Exhibit Y

Noise

Biglow Canyon Wind Farm
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Prepared for

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Table of Contents

1.0 Introduction ... 1

1.1 Acoustic Terminology ... 2

1.2 Analysis Area ... 3

2.0 Regulatory Environment ... 3

2.1 Federal Noise Regulations ... 3

2.2 State Noise Regulations ... 3

2.2.1 Exemptions to State Noise Regulations ... 5

2.3 County and Municipal Noise Regulations ... 6

3.0 Existing Conditions ... 6

4.0 Predicted Noise Levels – OAR 345-021-0010(1)(y)(A) ... 8

4.1 Construction Noise Assessment ... 8

4.2 Operational Noise Assessment ... 9

4.2.1 Acoustic Modeling Software and Calculation Methods ... 10

4.3 Input to the Noise Prediction Model ... 11

4.3.1 Solar and Battery Energy Storage Facilities ... 11

4.3.2 Substation ... 11

4.3.3 Generation-tie Line ... 12

4.3.4 Operating BCWF ... 14

5.0 Assessment of Compliance with Applicable Noise Regulations – OAR 345-021-0010(1)(y)(B) ... 15

5.1 Cumulative Acoustic Analysis ... 17

6.0 Measures to Reduce Noise Levels or Impacts to Address Public Complaints – OAR 345-021-0010(1)(y)(C) ... 19

7.0 Monitoring – OAR 345-021-0010(1)(y)(D) ... 20

8.0 Owners of Noise Sensitive Property– OAR 345-021-0010(1)(y)(E) ... 20

9.0 References ... 20

List of Tables

Table Y-1. New Industrial and Commercial Noise Standards 4
Table Y-2. Sound Pressure Levels (L_P) and Relative Loudness 7
Table Y-3. Estimated L_{max} Sound Pressure Levels from Construction Equipment 9
Table Y-4. Modeled Octave Band Sound Power Level of Solar/BESS Equipment 11
Table Y-5. Transformer Sound Power Level 12
Table Y-6. Acoustic Modeling Results, Operation of Solar Components 16
Table Y-7. Acoustic Modeling Results, Cumulative Operation of Solar Components and BCWF 18

List of Figures

Figure Y-1. Operational Received Sound Levels

List of Attachments

Attachment Y-1. Tabulated Summary of Acoustic Modeling Results (**Confidential – provided under separate cover**)

Acronyms and Abbreviations

AC	alternating current
BCWF or Existing Facility	Biglow Canyon Wind Farm
BESS	battery energy storage system
BIGL or Project Developer	BIGL bn, LLC
CadnaA	Computer-Aided Noise Abatement
Certificate Holder or PGE	Portland General Electric Company
Council or EFSC	Oregon Energy Facility Siting Council
dB	decibel
dBA	A-weighted decibel
EPRI	Electric Power Research Institute
gen-tie	generation tie
Hz	hertz
ISO	International Organization for Standardization
L_{10}	short-term intrusive noise level
L_{50}	median sound level
L_{90}	residual sound level
L_{eq}	equivalent sound level
L_{max}	maximum sound level
L_n	statistical sound level
L_w	sound power level
MVA	megavolt ampere
MW	megawatt
NSR	noise sensitive receptor
O&M	operations and maintenance
OAR	Oregon Administrative Rule
ODEQ	Oregon Department of Environmental Quality
RFA	Request for Amendment
Solar Components	photovoltaic solar energy generation and battery storage

1.0 Introduction

The Portland General Electric Company (PGE or Certificate Holder) submits this Request for Amendment (RFA) 4 to the Site Certificate for the Biglow Canyon Wind Farm (BCWF or Existing Facility) to add photovoltaic solar energy generation and battery storage (Solar Components) to the operating BCWF.

BCWF, owned and operated by PGE, is located within an approved site boundary comprising approximately 25,000 acres, approximately 4.5 miles northeast of Wasco in Sherman County, Oregon. The BCWF operates under the Site Certificate on Amendment 3, issued October 31, 2008 (Site Certificate), from the Oregon Energy Facility Siting Council (Council or EFSC) as administered by the Oregon Department of Energy. BCWF currently consists of 217 wind turbines, with a maximum blade tip height of 445 feet, and a peak generating capacity of 450 megawatts (MW).

In RFA 4, PGE proposes to add up to 125 MW alternating current (AC) generating capacity from photovoltaic solar arrays and 125 MW in battery storage capacity (Solar Components) in approximately 1,445 acres of land (Solar Area) sited within the existing BCWF site boundary Solar Micrositing Area (RFA 4 Site Boundary[1]).

The Solar Micrositing Area is approximately 1,924 acres and provides a conservative estimate of the maximum area needed for development, micrositing, and temporary disturbances from the Solar Components during construction, rather than the anticipated temporary and permanent disturbance footprint. Within the Solar Micrositing Area, the Certificate Holder has identified a reduced footprint where Solar Components will be concentrated (Solar Area; 1,445 acres). Solar Components will include solar arrays, inverters, battery energy storage system (BESS) facilities and their subcomponents (i.e., inverters), a collector substation, approximately 600 feet of a new 230-kilovolt generation tie (gen-tie) line, medium voltage collector lines, operations and maintenance (O&M) structures, site access roads, internal roads, perimeter fencing, facility entry gates, and temporary laydown areas. The maximum generating capacity from the Solar Components will be 125 MW AC, and the infrastructure will be fenced within the Solar Micrositing Area and will cover up to 1,445 acres (Solar Area).

PGE will own and operate the Solar Components as a part of the BCWF (together, Amended Facility or Facility), which, to date, have been developed by BIGL bn, LLC (BIGL or Project Developer). BIGL, in its capacity as the project developer, supports PGE in this RFA 4 and may construct and temporarily operate the Solar Components on behalf of PGE under a Build-Transfer Agreement.

Exhibit Y provides the information required by Oregon Administrative Rules (OAR) 345-021-0010(1)(y) in support of RFA 4. The information summarized in this exhibit and described in RFA 4 demonstrate that the Facility, as proposed, can be designed, engineered, constructed, operated, and retired in a manner that satisfies the applicable Council standards. The proposed changes in RFA 4

[1] Note, as described in further detail in Section 4.1.1.2 of the RFA 4 Division 27 document, the Solar Micrositing Area is the equivalent of the RFA 4 Site Boundary.

do not alter the Certificate Holder's ability to comply with applicable Site Certificate Conditions and the approval standard in OAR 340-035-0035.

1.1 Acoustic Terminology

Airborne sound is described as the rapid fluctuation or oscillation of air pressure above and below atmospheric pressure, creating a sound wave. Sound is characterized by properties of the sound waves, which are frequency, wavelength, period, amplitude, and velocity. Noise is defined as unwanted sound. A sound source is defined by a sound power level (L_w), which is independent of any external factors. The acoustic sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts. Sound energy travels in the form of a wave, a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure. A sound pressure level is a measure of this fluctuation and can be directly determined with a microphone or calculated from information about the source sound power level and the surrounding environment through predictive acoustic modeling. While the sound power of a source is strictly a function of the total amount of acoustic energy being radiated by the source, the sound pressure levels produced by a source are a function of the distance from the source and the effective radiating area or physical size of the source. In general, the magnitude of a source's sound power level is always considerably higher than the observed sound pressure level near a source since the acoustic energy is being radiated in various directions.

Sound levels are presented on a logarithmic scale to account for the large pressure response range of the human ear and are expressed in units of decibels (dB). A dB is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing defined as 20 micropascals. Conversely, sound power is commonly referenced to 1 picowatt, which is one trillionth of a watt. Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum is often completed to determine tonal characteristics. The unit of frequency is hertz (Hz), which corresponds to the rate in cycles per second that sound pressure waves are generated. Typically, a sound frequency analysis examines 11 octave bands (or 33 1/3 octave) ranging from 20 Hz (low) to 20,000 Hz (high). This range encompasses the entire human audible frequency range. Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to represent the frequency response of the human auditory system. Sound exposure in acoustic assessments is commonly measured and calculated as A-weighted dB (dBA). Unweighted sound levels are referred to as linear. Linear dB are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise.

Sound levels can be measured, modeled, and presented in various formats. The sound metrics that were employed in the following noise assessment have the following definitions:

- L_{eq}: Conventionally expressed in dBA, the L_{eq} is the energy-averaged, A-weighted sound level for the complete time period. It is defined as the steady, continuous sound level over a specified time, which has the same total sound energy as the actual varying sound levels over the specified period.

- L_n: This descriptor identifies the sound level that is exceeded "n" percent of the time over a measurement period (e.g., L_{90} = sound level exceeded 90 percent of the time). The sound level exceeded for a small percent of the time, L_{10}, closely corresponds to short-term, higher-level, intrusive noises (such as vehicle pass-by noise near a roadway). The sound level exceeded for a large percent of the time, L_{90}, closely corresponds to continuous, lower-level background noise (such as continuous noise from a distant industrial facility). L_{50} is the level exceeded 50 percent of the time and is typically referred to the median sound level over a given period.
- L_{max}: The maximum sound level (L_{max}) can be used to quantify the maximum instantaneous sound pressure level over a given measurement period or maximum sound generated by a source.

1.2 Analysis Area

Consistent with OAR 345-027-0360(3), ODOE concurred with the Certificate Holder's use of a defined portion of the approved BCWF site boundary (i.e., Solar Micrositing Area/RFA 4 Site Boundary) to establish study area boundaries for RFA 4 under OAR 345-001-0010(35). The RFA 4 Site Boundary reflects the Solar Micrositing Area, and all study areas within the meaning of ORS 345-001-0010(35) are measured from the RFA 4 Site Boundary. The analysis area for noise impacts is defined in OAR 345-021-0010 as including those noise sensitive receptors (NSRs) within 1 mile of the RFA 4 Site Boundary. Section 2.2 below includes the definition of an NSR. Figure Y-1 shows current site conditions and NSRs located within 1 mile of the RFA 4 Site Boundary.

2.0 Regulatory Environment

This section describes the applicable noise-related requirements at the federal, state, county, and local levels. The acoustic assessment described in this exhibit is limited to that of off-site receptors and not potential on-site noise exposure as regulated by the U.S. Occupational Health and Safety Administration.

2.1 Federal Noise Regulations

There are no federal environmental noise requirements specific to RFA 4.

2.2 State Noise Regulations

The Oregon Department of Environmental Quality (ODEQ) developed OAR Chapter 340, Division 35 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.

Response: Table Y-1 gives statistical noise limits as summarized below. All limits are presented in terms of 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."[2] 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 by OAR 340-035-0015(38) 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		

The ODEQ's noise control standards for industrial and commercial sites are provided in OAR 340-035-0035, which have recently been revised. Revisions were related to the compliance assessment for solar energy facilities. One of the revisions to the ODEQ's noise control standards was that, in addition to allowing for quantifying ambient sound levels through field measurements, an assumed background sound level of 26 dBA is also allowed for solar facilities per OAR 340-035-0035(1)(b)(B)(iii)(I), which states the following:

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

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

wind or solar energy facility may conduct measurements to determine the actual ambient L10 and L50 background level.

Furthermore, the revisions permit landowner participant status to be a justifiable reason for increasing ambient sound levels by more than 10 dBA if the agreement or covenant with that landowner indicates its acceptable and authorized (per OAR 340-035-0035(1)(b)(B)(iii)(III)):

The noise levels from a wind or solar energy facility may increase the ambient statistical noise levels L10 and L50 by more than 10 dBA (but not above the limits specified in Table 8), if the person who owns the noise sensitive property executes a legally effective easement or real covenant that benefits the property on which the wind or solar energy facility is located. The easement or covenant must authorize the wind or solar energy facility to increase the ambient statistical noise levels, L10 or L50 on the sensitive property by more than 10 dBA at the appropriate measurement point.

Response: In accordance with the regulatory definitions in OAR Chapter 340 Division 35, the analysis presented in this assessment assumes that the Solar Components will constitute an industrial or commercial use located on both previously used and unused sites. Compliance will be evaluated at residences within 1 mile of the Solar Micrositing Area relative to the most stringent 50 dBA L_{50} nighttime limit described in Table Y-1. Furthermore, compliance will be evaluated relative to the ambient anti-degradation standard, which does not allow the Solar Components to increase ambient sound levels by more than 10 dBA. If the assumed background sound level of 26 dBA is selected to represent existing conditions in the Solar Micrositing Area, that essentially results in an effective sound limit of 36 dBA.

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 project 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.

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

While there are no specific quantitative noise limits for Sherman County, the county zoning ordinance defers to the ODEQ noise standards as discussed above.

3.0 Existing Conditions

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 in part due to surrounding land use and population density. Areas in proximity to major transportation corridors such as interstate highways and areas with higher population densities 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
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: Beranek (1988) and EPA (1971).			

In the past, ambient sound measurements would be collected to characterize the pre-construction ambient acoustic environment for a proposed solar energy and BESS facility in Oregon; however, now that the ODEQ's noise control standards have been revised as described in Section 2.2, a baseline ambient sound of 26 dBA can be assumed, and collection of ambient sound data is not necessary.

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

Response: Potential noise impacts associated with the construction and operation of the Solar Components are provided below.

4.1 Construction Noise Assessment

Potential noise impacts associated with construction of the Solar Components 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 Solar Components will require the use of construction equipment that may have the potential for localized sound on a temporary basis, as construction activities progress. The list of construction equipment that may be used for the Solar Components and estimates of construction sound levels are presented in Table Y-3 using a semi-qualitative approach based on equipment sound levels provided in the *Federal Highway Administration Roadway Construction Noise Model* (FHWA 2006). This equipment is also used for solar projects, so the Federal Highway Administration's sound levels are applicable to incorporate into the Solar Components. Construction activities at the Solar Components can be generally divided into five phases:

- Preparation of the site and staging areas, including grading and on-site access roads;
- Installation of array foundations, conductors, the O&M building, and the control enclosure;
- Assembly of solar panels and electrical connection components;
- Construction of the inverter pad and battery pads, substation, cabling, terminations, and transmission lines; and
- Commissioning of the array and interconnection, revegetation, and waste removal and recycling facilities.

These activities will occur sequentially for discrete groupings of solar arrays, with the potential for overlap. In addition to the solar panels, construction activities will also occur for supporting infrastructure. The inverters and distribution transformers are likely to be completed while respective solar arrays are being constructed; completion of other components, such as the O&M building, will occur independently. Transmission and collector line construction is typically completed in the following stages, but various construction activities may overlap, with multiple construction crews operating simultaneously:

- Preparing the site and site access;
- Installing structure foundations, if required;
- Erecting support structures and poles; and
- Stringing conductors, shield wire and fiber optic ground wire.

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. Table Y-3 lists the typical sound levels associated with common construction equipment at various distances. Periodically, sound levels may be higher or lower; however, the overall sound levels should generally be lower due to excess attenuation.

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

Construction Equipment	Expected Sound Level by Distance (dBA)			
	50 feet	1,000 feet	2,500 feet	5,000 feet
Bulldozer (250 to 700 horsepower [hp])	88	62	54	43
Front-end loader (6 to 15 cubic yards)	88	62	54	43
Truck (200 to 400 hp)	86	60	52	41
Grader (13- to 16-foot blade)	85	59	51	40
Shovel (2 to 5 cubic yards)	84	58	50	39
Portable generators (50 to 200 kilowatts)	84	58	50	39
Mobile crane (11 to 20 tons)	83	57	49	38
Concrete pumps (30 to 150 cubic yards)	81	55	47	36
Tractor (0.75 to 2 cubic yards)	80	54	46	35
Pile driving	101	75	68	57

Sources: Beranek 1988, FHWA 2006.
dBA = A-weighted decibel; L_{max} = maximum sound level

All reasonable efforts will be made to minimize the impact of noise resulting from construction activities. 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 excessive noise emissions.

4.2 Operational Noise Assessment

The Certificate Holder modeled noise sources from the Solar Components to demonstrate that operations will not exceed the noise levels outlined in the ODEQ Noise Rules.

4.2.1 Acoustic Modeling Software and Calculation Methods

The Solar Components acoustic analysis used DataKustik GmbH's computer-aided noise abatement program (CadnaA; DataKustik 2025). Further details pertaining to this program are given in the following subsections.

4.2.1.1 CadnaA

The acoustic modeling analysis was conducted using the most recent version of CadnaA, 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 U.S. Geological Survey digital elevation dataset to accurately represent terrain in three dimensions (USGS 2023). 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). A mixed (semi-reflective) ground factor of G=0.5 was used in the Solar Components acoustic modeling analysis and is considered standard engineering practice. 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 and is considered standard engineering practice. 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 Solar Components sound sources, 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 propagation path and increase effects of attenuation.

4.3 Input to the Noise Prediction Model

4.3.1 Solar and Battery Energy Storage Facilities

The principal sources of noise associated with the solar and BESS facilities are the BESS cooling units, the electrical components of the inverters, the step-up transformer associated with each inverter skid, and the main power transformer planned for installation as part of the Solar Components. The inverter skids and battery storage units are mounted on pads at grade level.

It is expected that all equipment will potentially operate consistently during both daytime and nighttime hours. The projected operational noise levels are based on Certificate Holder-supplied manufacturer sound power level data with representative octave band sound power level information. Table Y-4 summarizes the equipment sound power level data used as inputs to the initial modeling analysis. It is assumed that the Solar Components equipment will have similar sound power profiles as those used in the acoustic modeling analysis; however, it is possible that the final manufacturer warranty values may vary slightly.

Table Y-4. Modeled Octave Band Sound Power Level of Solar/BESS Equipment

Equipment	Octave Band Sound Power Level (dBL) by Frequency (Hz)									Broadband (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
Photovoltaic Inverter	85	85	87	86	90	81	80	88	82	92
BESS Unit and Inverter	98	91	84	81	80	81	75	70	67	84
BESS Transformer	77	83	85	80	80	74	69	64	57	80
BESS = battery energy storage system; dBA = A-weighted decibel; dBL = linear decibel; Hz = hertz; Hz = hertz										

4.3.2 Substation

The primary noise sources at the substation is the transformer, which generates 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. The Solar Components include one collector substation located inside the solar array fence line. The substation will include one step-up transformer. The transformer rating of 135 megavolt amperes (MVA) corresponds to a National Electrical Manufacturers Association rating of 81 dBA. The L_W for the substation transformer was calculated using the methodology recommended by the Electric Power Plant Environmental Noise Guide (Volume 1, 2nd edition) (Edison Electric Institute 1983). Table Y-5 presents the transformer sound source data by octave band center frequency input to the acoustic modeling analysis.

Table Y-5. Transformer Sound Power Level

Equipment	Octave Band Sound Power Level (dBL) by Frequency (Hz)									Broadband (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
135 MVA Transformer	102	108	110	105	105	99	94	89	82	106

dBA = A-weighted decibel; dBL = linear decibel; Hz = hertz; MVA = megavolt ampere

4.3.3 Generation-tie Line

Noise generated by transmission lines typically contributes little to area noise levels when compared to other common sources such as vehicles, aircraft, and agricultural and industrial sources. Transmission line sound sources will consist primarily of corona noise in addition to Aeolian noise, and noise associated with maintenance activities. Transmission line noise (also known as 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 hum or crackling. 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 Hz for a 60-Hz system). Higher harmonics (e.g., 240 Hz) may also be present, but they are generally of lower significance (Electric Power Research Institute [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 (EPRI 2015).

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.

The electrical energy will be sent to the existing Biglow Canyon Substation through the addition of a 230-kilovolt gen-tie transmission line (approximately 600 feet long) that will connect to a new 230-kV line terminal; however, it is entirely interior to the Solar Micrositing Area in close proximity to the substation transformer and BESS area. The substation transformer and BESS area sound sources are dominant relative to the gen-tie transmission line sound contribution.

4.3.4 Operating BCWF

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.

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. 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.

As discussed above, the existing operational BCWF has been active since 2007 and consists of 217 wind turbines across three phases. Phase 1 consists of 76 Vestas V82 wind turbines and Phases 2 and 3 consist of 141 Siemens SWT-2.3-93 wind turbines. The dimensions and sound power level details of those wind turbines are the following:

- **Phase 1**: 76 Vestas V82 1.65 MW (hub height [HH] = 80 meters [m], rotor diameter [RD] = 82). Maximum sound power level of 109.8 dBA warranted by the manufacturer.
- **Phase 2:** 65 Siemens SWT-2.3-93 (HH = 80 m, RD = 93). Maximum sound power level of 107 dBA warranted by the manufacturer.
- **Phase 3**: 76 Siemens SWT-2.3-93 (HH = 80 m, RD = 93). Maximum sound power level of 107 dBA warranted by the manufacturer.

Additional information pertaining to the modeling inputs used to characterize BCWF operations is provided within the application submitted as part of the Site Certificate on Amendment 3.

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.

Response: 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.

The acoustic modeling analysis evaluated simultaneous operation of all components including the proposed Solar Components (BESS facilities, substation, and gen-tie line) and the Existing Facility. Resultant received sound levels were evaluated at the closest residences (within 1 mile of the Solar Micrositing Area) relative to the applicable ODEQ noise regulations. A sound contour plot displaying modeled operational sound levels in color-coded isopleths is provided in Figure Y-1. The resultant sound contour plot is independent of the existing acoustic environment (i.e., indicates project-generated sound levels only).

Table Y-6 presents the results of the acoustic modeling analysis for the Solar Components at each identified NSR. Sound levels are rounded to the nearest whole decimal for consistency with the ODEQ noise regulations. The assumed background sound level of 26 dBA is given as well as the sound contribution from the proposed Solar Components, and the resultant combined sound level of the background in conjunction with the proposed Solar Components. The incremental increase in sound level relative to background as a result of Solar Components operations is also presented.

Modeling results indicate the Solar Components successfully demonstrate compliance with the 50 dBA L_{50} nighttime maximum permissible noise level prescribed by ODEQ and with the 10 dBA ambient degradation standard at all NSRs. It should also be noted that, based on field observations, NSR ID 6 appears to be an abandoned structure.

Table Y-6. Acoustic Modeling Results, Operation of Solar Components

NSR ID	NSR[1] Status	UTM Coordinates (meters)		Distance to Site Boundary (miles)	Background Sound Level (dBA)	Facility Noise (dBA)	Combined Noise (Background + Facility) (dBA)	Change in Noise (dBA)	Compliance with OAR 340-035-0035
		Easting	Northing						
4	Participant	685111	5056667	0.26	26	21	27	1	Yes
5	Participant	686509	5055525	0.97	26	23	28	2	Yes
6	Participant	687586	5056964	0.07	26	30	31	5	Yes
7	Participant	687777	5057680	0	26	32	33	7	Yes
8	Participant	685949	5058808	0.07	26	29	31	5	Yes
13	Participant	687384	5055418	1.04	26	21	27	1	Yes
14	Non-participant	684851	5057491	0.19	26	24	28	2	Yes

dBA = A-weighted decibel; ID = identification; NSR = noise sensitive receptor; OAR = Oregon Administrative Rules; UTM = Universal Transverse Mercator

1. Participant status of the approved BCWF and/or proposed Solar Components.

5.1 Cumulative Acoustic Analysis

In response to a request from ODOE, an additional acoustic modeling analysis was conducted evaluating cumulative sound levels for the Solar Components and the existing operational BCWF. The details of the acoustic modeling analysis and assessment of the BCWF is documented within the application submitted as part of the Site Certificate on Amendment 3. Since the locations of the NSRs and BCWF wind turbines have remained the same since that time, cumulative acoustic impacts resulting from the Solar Components operating in conjunction with the BCWF could be calculated through energetic addition. The predicted received sound levels at NSRs from the sound contributions of the Solar Components and BCWF were calculated using the following equation:

$$L_{Cumulative} = 10 \cdot log_{10}\left(10^{\left(\frac{L_{Solar}}{10}\right)} + 10^{\left(\frac{L_{BCWF}}{10}\right)}\right)$$

Where:

$L_{Cumulative}$ = Cumulative sound level from the Solar Components and BCWF (dBA)

L_{Solar} = Sound level from the Solar Components (dBA)

L_{BCWF} = Sound level from the BCWF (dBA)

Cumulative modeling results are presented in Table Y-7. Modeling results indicate the cumulative noise from the Solar Components and existing wind turbines successfully demonstrates compliance with the 50 dBA L_{50} nighttime maximum permissible noise level prescribed by ODEQ and with the 10 dBA ambient degradation standard at all non-participating NSRs and/or NSRs with an existing noise waiver in place.

Table Y-7. Acoustic Modeling Results, Cumulative Operation of Solar Components and BCWF

NSR ID	NSR[1] Status		UTM Coordinates (meters)		Background Sound Level (dBA)	Approved Wind Facility Noise (dBA)	Solar Component Noise (dBA)	Combined Noise (Background + Amended Facility) (dBA)	Change in Noise (dBA)	Compliance with OAR 340-035-0035
	Approved BCWF	Amended BCWF	Easting	Northing						
4	Participant	Non-participant	685111	5056667	26	49	21	49	23	Yes[2]
5	Participant	Participant	686509	5055525	26	49	23	49	23	Yes[2]
6	Participant	Non-participant	687586	5056964	26	48	30	48	22	Yes[2]
7	Participant	Participant	687777	5057680	26	48	32	48	22	Yes[2]
8	Participant	Non-participant	685949	5058808	26	50	29	50	24	Yes[2]
13	Participant	Participant	687384	5055418	26	47	21	47	21	Yes[2]
14	Participant	Non-participant	684851	5057491	26	50	24	50	24	Yes[2]

dBA = A-weighted decibel; ID = identification; NSR = noise sensitive receptor; OAR = Oregon Administrative Rules; UTM = Universal Transverse Mercator

1. Participant status of the approved or amended BCWF.

2. Approved BCWF existing noise easement in place.

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.

Response: The Certificate Holder has successfully demonstrated compliance with the OAR 340-035-0035 noise regulations; therefore, it is not expected that any further noise mitigation measures will be required during operation of the Facility.

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

- Confine the noisiest operation of heavy construction equipment to the daylight hours per Site Certificate Condition 89(a).
- 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 per Site Certificate Condition 89(b). 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.
- Establish a complaint response system at the construction manager's office to address noise complaints per Site Certificate Condition 89(c). Records of noise complaints during construction must be made available to authorized representatives of the Department of Energy upon request.
- 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.
- During operation, the Certificate Holder will maintain a complaint response system to address noise complaints. The Certificate Holder will notify the Department within 15 days

of receiving a complaint about noise from the facility. The notification should include the date the complaint was received, the nature of the complaint, the complainant's contact information, the location of the affected property, and any actions taken, or planned to be taken, by the certificate holder to address the complaint.

- Final equipment 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.

Response: Noise monitoring is not proposed for the Solar Components during operation. However, the legislative authority granted to the 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.

Response: Confidential Attachment Y-1 provides the names and addresses, Universal Transverse Mercator coordinates, and a summary of modeled received sound levels at all noise sensitive properties within 1 mile of the site boundary.

9.0 References

Beranek, L. 1988. Noise and Vibration Control, Chapter 7 - Sound Propagation Outdoors. Institute of Noise Control Engineering, Washington, DC.

DataKustik (DataKustik GmbH). 2025. Computer-Aided Noise Abatement Model CadnaA. MR1, Munich, Germany.

Edison Electric Institute. 1983. Electric Power Plant Environmental Noise Guide (Volume 1, 2nd edition, Report 3637. 1983 Update). Prepared by Bolt Beranek and Newman Inc.

EPA (U.S. Environmental Protection Agency). 1971. Community Noise. NTID300.3 (N-96-01 IIA-231). Prepared by Wylie Laboratories.

EPRI. 2015. The Integrated Grid – a Benefit-Cost Framework. Palo Alto, California.

FHWA (Federal Highway Administration). 2006. Federal Highway Administration Roadway Construction Noise Model User's Guide. FHWA-HEP-05-054. January 2006.

ISO (International Organization for Standardization). 1996. Standard ISO 9613-2 Acoustics – Attenuation of Sound during Propagation Outdoors. Part 2 General Method of Calculation. Geneva, Switzerland.

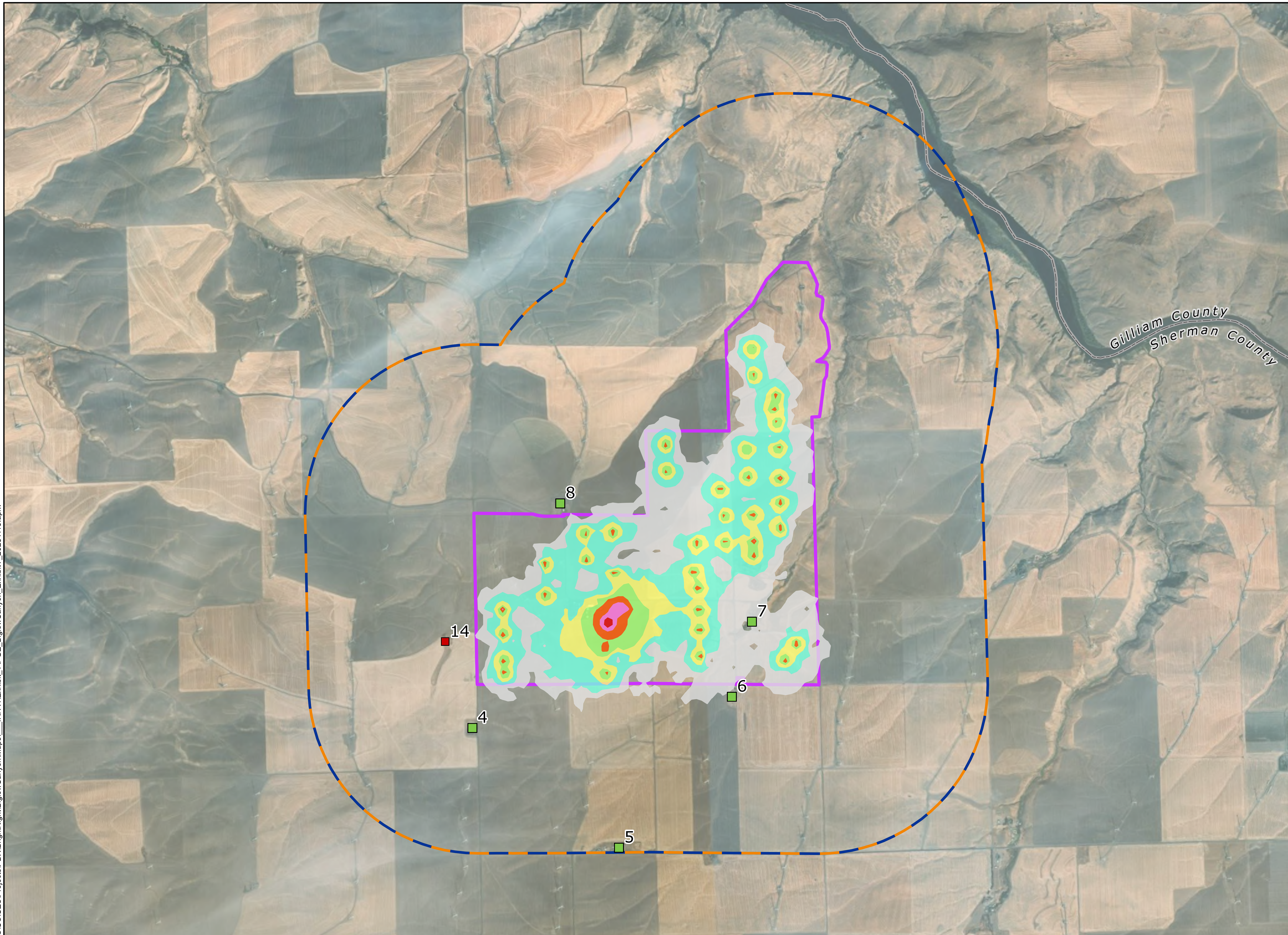
USGS (U.S. Geological Survey). 2023. National Geospatial Program, USGS National Elevation Dataset 1/3 arc-second. (Publish date unknown.)

Figures

Biglow Canyon Wind Farm Request for Amendment #4

Figure Y-1 Operational Received Sound Levels

SHERMAN COUNTY, OR



Solar Micrositing Area
Analysis Area (1-mile Buffer)
County Boundary

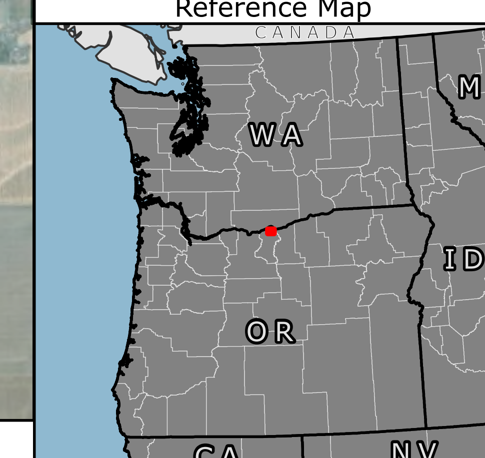
Sound Contours (dBA)
- 31-36
- 36-41
- 41-46
- 46-51
- 51-56
- 56-61
- >61

Noise Sensitive Receptor Status
- Non-participant
- Participant

TETRA TECH

PGE

Reference Map



1:35,000 WGS 1984 UTM Zone 10N

0 0.5 1 2 Miles

NOT FOR CONSTRUCTION

\\tt.local\GIS\US\CES\Projects\PDX\BrightNight\BiglowCanyon\Maps_fRFA4\Exhibit_Y\PGE_BiglowCanyon_ExhibitY_20251119.aprx

Attachment Y-1. Tabulated Summary of Acoustic Modeling Results (CONFIDENTIAL)

This attachment contains confidential information and will be provided under separate cover.