Sound Study

Prevailing Wind Park

Prevailing Wind Park, LLC

Prevailing Wind Park
Project No. 105644

Revision 5
05/30/2018

Sound Study

prepared for

Prevailing Wind Park, LLC
Prevailing Wind Park
Bon Homme/Charles Mix/Hutchinson Counties, SD

Project No. 105644

Revision 5
05/30/2018

prepared by

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

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LIST OF ABBREVIATIONS

Abbreviation	**Term/Phrase/Name**
ANSI	American National Standards Institute
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
CadnaA	Computer Aided Design for Noise Abatement
dB	Decibel
dBA	A-weighted decibels
DEM	Digital Elevation Model
Developer	Prevailing Wind Park, LLC
GE	General Electric
Hz	Hertz
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
L_{90}	the sound level exceeded 90 percent of the time period
L_{eq}	equivalent-continuous sound level
LWES	Large Wind Energy System
L_x	exceedance sound level
MP	measurement point
Project	Prevailing Wind Park
The Act	The Noise Control Act of 1972
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WES	Wind Energy System

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REVISION HISTORY

Rev	Issue Date	Release Notes
0	03-Apr-2018	Original release
1	09-Apr-2018	Revised wind turbine layout, incorporated client comments
2	11-Apr-2018	Added REC-138
3	16-Apr-2018	Revised wind turbine layout
4	27-Apr-2018	Revised wind turbine layout
5	14-May-2018	Incorporated client comments

1.0 EXECUTIVE SUMMARY

Prevailing Wind Park, LLC (Developer) is proposing to construct the Prevailing Wind Park near Avon, South Dakota, in Bon Homme, Hutchinson, and Charles Mix Counties (Project). The Project will consist of 57 to 61 wind turbines with a maximum nameplate capacity of up to 219.6 megawatts (MW), although output at the point of interconnection will be limited to a maximum of 200 MW. A total of 63 wind turbine sites were analyzed for two turbine models: General Electric (GE) 3.8-137 and Vestas V136-3.6. This sound assessment was completed to determine if the Project can operate in compliance with the applicable sound regulations.

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) conducted an ambient sound survey and sound modeling study for the proposed Project. There were several objectives in this study, which included:

- Identification of any applicable county, city, state, or federal noise ordinances and other applicable sound guidelines;
- Measure ambient sound levels at noise-sensitive receivers;
- Estimation of the operational sound levels from the hypothetical Project layout using the three-dimensional sound modeling program Computer Aided Design for Noise Abatement (CadnaA); and
- Determination if the wind farm can operate in compliance with the identified applicable regulatory standards.

There are no federal or state noise regulations that apply to this Project. Therefore, only local regulations would apply. Bon Homme County has adopted a zoning ordinance that pertains to wind energy systems. The ordinance limits sound levels of WES to 45 dBA at occupied receptors, unless a signed waiver or easement is obtained from the owner of the residence. Neither Charles Mix nor Hutchinson County has a numerical noise limit. Therefore, the Bon Homme County ordinance sound level limit was used as the design goal for all areas of the Project.

The wind turbines were modeled using manufacturer-specified sound power levels. Sound pressure levels were predicted at all receivers within and surrounding the Project area. There are no expected exceedances of the identified regulations due to operation of any of the proposed wind turbine locations of the Project.

2.0 ACOUSTICAL TERMINOLOGY

The term “sound level” is often used to describe two different sound characteristics: sound power and sound pressure. Every source that produces sound has a sound power level. The sound power level is the acoustical energy emitted by a sound source and is an absolute number that is not affected by the surrounding environment. The acoustical energy produced by a source propagates through media as pressure fluctuations. These pressure fluctuations, also called sound pressure, are what human ears hear and microphones measure.

Sound is physically characterized by amplitude and frequency. The amplitude of sound is measured in decibels (dB) as the logarithmic ratio of a sound pressure to a reference sound pressure (20 microPascals). The reference sound pressure corresponds to the typical threshold of human hearing. To the average listener, a 3-dB change in a continuous broadband sound is generally considered “just barely perceptible”; a 5-dB change is generally considered “clearly noticeable”; and a 10-dB change is generally considered a doubling (or halving, if the sound is decreasing) of the apparent loudness.

Sound waves can occur at many different wavelengths, also known as the frequency. Frequency is measured in hertz (Hz) and is the number of wave cycles per second that occur. The typical human ear can hear frequencies ranging from approximately 20 to 20,000 Hz. Normally, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the lower and higher frequencies. As such, the A-weighting scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. Any sound level to which the A-weighting scale has been applied is expressed in A-weighted decibels, or dBA. For reference, the A-weighted sound pressure level and subjective loudness associated with some common sound sources are listed in Table 2-1.

Table 2-1: Typical Sound Pressure Levels Associated with Common Noise Sources

Sound Pressure Level (dBA)[a]	Subjective Evaluation	Environment	
		Outdoor	**Indoor**
140	Deafening	Jet aircraft at 75 feet	--
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 feet	--
120	Threshold of feeling	Elevated train	Hard rock band
110		Jet flyover at 1,000 feet	Inside propeller plane
100	Very loud	Power mower, motorcycle at 25 feet, auto horn at 10 feet, crowd noise at football game	--
90	--	Propeller plane flyover at 1,000 feet, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately loud	Diesel truck (40 mph)[a] at 50 feet	Inside auto at high speed, garbage disposal
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner
60	Moderate	Air-conditioner condenser at 15 feet, near highway traffic	General office
50	Quiet	--	Private office
40	--	Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Bedroom, average residence (without TV and stereo)
20	--	Rustling leaves	Quiet theater, whisper
10	Just audible	--	Human breathing
0	Threshold of hearing	--	--

Source: Adapted from *Architectural Acoustics*, M. David Egan, 1988 and *Architectural Graphic Standards*, Ramsey and Sleeper, 1994.
(a) dBA = A-weighted decibels; mph = miles per hour

Sound metrics have been developed to quantify fluctuating environmental sound levels. These metrics include the exceedance sound level. The exceedance sound level, L_x, is the sound level exceeded during "x" percent of the sampling period and is also referred to as a statistical sound level. L_{90} levels are presented throughout this study. The L_{90} is a common L_x value and represents the sound level with minimal influence from short-term, loud transient sound sources. The L_{90} represents the sound level exceeded for 90 percent of the time period during which sound levels are measured. The L_{90} value is regarded as the most accurate tool for measuring relatively constant background noise and for minimizing the influence of isolated spikes in sound levels (i.e., barking dog, door slamming).

3.0 REGULATIONS

Federal, state, and county regulations were reviewed to determine the applicable overall sound level limits for the Project.

The Noise Control Act of 1972 (the Act) (U.S.C. 4901) mandated a national policy "to promote an environment for all Americans free from noise that jeopardizes their health or welfare, to establish a means for effective coordination of Federal research activities in noise control, to authorize the establishment of Federal noise emission standards for products distributed in commerce, and to provide information to the public respecting the noise emission and noise reduction characteristics of such products."

As required by the Act, the EPA established criteria for protecting the public health and wellbeing. However, these criteria do not constitute enforceable federal regulations or standards. The EPA has since delegated regulatory authority to local entities. Therefore, there are no federal noise regulations that apply to this Project.

Bon Homme County has adopted a zoning ordinance that pertains to wind energy systems. The ordinance limits sound levels of WES to 45 dBA at occupied receptors, unless a signed waiver or easement is obtained from the owner of the residence. Charles Mix County is only zoned in the townships, and because there are no turbines proposed for the townships, there are no zoning requirements for the Project within Charles Mix County (i.e., no zoning noise limits). Hutchinson County does not have a numerical noise ordinance.

Because there are no limits in Charles Mix and Hutchinson counties, the Bon Homme County ordinance sound level limit was used as the design goal for all areas of the Project. Therefore, the design criteria for the Project is 45 dBA at occupied receptors, unless a signed waiver or easement is obtained from the owner of the residence.

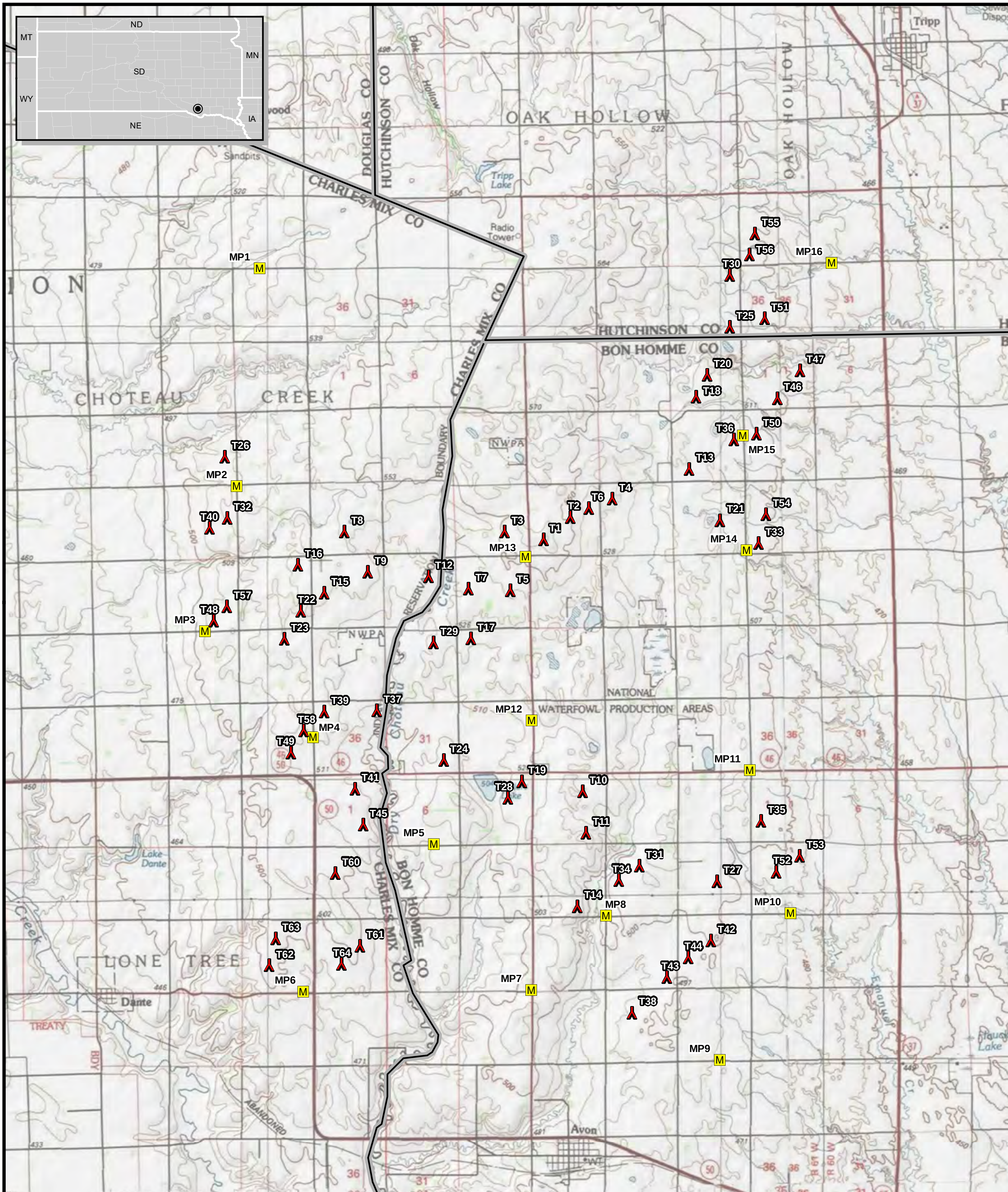
4.0 AMBIENT SOUND SURVEY

Burns & McDonnell personnel conducted an ambient sound survey of surrounding Project areas on March 12 and 13, 2018.

Measurements were taken using an American National Standards Institute (ANSI) S1.4 type 1 sound level meter (Larson David Model 831). The sound level meter was calibrated at the beginning and end of each set of measurements. None of the calibration level changes exceeded ± 0.5 dB. A windscreen was used at all times on the microphone, and the meter was mounted on a tripod. Certificates of calibration for the equipment used are available upon request. The microphone was located approximately 5 feet above ground level with the microphone directed towards the closest proposed wind turbine location and angled per the manufacturer's recommendation. All measurements were taken when meteorological conditions were favorable for conducting ambient sound measurements, per ANSI standards (low wind, moderate temperatures, humidity, and no precipitation).

Ambient far-field measurements were made at 16 locations, labeled measurement point (MP) MP1 through MP16, as shown in Figure 4-1. The measurement points were selected because they were accessible and representative of existing ambient sound levels in the vicinity of noise-sensitive receivers.

The far-field sound level measurements were 5 minutes in duration, and measured values were logged by the sound meter at each measurement point. The sound levels varied at each measurement point due to the extraneous sounds that occurred during each measurement. The overall A-weighted L_{eq} and L_{90} sound levels collected during the ambient far-field measurements are shown below in Table 4-1. Sound levels measured were in the range of 21.5 dBA to 45.0 dBA L_{90}.



LEGEND

- County Boundary
- Wind Turbine
- Measurement Points

REFERENCE

0 1 2
MILES

0 1 2
KILOMETERS

N

PREVAILING WIND PARK
Measurement Points

LOCATION:	Charles Mix/Bonne Homme/Hutchinson Cty, SD
CLIENT:	Prevailing Wind Park, LLC
PROJ. NO.:	105644
CREATED:	04/25/2018

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Path: \\bmcd\dfs\Clients\BTS\SPowerDC\105644_PrvWindStudies\Studies\Geospatial\DataFiles\ArcDocs\105644_PrevailingWinds_85x11P.mxd • Coordinate System: NAD 1983 UTM Zone 14N • Units: Meter

Table 4-1: Ambient Measurements Data

Measurement Location	Sound Pressure Level (dBA)					
	Ambient (5:00 PM on 03/12/18)		Ambient (12:00 AM on 03/13/18)		Ambient (10:00 AM on 03/13/18)	
	L_{eq}	L_{90}	L_{eq}	L_{90}	L_{eq}	L_{90}
MP1	34.6	26.0	40.4	30.0	35.2	25.1
MP2	36.5	29.6	35.7	28.6	39.0	30.2
MP3	37.7	29.2	32.6	22.3	41.0	28.0
MP4	39.6	29.1	33.7	24.3	35.0	28.9
MP5	36.9	28.0	34.6	22.6	35.4	25.4
MP6	47.9	33.4	34.7	26.3	40.0	31.8
MP7	38.3	31.0	30.2	24.0	42.6	37.7
MP8	34.8	28.4	28.6	22.7	47.7	27.9
MP9	35.7	27.0	35.3	29.5	33.2	24.4
MP10	37.4	30.6	39.4	35.2	35.0	27.1
MP11	62.7	45.0	35.6	31.6	69.1	28.1
MP12	39.5	32.6	37.1	21.5	40.6	29.4
MP13	36.3	27.1	38.9	32.1	59.5	28.4
MP14	35.7	28.8	34.1	27.4	35.1	28.9
MP15	33.8	28.4	35.7	28.7	35.0	29.3
MP16	49.8	36.9	39.0	29.8	35.0	28.8

Extraneous sounds during the measurement periods included high speed traffic, birds, wind noise, and farm equipment. The measured sound levels and noise sources are presented in Appendix A.

5.0 SOUND MODELING

5.1 Wind Turbine and Transformer Sound Characteristics

The sound commonly associated with a wind turbine is described as a rhythmic “whoosh” caused by aerodynamic processes. This sound is created as air flow interacts with the surface of rotor blades. As air flows over the rotor blade, turbulent eddies form in the surface boundary layer and wake of the blade. These eddies are where most of the “whooshing” sound is formed. Additional sound is generated from vortex shedding produced by the tip of the rotor blade. Air flowing past the rotor tip creates alternating low-pressure vortices on the downstream side of the tip, causing sound generation to occur. Older wind turbines, built with rotors which operate downwind of the tower (downwind turbines), often have higher aerodynamic impulse sound levels. This is caused by the interaction between the aerodynamic lift created on the rotor blades and the turbulent wake vortices produced by the tower. Modern wind turbine rotors are mostly built to operate upwind of the tower (upwind turbines). Upwind wind turbines are not impacted by wake vortices generated by the tower and, therefore, overall sound levels can be as much as 10 dBA less. The rhythmic fluctuations of the overall sound level are less perceivable the farther one gets from the turbine. Additionally, multiple turbines operating at the same time will create the whooshing sound at different times. These non-synchronized sounds will blend together to create a more constant sound to an observer at most distances from the turbines. Another phenomenon that reduces perceivable noise from turbines is the wind itself. Higher wind speed produces noise in itself that tends to mask (or drown out) the sounds created by wind turbines.

Advancement in wind turbine technology has reduced pure tonal emissions of modern wind turbines. Manufacturers have reduced distinct tonal sounds by reshaping turbine blades and adjusting the angle at which air contacts the blade. Pitching technology allows the angle of the blade to adjust when the maximum rotational speed is achieved, which allows the turbine to maintain a constant rotational velocity. Therefore, sound emission levels remain constant as the velocity remains the same.

Wind turbines can create noise in other ways as well. Wind turbines have a nacelle where the mechanical portions of the turbine are housed. The current generation of wind turbines uses multiple techniques to reduce the noise from this portion of the turbine: vibration isolating mounts, special gears, and acoustic insulation. In general, all moving parts and the housing of the current generation wind turbines have been designed to minimize the noise they generate.

5.2 Model Inputs and Settings

Predicted sound levels were modeled using industry-accepted sound modeling software. The program used to model the turbines was the CadnaA, Version 2017, published by DataKustik, Ltd., Munich, Germany. The CadnaA program is a scaled, three-dimensional program that accounts for air absorption, terrain, ground absorption, and ground reflection for each piece of noise-emitting equipment and predicts downwind sound pressure levels. The model calculates sound propagation based on International Organization for Standardization (ISO) 9613-2:1996, General Method of Calculation. ISO 9613, and therefore CadnaA, assesses the sound pressure levels based on the Octave Band Center Frequency range from 31.5 to 8,000 Hz. Compliance with the regulations for all turbines operating should equate to compliance for any combination of the turbines operating.

5.2.1 Project Layout

Prevailing Wind's hypothetical layout contains 63 wind turbine sites, including alternatives. Predictive modeling was conducted to determine the impacts at the occupied residences shown in Appendix B.

5.2.2 Terrain and Vegetation

Terrain and attenuation from ground absorption can have a significant impact on sound transmission. U.S. Geological Survey (USGS) Digital Elevation Model (DEM) contours were imported into the model to account for topographic variations around the Project. The contours were overlaid onto high resolution, digital orthoimagery obtained from the U.S. Department of Agriculture (USDA) to visually check proper contour positioning. The terrain around the proposed Project is mostly rural with few minor changes in elevation. The land is primarily used for agricultural purposes. As such, vegetation is mostly low-lying with some small areas of trees. Therefore, vegetation was excluded from the analysis to maintain conservativeness in the model. Ground attenuation is expected to be fairly high, due to the "soft ground" of the surrounding areas; however, a conservative value was used in the model.

5.2.3 Sound Propagation and Directivity

CadnaA calculates downwind sound propagation using ISO 9613 standards, which use omnidirectional downwind sound propagation and worst-case directivity factors. In other words, the model assumes that each turbine propagates its maximum sound level in all directions at all times. While this may seem to over-predict upwind sound levels, this approach has been validated by field measurements. Under most normal circumstances, wind turbine noise is not significantly directional, but tends to radiate uniformly in all directions.

5.2.4 Atmospheric Conditions

Atmospheric conditions were based on program defaults. Layers in the atmosphere often form where temperature increases with height (temperature inversions). Sound waves can reflect off of the temperature inversion layer and return to the surface of the earth. This process can increase sound levels at the surface, especially if the height of the inversion begins near the surface of the earth. Temperature inversions tend to occur mainly at night when winds are light or calm, usually when wind turbines are not operating. CadnaA calculates the downwind sound in a manner which is favorable for propagation (worst-case scenario) by assuming a well-developed moderate ground-based temperature inversion such as can occur at night. Therefore, predicted sound level results tend to be higher than would actually occur.

The atmosphere does not flow smoothly and tends to have swirls and eddies, also known as turbulence. Turbulence is basically formed by two processes: thermal turbulence and mechanical turbulence. Thermal turbulence is caused by the interaction of heated air rapidly rising from the heated earth’s surface, with cooler air descending from the atmosphere. Mechanical turbulence is caused as moving air interacts with objects such as trees, buildings, and wind turbines. Turbulent eddies generated by wind turbines and other objects can cause sound waves to scatter, which in turn, provides sound attenuation between the wind turbine and the receiver. The acoustical model assumes laminar air flow, which minimizes sound attenuation that would occur in a realistic inhomogeneous atmosphere. This assumption also causes the predicted sound levels to be higher than would actually occur.

5.2.5 Sound Emission Data

Acoustical modeling was conducted for the entire Project. Wind turbine heights and acoustical emissions were input into the model. The expected worst-case sound power levels for the GE 3.8-137 and Vestas V136-3.6 turbines were contained in documents provided by GE and Vestas based on various wind speeds. The sound emissions data supplied was developed using the International Electrotechnical Commission (IEC) 61400-11 acoustic measurement standards. The expected sound power level and modeled height for each turbine is displayed in Table 5-1.

Table 5-1: Wind Turbine Sound Power Levels

Turbine	Height	Sound Power Level (dBA)									
		31.5	63	125	250	500	1000	2000	4000	8000	A-wt.[a]
GE 3.8-137	110 m	78.5	86.8	92.6	96.4	99.4	102.1	102.0	93.7	79.2	**107.0**
Vestas V136-3.6	105 m	81.3	86.5	94.5	97.2	101.0	104.0	102.4	92.7	77.3	**108.2**

(a) A-wt. = A-weighted decibels

A point source at the hub was used to model sound emissions from the wind turbines. This approach is appropriate for simulating wind turbine noise emissions due to the large distances between the turbines and the receivers as compared to the dimensions of the wind turbines. The corresponding sound levels from the table above were applied to every point source.

Figure 4-1 shows the entire wind farm layout. Locations of receivers and wind turbines around the Project area were provided by the developer and are listed in Appendix B. Each receiver was assumed to have a height of 1.52 meters (5.0 feet) above ground level. Compliance with the regulation was assessed at the physical residence (each receiver).

The following assumptions were made to maintain the inherent conservativeness of the model and to estimate the worst case modeled sound levels:

- Attenuation was not included for sound propagation through wooded areas, existing barriers, and shielding
- All turbines were assumed to be operating at maximum power output (and therefore, maximum sound levels) at all times to represent worst-case noise impacts from the wind farm as a whole

5.3 Acoustical Modeling Results

Sound pressure levels were predicted for the identified receivers in the CadnaA noise modeling software using the manufacturer-specified sound power levels at each frequency and the assumptions listed above. CadnaA modeling results have been demonstrated in previous studies to conservatively approximate real-life measured noise from a source when extraneous noises are not present.

As previously mentioned, decibels are a logarithmic ratio of a sound pressure to a reference sound pressure. Therefore, they must be logarithmically added to determine a cumulative impact (i.e., logarithmically adding 50 dBA and 50 dBA results in 53 dBA). Logarithmically adding each of the individual turbine’s impacts together at each receiver provides an overall Project impact at each receiver.

The maximum model-predicted L_{eq} sound pressure levels at each receiver (the logarithmic addition of sound levels from each frequency from every turbine) are included in Appendix C. These values represent only the noise emitted by the wind turbines and do not include any extraneous noises (traffic, etc.) that could be present during physical noise measurements. There are no expected exceedances of the identified regulations due to operation of any of the proposed wind turbine locations of the Project. Extraneous sounds (grain dryers, traffic, etc.) may make the overall sound level higher than 45.0 dBA in some circumstances, but the turbines alone are not expected to cause that to happen.

Appendix D contains graphical representation of the Project's impact on the surrounding area for both GE and Vestas turbines. The figure depicts the maximum sound levels attributable to the new turbines.

6.0 CONCLUSION

Burns & McDonnell conducted a predictive sound assessment study for the proposed Prevailing Wind Park. The study included identification of applicable sound regulations and predictive modeling to estimate Project-related sound levels in the surrounding community.

Sound pressure levels were predicted at occupied receivers within and surrounding the Project area using manufacturer-specified sound power levels for each wind turbine. A number of conservative assumptions were applied to provide worst-case predicted sound pressure levels. Those results were then compared to the identified applicable regulations. There are no expected exceedances of the identified regulations due to operation of any of the proposed wind turbine locations of the Project.

APPENDIX A - AMBIENT MEASUREMENT DATA

Appendix A - Ambient Measurement Data

Prevailing Winds

Point Number	***LAeq***	***LA90***	***Notes***	
03/12/18 - 5:00PM to 7:00PM			**Meter1 Calibration before: 114.11**	**Meter2 Calibration before: 114.05**
36°F, 60% hm, 31°F dp, 4-9mph , clear skies			**Meter1 Calibration after: 113.91**	**Meter2 Calibration after: 113.91**
MP1	34.6 dBA	26.0 dBA	Distant traffic, light wind, existing wind farm not audible	
MP2	36.5 dBA	29.6 dBA	Distant traffic, birds, light wind, fan noise from nearby business	
MP3	37.7 dBA	29.2 dBA	Birds, light wind, distant traffic including large trucks, very distant airplane	
MP4	39.6 dBA	29.1 dBA	Birds, light wind, distant traffic	
MP5	36.9 dBA	28.0 dBA	Highway traffic, birds	
MP6	47.9 dBA	33.4 dBA	Highway traffic dominant, paused for local traffic	
MP7	38.3 dBA	31.0 dBA	Highway traffic, birds	
MP8	34.8 dBA	28.4 dBA	Birds, distant high speed traffic	
MP9	35.7 dBA	27.0 dBA	Nearby high speed traffic (409th Street), birds	
MP10	37.4 dBA	30.6 dBA	Distant high speed traffic, birds, horns	
MP11	62.7 dBA	45.0 dBA	Birds dominant, two high speed car passbys	
MP12	39.5 dBA	32.6 dBA	Birds, farm equipment, slight wind	
MP13	36.3 dBA	27.1 dBA	Slight wind	
MP14	35.7 dBA	28.8 dBA	Slight wind, distant high speed traffic	
MP15	33.8 dBA	28.4 dBA	Slight wind, distant birds, distant high speed traffic, backup alarm	
MP16	49.8 dBA	36.9 dBA	Birds dominant, slight wind	

Appendix A - Ambient Measurement Data

Prevailing Winds

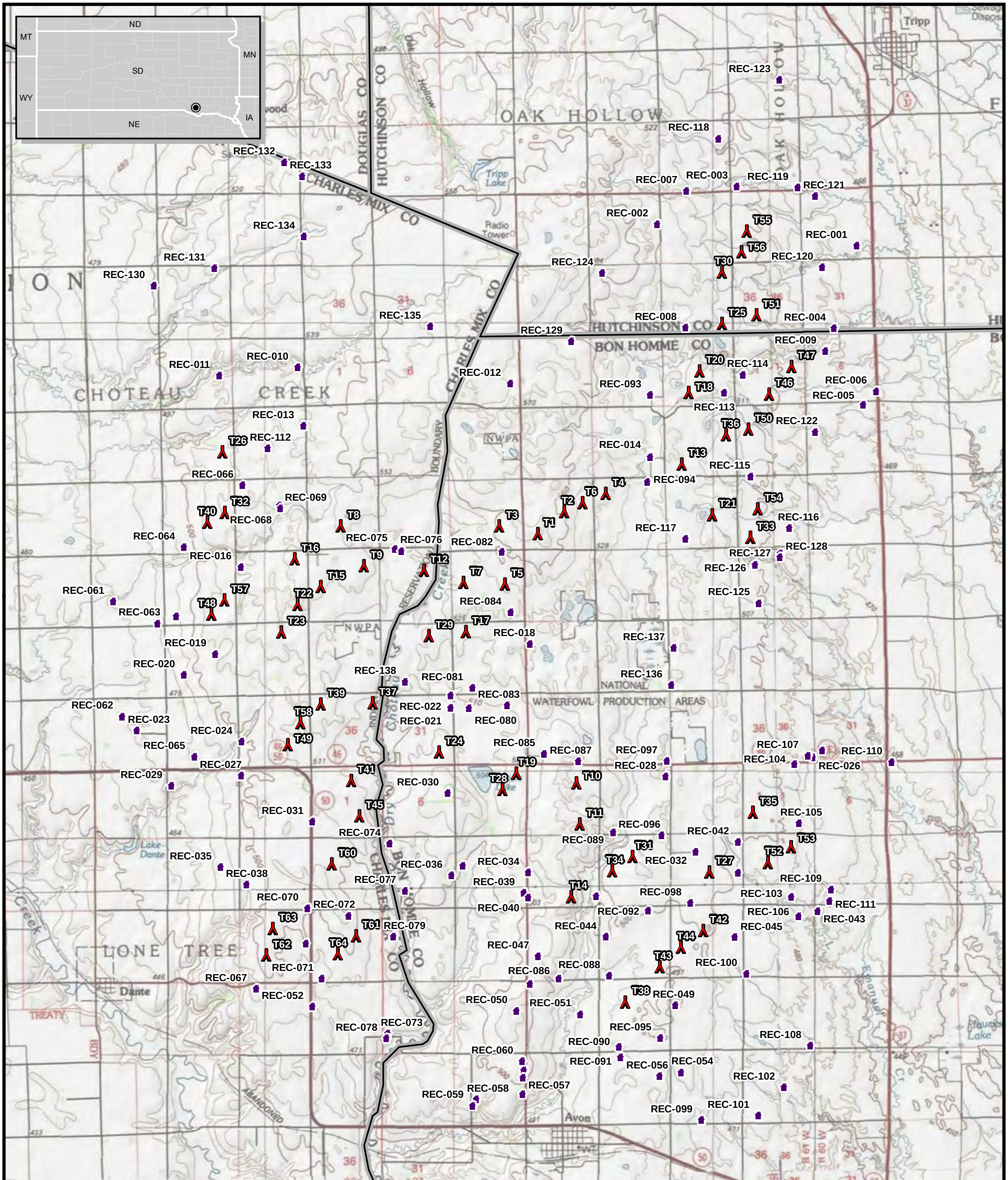
Point Number	*LAeq*	*LA90*	*Notes*	
03/13/18 - 12:00AM to 2:00AM			**Meter1 Calibration before: 114.19**	**Meter2 Calibration before: 113.87**
29°F, 74% hm, 21°F dp, 6-9 mph , clear skies			**Meter1 Calibration after: 113.83**	**Meter2 Calibration after: 114.20**
MP1	40.4 dBA	30.0 dBA	Wind turbines audible, light winds	
MP2	35.7 dBA	28.6 dBA	Wind turbines audible, light winds, sheep noise	
MP3	32.6 dBA	22.3 dBA	Very quiet, faint traffic	
MP4	33.7 dBA	24.3 dBA	Very quiet, faint traffic	
MP5	34.6 dBA	22.6 dBA	Distant traffic, large trucks, bull snort	
MP6	34.7 dBA	26.3 dBA	Traffic	
MP7	30.2 dBA	24.0 dBA	Traffic	
MP8	28.6 dBA	22.7 dBA	Distant high speed traffic	
MP9	35.3 dBA	29.5 dBA	Distant high speed traffic	
MP10	39.4 dBA	35.2 dBA	Slight wind	
MP11	35.6 dBA	31.6 dBA	Slight wind	
MP12	37.1 dBA	21.5 dBA	Distant high speed traffic	
MP13	38.9 dBA	32.1 dBA	Slight wind	
MP14	34.1 dBA	27.4 dBA	Slight wind	
MP15	35.7 dBA	28.7 dBA	Slight wind, distant high speed traffic	
MP16	39.0 dBA	29.8 dBA	Distant high speed traffic	

Appendix A - Ambient Measurement Data

Prevailing Winds

Point Number	***LAeq***	***LA90***	***Notes***	
03/13/18 - 10:00AM to 12:00PM			**Meter1 Calibration before: 114.24**	**Meter2 Calibration before: 114.04**
30°F, 62% hm, 19°F dp, 3-4 mph , clear skies			**Meter1 Calibration after: 113.82**	**Meter2 Calibration after: 113.97**
MP1	35.2 dBA	25.1 dBA	Distant traffic, distant plane, wind turbines barely audible	
MP2	39.0 dBA	30.2 dBA	Birds, wind turbines barely audible, tractor distant loading/unloading Birds,	
MP3	41.0 dBA	28.0 dBA	distant traffic, wind	
MP4	35.0 dBA	28.9 dBA	Birds, distant traffic, wind, distant airplane	
MP5	35.4 dBA	25.4 dBA	Birds, wind, distant traffic	
MP6	40.0 dBA	31.8 dBA	Birds, highway traffic	
MP7	42.6 dBA	37.7 dBA	Birds, distant traffic, paused for local traffic	
MP8	47.7 dBA	27.9 dBA	Owl, birds, distant high speed traffic, woman speaking (very end) Birds	
MP9	33.2 dBA	24.4 dBA	Birds, dog barking, distant high speed traffic	
MP10	35.0 dBA	27.1 dBA	High speed car passing	
MP11	69.1 dBA	28.1 dBA	Farm equipment, cows	
MP12	40.6 dBA	29.4 dBA	Birds, one car passing	
MP13	59.5 dBA	28.4 dBA	Distant constant high speed traffic, birds	
MP14	35.1 dBA	28.9 dBA	Birds, distant high speed traffic	
MP15	35.0 dBA	29.3 dBA	Distant birds, distant high speed traffic	
MP16	35.0 dBA	28.8 dBA		

APPENDIX B - SITE LAYOUT AND RECEIVER LOCATIONS



LEGEND

County Boundary

Wind Turbine

Receptor

REFERENCE

0 1 2 MILES

0 1 2 KILOMETERS

N

PREVAILING WIND PARK

Project Site Layout

LOCATION:	Charles Mix/Bonne Homme/Hutchinson Cty, SD
CLIENT:	Prevailing Wind Park, LLC
PROJ. NO.:	105644
CREATED:	04/25/2018

BURNS McDONNELL
www.burnsmcd.com

Path: \\bmcd\dfs\Clients\BTS\SPowerDC\105644_PrvWindStudies\Studies\Geospatial\DataFiles\ArcDocs\105644_PrevailingWinds_85x11P.mxd • Coordinate System: NAD 1983 UTM Zone 14N • Units: Meter

APPENDIX C - MODELING RESULTS

Appendix C - Modeling Results

GE 3.8-137, 110 m

Receiver	Coordinates Easting (m)	Northing (m)	Base Elevation (m)	Modeled LAeq	Limit Value	Exceed? (Y/N)
REC-001	583178.93	4781949.36	473.94	24.7	45	N
REC-002	578731.00	4782428.97	540.99	29.1	45	N
REC-003	580506.89	4783273.92	505.27	33.7	45	N
REC-004	582678.66	4780104.52	480.03	32.4	45	N
REC-005	583326.78	4778396.84	476.81	27.5	45	N
REC-006	583615.28	4778695.43	471.94	26.2	45	N
REC-007	579386.45	4783171.84	519.65	29.7	45	N
REC-008	579364.54	4780122.78	515.18	38.2	45	N
REC-009	582485.70	4779597.03	481.47	34.3	45	N
REC-010	570706.40	4779232.69	531.85	20.3	45	N
REC-011	568954.92	4779049.93	516.88	23.0	45	N
REC-012	575450.96	4778869.67	571.47	-	45	N
REC-013	570834.43	4777923.92	539.22	27.4	45	N
REC-014	578568.31	4777265.47	526.35	38.1	45	N
REC-015	578578.94	4777228.45	526.13	38.3	45	N
REC-016	569437.95	4774776.35	523.53	38.9	45	N
REC-017	567999.72	4773683.50	489.60	36.8	45	N
REC-018	575893.85	4773069.05	525.25	32.5	45	N
REC-019	568870.35	4772837.61	510.51	36.3	45	N
REC-020	568170.58	4772373.09	491.63	30.5	45	N
REC-021	574122.73	4771641.66	507.46	35.0	45	N
REC-022	574117.98	4771913.43	508.31	34.7	45	N
REC-023	567115.19	4771132.04	470.89	-	45	N
REC-024	569455.79	4770885.60	499.55	34.2	45	N
REC-025	582409.59	4770691.28	486.10	26.3	45	N
REC-026	582205.90	4770538.43	489.18	27.7	45	N
REC-027	569450.78	4770122.57	499.25	32.0	45	N
REC-028	578915.96	4770106.59	519.65	30.5	45	N
REC-029	567890.47	4769896.98	472.42	19.1	45	N
REC-030	574057.84	4769738.20	530.58	35.9	45	N
REC-031	571038.40	4769099.63	510.51	36.6	45	N
REC-032	579594.58	4768433.69	507.46	40.2	45	N
REC-033	574388.42	4768112.11	502.26	29.5	45	N
REC-034	575856.91	4767968.51	509.35	34.3	45	N
REC-035	568988.11	4768088.17	487.50	27.6	45	N
REC-036	574139.54	4767903.27	507.06	28.6	45	N
REC-037	580534.75	4767955.77	497.42	40.6	45	N
REC-038	569570.52	4767693.73	493.87	33.1	45	N
REC-039	575753.59	4767511.52	511.25	33.5	45	N
REC-040	575853.92	4767408.85	513.56	34.3	45	N
REC-041	577365.54	4767429.45	496.85	41.4	45	N
REC-042	580534.93	4768649.62	501.93	40.0	45	N
REC-043	582314.18	4767105.01	476.98	30.8	45	N
REC-044	577581.91	4766535.38	501.37	35.6	45	N
REC-045	580459.53	4766528.35	495.27	37.9	45	N
REC-046	570892.00	4766384.10	500.34	39.9	45	N
REC-047	576071.91	4766099.10	511.58	28.5	45	N
REC-048	575888.47	4765484.03	507.46	26.2	45	N
REC-049	579136.06	4765003.57	501.37	36.3	45	N
REC-050	575594.26	4764877.78	513.56	22.9	45	N
REC-051	577014.96	4764806.12	483.08	32.6	45	N
REC-052	571034.71	4764976.49	483.08	32.4	45	N
REC-053	575751.76	4763553.72	504.89	18.1	45	N
REC-054	579261.02	4763508.83	493.92	26.2	45	N
REC-055	575738.19	4763383.18	501.37	18.7	45	N

Appendix C - Modeling Results

GE 3.8-137, 110 m

Receiver	Coordinates Easting (m)	Northing (m)	Base Elevation (m)	Modeled LAeq	Limit Value	Exceed? (Y/N)
REC-056	578784.40	4763423.45	495.27	26.8	45	N
REC-057	575728.70	4763020.56	496.19	-	45	N
REC-058	574689.98	4762905.51	489.18	-	45	N
REC-059	574608.88	4762765.31	484.23	-	45	N
REC-060	575719.36	4763758.78	507.46	19.6	45	N
REC-061	566590.17	4774005.26	470.89	25.5	45	N
REC-062	566794.52	4771446.01	467.84	-	45	N
REC-063	567575.59	4773523.26	480.49	32.1	45	N
REC-064	568169.85	4775221.75	493.83	37.5	45	N
REC-065	568402.45	4770548.21	483.08	24.8	45	N
REC-066	569474.73	4776605.15	525.75	39.0	45	N
REC-067	569782.41	4765373.88	493.98	36.1	45	N
REC-068	570301.18	4776152.11	533.82	35.8	45	N
REC-069	570320.63	4776086.07	530.62	36.0	45	N
REC-070	570930.65	4767169.47	502.79	37.7	45	N
REC-071	571246.87	4765598.42	488.81	38.5	45	N
REC-072	571847.73	4767001.23	507.46	41.7	45	N
REC-073	572712.41	4764371.30	476.98	25.2	45	N
REC-074	572760.45	4768609.65	494.96	35.3	45	N
REC-075	572875.14	4775183.93	528.80	39.1	45	N
REC-076	573023.77	4775137.74	528.80	39.6	45	N
REC-077	573104.39	4767558.79	488.61	31.1	45	N
REC-078	572689.83	4764269.58	472.84	24.7	45	N
REC-079	572840.24	4766532.05	483.08	35.8	45	N
REC-080	574527.24	4771635.20	508.86	34.0	45	N
REC-081	574606.23	4772084.46	513.56	34.0	45	N
REC-082	575265.41	4775117.32	552.59	41.9	45	N
REC-083	575384.42	4771695.61	513.56	32.3	45	N
REC-084	575459.57	4773771.95	533.47	39.2	45	N
REC-085	576210.31	4770611.18	524.57	38.1	45	N
REC-086	576537.52	4765598.06	498.89	30.2	45	N
REC-087	576971.43	4770447.24	531.85	40.8	45	N
REC-088	577659.69	4765661.22	489.18	38.1	45	N
REC-089	577747.37	4768859.92	513.80	40.5	45	N
REC-090	577878.24	4764078.53	490.80	32.8	45	N
REC-091	577915.85	4763844.06	489.18	30.5	45	N
REC-092	578531.67	4767119.28	501.56	37.6	45	N
REC-093	578575.67	4778618.52	525.75	36.7	45	N
REC-094	578514.65	4776677.36	519.65	37.9	45	N
REC-095	578804.05	4764274.93	501.37	32.8	45	N
REC-096	578827.98	4768793.31	520.74	37.4	45	N
REC-097	578943.49	4770454.51	519.65	29.0	45	N
REC-098	579475.34	4767289.07	507.32	40.3	45	N
REC-099	579720.64	4762441.83	480.38	-	45	N
REC-100	580720.17	4765706.10	489.18	32.2	45	N
REC-101	580991.94	4762540.89	476.98	-	45	N
REC-102	581560.41	4763175.20	470.14	-	45	N
REC-103	581721.12	4767420.32	484.05	35.9	45	N
REC-104	581794.35	4770381.50	494.21	30.1	45	N
REC-105	581890.50	4769063.10	495.27	40.1	45	N
REC-106	581882.94	4766984.50	478.66	32.1	45	N
REC-107	582089.90	4770568.08	488.75	27.9	45	N
REC-108	582148.44	4764102.27	470.89	-	45	N
REC-109	582609.65	4767582.94	483.08	31.6	45	N
REC-110	583963.39	4770430.23	460.42	18.2	45	N

Appendix C - Modeling Results

GE 3.8-137, 110 m

Receiver	*Coordinates* Easting (m)	Northing (m)	*Base Elevation (m)*	*Modeled LAeq*	*Limit Value*	*Exceed? (Y/N)*
REC-111	582577.80	4767332.36	480.99	30.7	45	N
REC-112	570034.28	4777428.88	531.85	33.7	45	N
REC-113	580225.65	4778670.25	516.61	41.3	45	N
REC-114	580643.69	4779065.86	510.51	40.5	45	N
REC-115	580812.98	4776797.89	507.54	39.5	45	N
REC-116	581676.22	4775653.66	495.49	37.4	45	N
REC-117	579367.75	4775404.23	525.75	36.8	45	N
REC-118	580095.28	4784336.60	507.46	25.3	45	N
REC-119	581867.73	4783246.46	489.52	29.7	45	N
REC-120	582410.57	4781467.20	486.13	30.9	45	N
REC-121	582256.16	4783054.99	483.20	28.4	45	N
REC-122	582261.38	4777793.15	487.45	33.8	45	N
REC-123	581460.71	4785645.95	483.97	-	45	N
REC-124	577505.30	4781336.06	557.16	19.3	45	N
REC-125	580995.88	4773976.31	501.99	29.4	45	N
REC-126	580915.69	4774830.29	502.29	38.6	45	N
REC-127	581473.61	4775075.61	495.27	37.0	45	N
REC-128	581468.21	4774997.26	495.27	36.4	45	N
REC-129	576815.58	4779814.18	556.23	21.4	45	N
REC-130	567502.00	4781060.00	502.37	-	45	N
REC-131	568850.00	4781446.00	523.04	-	45	N
REC-132	570408.00	4783811.00	527.44	-	45	N
REC-133	570806.00	4783497.00	538.25	-	45	N
REC-134	570845.00	4782153.00	543.29	-	45	N
REC-135	573665.00	4780153.00	564.37	-	45	N
REC-136	579049.00	4772150.00	519.65	-	45	N
REC-137	579104.00	4772978.00	519.65	17.9	45	N
REC-138	573105.45	4772224.12	513.56	37.1	45	N

"-" represents no expected impacts at the receiver location

Appendix C - Modeling Results

Vestas V136-3.6, 105 m

Receiver	*Coordinates* *Easting (m)*	*Northing (m)*	*Base Elevation (m)*	*Modeled LAeq*	*Limit Value*	*Exceed? (Y/N)*
REC-001	583178.93	4781949.36	473.94	26.2	45	N
REC-002	578731.00	4782428.97	540.99	30.6	45	N
REC-003	580506.89	4783273.92	505.27	35.3	45	N
REC-004	582678.66	4780104.52	480.03	33.9	45	N
REC-005	583326.78	4778396.84	476.81	29.0	45	N
REC-006	583615.28	4778695.43	471.94	27.6	45	N
REC-007	579386.45	4783171.84	519.65	31.2	45	N
REC-008	579364.54	4780122.78	515.18	39.7	45	N
REC-009	582485.70	4779597.03	481.47	35.8	45	N
REC-010	570706.40	4779232.69	531.85	21.7	45	N
REC-011	568954.92	4779049.93	516.88	24.2	45	N
REC-012	575450.96	4778869.67	571.47	-	45	N
REC-013	570834.43	4777923.92	539.22	28.8	45	N
REC-014	578568.31	4777265.47	526.35	39.5	45	N
REC-015	578578.94	4777228.45	526.13	39.7	45	N
REC-016	569437.95	4774776.35	523.53	40.4	45	N
REC-017	567999.72	4773683.50	489.60	38.3	45	N
REC-018	575893.85	4773069.05	525.25	34.0	45	N
REC-019	568870.35	4772837.61	510.51	37.8	45	N
REC-020	568170.58	4772373.09	491.63	32.0	45	N
REC-021	574122.73	4771641.66	507.46	36.5	45	N
REC-022	574117.98	4771913.43	508.31	36.2	45	N
REC-023	567115.19	4771132.04	470.89	-	45	N
REC-024	569455.79	4770885.60	499.55	35.7	45	N
REC-025	582409.59	4770691.28	486.10	27.7	45	N
REC-026	582205.90	4770538.43	489.18	29.2	45	N
REC-027	569450.78	4770122.57	499.25	33.5	45	N
REC-028	578915.96	4770106.59	519.65	32.0	45	N
REC-029	567890.47	4769896.98	472.42	20.5	45	N
REC-030	574057.84	4769738.20	530.58	37.4	45	N
REC-031	571038.40	4769099.63	510.51	38.1	45	N
REC-032	579594.58	4768433.69	507.46	41.7	45	N
REC-033	574388.42	4768112.11	502.26	31.0	45	N
REC-034	575856.91	4767968.51	509.35	35.8	45	N
REC-035	568988.11	4768088.17	487.50	29.1	45	N
REC-036	574139.54	4767903.27	507.06	30.0	45	N
REC-037	580534.75	4767955.77	497.42	42.1	45	N
REC-038	569570.52	4767693.73	493.87	34.6	45	N
REC-039	575753.59	4767511.52	511.25	35.0	45	N
REC-040	575853.92	4767408.85	513.56	35.8	45	N
REC-041	577365.54	4767429.45	496.85	42.9	45	N
REC-042	580534.93	4768649.62	501.93	41.5	45	N
REC-043	582314.18	4767105.01	476.98	32.3	45	N
REC-044	577581.91	4766535.38	501.37	37.2	45	N
REC-045	580459.53	4766528.35	495.27	39.4	45	N
REC-046	570892.00	4766384.10	500.34	41.4	45	N
REC-047	576071.91	4766099.10	511.58	30.0	45	N
REC-048	575888.47	4765484.03	507.46	27.6	45	N
REC-049	579136.06	4765003.57	501.37	37.8	45	N
REC-050	575594.26	4764877.78	513.56	24.3	45	N
REC-051	577014.96	4764806.12	483.08	34.1	45	N
REC-052	571034.71	4764976.49	483.08	33.9	45	N
REC-053	575751.76	4763553.72	504.89	19.6	45	N
REC-054	579261.02	4763508.83	493.92	27.7	45	N
REC-055	575738.19	4763383.18	501.37	20.1	45	N

Appendix C - Modeling Results

Vestas V136-3.6, 105 m

Receiver	Coordinates Easting (m)	Coordinates Northing (m)	Base Elevation (m)	Modeled LAeq	Limit Value	Exceed? (Y/N)
REC-056	578784.40	4763423.45	495.27	28.2	45	N
REC-057	575728.70	4763020.56	496.19	-	45	N
REC-058	574689.98	4762905.51	489.18	-	45	N
REC-059	574608.88	4762765.31	484.23	-	45	N
REC-060	575719.36	4763758.78	507.46	21.1	45	N
REC-061	566590.17	4774005.26	470.89	26.9	45	N
REC-062	566794.52	4771446.01	467.84	-	45	N
REC-063	567575.59	4773523.26	480.49	33.6	45	N
REC-064	568169.85	4775221.75	493.83	39.0	45	N
REC-065	568402.45	4770548.21	483.08	26.2	45	N
REC-066	569474.73	4776605.15	525.75	40.5	45	N
REC-067	569782.41	4765373.88	493.98	37.5	45	N
REC-068	570301.18	4776152.11	533.82	37.4	45	N
REC-069	570320.63	4776086.07	530.62	37.5	45	N
REC-070	570930.65	4767169.47	502.79	39.2	45	N
REC-071	571246.87	4765598.42	488.81	40.0	45	N
REC-072	571847.73	4767001.23	507.46	43.2	45	N
REC-073	572712.41	4764371.30	476.98	26.7	45	N
REC-074	572760.45	4768609.65	494.96	36.8	45	N
REC-075	572875.14	4775183.93	528.80	40.6	45	N
REC-076	573023.77	4775137.74	528.80	41.1	45	N
REC-077	573104.39	4767558.79	488.61	32.6	45	N
REC-078	572689.83	4764269.58	472.84	26.2	45	N
REC-079	572840.24	4766532.05	483.08	37.3	45	N
REC-080	574527.24	4771635.20	508.86	35.6	45	N
REC-081	574606.23	4772084.46	513.56	35.5	45	N
REC-082	575265.41	4775117.32	552.59	43.3	45	N
REC-083	575384.42	4771695.61	513.56	33.8	45	N
REC-084	575459.57	4773771.95	533.47	40.7	45	N
REC-085	576210.31	4770611.18	524.57	39.6	45	N
REC-086	576537.52	4765598.06	498.89	31.7	45	N
REC-087	576971.43	4770447.24	531.85	42.3	45	N
REC-088	577659.69	4765661.22	489.18	39.6	45	N
REC-089	577747.37	4768859.92	513.80	42.0	45	N
REC-090	577878.24	4764078.53	490.80	34.3	45	N
REC-091	577915.85	4763844.06	489.18	32.0	45	N
REC-092	578531.67	4767119.28	501.56	39.1	45	N
REC-093	578575.67	4778618.52	525.75	38.2	45	N
REC-094	578514.65	4776677.36	519.65	39.4	45	N
REC-095	578804.05	4764274.93	501.37	34.3	45	N
REC-096	578827.98	4768793.31	520.74	38.9	45	N
REC-097	578943.49	4770454.51	519.65	30.5	45	N
REC-098	579475.34	4767289.07	507.32	41.8	45	N
REC-099	579720.64	4762441.83	480.38	-	45	N
REC-100	580720.17	4765706.10	489.18	33.7	45	N
REC-101	580991.94	4762540.89	476.98	-	45	N
REC-102	581560.41	4763175.20	470.14	-	45	N
REC-103	581721.12	4767420.32	484.05	37.4	45	N
REC-104	581794.35	4770381.50	494.21	31.6	45	N
REC-105	581890.50	4769063.10	495.27	41.6	45	N
REC-106	581882.94	4766984.50	478.66	33.6	45	N
REC-107	582089.90	4770568.08	488.75	29.4	45	N
REC-108	582148.44	4764102.27	470.89	-	45	N
REC-109	582609.65	4767582.94	483.08	33.1	45	N
REC-110	583963.39	4770430.23	460.42	19.6	45	N

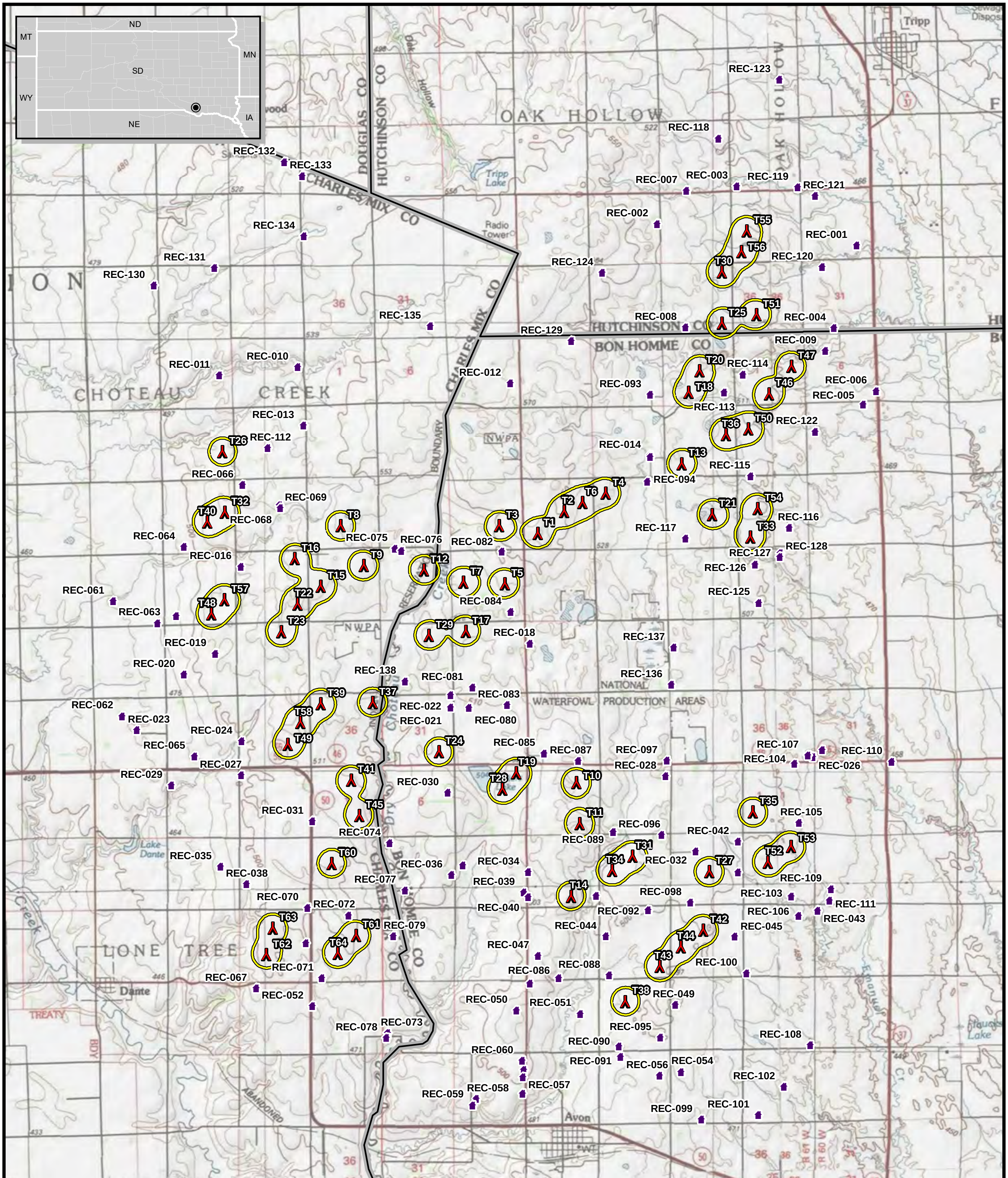
Appendix C - Modeling Results

Vestas V136-3.6, 105 m

Receiver	*Coordinates* Easting (m)	Northing (m)	*Base Elevation (m)*	*Modeled LAeq*	*Limit Value*	*Exceed? (Y/N)*
REC-111	582577.80	4767332.36	480.99	32.2	45	N
REC-112	570034.28	4777428.88	531.85	35.2	45	N
REC-113	580225.65	4778670.25	516.61	42.8	45	N
REC-114	580643.69	4779065.86	510.51	42.0	45	N
REC-115	580812.98	4776797.89	507.54	41.0	45	N
REC-116	581676.22	4775653.66	495.49	38.9	45	N
REC-117	579367.75	4775404.23	525.75	38.3	45	N
REC-118	580095.28	4784336.60	507.46	26.7	45	N
REC-119	581867.73	4783246.46	489.52	31.2	45	N
REC-120	582410.57	4781467.20	486.13	32.4	45	N
REC-121	582256.16	4783054.99	483.20	29.9	45	N
REC-122	582261.38	4777793.15	487.45	35.3	45	N
REC-123	581460.71	4785645.95	483.97	-	45	N
REC-124	577505.30	4781336.06	557.16	20.8	45	N
REC-125	580995.88	4773976.31	501.99	30.9	45	N
REC-126	580915.69	4774830.29	502.29	40.0	45	N
REC-127	581473.61	4775075.61	495.27	38.5	45	N
REC-128	581468.21	4774997.26	495.27	37.9	45	N
REC-129	576815.58	4779814.18	556.23	22.8	45	N
REC-130	567502.00	4781060.00	502.37	-	45	N
REC-131	568850.00	4781446.00	523.04	-	45	N
REC-132	570408.00	4783811.00	527.44	-	45	N
REC-133	570806.00	4783497.00	538.25	-	45	N
REC-134	570845.00	4782153.00	543.29	-	45	N
REC-135	573665.00	4780153.00	564.37	-	45	N
REC-136	579049.00	4772150.00	519.65	-	45	N
REC-137	579104.00	4772978.00	519.65	19.3	45	N
REC-138	573105.45	4772224.12	513.56	38.6	45	N

"-" represents no expected impacts at the receiver location

APPENDIX D - SOUND LEVEL CONTOURS



LEGEND

- County Boundary
- Wind Turbine
- Receptor
- 45 dBA Limit, GE 3.8-137

REFERENCE

0 1 2
MILES

0 1 2
KILOMETERS

N

PREVAILING WIND PARK
45 dBA Contours - GE 3.8-137 Layout

LOCATION:	Charles Mix/Bonne Homme/Hutchinson Cty, SD
CLIENT:	Prevailing Wind Park, LLC
PROJ. NO.:	105644
CREATED:	04/26/2018

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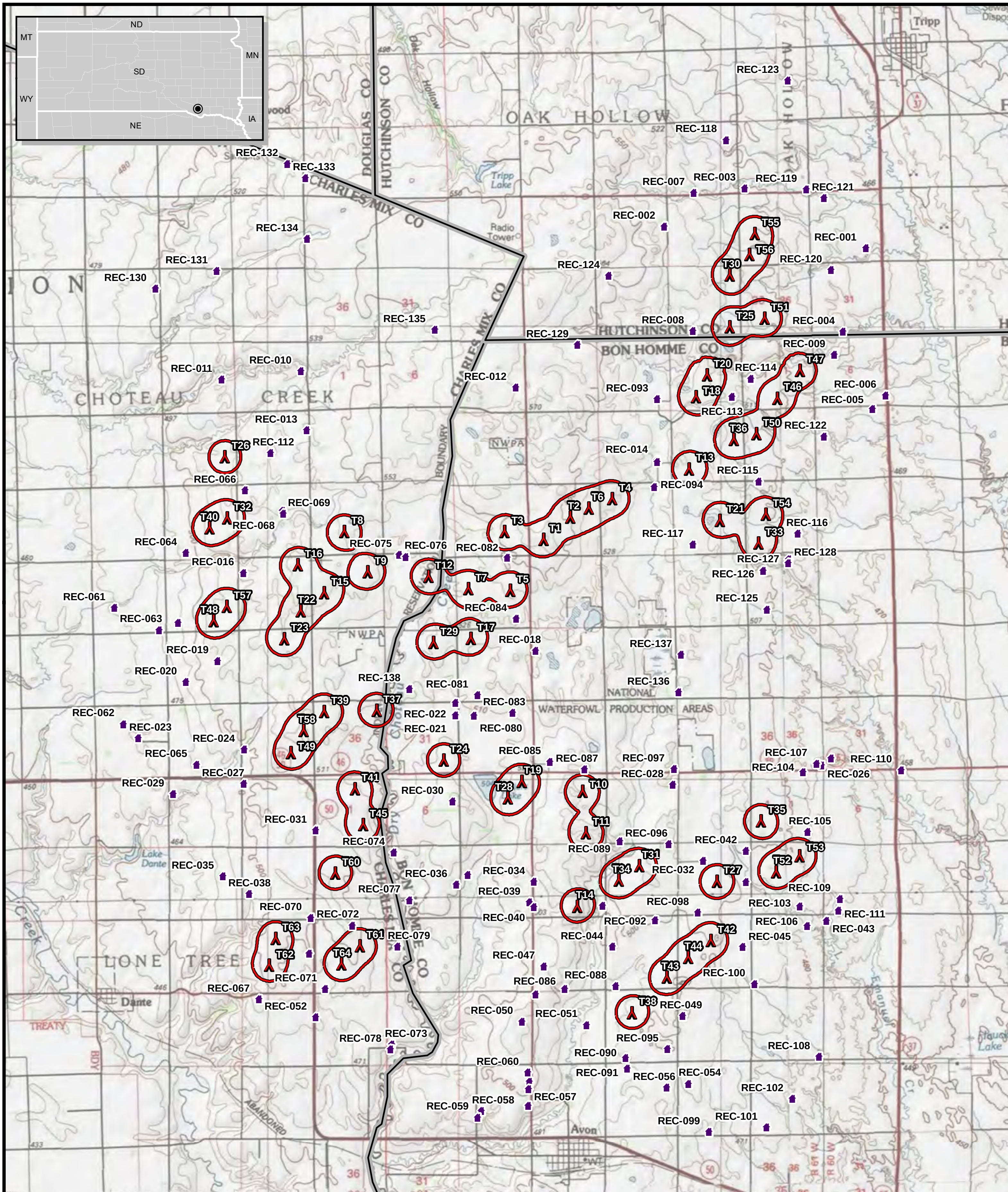
Path: \\bmcd\dfs\Clients\BTS\SPowerDC\105644_PrvWindStudies\Studies\Geospatial\DataFiles\ArcDocs\105644_PrevailingWinds_85x11P.mxd • Coordinate System: NAD 1983 UTM Zone 14N • Units: Meter



LEGEND

- County Boundary
- Wind Turbine
- Receptor
- 45 dBA Limit, Vestas V136-3.6

REFERENCE

0 1 2
MILES

0 1 2
KILOMETERS

N

PREVAILING WIND PARK
45 dBA Contours - Vestas V136-3.6 Layout

LOCATION:	Charles Mix/Bonne Homme/Hutchinson Cty, SD
CLIENT:	Prevailing Wind Park, LLC
PROJ. NO.:	105644
CREATED:	04/26/2018

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Path: \\bmcd\dfs\Clients\BTS\SPowerDC\105644_PrvWindStudies\Studies\Geospatial\DataFiles\ArcDocs\105644_PrevailingWinds_85x11P.mxd • Coordinate System: NAD 1983 UTM Zone 14N • Units: Meter

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