Exhibit Y

Noise

Wheatridge Renewable Energy Facility East
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Prepared for
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Acronyms and Abbreviations

BESS	battery energy storage system
BPA	Bonneville Power Administration
Certificate Holder	Wheatridge East Wind, LLC
Council	Oregon Energy Facility Siting Council
dBA	A-weighted decibels
Facility	Wheatridge Renewable Energy Facility East
Hz	Hertz
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
LNTE	low noise trailing edge
MVA	Megavolt-ampere
NEMA	National Electrical Manufacturer Association
NSR	noise sensitive receptor
OAR	Oregon Administrative Rules
ODEQ	Oregon Department of Environmental Quality
RFA	Request for Amendment
UTM	Universal Transverse Mercator

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1.0 Introduction

The Wheatridge Renewable Energy Facility East (Facility) is an approved, but not yet constructed, wind energy generation facility consisting of up to 66 turbines and related or supporting facilities with a peak generating capacity of up to 200 megawatts, to be located in an Approved Site Boundary of approximately 4,582 acres on over 42,000 acres of leased land in Morrow and Umatilla counties, Oregon. As part of Request for Amendment (RFA) 1 to the Facility Site Certificate, Wheatridge East Wind, LLC (Certificate Holder) is proposing to expand wind power generation at the Facility to provide the opportunity for increased power capacity and availability. This includes expanding the Site Boundary and micrositing corridors, increasing the peak generating capacity by adding more and newer turbines, changing the intraconnection routes, and extending the construction date. See the RFA 1's Division 27 document (*Request for Amendment #1 for the Wheatridge Renewable Energy Facility East*) for a more detailed summary of the proposed changes.

This Exhibit Y was prepared to meet the submittal requirements in Oregon Administrative Rules (OAR) 345-021-0010(1)(y). Analysis in this exhibit incorporates and/or relies on reference information, analysis, and findings found in the Application for Site Certificate, previous RFAs, and Oregon Department of Energy Final Orders to demonstrate that the Facility, as modified by RFA 1, continues to comply with applicable Site Certificate conditions and the standard in OAR 345-021-0010(1)(y).

The approved Facility resulted from a Site Certificate and facility division approved in the Final Order on the RFA 1 to the Site Certificate[1] for Wheatridge Renewable Energy Facility II (WREFII). The Final Order imposed five conditions[2] intended to prevent and mitigate noise impacts.[3] Under this RFA 1, the changes proposed will not compromise the Certificate Holder's ability to comply with these conditions. Modifications to the current conditions are listed in Section 2.4.

2.0 Regulatory Environment

This section describes the noise-related requirements that may be applicable to the Facility at the federal, state, county, and municipal levels. The acoustic assessment described in Exhibit Y is limited to that of off-site receptors and not potential on-site noise exposure, as regulated by the United States Occupational Health and Safety Administration.

[1] Final Order on Request for Amendment 1 to the Site Certificate for the Wheatridge Renewable Energy Facility II (November 2020)
[2] PRE-NC-01 Final design locations, noise analysis and noise waivers.
CON-NC_01 Reduction of construction noise impacts.
OPR-NC-01 NRO mode turbines.
OPR-NC-02 Implement complaint response system.
OPR-NC-03 Operational noise monitoring.
[3] Final Order on Application for the Wheatridge Wind Energy Facility (April 2017)

2.1 Federal Noise Regulations

There are no federal regulatory requirements in the United States that apply to the Facility.

2.2 State Noise Regulations

OAR Chapter 340, Division 35 prescribes noise regulations applicable throughout the State of Oregon, with specific requirements in OAR 340-035-0035, “Noise Control Regulations for Industry and Commerce.” This standard provides guidance for new noise sources on a previously used site:

> *OAR 340-035-0035(1)(b)(A) New Sources Located on Previously Used Sites. No person owning or controlling a new industrial or commercial noise source located on a previously used industrial or commercial site shall cause or permit the operation of that noise source if the statistical noise levels generated by that new source and measured at an appropriate measurement point, specified in subsection (3)(b) of this rule, exceed the levels specified in Table 8, except as otherwise provided in these rules. For noise levels generated by a wind energy facility including wind turbines of any size and any associated equipment or machinery, subparagraph (1)(b)(B)(iii) applies.*

Table Y-1 gives statistical noise limits as summarized below. All limits are presented in terms of A-weighted decibels (dBA). The L_{50} is the median sound level (50 percent of the measurement interval is above this level, 50 percent is below). The noise limits apply at “appropriate measurement points” on “noise sensitive property.”[4] The appropriate measurement point is defined as whichever of the following is farther from the noise source:

- 25 feet toward the noise source from that point on the noise sensitive building nearest the noise source; or
- The point on the noise sensitive property line nearest the noise source.

“Noise sensitive property” is defined as “real property normally used for sleeping, or normally used as schools, churches, hospitals or public libraries. Property used in industrial or agricultural activities is not noise sensitive property unless it meets the above criteria in more than an incidental manner.”

Table Y-1. New Industrial and Commercial Noise Standards

Statistical Descriptor	Maximum Permissible Statistical Noise Levels (dBA)	
	Daytime (7:00 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)
L_{50}	55	50
L_{10}	60	55
L_{1}	75	60
Source: OAR 340-035-0035, Table 8		

[4] OAR 340-035-0035(3)(b)

The standard also provides guidance for new noise sources on a previously unused site, which is defined in OAR 340 -035-0015(47) as property that has not been used by any industrial or commercial noise source during the 20 years immediately preceding commencement of construction of a new industrial or commercial source on that property. The standard reads as follows:

> *OAR 340-035-0035(1)(b)(B)(i) No person owning or controlling a new industrial or commercial noise source located on a previously unused industrial or commercial site shall cause or permit the operation of that noise source if the noise levels generated or indirectly caused by that noise source increase the ambient statistical noise levels, L_{10} or L_{50}, by more than 10 dBA in any one hour, or exceed the levels specified in Table 8, as measured at an appropriate measurement point, as specified in subsection (3)(b) of this rule, except as specified in subparagraph (1)(b)(B)(iii).*
>
> *OAR 340-035-0035(1)(b)(B)(ii) The ambient statistical noise level of a new industrial or commercial noise source on a previously unused industrial or commercial site shall include all noises generated or indirectly caused by or attributable to that source including all of its related activities. Sources exempted from the requirements of section (1) of this rule, which are identified in subsections (5)(b)–(f), (j), and (k) of this rule, shall not be excluded from this ambient measurement.*

Specifically for wind energy facilities, the following provision is provided at OAR 340-035-0035(1)(b)(B)(iii)(I) with regard to establishing existing conditions:

> *The increase in ambient statistical noise levels is based on an assumed background L50 ambient noise level of 26 dBA or the actual ambient background level. The person owning the wind energy facility may conduct measurements to determine the actual ambient L_{10} and L_{50} background level.*

2.2.1 Exemptions to State Noise Regulations

OAR 340-035-0035(5) specifically exempts construction activity from the state noise standards and regulations, as indicated below. This section also provides an exemption for maintenance of capital equipment, the operation of aircraft (such as helicopters used in Facility construction), and sounds created by activities related to timber harvest.

> *OAR 340-035-0035(5) Exemptions:*
>
> *Except as otherwise provided in subparagraph (1)(b)(B)(ii) of this rule, the rules in section (1) of this rule shall not apply to:*
>
> [section abridged for brevity]
>
> > *(b) Warning devices not operating continuously for more than 5 minutes;*
> >
> > *(g) Sounds that originate on construction sites.*
> >
> > *(h) Sounds created in construction or maintenance of capital equipment;*
> >
> > *(j) Sounds generated by the operation of aircraft and subject to pre-emptive federal regulation. This exception does not apply to aircraft engine testing, activity conducted at the*

airport that is not directly related to flight operations, and any other activity not pre-emptively regulated by the federal government or controlled under OAR 340-035-0045;

(k) Sounds created by the operation of road vehicle auxiliary equipment complying with the noise rules for such equipment as specified in OAR 340-035-0030(1)(e);

(m) Sounds created by activities related to the growing or harvesting of forest tree species on forest land as defined in subsection (1) of ORS 526.324.

2.2.2 Exceptions to State Noise Regulations

OAR 340-035-0035(6) allows for some exceptions to the state noise regulations:

OAR 340-035-0035 (6) Exceptions:

Upon written request from the owner or controller of an industrial or commercial noise source, the Department may authorize exceptions to section (1) of this rule, pursuant to rule 340-035-0010, for:

(a) Unusual and/or infrequent events;

(b) Industrial or commercial facilities previously established in areas of new development of noise sensitive property;

(c) Those industrial or commercial noise sources whose statistical noise levels at the appropriate measurement point are exceeded by any noise source external to the industrial or commercial noise source in question;

(d) Noise sensitive property owned or controlled by the person who controls or owns the noise source;

(e) Noise sensitive property located on land zoned exclusively for industrial or commercial use.

2.3 County and Municipal Noise Regulations

There are no quantitative noise limits in Morrow or Umatilla counties. Morrow County stipulates that noise shall not be "plainly audible within a dwelling unit one hundred feet (100') or more away from the source of the noise," between 11:00 PM and 7:00 AM, and allows an exception for construction between 6:00 AM and 10:00 PM (Morrow County 2021).

2.4 Site Certificate Conditions – Noise

As discussed above, the Final Order on the RFA 1 to the Site Certificate for WREFII imposed five conditions intended to prevent and mitigate noise impacts. Those conditions are PRE-NC-01, CON-NC-01, OPR-NC-01, OPR-NC-02, and OPR-NC-03. The previously approved Site Certificate conditions, CON-NC-01, OPR-NC-02, and OPR-NC-03 will remain applicable to prevent significant noise impacts. Recommended edits to Conditions PRE-NC-01 and OPR-NC-01 are provided in redline below.

PRE-NC-01

Prior to construction, the certificate holder shall provide to the department:

a. Information that identifies the final design locations of all facility components to be built at the facility;

b. The maximum sound power level for the facility components and the maximum sound power level and octave band data for the turbine type(s), transformers (substation), invertors, AC and DC-coupled battery storage cooling system selected for the facility based on manufacturers' warranties or confirmed by other means acceptable to the department;

c. The results of the noise analysis of the final facility design performed in a manner consistent with the requirements of OAR 340-035-0035(1)(b)(B) (iii)(IV) and (VI). The analysis must demonstrate to the satisfaction of the department that the total noise generated by the facility (including turbines, transformers, ~~invertors~~ inverters, AC- and DC-coupled battery storage cooling systems) would meet the ambient noise degradation test and maximum allowable test at the appropriate measurement point for all potentially-affected noise sensitive properties, or that the certificate holder has obtained the legally effective easement or real covenant for expected exceedances of the ambient noise degradation test described (d) below. If applicable, t~~T~~he analysis must also identify noise mitigation that ~~the noise reduction operation (NRO) mode approach that~~ will be used during facility operation and include a figure that depicts the turbines (or other equipment) that will implement noise mitigation ~~be operating in NRO mode~~ and the associated dBA reduction level; if required to meet the maximum allowable decibel threshold of 50 dBA; and,

d. For each noise-sensitive property where the certificate holder relies on a noise waiver to demonstrate compliance in accordance with OAR 340-035-0035(1)(b)(B)(iii)(III), a copy of the legally effective easement or real covenant pursuant to which the owner of the property authorizes the certificate holder's operation of the facility to increase ambient statistical noise levels L_{10} and L_{50} by more than 10 dBA at the appropriate measurement point. The legally effective easement or real covenant must: include a legal description of the burdened property (the noise sensitive property); be recorded in the real property records of the county; expressly benefit the property on which the wind energy facility is located; expressly run with the land and bind all future owners, lessees or holders of any interest in the burdened property; and not be subject to revocation without the certificate holder's written approval.

OPR-NC-01

During operation of the facility, if required to meet the maximum allowable decibel threshold of 50 dBA, the certificate holder shall only operate the facility ~~in the NRO mode~~ inclusive of noise mitigation that is identified prior to construction pursuant to Noise Control Condition 2. After beginning operation of the facility, the certificate holder shall include ~~a certification~~

documentation in its annual Compliance Report confirming that the noise mitigation measures ~~that the NRO mode turbines~~ identified in the preconstruction analysis required by Noise Control Condition 2 are in place ~~operating~~ and turbines (or other equipment) are operating at or below the identified dBA reduction level.

3.0 Existing Conditions

The Facility area is rural, with occasional farmhouses interspersed throughout. For the purposes of the acoustic analysis, it is considered by OAR 340-035-0035 as being lands that were previously "unused" for commercial or industrial uses. Existing ambient sound levels were not monitored in the Analysis Area; however, to assess compliance with OAR 340-035-0035 an assumed default rural background sound level of 26 dBA was used as ambient background in this acoustic analysis.

A wide range of noise settings occur within the acoustic Analysis Area. The background sound level will vary spatially and is related to various physical characteristics such as topography, land use, proximity to transportation corridors and terrain coverage including extent and height of exposed vegetation. The acoustic environment will also vary due in part to surrounding land use and population density. Areas in proximity to major transportation corridors such as interstate highways and areas with higher population densities and are expected to generally have higher existing ambient sound levels as compared to open and rural lands. Table Y-2 shows the relative A-weighted noise levels of common sounds measured in the environment and industry.

Table Y-2. Sound Pressure Levels (L_P) and Relative Loudness

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (Perception of Different Sound Levels)
Jet aircraft takeoff from carrier (50 ft.)	140	Threshold of pain	64 times as loud
50-hp siren (100 ft.)	130		32 times as loud
Loud rock concert near stage Jet takeoff (200 ft.)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 ft.)	110		8 times as loud
Jet takeoff (2,000 ft.)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 ft.)	90		2 times as loud
Garbage disposal Food blender (2 ft.) Pneumatic drill (50 ft.)	80	Loud	Reference loudness
Vacuum cleaner (10 ft.)	70	Moderate	1/2 as loud
Passenger car at 65 mph (25 ft.)	65		
Large store air-conditioning unit (20 ft.)	60		1/4 as loud

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (Perception of Different Sound Levels)
Light auto traffic (100 ft.)	50	Quiet	1/8 as loud
Quiet rural residential area with no activity	45		
Bedroom or quiet living room Bird calls	40	Faint	1/16 as loud
Typical wilderness area	35		
Quiet library, soft whisper (15 ft.)	30	Very quiet	1/32 as loud
Wilderness with no wind or animal activity	25	Extremely quiet	
High-quality recording studio	20		1/64 as loud
Acoustic test chamber	10	Just audible	
	0	Threshold of hearing	
Adapted from: Bolt, Beranek and Newman, Inc. 1988 and EPA 1971.			

4.0 Predicted Noise Levels – OAR 345-021-0010(1)(y)(A)

OAR 345-021-0010(1)(y) Information about noise generated by construction and operation of the proposed facility, providing evidence to support a finding by the Council that the proposed facility complies with the Oregon Department of Environmental Quality's noise control standards in OAR 340-035-0035. The applicant shall include:

OAR 345-021-0010(1)(y)(A) Predicted noise levels resulting from construction and operation of the proposed facility.

OAR 345-021-0010(1)(y)(B) An analysis of the proposed facility's compliance with the applicable noise regulations in OAR 340-035-0035, including a discussion and justification of the methods and assumptions used in the analysis.

4.1 Construction Noise Assessment

Potential noise impacts associated with Facility construction were reviewed; however, according to OAR 340-035-0035(5)(g), sound originating from construction sites is exempt from state noise regulations. Construction of the Facility will require the use of heavy construction equipment that may be periodically audible at off-site noise sensitive receptors (NSRs). Construction of the Facility may cause short-term increases in the ambient sound levels. The list of construction equipment that may be used on the Facility and estimates of construction sound levels are presented in Table Y-3 at a reference distance of 50 feet and far field distance of 2,000 feet. The variation in power and usage imposes additional complexity in characterizing construction noise levels. The estimated composite site noise level assumes that all equipment would operate simultaneously at the given usage load rating, over a standard eight-hour workday, to calculate the composite average daytime L_{eq}. Usage factor accounts for the fraction of time that the equipment is in use over the specified time period.

Table Y-3. Estimated L_{max} Sound Pressure Levels from Construction Equipment

Equipment	L_{max} Equipment Sound Level at 50 feet (dBA)	Usage Factor (%)[1]	Equipment Sound Level at 50 feet, L_{eq} (dBA)	Equipment Sound Level at 2,000 feet, L_{eq} (dBA)	Composite Equipment Sound Level at 2,000 feet, L_{eq} (dBA)
Crane	85	16	77	34	48
Forklift	80	40	76	33	
Backhoe	80	40	76	33	
Grader	85	40	81	38	
Man basket	85	20	78	35	
Dozer	-88	40	84	41	
Loader	88	40	84	41	
Scissor Lift	85	20	78	35	
Truck	85	40	81	38	
Welder	73	40	69	26	
Compressor	80	40	76	33	
Concrete Pump	77	50	74	31	

Note: Data compiled in part from the following sources: FHWA 2006, Bolt Beranek and Newman, Inc. 1977.

1. Percentage of time during operation that a piece of construction equipment is operating at full power.

The construction of the Facility may cause short-term but unavoidable noise impacts. The sound levels resulting from construction activities vary significantly depending on several factors such as the type and age of equipment, the specific equipment manufacturer and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers.

All reasonable efforts will be made to minimize the impact of noise resulting from construction activities. As the design of the Facility progresses and construction scheduling is finalized, the construction engineer normally notifies the community via public notice or alternative method of the expected Facility construction commencement and duration to help minimize the effects of construction noise. In addition, the location of stationary equipment and the siting of construction laydown areas will be carefully selected to be as far removed from existing NSRs as is practical. Candidate construction noise mitigation measures include scheduling louder construction activities during daytime hours and equipping internal combustion engines with appropriately sized muffler systems to minimize noise excessive emissions.

4.2 Operational Noise Assessment

This section describes the model utilized for the assessment; input assumptions used to calculate noise levels due to the Facility's normal operation; a conceptual noise mitigation strategy, and the results of the noise impact analysis.

4.2.1 Wind Turbines

Sound generated by an operating wind turbine comprises both aerodynamic and mechanical sound, with the dominant sound component from modern utility-scale wind turbines being largely aerodynamic. Aerodynamic sound refers to the sound produced from air flow and the interaction with the wind turbine tower structure and moving rotor blades. Mechanical sound is generated at the gearbox, generator, and cooling fan, and is radiated from the surfaces of the nacelle and machinery enclosure and by openings in the nacelle casing. Due to the improved design of wind turbine mechanical components and the use of improved noise damping materials within the nacelle, including elastomeric elements supporting the generator and gearbox, mechanical noise emissions have been minimized. Sound reduction elements designed as a part of the wind turbines include impact noise insulation of the gearbox and generator, sound reduced gearbox, sound reduced nacelle, and rotor blades designed to minimize noise generation.

Wind energy facilities, in comparison to other energy-related facilities, are unique in that the sound generated by each individual wind turbine will increase as the wind speed across the site increases. Wind turbine sound is negligible when the rotor is at rest, increases as the rotor tip speed increases, and is generally constant once rated power output and maximum rotational speed are achieved. Under this condition, the wind turbine maximum sound power level will be reached at approximately 7 to 9 meters per second according to the wind turbine manufacturer specifications (GE 2021). It is important to recognize that, as wind speeds increase, the background ambient sound level will generally increase as well, resulting in acoustic masking effects; however, this trend is also affected by local contributing sound sources. As such, during periods of elevated wind speeds when higher wind turbine sound emissions occur, the sound produced from a wind turbine operating at maximum rotational speed may be largely or fully masked due to wind generated sound in foliage or vegetation. In practical terms, this means a nearby receptor would tend to hear leaves or vegetation rustling rather than wind turbine noise. This relationship is expected to further minimize the potential for any adverse noise effects of the Facility. Conversely, these acoustic masking effects may be limited during periods of unusually high wind shear or at receiver locations that are sheltered from the prevailing wind direction.

4.2.2 Transmission Lines

Transmission line sound sources will primarily consist of corona noise in addition to Aeolian noise, and noise associated with maintenance activities. Transmission line noise (also called corona noise) is caused by the partial electrical breakdown of the insulating properties of air around the electrical conductors and overhead power lines. Audible noise generated by corona on transmission lines is composed of two major components. The higher frequencies of the broadband component distinguish it from more common outdoor environmental noise. The random phase relationship of the pressure waves generated by each corona source along a transmission line results in a characteristic sound commonly described as crackling, frying, or hissing. The second component is a lower-frequency sound that is superimposed over the broadband noise. The corona discharges produce positive and negative ions that, under the influence of the alternating electric field around alternating current conductors, are alternately attracted to and repelled from the conductors. This motion establishes a sound-pressure wave having a frequency twice that of the voltage (i.e., 120 Hertz [Hz] for a 60-Hz system). Higher harmonics (e.g., 240 Hz) may also be present, but they are generally of lower significance (EPRI 2015). Corona activity increases with increasing altitude, and with increasing voltage in the line, but is generally not affected by system loading. The relative magnitude of hum and broadband noise may be different depending on weather conditions at the line. According to EPRI, when the line is wet (such as during rainy weather conditions), the broadband component typically dominates; however, under icing conditions, the lower frequency components may be more prevalent.

Corona noise levels during precipitation may vary over a wide range. During the initial stages, when the conductors are not thoroughly wet, there may be considerable fluctuation in the noise level as the precipitation intensity varies. When the conductors are thoroughly wet, the noise fluctuations will often be less significant, because even as the intensity of precipitation diminishes the conductors will still be saturated, which can result in corona discharge. The variation in noise levels during rain depends greatly on the condition of the conductor surface and on the voltage gradient at which the conductors are operating. At high operating gradients, the audible noise is less sensitive to rain rate than at low gradients. Consequently, the variation in noise levels is less for the higher gradients. In different weather conditions the relative magnitudes of random noise and hum may be different. Noise levels in fog and snow usually do not attain the same magnitude as compared to rain, and elevated noise levels during fog and snow are usually for a shorter duration in proportion to the event (EPRI 1982).

During fair weather conditions, corona occurs only at scratches or other imperfections in the conductor surface or where dust has settled on the line. These limited sources are such that the corona activity is minimal, and the audible noise generated is very low. Generally, the fair-weather audible noise of transmission lines cannot be distinguished from ambient noise at the edge of the right-of-way.

Corona noise is not generally an issue at substations. The presence of equipment such as circuit breakers, switches, and measuring devices reduces the electromagnetic field gradient on the buses to a great extent. In addition, the distance from most of the buses to the perimeter of the substation is considerable (on average, greater than 100 meters). Consequently, low levels of corona noise would likely not be readily detectable immediately outside the substation fence line (EPRI 1982).

In addition to corona noise, wind blowing across power lines and power poles can generate noise when airflow is non-laminar or turbulent. Aeolian, or wind, noise is produced when a steady flow of wind interacts with a solid object, such as a tower. The interaction produces oscillating forces on the object that in turn can radiate sound as a dipole source at a given frequency.

The occurrence of Aeolian noise is dependent on several factors and is difficult to predict. Wind noise from a stationary source requires perfect conditions: to produce any sound, the wind must blow for enough time in a specific direction at a specific speed; a slight deviation in either the direction or intensity would disrupt the conditions necessary to produce noise. Wind can create a variety of sounds, ranging from a low hum to a snapping sound to a high whistle. Aeolian noise is not considered a significant contributor to noise disturbance and has not been considered further in the acoustic analysis.

4.2.3 Substations

The primary ongoing noise sources at substations are the transformers, which generate sound generally described as a low humming. There are three main sound sources associated with a transformer: core noise, load noise, and noise generated by the operation of the cooling equipment. The core vibrational noise is the principal noise source and does not vary significantly with electrical load.

Transformer noise varies with transformer dimensions, voltage rating, and design, and attenuates with distance. The noise produced by substation transformers is primarily caused by the load current in the transformer's conducting coils (or windings) and consequently the main frequency of this sound is twice the supply frequency (60 Hz). The characteristic humming sound consists of tonal components generated at harmonics of 120 Hz. Most of the acoustical energy resides in the fundamental tone (120 Hz) and the first three or four harmonics (240, 360, 480, and 600 Hz).

Circuit-breaker operations may also cause audible noise, particularly the operation of air-blast breakers, which is characterized as an impulsive sound event of very short duration and expected to occur no more than a few times throughout the year. Because of its short duration and infrequent occurrence, circuit breaker noise was not considered in this analysis.

4.2.4 Battery Storage Facilities

The battery energy storage system (BESS) area will be consolidated adjacent to the northern substation. The primary noise sources during operations are the transformers, power conversion systems, and battery storage Heating, Ventilation and Air Conditioning (HVAC) units. It is expected that all equipment would operate in a consistent manner during both daytime and nighttime hours.

4.2.5 Acoustic Modeling Software and Calculation Methods

Two programs were used for the Facility acoustic analysis, DataKustik GmbH's computer-aided noise abatement program (CadnaA; DataKustik 2023) and the Corona and Field Effects Program Version 3 (Corona 3; BPA 1991). Further details pertaining to these two programs are given in the following subsections.

4.2.5.1 CadnaA

The acoustic modeling analysis was conducted using the most recent version of CadnaA. CadnaA is a comprehensive three-dimensional acoustic software model that conforms to the International Organization for Standardization (ISO) standard ISO 9613-2 "Attenuation of Sound during Propagation Outdoors" (ISO 1996). The engineering methods specified in this standard consist of full (1/1) octave band algorithms that incorporate geometric spreading due to wave divergence, reflection from surfaces, atmospheric absorption, screening by topography and obstacles, ground effects, source directivity, heights of both sources and receptors, seasonal foliage effects, and meteorological conditions. Topographical information was imported into the acoustic model using the official United States Geological Survey digital elevation dataset to accurately represent terrain in three dimensions. Terrain conditions, vegetation type, ground cover, and the density and height of foliage can also influence the absorption that takes place when sound waves travel over land. The ISO 9613-2 standard accounts for ground absorption rates by assigning a numerical coefficient of G=0 for acoustically hard, reflective surfaces and G=1 for absorptive surfaces and soft ground. If the ground is hard-packed dirt, typically found in industrial complexes, pavement, bare rock or for sound traveling over water, the absorption coefficient is defined as G=0 to account for reduced sound attenuation and higher reflectivity. In contrast, ground covered in vegetation, including suburban lawns, livestock and agricultural fields (both fallow with bare soil and planted with crops), will be acoustically absorptive and aid in sound attenuation (i.e., G=1.0). A mixed (semi-reflective) ground factor of G=0.5 was used in the Facility acoustic modeling analysis. In addition to geometrical divergence, attenuation factors include topographical features, terrain coverage, and/or other natural or anthropogenic obstacles that can affect sound attenuation and result in acoustical screening. To be conservative, sound attenuation through foliage and diffraction around and over existing anthropogenic structures such as buildings was not included in this modeling analysis.

Sound attenuation by the atmosphere is not strongly dependent on temperature and humidity; however, the temperature of 10 degrees Celsius (50 degrees Fahrenheit) and 70 percent relative humidity parameters were selected for this analysis. Over short distances, the effects of atmospheric absorption are minimal. The ISO 9613-2 standard calculates attenuation for meteorological conditions favorable to propagation; i.e., downwind sound propagation or what might occur typically during a moderate atmospheric ground level inversion. Though a physical impracticality, the ISO 9613-2 standard simulates omnidirectional downwind propagation. For receivers located between discrete wind turbine locations or wind turbine groupings, the acoustic model may result in over-prediction. In addition, the acoustic modeling algorithms essentially assume laminar atmospheric conditions, in which neighboring layers of air do not mix. This conservative assumption does not take into consideration turbulent eddies and micrometeorological inhomogeneities that may form when winds change speed or direction, which can interfere with the sound wave propagation path and increase attenuation effects.

4.2.5.2 Corona and Field Effects Program

Transmission line corona sound levels were evaluated using Corona 3, a DOS-based computer model developed by the Bonneville Power Administration (BPA; BPA 1991). The Corona 3 program uses the algorithms developed by BPA to predict a variety of outputs including electric and magnetic fields and audible noise. The inputs to the Corona 3 model are line voltage, load flow (current), and the physical dimensions of the line (number of phases, conductor diameter, spacing, height, and subconductor configuration) and site elevation.

The BPA method of calculating audible noise from transmission lines is based on long-term statistical data collected from operating and test transmission lines. This method calculates the L_{50} noise level during rainy conditions of 1 millimeter per hour. Long-term measurements show that L_{50} audible noise levels occur at this rain rate. Results during fair weather conditions are also evaluated. Additional details regarding the Corona 3 program are provided in Exhibit AA.

4.2.6 Input to the Noise Model

4.2.6.1 Wind Turbines

The operational acoustic assessment was performed using the proposed combination of the August 3 and September 8, 2023, layout, which includes 107 primary turbines and 21 alternate turbines. The following wind turbine model was evaluated in the acoustic analysis:

- **GE 2.82-127–** Wind turbine with a rotor diameter of 127 meters and a hub height of 89 meters.

To minimize received sound levels and eliminate predicted exceedance conditions identified during preliminary modeling, noise mitigation was implemented on all turbines by using low noise trailing edge (LNTE) technology. LNTE essentially consists of the addition of plastic or metal sawtooth serrations that can be affixed to the blade's rear edge to reduce blade trailing edge noise.

To assist project developers and acoustical engineers, wind turbine manufacturers report wind turbine sound power data at integer wind speeds referenced to the effective hub height, ranging from cut-in to full-rated power per International Electrotechnical Commission (IEC) standard 61400-11:2006 Wind Turbine Generator Systems – Part 11: Acoustic Noise Measurement Techniques. This accepted IEC standard was developed to ensure consistent and comparable sound emission data of utility-scale wind turbines between manufacturers. Table Y-4 presents a summary of sound power data correlated to wind speeds at 10 meters above ground level using a roughness length coefficient of 0.05 meters. The roughness length describes the vertical wind profile per IEC specification in a neutral atmosphere with the wind profile following a logarithmic curve.

Table Y-4. Broadband Sound Power Levels (dBA) Correlated with Wind Speed

Turbine	Wind Turbine L_{max} Sound Power Level (L_W) at Reference Wind Speed (meters per second / miles per hour)								
	4/8.9	5/11.2	6/13.4	7/15.7	8/17.9	9/20.1	10/22.4	11/24.6	12/26.8
GE 2.82-127 with LNTE	95.2	95.4	98.9	102.4	105.3	107.7	108.5	108.5	108.5

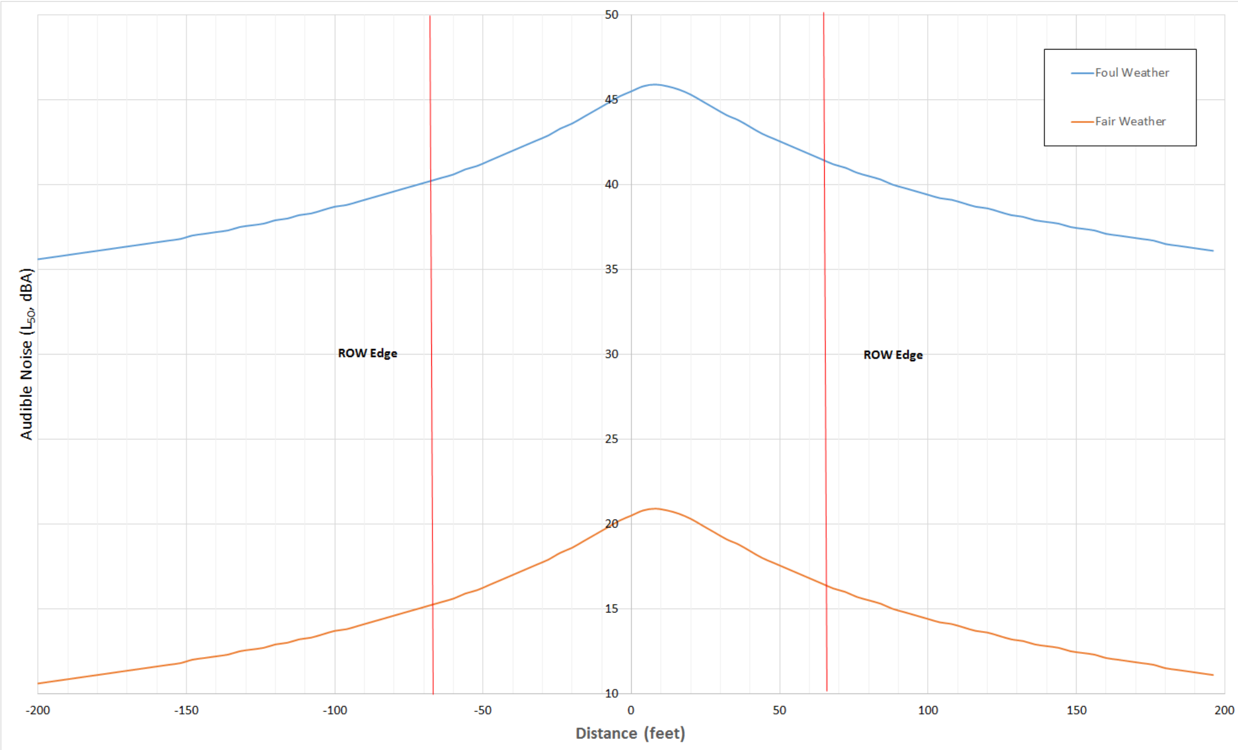
Wind turbines can be somewhat directional, radiating more sound in some directions than others. The IEC test measurement protocol requires that sound measurements are made for the maximum downwind directional location when reporting apparent sound power levels. Thus, it is assumed that wind turbine directivity and sound generating efficiencies are inherently incorporated in the sound source data and used in acoustic model development. The specification for the wind turbines includes an expected warranty confidence interval, or k-factor, which was added to the nominal sound power level in the acoustic model. A confidence interval of k = 2 dBA was applied to account for the uncertainty in independent sound power level measurements conducted, the applied probability level and standard deviation for test measurement reproducibility, and product variability. A summary of sound power data by octave band center frequency for wind turbines operating at maximum rotation is presented in Table Y-5 (1/1 octave band frequency data provided with stated intended use limited for informational purposes only).

Table Y-5. Sound Power Level by Octave Band Center Frequency

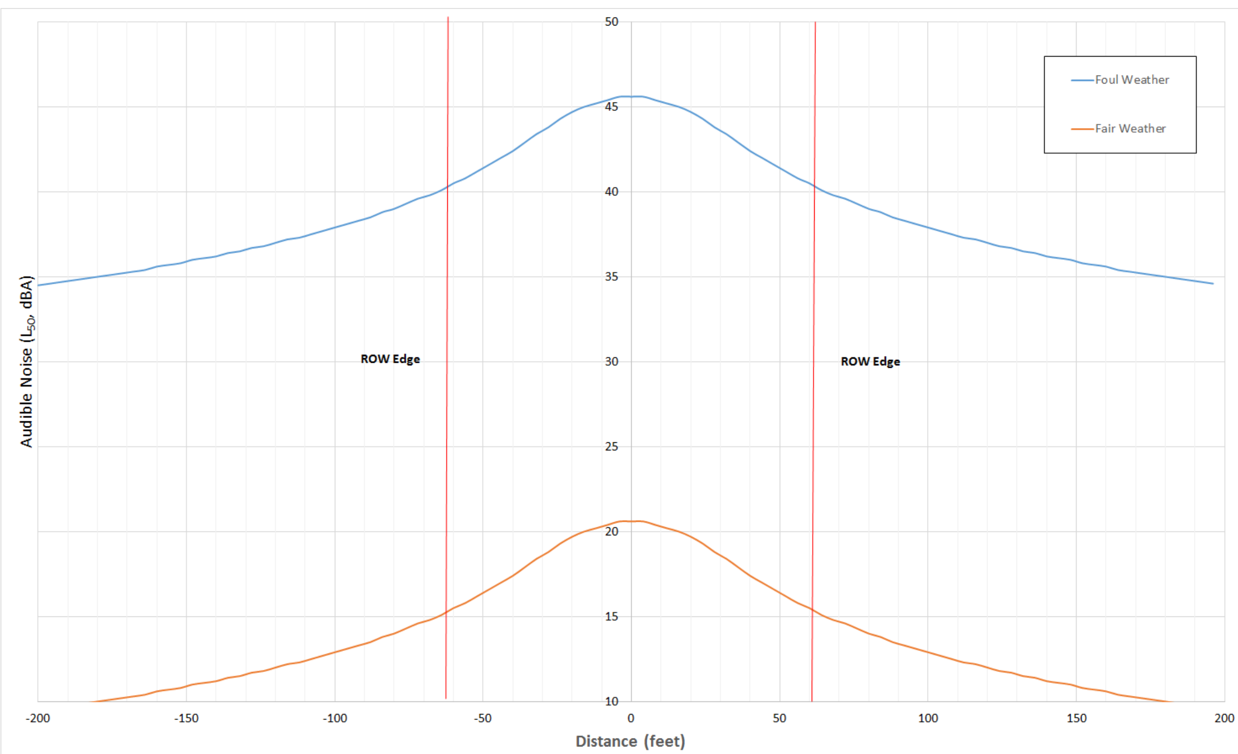
Turbine	Octave Band Sound Power Level (dBA) by Frequency (Hz)								Broadband (dBA)
	63	125	250	500	1000	2000	4000	8000	
GE 2.82-127 with LNTE	92.6	97.2	98.2	100.4	103.8	102.7	95.0	76.9	108.5

4.2.6.2 Transmission Line

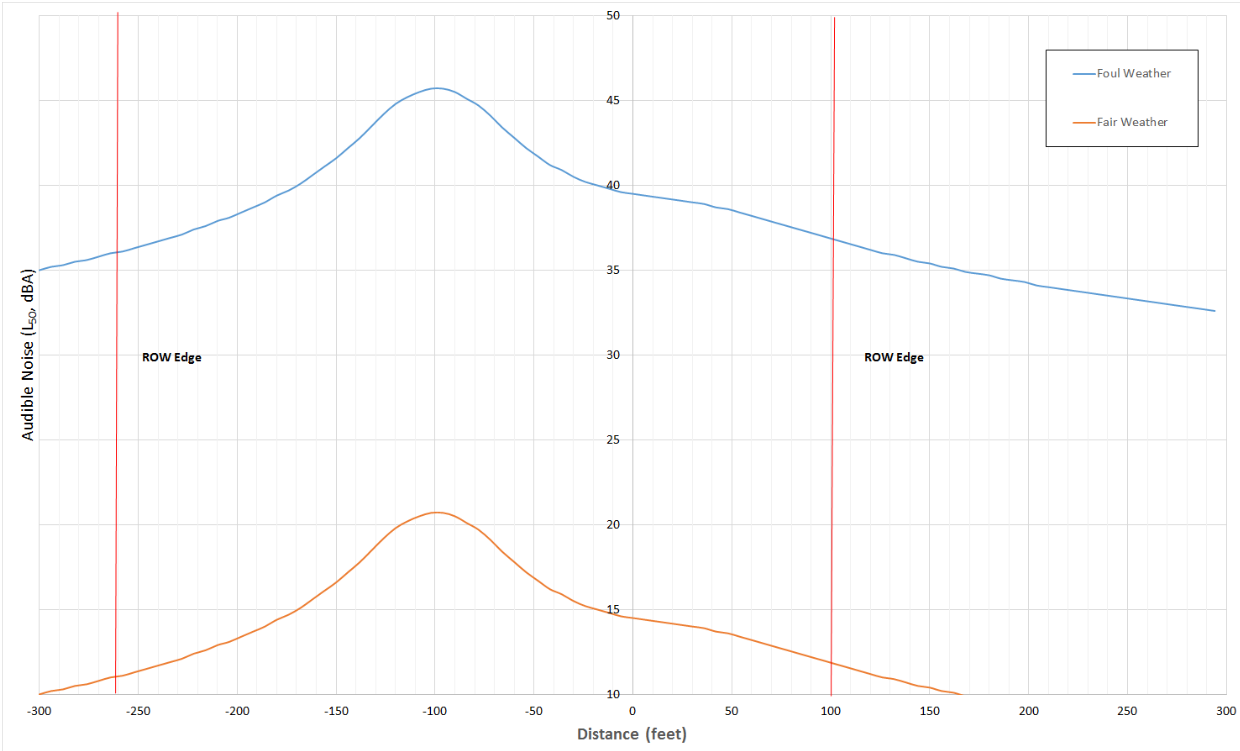
Audible noise levels associated with the transmission line is dependent upon the configuration of the transmission line. Exhibit AA provides the modeling assumptions used as inputs to Corona 3. Graphs Y-1 through Y-3 display the Corona 3 audible noise modeling results for the Facility transmission line in both fair and foul weather conditions. The transmission line is modeled in the center of a 100-foot right-of-way, which is the width anticipated, pending completion of a detailed design. The plot shows that during foul weather conditions, when more corona is generated, received sound levels attenuate to approximately 40 to 41 dBA at the edge of the right-of-way.



Graph Y-1. Audible Noise for Double-Circuit 230/115-kV Single Pole Structures



Graph Y-2. Audible Noise for Single-Circuit 230-kV H-Frame Structures



Graph Y-3. Audible Noise for Double-Circuit 230/115-kV Single Pole Structures Adjacent to Existing 230-kV H-Frame Structures

4.2.6.3 Substations

There are two on-site collection substations, which are planned as part of the Facility; one that is centrally located and one that is located in the northern portion of the site. Each substation includes one transformer and they are specified the same as three-phase transformers rated at 100/133/167 MVA with corresponding NEMA ratings of 82/84/85 dBA. For the purposes of the acoustic modeling analysis the maximum NEMA rating of 85 dBA operating under Oil Natural, Air Natural Cooling Stage 2 mode was assumed. Table Y-6 presents the transformer sound source data by octave band center frequency calculated based using the algorithms recommended by the Electric Power Plant Environmental Noise Guide (Miller et al. 1984).

Table Y-6. Substation Transformer Sound Power Level

Equipment	Octave Band Sound Power Level (dB) by Frequency (Hz)									Broadband (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
Transformer	95.0	101.0	103.0	98.0	98.0	92.0	87.0	82.0	75.0	98.4

4.2.6.4 *Battery Storage Area*

As mentioned previously, the BESS area will be located adjacent to the northern substation. It is expected that all equipment would operate during the daytime period. Reference sound power levels input to Cadna-A were provided by equipment manufacturers, based on information contained in reference documents or developed using empirical methods. The source levels used in the predictive modeling are based on estimated sound power levels that are generally deemed to be conservative. The projected operational noise levels are based on Certificate Holder-supplied sound power level data for the major sources of equipment. Table Y-7 summarizes the equipment sound power level data used as inputs to the initial modeling analysis.

Table Y-7. Modeled Octave Band Sound Power Level of BESS Equipment

Equipment	Octave Band Sound Power Level (dB) by Frequency (Hz)									Broadband (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
BESS HVAC Units (28 total)	110.7	107.7	104.7	103.2	100.7	96.7	94.2	89.2	82.7	102.7
Power Conversion Systems (14 total)	68.6	74.6	76.6	71.6	71.6	65.6	60.6	55.6	48.6	72.0
Distribution Transformers (14 total)	95.0	101.0	103.0	98.0	98.0	92.0	87.0	82.0	75.0	98.4
1. Sound source represents 5 solar panel inverters as well as the distribution transformer.										

5.0 Assessment of Compliance with Applicable Noise Regulations – OAR 345-021-0010(1)(y)(B)

OAR 345-021-0010(1)(y)(B) An analysis of the proposed facility's compliance with the applicable noise regulations in OAR 340-035-0035, including a discussion and justification of the methods and assumptions used in the analysis.

Construction activities are categorically exempted under OAR 340-35-0035(5)(g). Construction noise is short term and not expected to result in any significant long-term impacts at any NSRs. A sound contour plot displaying modeled Facility operational sound levels in color-coded isopleths is provided in Figure Y-1. The resultant noise contour plots are independent of the existing acoustic environment (i.e., are Facility-generated sound levels only). Values presented in the contour isopleths and table are downwind of the wind turbines; lower sound levels would occur in other directions.

Table Y-8 presents the results of the Facility acoustic modeling analysis and includes the feature ID, Universal Transverse Mercator (UTM) coordinates, and the received sound levels at each NSR resulting from transmission line operation, wind turbine facility operation, solar facility operation, and cumulative sound levels of the transmission line, the wind facility, and the solar facility operating simultaneously. Received sound levels are rounded to the nearest whole decimal for consistency with the Oregon Department of Environmental Quality (ODEQ) noise regulations. Modeling results indicate the Facility successfully demonstrates compliance with the applicable ODEQ 50 dBA L_{50} and with the OAR 340-035-0035(B)(iii)(III) 10 dBA ambient degradation standard at all NSRs.

5.1 Conclusions

Acoustic modeling analysis per ISO 9613-2 (ISO 1996), inclusive of a number of conservative assumptions, demonstrates that Facility operation will generate a low-level sound within the Analysis Area. The results of the acoustic analyses of the combined Facility wind turbine layout, BESS, and transmission line indicate that the Facility successfully demonstrates compliance with the applicable ODEQ 50 dBA L_{50} limit and with the OAR 340-035-0035(B)(iii)(III) 10 dBA ambient degradation standard at all NSRs.

Table Y-8. Acoustic Modeling Results Summary

NSR ID	NSR Status	UTM Coordinates (meters)		UTM Coordinates (feet)		Ambient Sound Level (dBA)	Wind Turbines with LNTE, Substations and BESS Area Sound Levels (dBA)	Transmission Line Sound Level (dBA)	Wind Turbines with LNTE, Substations and BESS Area, Transmission Line + Ambient Sound Level (dBA)	Increase Above Ambient (dBA)
		Easting	Northing	Easting	Northing					
1006	Participating	313972	5042084	1030091	16542270	26	39	15	39	13
1008	Participating	303597	5038755	996055	16531348	26	40	16	40	14
1009	Participating	321195	5059843	1053789	16600534	26	46	<1	46	20
1025	Participating	318874	5046093	1046176	16555425	26	36	32	38	12
1026	Participating	318945	5046038	1046407	16555242	26	36	31	37	11
1027	Participating	318936	5046079	1046378	16555379	26	35	31	37	11
1028	Participating	318851	5046078	1046100	16555375	26	36	33	38	12
1029	Participating	318829	5046049	1046028	16555280	26	36	33	38	12
1044	Participating	302689	5043006	993074	16545297	26	32	20	33	7
1047	Participating	302811	5043075	993474	16545521	26	31	19	32	6
1048	Participating	302821	5043009	993508	16545306	26	32	19	33	7
1069	Participating	306400	5033670	1005248	16514665	26	38	1	38	12
1070	Participating	306570	5033816	1005808	16515145	26	39	3	39	13
1076	Participating	306256	5036244	1004778	16523112	26	47	6	47	21
1079	Participating	316799	5036055	1039366	16522491	26	39	5	39	13
1083	Participating	316841	5035982	1039504	16522251	26	39	4	39	13
1084	Participating	316867	5035962	1039590	16522186	26	39	4	39	13
1093	Participating	313960	5041193	1030052	16539346	26	37	21	37	11
1094	Participating	313881	5041168	1029794	16539265	26	38	23	38	12
1096	Participating	313901	5041098	1029859	16539036	26	38	23	38	12
1114	Participating	308032	5036983	1010604	16525534	26	42	12	42	16
1189	Participating	313867	5041100	1029749	16539043	26	38	23	38	12

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6.0 Measures to Reduce Noise Levels or Impacts to Address Public Complaints – OAR 345-021-0010(1)(y)(C)

OAR 345-021-0010(1)(y)(C) Any measures the applicant proposes to reduce noise levels or noise impacts or to address public complaints about noise from the facility.

The Certificate Holder has secured the necessary noise waivers to achieve compliance with OAR 340-035-0035 at all NSRs; therefore, it is not expected that any further noise mitigation measures will be required during Facility operation.

During construction, the following mitigation measures will be considered and incorporated into the Facility's contract specifications, as necessary and appropriate, to minimize Facility noise levels to the extent practicable:

- Construction site and access road speed limits will be established and enforced during the construction period.
- Electrically-powered equipment will be used instead of pneumatic or internal combustion powered equipment, where feasible.
- Material stockpiles and mobile equipment staging, parking, and maintenance areas will be located as far as practicable from NSRs.
- The use of noise-producing signals, including horns, whistles, alarms, and bells, will be for safety warning purposes only.
- All noise-producing construction equipment and vehicles using internal combustion engines will be equipped with mufflers, air-inlet silencers where appropriate, and any other shrouds, shields, or other noise-reducing features in good operating condition that meet or exceed original factory specification. Mobile or fixed "package" equipment (e.g., arc-welders, air compressors) will be equipped with shrouds and noise control features that are readily available for that type of equipment.
- All construction noise complaints will be logged within 48 hours of issuance. The construction supervisor will have the responsibility and authority to receive and resolve noise complaints. A clear appeal process to the Certificate Holder will be established prior to the start of construction that will allow for resolution of noise problems that cannot be resolved by the site supervisor in a reasonable period of time.
- Final transformer specifications and noise warranty data will be reviewed by an acoustician to ensure compliance with OAR 340-035-0035.

7.0 Monitoring – OAR 345-021-0010(1)(y)(D)

OAR 345-021-0010(1)(y)(D) Any measures the applicant proposes to monitor noise generated by operation of the facility.

Noise monitoring is not proposed for the Facility. With the mitigation measures implemented, no exceedances of the OAR 340-035-0035 anti-degradation rule or the fixed thresholds are predicted. Additionally, the legislative authority granted to the Oregon Energy Facility Siting Council (Council) in OAR 345-026-0010(1) states that under Oregon Revised Statute 469.430, "the Council has continuing authority over the site for which a site certificate is issued and may inspect, direct the Department of Energy to inspect, or ask another state agency or local government to inspect, the site at any time to ensure that the certificate holder is operating the facility in compliance with the terms and conditions of the site certificate."

8.0 Owners of Noise Sensitive Property– OAR 345-021-0010(1)(y)(E)

OAR 345-021-0010(1)(y)(E) A list of the names and addresses of all owners of noise sensitive property, as defined in OAR 340-035-0015, within one mile of the proposed site boundary.

Confidential Attachment Y-1 provides the names and addresses, UTM Zone 11 North X and Y coordinates in meters, and a summary of modeled received sound levels at all noise sensitive properties within 1 mile of the Site Boundary (which includes the Approved Site Boundary and the Amended Site Boundary).

9.0 References

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Figures

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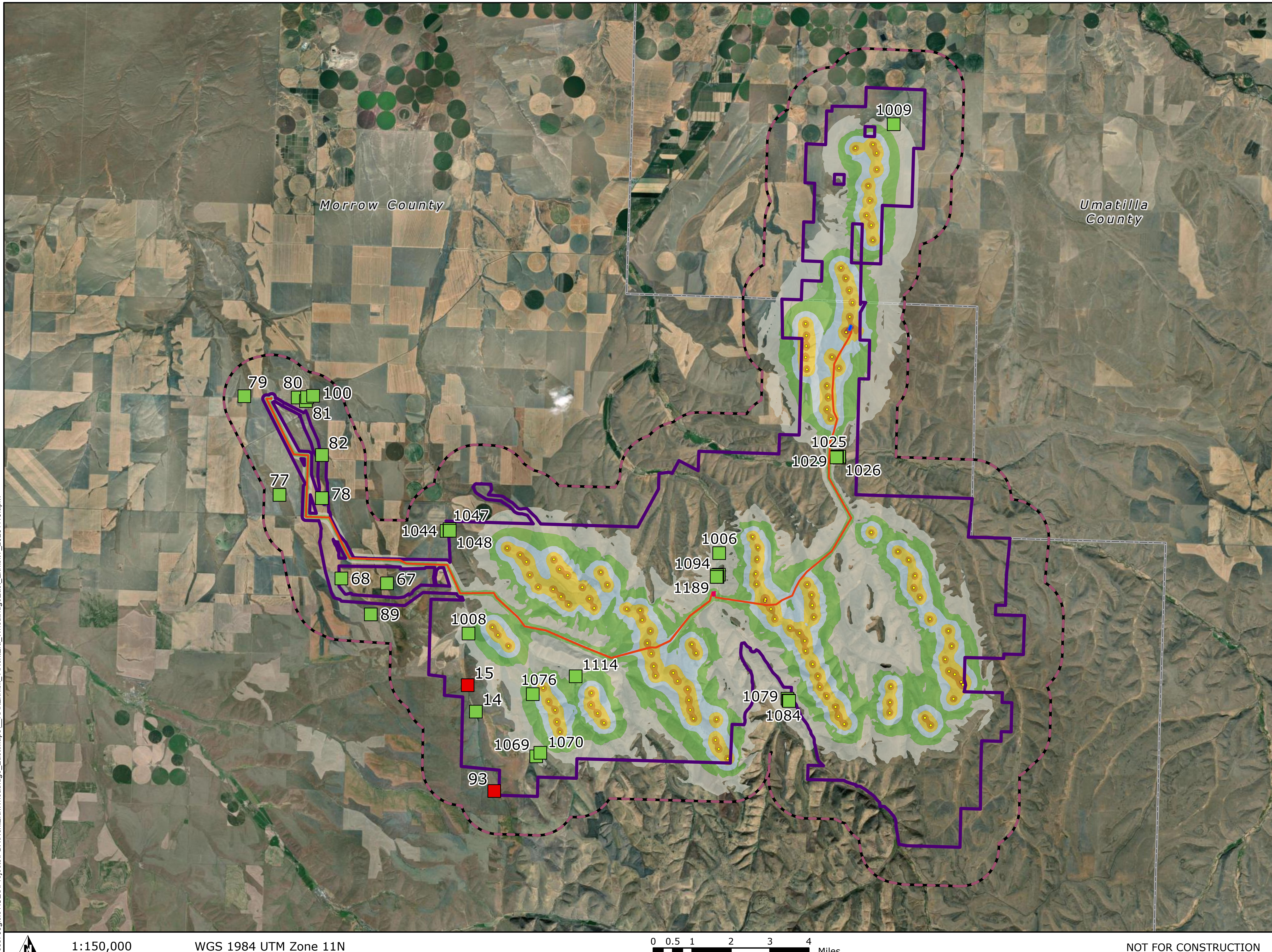
Wheatridge Renewable Energy Facility East

Figure Y-1
Operational Received Sound Levels – Wind Turbines at Maximum Rotation, Substation and BESS Area, and Transmission

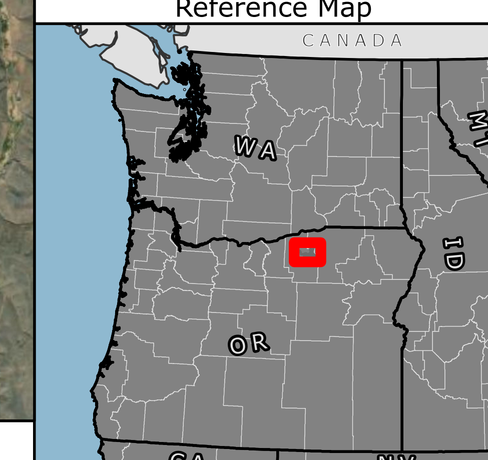
MORROW AND UMATILLA COUNTIES, OR



Amended Site Boundary
Analysis Area (1-mile buffer)
County Boundary
Turbines
Proposed Substation
Alternate Substation and Battery Storage
Transmission Line
Landowner Status
Participating
Non-Participating
Sound Level Contour (dBA)
36 - 41 dBA
41 - 46 dBA
46 - 51 dBA
51 - 56 dBA
56 - 61 dBA
61 - 66 dBA
> 66 dBA

TETRA TECH
NEXTera ENERGY RESOURCES

Reference Map



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Attachment Y-1. Tabulated Summary of Acoustic Modeling Results by Receptor Location

(Confidential, Provided under Separate Cover as an Excel File)

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