

# Memorandum



Date: September 26, 2018

To: Prevailing Winds Project Team

From: Burns & McDonnell

Subject: Updated Modeling Results – Prevailing Wind Park

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 60-62 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 62 wind turbine sites were analyzed for the sound model, General Electric (GE) 3.8-137<sup>1</sup>. Directly north of the Project, NorthWestern Energy operates 43, 1.85-MW GE 1.85-87 wind turbines as part of the Beethoven Wind Farm. Sound emitted by the Beethoven Wind Farm turbines were not included in this analysis. This sound assessment was completed to model the sound that would be generated by the Project and to determine if the Project could operate in compliance with the applicable sound regulations.

The Bon Homme County ordinance limits sound levels of wind energy systems to 45 dBA at occupied receptors, unless a signed waiver or easement is obtained from the owner of the residence. There are no zoning requirements for this Project within Charles Mix County. Hutchinson County has no numeric noise ordinance. Therefore, the Bon Homme County ordinance sound level limit was used as the design goal for all areas of the Project.

## Sound Modeling

The program used to model the turbines was the Computer Aided Noise Abatement (CadnaA), Version 2018, published by DataKustik, Ltd., Munich, Germany. The program is a scaled, three-dimensional program that takes into account air absorption, terrain, ground absorption, and ground reflection for each piece of noise-emitting equipment and predicts downwind sound pressure levels. The Project contains 62 wind turbine locations. Predictive modeling was conducted to determine the impacts from the new turbines at the nearest occupied residences. Wind turbine heights and acoustical emissions were input into the model. The nacelles of each wind turbine are mounted on towers 111.5 meters high.

The sound emissions data supplied by GE was developed using the International Electrotechnical Commission (IEC) 61400-11 acoustic measurement standards. The Project also includes a collection substation with one transformer designed to 82 dBA at 2 meters. The octave band sound levels for the transformer were based on the National Environmental Management Authority (NEMA) sound pressure level rating from the environmental noise guide. The

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<sup>1</sup> Prevailing Wind Park, LLC directed us to remove turbine location T19 for purposes of this analysis.

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expected sound power levels for each turbine and the collection substation transformer are displayed in Table 1.

Table 1: Maximum Sound Power Levels

Sound Source	Height (m)	Sound Power Level (dBA)									
		31.5	63	125	250	500	1000	2000	4000	8000	dBA
GE 3.8-137	111.5	78.5	86.8	92.6	96.4	99.4	102.1	102.0	93.7	79.2	<b>107.0</b>
Transformer <sup>a</sup>	4.5	99.0	105.0	107.0	102.0	102.0	96.0	91.0	86.0	79.0	<b>102.4</b>

a) Transformer sound power level is based on the NEMA standard sound level for a transformer rated to 82 dBA at 6 meters.

### Results

The maximum model-predicted  $L_{eq}$  sound pressure levels at each receiver (the logarithmic addition of sound levels from each frequency from every turbine and transformer) are included in Attachment 1. The highest predicted sound level at an occupied residence is 41.9 dBA. These values represent only the noise emitted by the GE wind turbines. There are no expected exceedances of the identified regulations due to operation of any of the proposed wind turbine locations of the Project.

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Attachment 1 – Predicted Sound Pressure Levels

Attachment 2 – Sound Contour Figure

**Memorandum**



**Attachment 1 – Predicted Sound Pressure Levels**

# Attachment 1 - Modeling Results

All Turbines: GE 3.8-137, 111.5 m hub height

Receiver	Coordinates		Base Elevation (m)	Modeled	Exceed 45 dBA?
	Easting (m)	Northing (m)		LAeq	(Y/N)
REC-001	583178.93	4781949.36	473.94	24.7	N
REC-002	578731.00	4782428.97	540.99	29.1	N
REC-003	580506.89	4783273.92	505.27	33.7	N
REC-004	582678.66	4780104.52	480.03	32.4	N
REC-005	583326.78	4778396.84	476.81	27.5	N
REC-006	583615.28	4778695.43	471.94	26.2	N
REC-007	579386.45	4783171.84	519.65	29.7	N
REC-008	579364.54	4780122.78	515.18	38.2	N
REC-009	582485.70	4779597.03	481.47	35.1	N
REC-010	570706.40	4779232.69	531.85	20.3	N
REC-011	568954.92	4779049.93	516.88	23.1	N
REC-012	575450.96	4778869.67	571.47	-	N
REC-013	570834.43	4777923.92	539.22	27.4	N
REC-014	578568.31	4777265.47	526.35	38.1	N
REC-015	578578.94	4777228.45	526.13	38.3	N
REC-016	569437.95	4774776.35	523.53	38.9	N
REC-017	567999.72	4773683.50	489.60	36.8	N
REC-018	575893.85	4773069.05	525.25	32.7	N
REC-019	568870.35	4772837.61	510.51	36.3	N
REC-020	568170.58	4772373.09	491.63	30.5	N
REC-021	574122.73	4771641.66	507.46	34.9	N
REC-022	574117.98	4771913.43	508.31	34.5	N
REC-023	567115.19	4771132.04	470.89	-	N
REC-024	569455.79	4770885.60	499.55	34.2	N
REC-025	582409.59	4770691.28	486.10	26.3	N
REC-026	582205.90	4770538.43	489.18	27.7	N
REC-027	569450.78	4770122.57	499.25	32.0	N
REC-028	578915.96	4770106.59	519.65	30.5	N
REC-029	567890.47	4769896.98	472.42	19.1	N
REC-030	574057.84	4769738.20	530.58	35.4	N
REC-031	571038.40	4769099.63	510.51	36.6	N
REC-032	579594.58	4768433.69	507.46	40.2	N
REC-033	574388.42	4768112.11	502.26	28.9	N
REC-034	575856.91	4767968.51	509.35	34.0	N
REC-035	568988.11	4768088.17	487.50	27.6	N
REC-036	574139.54	4767903.27	507.06	28.0	N
REC-037	580534.75	4767955.77	497.42	40.6	N
REC-038	569570.52	4767693.73	493.87	33.1	N
REC-039	575753.59	4767511.52	511.25	33.3	N
REC-040	575853.92	4767408.85	513.56	34.2	N
REC-041	577365.54	4767429.45	496.85	41.4	N
REC-042	580534.93	4768649.62	501.93	40.0	N
REC-043	582314.18	4767105.01	476.98	30.8	N
REC-044	577581.91	4766535.38	501.37	35.6	N
REC-045	580459.53	4766528.35	495.27	37.9	N
REC-046	570892.00	4766384.10	500.34	39.9	N
REC-047	576071.91	4766099.10	511.58	28.5	N
REC-048	575888.47	4765484.03	507.46	26.2	N
REC-049	579136.06	4765003.57	501.37	36.3	N
REC-050	575594.26	4764877.78	513.56	22.9	N
REC-051	577014.96	4764806.12	483.08	32.7	N
REC-052	571034.71	4764976.49	483.08	32.4	N
REC-053	575751.76	4763553.72	504.89	18.1	N
REC-054	579261.02	4763508.83	493.92	26.2	N
REC-055	575738.19	4763383.18	501.37	18.7	N
REC-056	578784.40	4763423.45	495.27	26.7	N
REC-057	575728.70	4763020.56	496.19	-	N
REC-058	574689.98	4762905.51	489.18	-	N
REC-059	574608.88	4762765.31	484.23	-	N
REC-060	575719.36	4763758.78	507.46	19.6	N
REC-061	566590.17	4774005.26	470.89	25.5	N
REC-062	566794.52	4771446.01	467.84	-	N

# Attachment 1 - Modeling Results

All Turbines: GE 3.8-137, 111.5 m hub height

Receiver	Coordinates		Base Elevation (m)	Modeled	Exceed 45 dBA?
	Easting (m)	Northing (m)		LAeq	(Y/N)
REC-063	567575.59	4773523.26	480.49	32.1	N
REC-064	568169.85	4775221.75	493.83	37.4	N
REC-065	568402.45	4770548.21	483.08	24.8	N
REC-066	569474.73	4776605.15	525.75	39.0	N
REC-067	569782.41	4765373.88	493.98	36.0	N
REC-068	570301.18	4776152.11	533.82	35.8	N
REC-069	570320.63	4776086.07	530.62	36.0	N
REC-070	570930.65	4767169.47	502.79	37.7	N
REC-071	571246.87	4765598.42	488.81	38.5	N
REC-072	571847.73	4767001.23	507.46	41.7	N
REC-073	572712.41	4764371.30	476.98	25.2	N
REC-074	572760.45	4768609.65	494.96	35.3	N
REC-075	572875.14	4775183.93	528.80	39.1	N
REC-076	573023.77	4775137.74	528.80	39.6	N
REC-077	573104.39	4767558.79	488.61	31.1	N
REC-078	572689.83	4764269.58	472.84	24.7	N
REC-079	572840.24	4766532.05	483.08	35.8	N
REC-080	574527.24	4771635.20	508.86	33.7	N
REC-081	574606.23	4772084.46	513.56	33.9	N
REC-082	575265.41	4775117.32	552.59	41.9	N
REC-083	575384.42	4771695.61	513.56	34.9	N
REC-084	575459.57	4773771.95	533.47	39.3	N
REC-085	576210.31	4770611.18	524.57	35.2	N
REC-086	576537.52	4765598.06	498.89	30.2	N
REC-087	576971.43	4770447.24	531.85	40.6	N
REC-088	577659.69	4765661.22	489.18	38.1	N
REC-089	577747.37	4768859.92	513.80	40.5	N
REC-090	577878.24	4764078.53	490.80	32.8	N
REC-091	577915.85	4763844.06	489.18	30.5	N
REC-092	578531.67	4767119.28	501.56	37.6	N
REC-093	578575.67	4778618.52	525.75	36.7	N
REC-094	578514.65	4776677.36	519.65	37.9	N
REC-095	578804.05	4764274.93	501.37	32.8	N
REC-096	578827.98	4768793.31	520.74	37.4	N
REC-097	578943.49	4770454.51	519.65	29.0	N
REC-098	579475.34	4767289.07	507.32	40.3	N
REC-099	579720.64	4762441.83	480.38	-	N
REC-100	580720.17	4765706.10	489.18	32.2	N
REC-101	580991.94	4762540.89	476.98	-	N
REC-102	581560.41	4763175.20	470.14	-	N
REC-103	581721.12	4767420.32	484.05	35.9	N
REC-104	581794.35	4770381.50	494.21	30.1	N
REC-105	581890.50	4769063.10	495.27	40.1	N
REC-106	581882.94	4766984.50	478.66	32.1	N
REC-107	582089.90	4770568.08	488.75	27.9	N
REC-108	582148.44	4764102.27	470.89	-	N
REC-109	582609.65	4767582.94	483.08	31.6	N
REC-110	583963.39	4770430.23	460.42	18.2	N
REC-111	582577.80	4767332.36	480.99	30.7	N
REC-112	570034.28	4777428.88	531.85	33.7	N
REC-113	580225.65	4778670.25	516.61	41.3	N
REC-114	580643.69	4779065.86	510.51	40.5	N
REC-115	580812.98	4776797.89	507.54	39.5	N
REC-116	581676.22	4775653.66	495.49	37.4	N
REC-117	579367.75	4775404.23	525.75	36.8	N
REC-118	580095.28	4784336.60	507.46	25.3	N
REC-119	581867.73	4783246.46	489.52	29.7	N
REC-120	582410.57	4781467.20	486.13	30.9	N
REC-121	582256.16	4783054.99	483.20	28.4	N
REC-122	582261.38	4777793.15	487.45	33.8	N
REC-123	581460.71	4785645.95	483.97	-	N
REC-124	577505.30	4781336.06	557.16	19.3	N

## Attachment 1 - Modeling Results

All Turbines: GE 3.8-137, 111.5 m hub height

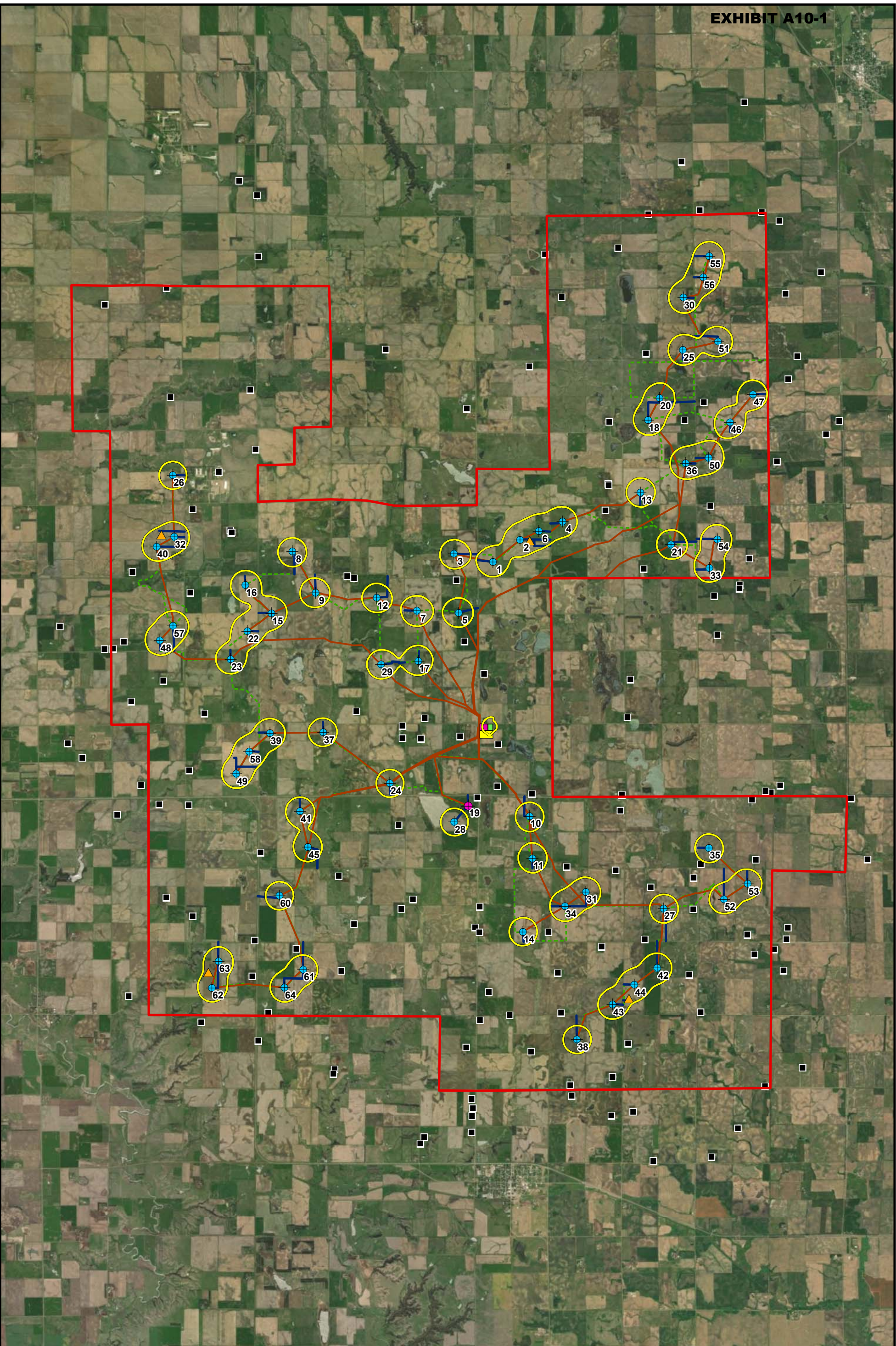
Receiver	Coordinates			Modeled LAeq	Exceed 45 dBA? (Y/N)
	Easting (m)	Northing (m)	Base Elevation (m)		
REC-125	580995.88	4773976.31	501.99	29.4	N
REC-126	580915.69	4774830.29	502.29	38.6	N
REC-127	581473.61	4775075.61	495.27	37.0	N
REC-128	581468.21	4774997.26	495.27	36.4	N
REC-129	576815.58	4779814.18	556.23	21.4	N
REC-130	567502.00	4781060.00	502.37	-	N
REC-131	568850.00	4781446.00	523.04	-	N
REC-132	570408.00	4783811.00	527.44	-	N
REC-133	570806.00	4783497.00	538.25	-	N
REC-134	570845.00	4782153.00	543.29	-	N
REC-135	573665.00	4780153.00	564.37	-	N
REC-136	579049.00	4772150.00	519.65	-	N
REC-137	579104.00	4772978.00	519.65	17.9	N
REC-138	573105.45	4772224.12	513.56	37.1	N
REC-139 Schoenfelder House	569781.24	4772133.60	510.51	35.5	N
REC-140 Gramkow-Vesper Cemetery	580689.30	4768952.27	507.46	43.2	N
REC-141	577129.69	4782270.05	574.52	-	N
REC-142	584339.55	4769092.88	460.78	19.4	N
REC-143	582521.68	4766643.44	470.89	27.4	N
REC-144	582964.12	4764513.68	462.13	-	N
REC-145	568186.44	4765929.46	457.18	26.7	N
REC-146	576220.57	4771526.69	525.75	34.4	N
REC-147	575778.28	4770360.98	519.65	37.3	N
REC-148	568806.39	4770128.32	487.99	27.0	N
REC-149 Presbyterian-Bohemian Cemetery	567762.65	4773526.07	482.79	33.8	N

"- " represents no expected impacts at the receiver location

**Memorandum** *(cont'd)*



**Attachment 2 – Sound Contour Figure**



Path: Z:\Clients\SPowerGroup\104294\_PrevailingWinds\Permitting\Noise\GIS\105644\_PrevailingWinds\_Update\_Noise\_Contours2.mxd gweiger 9/26/2018  
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- Project Area
- 45 dBA Contour
- Occupied Residence
- + Turbine
- + Removed from Project Layout
- + MET Tower
- Laydown Yard
- O&M
- Project Substation
- Access Road
- Collector Line
- Crane Path

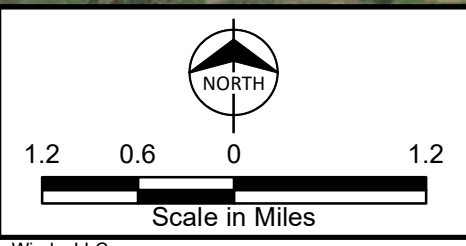


Figure 2-1  
 Prevailing Wind Park  
 Wind Energy Facility  
 SDPUC Application