and Grant County noise regulations.

Total sound propagation was calculated for the proposed Dakota Range I layout. No residence is expected to experience sound levels in excess of the regulation. Noise compliance was also verified along the non-participating property lines; all non-participating property lines are expected to experience sound levels below the allowable limit. All turbines are sited at least 1,000 feet from non-participating residences, and 500 feet from participating residences.



1. INTRODUCTION

AWS Truepower, LLC, a UL company ("AWS Truepower"), was retained by Apex Clean Energy (the "Client") to evaluate the turbine sound propagation of the proposed Dakota Range I wind project located in Codington and Grant Counties, South Dakota. The layout modeled in this analysis consists of 157 Vestas V110-2.0 MW turbines with a rotor diameter of 110 m and a hub height of 95 m. The turbines will be equipped with blades with the optional serrated trailing edge. This report presents the results of AWS Truepower's analysis and discusses the methods used to develop the turbine sound propagation estimates.

2. BACKGROUND

2.1 Sound Perception

The perception of sound at a given point in the vicinity of a wind project is determined by a number of factors. These factors include distance from the source of sound to receptor, surrounding terrain, ambient sound level, time of day, wind direction, temperature gradient, and relative humidity. Sound characteristics such as amplitude (loudness), frequency (pitch), impulse patterns, and duration all affect the potential for sound to be considered noise.

Various filters can be applied to sound meters to account for how the human ear perceives sound. The most commonly used is the A-weighting scale, which accounts for human hearing being more sensitive to sound from mid-level frequencies than sound at low or high frequencies. A-weighting is applied by adding values by octave band to sound levels and is designated with the units dB(A).

2.2 Turbine Sound Emissions

Unlike some early wind turbine designs, sound emissions tend to be less of a concern for modern megawatt-scale wind turbines, especially when those turbines are sited a sufficient distance from dwellings. Aerodynamic sound has been reduced by adjusting the thickness of the blades' trailing edges, by orienting the blades upwind of the turbine tower, and by dramatically reducing the rotor rotation rate. Sound generated by the mechanical components of the turbines has been largely reduced as a result of structure-borne sound insulation of the gearbox and generator. The cooling ducts are also baffled to further reduce sound emissions.

Most turbines begin operating when the wind speed is 3 m/s or greater. Although sound emissions from the turbines tend to increase as the wind speed increases, the ambient sound from the wind tends to be louder than the sound from the turbine at wind speeds above 8–9 m/s. While acceptable distances vary with the number of turbines, ambient background noise, and screening structures and vegetation, a distance of at least 1,000 feet from occupied dwellings is typically used for wind turbine placement.

Figure 2.1 compares the average sound emissions from a typical megawatt-scale wind turbine at a receptor distance of 200 meters relative to other common sounds.

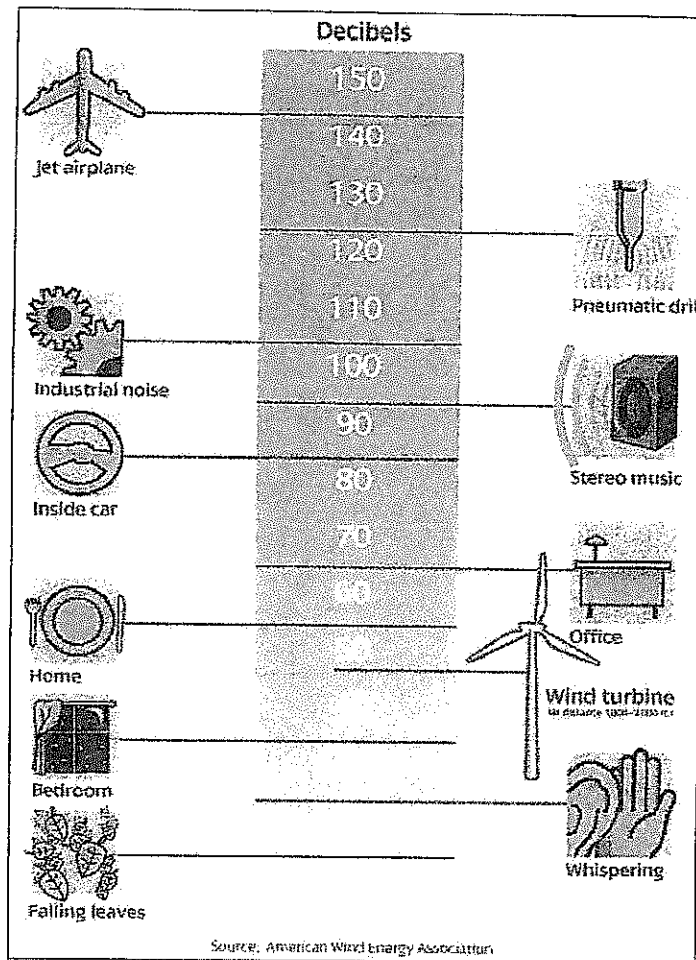


Figure 2.1: Sound Emission Comparisons

3. NOISE REGULATIONS

3.1 Federal Regulations

There are no known federal noise regulations that are applicable to this project.

3.2 State Regulations

There are no known state noise regulations that are applicable to this project.

3.3 County Regulations

Chapter 5, Section 5.22.03 of the Ordinance #65 Zoning Ordinance for Codington County outlines specific regulations for wind energy conversion systems.^{3.1} The zoning ordinance specifies that the average A-weighted sound pressure level shall not exceed 50 dB(A) at any existing off-site residence. The zoning ordinance also specifies that turbines shall be setback at least 1,000 feet from any off-site

^{3.1} Ordinance #65 Zoning Ordinance for Codington County, Chapter 5, Section 5.22.03, Item 12

residence, and at least 500 feet from on-site residences. Although this is not specifically in reference to sound, siting turbines a considerable distance from occupied dwellings will help to reduce the impacts of sound. All turbines within Codington County are sited at least 1,000 feet from non-participating residences, and 500 feet from participating residences.

Article XII, Section 1211.04 of the Zoning Ordinance for Grant County outlines specific regulations for wind energy conversion systems.^{3,2} The zoning ordinance specifies that the average A-weighted sound pressure level shall not exceed 50 dB(A) at any existing off-site residence. The zoning ordinance also specifies that turbines shall be setback at least 1,000 feet from any off-site residence, and at least 500 feet from on-site residences. Although this is not specifically in reference to sound, siting turbines a considerable distance from occupied dwellings will help to reduce the impacts of sound. All turbines within Grant County are sited at least 1,000 feet from non-participating residences, and 500 feet from participating residences.

4. METHODOLOGY

The turbine sound propagation of the proposed Dakota Range I wind project was estimated using the Openwind software. Openwind was developed by AWS Truepower as an aid for the design, optimization, and assessment of wind power projects.^{4,3} The sound model in Openwind is based on ISO 9613-2, which is the international standard for the attenuation of sound during propagation outdoors.^{4,4} Under this standard, all sound sources are treated as point sources, all sound propagation is assumed to be in the same direction as the wind, all atmospheric conditions are to be favorable to sound propagation, and all wind speeds that are between 3 and 11 meters above ground level are assumed to be between 1 and 5 m/s.

There are several types of attenuation, or decrease of the intensity of sound energy, considered in ISO 9613-2 and incorporated into the model within Openwind:

- Atmospheric—This is the conversion of sound energy into heat.
- Geometric Spreading—As the hemisphere of sound travels outwards from its point source, the sound energy is spread out over an area proportional to the distance squared.
- Ground Effect—Soft or porous ground (e.g. soil, vegetation) tends to absorb sound energy, whereas hard ground (e.g. concrete, ice, water, tamped earth) tends to reflect sound back upwards towards the observer.

The atmospheric attenuation coefficients are calculated using equations from ISO 9613-1 and the site relative humidity, temperature, and air density. Using data from a nearby reference station, a relative humidity of 76.2%, a temperature of 6.7° C, and an air density of 1.162 kg/m³ were calculated for the site.

^{3,2} Zoning Ordinance for Grant County, Article XII, Section 1211.04, Item 13; effective 25 May 2004

^{4,3} "Openwind – Theoretical Basis and Validation," Version 1.3, AWS Truewind, LLC, April 2010.

^{4,4} International Standard, ISO 9613-2, First edition, – Reference Number: ISO9613-2:1996(E) – 15 Dec 1996.



The observer height and ground porosity are both factors in calculating attenuation due to ground effect. An observer height of 1.75 m was used in this analysis, representing the height of an average to tall person. The ground porosity for the site was estimated for a distance of 5,000 m around the turbine locations using land classifications from the National Land Cover Database 2011. The percent of the area considered to be soft ground was calculated as 95%; therefore, a ground porosity of 0.95 was used in this analysis.

Additional inputs to the model included the turbine locations and receptor locations. The turbine layout used in this analysis consists of 157 Vestas V110-2.0 MW turbines at a hub height of 95 m. The layout was provided by the Client on 09 May 2017.^{4.5} Coordinates for the turbines are presented in Table 6.1 of Appendix A. There were two sets of receptors provided by the Client for the analysis: participating residences and non-participating residences. The Client also provided data for the non-participating parcels. It is recommended that the locations of both sets of receptors are verified by a site visit, if they haven't been already.

The octave band-spreading version of the model was used for this study. In this model, turbine sound power levels by octave band are used to calculate attenuation separately for each octave band before combining the octave band sound pressure levels at the receptor. The total sound power level and A-weighted total sound power level by one-third octave bands for the Vestas V110-2.0 MW turbine, with optional serrated trailing edge, were taken from manufacturer specifications provided by the Client on 18 May 2017.^{4.6} The one-third octave band sound power levels were converted to octave band sound power levels and are presented in Table 4.1.

^{4.5} Layout Version: DKR_LAY_022

^{4.6} Document Version: 0051-2907_04 dated 28 April 2016

Table 4.1: A-Weighted Sound Power Levels by Hub Height Wind Speed and Octave Band for the Vestas V110-2.0 MW Turbine

	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s
31.5 Hz	65.9	64.4	64.1	69.4	70.7	73.6	76.1	77.2	78.2
63 Hz	78.7	77.7	77.5	81.5	82.5	84.7	86.7	87.5	88.2
125 Hz	83.1	83.7	84.8	88.5	90.1	92.3	93.6	93.4	93.3
250 Hz	87.4	88.8	90.4	93.3	95.1	96.9	97.8	96.9	96.3
500 Hz	89.0	90.1	91.6	94.8	96.6	98.6	99.7	99.0	98.6
1 kHz	88.4	88.1	88.7	93.5	95.1	97.8	99.8	100.2	100.5
2 kHz	88.7	88.7	89.4	93.7	95.3	97.7	99.5	99.8	100.0
4 kHz	85.4	85.0	85.4	89.8	91.2	93.6	95.5	95.9	96.2
8 kHz	70.3	70.2	70.9	75.3	76.9	79.3	81.1	81.3	81.5
Total [dB(A)]	95.3	95.8	96.9	100.7	102.3	104.5	106	106	106
	12 m/s	13 m/s	14 m/s	15 m/s	16 m/s	17 m/s	18 m/s	19 m/s	20 m/s
31.5 Hz	78.8	79.4	79.8	80.2	80.5	80.8	81.0	81.3	81.5
63 Hz	88.6	89.0	89.3	89.6	89.8	90.0	90.2	90.4	90.5
125 Hz	93.1	93.1	92.9	92.8	92.7	92.6	92.6	92.5	92.3
250 Hz	95.8	95.5	95.2	94.8	94.5	94.2	94.0	93.8	93.5
500 Hz	98.2	98.0	97.7	97.5	97.3	97.0	96.9	96.7	96.5
1 kHz	100.6	100.8	100.9	101.0	101.0	101.1	101.1	101.2	101.2
2 kHz	100.1	100.3	100.3	100.4	100.4	100.5	100.5	100.6	100.6
4 kHz	96.4	96.7	96.8	96.9	96.9	97.0	97.1	97.1	97.1
8 kHz	81.5	81.6	81.7	81.7	81.7	81.7	81.7	81.8	81.7
Total [dB(A)]	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0

5. RESULTS

Given the sound model inputs specified above, total sound propagation was calculated for the proposed Dakota Range I layout. Figure 6.1 in Appendix A presents the total sound pressure level in the vicinity of the turbine locations at 15 m/s, which is among the wind speeds with the highest output; not all of the receptor locations are visible on the map. The total sound pressure level at each of the participating residences can be found in Table 6.2, while the total sound pressure level at each of the non-participating residences can be found in Table 6.3. No residence is expected to experience sound levels in excess of the regulation for either county. Noise compliance was also verified along the property lines. All property lines are expected to experience sound levels below the allowable limit.

The sound modeling results represent a conservative estimate of the actual sound levels that may be experienced at receptor locations near the project site due to the following conditions:

- The sound model is designed mainly for use in flat or constantly sloping terrain. Terrain data is only used to calculate 3-dimensional distances between source and receiver. The model does not take into account the fact that terrain features such as hills can act as barriers to the propagation of sound.
- Other obstacles to the propagation of sound such as trees and buildings are also ignored.

- Ambient sound, such as the rustling of leaves, which tends to mask turbine sounds at higher wind speeds, is ignored.

On-site measurement is recommended to account for site-specific variables and conditions like ground porosity and locations of receptors. In the unlikely event that on-site measurement yields non-compliance once the project is operational, reductions of sound levels can be achieved by altering the turbine operating parameters used at the site. Many turbine models, including the Vestas V110-2.0 MW, offer reduced sound output modes that can be used for certain turbine locations and during certain times of day.

6. APPENDIX A—VESTAS V110-2.0 MW RESULTS

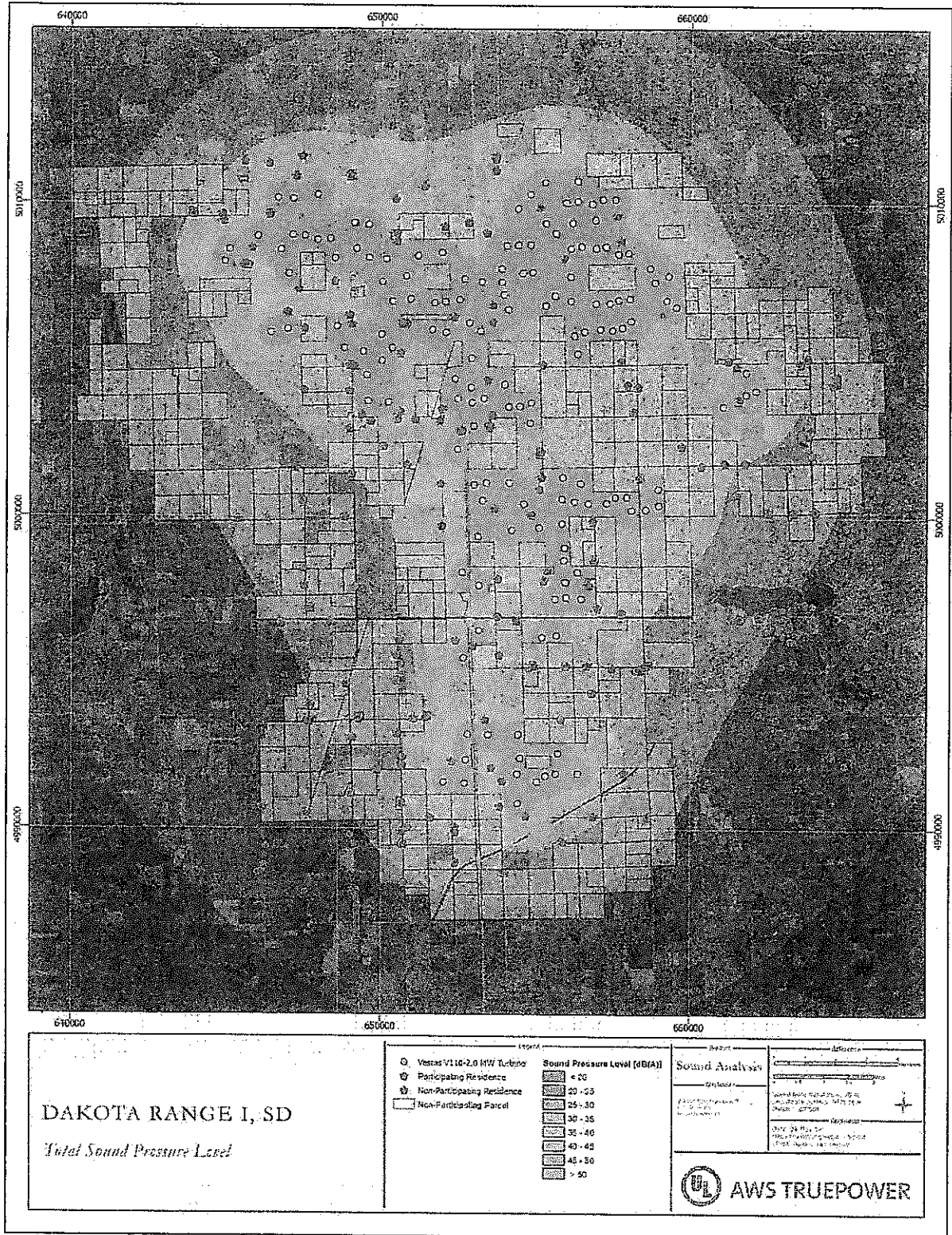


Figure 6.1: Total Sound Pressure Level for the Dakota Range I—Vestas V110-2.0 MW Layout

Table 6.1: Dakota Range I Turbine Layout Coordinates

Turbine ID	Easting	Northing
T1	654437	4990818
T2	652744	4991457
T3	655041	4991504
T4	655320	4991691
T5	654417	4991753
T6	655655	4991763
T7	656351	4991767
T8	652772	4992208
T9	654509	4992272
T10	655721	4992419
T11	653496	4993021
T12	652836	4993026
T13	654445	4993035
T14	655196	4996147
T15	655666	4996204
T16	653194	4996356
T17	656446	4997379
T18	655629	4997383
T19	655975	4997421
T20	653188	4997799
T21	655951	4997909
T22	652656	4998211
T23	656328	4998223
T24	655904	4998613
T25	655918	4999018
T26	653176	4999371
T27	654239	4999575
T28	655096	4999662
T29	655845	4999788
T30	658112	5000221
T31	658571	5000246
T32	658986	5000374
T33	654618	5000416
T34	656684	5000431
T35	657273	5000452
T36	656230	5000489
T37	653317	5000510
T38	655840	5000580
T39	657586	5000632
T40	657966	5000649
T41	658975	5000894
T42	653043	5001014
T43	656441	5001077
T44	654160	5001084
T45	653434	5001084
T46	655861	5001267
T47	653017	5002903
T48	654805	5002994
T49	654133	5003520
T50	654486	5003526
T51	661070	5003538
T52	652951	5003633
T53	654837	5003644

Table 6.1: Dakota Range I Turbine Layout Coordinates

Turbine ID	Easting	Northing
T54	650236	5003652
T55	649568	5003692
T56	652494	5003760
T57	653350	5003784
T58	661820	5003921
T59	662143	5004047
T60	652929	5004123
T61	654001	5004223
T62	652407	5004389
T63	649539	5004505
T64	661822	5004632
T65	650022	5004973
T66	652946	5005057
T67	656327	5005195
T68	649412	5005254
T69	648810	5005368
T70	650353	5005382
T71	656226	5005775
T72	650010	5005792
T73	652107	5005873
T74	656538	5005899
T75	653232	5005916
T76	651651	5005951
T77	657462	5005957
T78	657062	5005987
T79	657792	5006040
T80	648574	5006041
T81	652869	5006175
T82	658085	5006247
T83	654108	5006602
T84	659536	5006690
T85	655288	5006741
T86	656908	5006794
T87	651726	5006804
T88	657364	5006812
T89	652084	5006846
T90	650375	5006856
T91	656106	5006880
T92	659223	5006900
T93	652556	5006911
T94	657670	5006917
T95	650951	5006932
T96	658042	5006958
T97	655606	5007049
T98	653977	5007075
T99	658846	5007474
T100	653908	5007477
T101	650039	5007482
T102	653280	5007490
T103	652715	5007567
T104	650808	5007652
T105	656089	5007654
T106	659289	5007676

Table 6.1: Dakota Range I Turbine Layout Coordinates

Turbine ID	Easting	Northing
T107	647010	5007728
T108	654563	5007759
T109	654877	5007787
T110	653901	5007895
T111	658684	5007931
T112	650166	5008209
T113	648494	5008227
T114	649609	5008256
T115	651198	5008310
T116	657659	5008385
T117	657992	5008416
T118	651981	5008419
T119	646755	5008498
T120	649198	5008542
T121	656102	5008559
T122	656918	5008574
T123	656449	5008620
T124	657239	5008625
T125	654062	5008649
T126	654818	5008668
T127	654425	5008672
T128	647921	5008811
T129	648345	5008844
T130	646023	5008935
T131	647526	5008948
T132	647122	5008962
T133	655630	5009033
T134	649591	5009297
T135	649130	5009361
T136	655296	5009363
T137	656148	5009371
T138	656888	5009470
T139	654407	5009826
T140	656776	5009978
T141	655947	5010011
T142	656318	5010061
T143	657557	5010121
T144	657123	5010123
T145	647137	5010125
T146	646649	5010148
T147	647928	5010260
T148	654805	5010277
T149	655270	5010661
T150	656318	5010703
T151	652048	4991488
T152	652689	4995485
T153	652485	5002146
T154	646437	5005858
T155	646967	5005964
T156	644953	5008122
T157	645110	5008515

Note: Coordinates are in WGS84 UTM14N

Table 6.2: Total Sound Pressure Level [dB(A)] at Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
20	654682	4990406	39.3
26	656835	4990400	31.4
105	665082	4993093	22.8
146	653951	4991544	40.4
156	653588	4991975	38.8
161	652432	4989894	30.8
209	650707	4992321	30.4
222	652311	4992164	40.9
232	653395	4993505	39.9
398	663380	4996039	25.2
500	656622	4995250	32.7
592	648375	4996645	27.1
656	650473	4996848	29.5
675	649341	4999050	29.0
689	651994	4999721	34.5
723	655254	4997957	40.2
789	648160	5000058	28.6
843	655103	5000902	40.1
848	654852	5000076	43.3
851	653693	5000273	41.9
863	644357	5002651	27.1
880	647235	5001567	28.9
906	650524	5003104	37.9
910	651108	5003102	35.8
917	651910	5003058	37.9
929	652661	5002766	42.8
930	652602	5002742	42.0
951	661784	5001742	30.5
954	661127	5001722	31.2
970	664756	5004487	27.4
1003	653600	5003245	42.4
1006	653457	5004344	42.9
1015	651979	5003440	39.7
1016	651998	5003451	39.9
1019	650606	5003348	39.7
1030	649364	5003248	39.6
1085	649046	5006118	41.2
1101	647304	5007251	38.8
1110	648481	5007490	38.2
1133	650627	5005202	43.7
1135	661518	5004784	42.3
1141	661600	5003749	44.8
1157	649872	4991904	27.9
1158	649922	4991918	28.0
1181	652367	5006353	44.0
1183	653594	5006201	42.5
1235	653613	5006756	43.3
1259	664924	5006726	26.5

Table 6.2: Total Sound Pressure Level [dB(A)] at Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
1260	665844	5006677	25.5
1261	665811	5006676	25.5
1278	665811	5006676	25.5
1279	665811	5006676	25.5
1294	661511	5009230	29.7
1312	657735	5008810	44.1
1316	657619	5009595	42.0
1321	655865	5008248	43.8
1335	653412	5009060	38.8
1336	653437	5009051	38.9
1402	645841	5008575	41.9
1414	645631	5008057	39.2
1415	645560	5008023	39.5
1425	644921	5009426	35.2
1435	647229	5010860	37.7
1446	650458	5010136	34.8
1447	651400	5010537	32.8
1454	653709	5011042	34.6
1463	655074	5009887	43.4
1473	663067	5009863	27.2
1512	645592	5011331	31.1
1525	653707	5011413	33.5
1526	653707	5011446	33.4
1527	653705	5011489	33.2
1537	659888	5013103	27.8
1540	656697	5014471	27.9
1543	657521	5013443	29.1
1546	657918	5013363	29.0
1549	654214	5014599	27.8
1552	653464	5014791	27.4
1553	653470	5014748	27.5
1569	654441	5017765	24.5
1572	650616	5013442	28.4
1593	648988	5013202	28.6
1609	647139	5014024	27.0
1640	646112	5014302	26.2
1641	650228	5014435	27.2
1648	648858	5014749	26.6
1658	647098	5014730	26.1
1664	645511	5015039	25.1
1665	645500	5015040	25.1
1666	645488	5015042	25.1
1667	645476	5015042	25.1
1689	647399	5015987	25.0
1698	651813	5014591	27.4
1699	651778	5014579	27.4
1700	651881	5014455	27.5
1704	660721	5013272	26.9
1711	660611	5014484	25.9
1712	660716	5014630	25.7
1715	659630	5014923	26.1

Table 6.2: Total Sound Pressure Level [dB(A)] at Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
1725	646222	5016509	24.2
1738	647225	5016639	24.4
1761	647898	5017254	24.1
1768	652439	5016206	25.8
1770	662657	5015411	24.0
1792	663811	5014304	24.0
1813	660406	5016495	24.3
1815	659371	5017345	24.1
1816	659533	5018317	23.3
1875	655281	5020979	22.1
1876	655229	5021036	22.0
1946	652007	5018429	23.9
1982	646631	5018928	22.6
1993	644599	5020890	20.8
2001	644610	5020921	20.8
2003	645451	5022016	20.4
2008	650430	5020350	22.3
2009	651846	5019969	22.7
2015	653454	5019125	23.4
2017	653879	5019205	23.4
2018	653893	5019481	23.2
2019	654051	5019610	23.1
2020	654294	5019608	23.1
2033	657346	5024816	19.6
2040	656611	5026995	18.5
2075	648291	5024622	19.5
2084	652138	5021042	22.0
2091	651774	5022027	21.4
2097	650244	5022881	20.7
2114	646174	5024200	19.4
2121	645347	5024827	18.9
2143	653402	5022226	21.3
2144	653676	5022816	20.9
2233	640496	5026596	17.1
2236	640622	5026118	17.3
2261	639687	5025191	17.4
2303	648352	4991903	25.5
2351	651938	5001067	35.6
2407	643160	5007930	29.4

Note: Coordinates are in WGS84 UTM14N

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
3	650712	4988266	25.1
6	650731	4988249	25.1
7	652416	4988919	27.7
13	654015	4988590	27.8
21	655847	4989588	30.3
35	657862	4991817	30.4
37	659447	4992233	26.8
38	659433	4992153	26.8
58	660141	4991656	25.7
68	660636	4991546	25.2
88	663565	4991347	23.0
89	665046	4992088	22.5
92	666762	4991802	21.4
109	664242	4993659	23.6
129	662819	4993516	24.5
136	662251	4993738	25.0
144	653858	4990720	38.2
162	652414	4990051	31.6
173	651609	4990365	31.6
181	650704	4989527	27.0
184	650662	4989915	27.6
185	650857	4990054	28.4
200	650658	4990853	29.6
208	650693	4992058	30.5
246	655804	4993536	34.0
249	656798	4994383	31.0
255	657465	4995164	30.7
270	658362	4995128	29.3
271	658579	4995244	29.2
284	660999	4995203	26.7
285	660903	4995173	26.7
294	663415	4995388	24.9
295	662991	4995236	25.1
302	665798	4995300	23.2
309	663991	4997186	25.2
310	663745	4997206	25.4
311	663744	4997244	25.4
314	663484	4997238	25.6
315	663431	4997226	25.7
316	663419	4997187	25.7
317	663395	4997160	25.7
318	663375	4997146	25.7
319	663273	4997064	25.7
320	663389	4996957	25.6
321	663323	4996965	25.6
322	663293	4996959	25.7
323	663273	4996826	25.6
324	663248	4996819	25.6
325	663229	4996823	25.6
326	663204	4996818	25.7
327	663258	4996949	25.7

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
328	663219	4996939	25.7
329	663169	4996762	25.7
330	663136	4996763	25.7
331	663120	4996761	25.7
332	663108	4996722	25.7
333	663218	4996750	25.6
334	663292	4996645	25.5
335	663261	4996643	25.5
336	663230	4996642	25.6
337	663208	4996633	25.6
338	663169	4996633	25.6
339	663111	4996636	25.7
340	663108	4996621	25.7
341	663066	4996632	25.7
342	663259	4996492	25.5
343	663211	4996562	25.5
344	663176	4996555	25.6
345	663174	4996500	25.5
346	663176	4996460	25.5
347	663124	4996507	25.6
348	663112	4996551	25.6
349	663140	4996554	25.6
350	663067	4996579	25.7
351	663046	4996547	25.7
352	663060	4996472	25.6
353	662996	4996410	25.6
354	662991	4996458	25.7
355	662994	4996500	25.7
356	662986	4996551	25.7
357	662983	4996576	25.7
358	662984	4996590	25.7
359	662982	4996613	25.8
360	662980	4996638	25.8
361	662981	4996676	25.8
362	663007	4996673	25.8
363	663060	4996680	25.7
364	662982	4996706	25.8
365	662981	4996737	25.8
366	662980	4996755	25.8
367	662979	4996765	25.8
368	663012	4996771	25.8
369	663013	4996755	25.8
370	663058	4996754	25.8
371	663063	4996726	25.7
372	662929	4996717	25.8
373	662926	4996734	25.9
374	662930	4996677	25.8
375	662911	4996757	25.9
376	662916	4996622	25.8
377	662917	4996590	25.8
378	662917	4996541	25.8

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
379	662898	4996539	25.8
380	662863	4996545	25.8
381	662935	4996479	25.7
382	662934	4996459	25.7
383	662932	4996434	25.7
384	662934	4996405	25.7
385	662931	4996502	25.7
386	662932	4996348	25.7
387	662800	4996400	25.8
388	662822	4996402	25.8
389	662732	4996399	25.9
390	662813	4996444	25.8
391	662811	4996488	25.8
392	662851	4996476	25.8
393	663278	4996054	25.3
399	663010	4996268	25.6
400	663018	4996232	25.5
410	662508	4996371	26.0
411	662675	4996565	26.0
412	662669	4996623	26.0
413	662668	4996732	26.1
414	662715	4996674	26.0
415	662713	4996727	26.0
416	662731	4996746	26.0
417	662789	4996742	26.0
418	662789	4996686	25.9
419	662850	4996690	25.9
420	662847	4996722	25.9
421	662845	4996748	25.9
422	662875	4996761	25.9
423	662848	4996667	25.9
424	662739	4996872	26.1
425	662789	4996854	26.0
426	662844	4996850	26.0
427	662853	4996812	26.0
428	662932	4996804	25.9
429	662929	4996822	25.9
430	662973	4996814	25.9
431	662997	4996813	25.8
432	663053	4996848	25.8
433	663061	4996871	25.8
434	663056	4996905	25.8
435	663126	4996818	25.7
436	663144	4996897	25.8
471	662669	4997061	26.2
472	662697	4997062	26.2
473	662752	4997054	26.2
474	662796	4997057	26.1
475	662842	4997048	26.1
483	663076	4997051	25.9
484	663024	4997055	25.9

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences — Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
485	662971	4997031	26.0
486	663019	4997036	25.9
487	662283	4996825	26.4
488	662240	4996823	26.5
494	661651	4996767	27.0
495	661619	4996758	27.0
513	655955	4995240	34.5
523	654917	4995237	34.6
531	653838	4995578	34.5
534	652996	4995886	40.8
535	652437	4996048	37.8
541	650593	4996054	29.5
542	650496	4995587	29.2
545	650637	4995303	29.4
579	650502	4994754	29.0
586	648862	4994650	26.9
628	647648	4997080	26.7
636	647523	4997800	26.9
644	649155	4997753	28.2
662	650596	4997697	30.1
671	647489	4998353	27.1
701	653787	4998023	37.8
706	653778	4996826	36.6
713	654385	4996688	35.7
724	655369	4998297	40.7
733	656685	4997836	42.3
738	656977	4997093	38.6
749	656868	4998570	39.3
753	657770	4996904	33.0
754	657793	4996940	33.0
758	656816	4999863	41.1
762	663163	4998857	26.7
766	663292	4998945	26.6
768	662735	4999393	27.4
770	663358	5000159	27.1
771	663387	5000154	27.1
774	664063	5000216	26.4
775	664074	5000199	26.4
780	647461	5000525	28.3
781	647456	5000456	28.3
803	648809	4999992	29.1
806	649064	5001386	30.6
808	663179	5001621	28.4
819	662551	5000165	28.0
823	661543	5000761	29.8
828	660362	5001638	32.3
835	658372	5001257	39.7
837	655170	5001262	39.3
857	645387	4999932	26.4
858	646345	4999960	27.1
890	648970	5002809	34.1

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
897	649665	5003051	38.1
907	650075	5002249	33.4
920	650833	5001658	33.0
932	653531	5002925	41.4
934	653518	5002857	41.2
939	667072	5000419	23.9
948	665253	5001243	25.7
950	665545	5000338	25.1
958	663970	5002020	27.7
964	666497	5005153	25.0
971	664644	5004251	27.6
974	663576	5004902	30.4
981	657975	5004221	34.1
993	658165	5003370	32.7
997	655166	5002087	36.9
1044	648978	5004009	39.0
1048	647494	5004033	32.7
1057	647511	5006002	39.0
1078	648977	5004832	41.6
1080	649090	5004809	42.1
1091	648970	5006430	39.6
1093	646969	5006521	39.1
1120	650685	5006150	40.7
1121	650838	5006169	40.5
1124	650686	5006188	40.8
1136	661243	5005003	36.6
1150	659717	5002264	32.5
1152	658319	5004153	33.5
1154	650528	4993062	29.3
1174	646887	4994910	25.3
1180	646744	4996588	25.8
1200	667698	5004863	23.9
1211	666221	5005552	25.3
1214	664806	5006460	26.7
1222	663797	5005086	29.4
1229	657770	5004970	37.4
1234	655202	5004866	36.7
1251	664537	5007281	26.7
1350	652821	5009387	36.1
1366	652045	5009239	36.9
1382	650503	5009034	38.5
1399	650494	5008777	39.9
1412	645709	5008004	38.5
1413	645721	5008021	38.5
1431	646375	5009625	40.1
1439	648982	5010915	34.1
1445	648974	5010823	34.5
1475	664388	5011012	25.3
1484	665390	5009888	24.9
1513	646356	5011254	33.4
1523	647415	5011482	33.3

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
1567	654426	5017892	24.4
1568	654209	5017869	24.5
1594	647291	5013274	28.1
1647	648895	5014568	26.8
1676	644633	5014491	25.2
1723	643999	5016084	23.6
1724	643978	5016340	23.4
1771	663759	5015440	23.4
1772	663622	5013709	24.5
1773	663500	5014120	24.3
1774	663525	5014112	24.3
1775	663712	5014003	24.2
1776	663747	5014077	24.2
1777	663802	5013975	24.2
1778	663844	5013978	24.2
1779	663994	5013843	24.2
1780	663998	5013883	24.1
1781	663994	5013905	24.1
1782	663956	5013925	24.1
1783	663960	5013999	24.1
1784	663956	5014028	24.1
1785	663809	5014059	24.1
1786	663745	5014061	24.2
1787	663822	5014118	24.1
1788	663844	5014118	24.1
1789	663938	5014040	24.1
1790	663994	5014032	24.0
1791	663991	5013958	24.1
1793	663761	5014298	24.0
1794	663763	5014263	24.1
1795	663649	5014196	24.2
1796	663574	5014325	24.1
1812	663600	5014179	24.2
1817	662958	5019757	21.3
1818	662287	5020608	21.0
1834	662687	5022843	19.7
1835	662695	5022980	19.6
1836	662371	5022974	19.7
1867	661641	5022645	20.1
1868	659804	5022129	20.7
1878	654009	5018004	24.3
1879	653948	5018047	24.3
1880	653727	5018884	23.6
1881	653645	5018765	23.7
1882	653647	5018716	23.8
1883	653686	5018751	23.7
1884	653727	5018733	23.7
1885	653733	5018804	23.7
1886	653775	5018821	23.7
1887	653779	5018775	23.7
1888	653796	5018756	23.7

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
1889	653812	5018730	23.7
1890	653790	5018684	23.8
1891	653802	5018650	23.8
1892	653830	5018655	23.8
1893	653872	5018648	23.8
1894	653825	5018767	23.7
1895	653822	5018838	23.7
1896	653773	5018844	23.7
1897	653730	5018838	23.7
1898	654082	5018861	23.6
1899	654098	5018819	23.7
1900	654051	5018820	23.7
1901	654061	5018782	23.7
1902	654100	5018784	23.7
1903	654099	5018738	23.7
1904	654059	5018740	23.7
1905	654135	5018785	23.7
1906	654136	5018745	23.7
1907	654104	5018657	23.8
1908	654055	5018682	23.8
1909	654011	5018693	23.8
1910	654193	5018864	23.6
1911	654247	5018830	23.7
1912	654284	5018758	23.7
1913	654238	5018696	23.8
1914	654160	5018557	23.9
1915	654118	5018592	23.9
1916	654088	5018586	23.9
1917	654097	5018547	23.9
1918	654076	5018498	23.9
1919	654076	5018466	24.0
1920	654168	5018459	24.0
1921	654156	5018498	23.9
1922	654013	5018455	24.0
1923	653987	5018446	24.0
1924	653980	5018480	23.9
1925	653975	5018569	23.9
1926	653934	5018492	23.9
1927	653877	5018493	23.9
1928	653881	5018544	23.9
1929	653833	5018607	23.8
1930	653790	5018605	23.8
1931	653790	5018572	23.9
1932	653786	5018530	23.9
1933	653792	5018446	24.0
1934	653793	5018411	24.0
1935	653755	5018416	24.0
1936	653747	5018463	24.0
1937	653702	5018464	24.0
1938	653707	5018315	24.1
1939	653758	5018316	24.1

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
1940	653752	5018374	24.0
1941	653661	5018297	24.1
1942	653758	5018240	24.1
1943	653752	5018171	24.2
1944	653751	5018124	24.2
1945	653942	5017978	24.4
1947	651904	5018494	23.8
1958	645562	5018102	22.8
1959	645442	5018145	22.7
1971	643942	5018308	22.1
1972	643141	5019297	21.2
1983	647631	5019089	22.7
1989	648740	5019369	22.7
1990	649770	5019268	23.0
1994	645357	5021363	20.7
2025	656471	5023844	20.2
2032	660021	5024568	19.4
2042	655366	5029593	17.3
2048	653243	5028379	17.9
2049	652791	5028959	17.6
2058	653400	5029334	17.5
2060	648024	5029228	17.2
2063	648888	5025331	19.2
2072	648977	5025316	19.2
2102	648470	5022730	20.6
2103	648649	5021827	21.1
2108	648674	5021783	21.2
2136	647038	5026606	18.3
2151	641990	5025734	17.8
2152	641714	5025752	17.7
2156	642112	5026144	17.6
2166	642188	5027612	17.0
2167	643553	5027244	17.5
2172	645163	5028670	17.1
2179	644981	5029359	16.8
2184	644765	5030512	16.3
2192	638883	5030528	15.3
2197	639861	5027966	16.4
2212	639954	5030126	15.6
2221	641151	5027693	16.8
2234	639695	5027134	16.7
2244	640897	5024476	18.1
2253	640821	5024221	18.1
2254	636866	5024015	17.1
2270	637353	5024924	16.9
2284	637328	5028811	15.5
2288	641136	5022492	19.0
2300	649019	4991139	26.0
2309	649026	4989797	25.0
2310	649165	4989509	25.0
2317	649212	4987960	23.7

Table 6.3: Total Sound Pressure Level [dB(A)] at Non-Participating Residences —Vestas V110-2.0 MW Layout

Residence ID	Easting	Northing	Total Sound Pressure Level
2318	649190	4988056	23.7
2319	649114	4988078	23.7
2325	649064	4992930	26.7
2333	649280	4993534	27.1
2334	649271	4993557	27.1
2341	647627	4993445	25.4
2344	647698	4993970	25.6
2348	647604	4994984	25.9
2352	651457	4993587	31.6
2358	651076	4993540	30.5
2362	658654	4990393	26.8
2364	647608	4990512	24.1
2369	647546	4987953	22.6
2373	646299	4989430	22.7
2378	646229	4988848	22.3
2379	646166	4988614	22.2
2380	646047	4988570	22.1
2383	646173	4990709	23.2
2386	649219	4987865	23.6
2387	649229	4987772	23.5
2388	649229	4987697	23.5
2389	649231	4987636	23.4
2390	649237	4987548	23.3
2393	649251	4987389	23.2
2394	649234	4987308	23.1
2395	649251	4987246	23.1
2396	649263	4987476	23.3
2397	649234	4987167	23.0
2398	649236	4987056	22.9
2399	649241	4986974	22.9
2400	649241	4986927	22.8
2401	649250	4986857	22.8
2402	649245	4986811	22.8
2403	649244	4986724	22.7
2404	649247	4986676	22.6
2405	649259	4986631	22.6
2406	649254	4986581	22.6
2414	643934	5009635	30.7
2415	643946	5009641	30.7
2417	644853	5009639	33.9
2418	644862	5009641	33.9

Note: Coordinates are in WGS84 UTM14N

Dakota Range

Codington and Grant Counties, South Dakota

To: Conditional Use Permit Application Reviewers

From: Mark Mauersberger, Dakota Range

Date: May 3, 2017

RE: Third Party Reports

The Example Decommissioning Report (Tab 11), the Example Noise Impact Analysis (Tab 12), and the Example Shadow Flicker Analysis (Tab 13), will be provided to the Codington County Planner separately from the May 3 application submission. Dakota Range will provide these documents no later than two weeks before the scheduled Board of Adjustment meeting.

Dakota Range

Codington and Grant Counties, South Dakota

To: Conditional Use Permit Application Reviewers

From: Mark Mauersberger, Dakota Range

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