EXHIBIT X – Application for Site Certificate

NOISE

OAR 345-021-0010(1)(x)

REVIEWER CHECKLIST

(x) Exhibit X. 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:

Rule Sections	Section	✓
(A) Predicted noise levels resulting from construction and operation of the proposed facility.	X.3	
(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.	X.4	
(C) Any measures the applicant proposes to reduce noise levels or noise impacts or to address public complaints about noise from the facility.	X.5	
(D) Any measures the applicant proposes to monitor noise generated by operation of the facility.	X.6	
(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.	X.7	

EXHIBIT X – Application for Site Certificate

NOISE
OAR 345-021-0010(1)(x)

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

X.1 INTRODUCTION

Obsidian Solar Center LLC (Applicant) proposes to construct the Obsidian Solar Center (Facility) in Lake County, Oregon, with an alternating current generating capacity of up to 400 megawatts. Please refer to Exhibit B for Facility layout information and Exhibit C for Facility location information.

This exhibit provides the information required by Oregon Administrative Rules (OAR) 345-021-0010(1)(x): *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.*

As described in Exhibit B, this Application for Site Certificate analyzes the potential impacts from two design scenarios: a stand-alone photovoltaic (PV) solar power generation build-out, and a PV solar power generation plus battery storage build-out. This exhibit analyzes a layout for the PV solar power generation plus battery storage build-out scenario because it will require a larger number of noise-producing equipment during Facility operation.

Executive Summary

The evidence presented in this exhibit demonstrates that Facility construction and operation will comply with the standards provided in OAR 340-035-0035. The results of the noise analysis show that there will be no exceedances of the thresholds provided in the standards. Specifically, noise levels at all nearby noise sensitive properties are predicted to be below the maximum allowable limits for new industrial noise sources, as provided in the Oregon Department of Environmental Quality (DEQ) "Table 8" (DEQ 2018). Predicted noise level increases above existing ambient levels at noise sensitive properties are also all below the 10 A-weighted decibel (dBA) maximum allowed by the standards. The noise analysis did not include any additional attenuation for groundcover, such as trees and shrubs. Furthermore, the noise levels presented were calculated assuming wet conditions and include noise from the 115-kV transmission lines where applicable. Therefore, the noise levels presented are likely more conservative and higher than what would be expected from the actual installation. Noise levels that will be generated by this Facility—and solar PV facilities in general—are inherently low. However, to further decrease potential noise levels, Applicant will place all solar array inverter/transformer units—one of the primary potential sources of noise of this Facility—at least 500 feet from the site boundary in areas within proximity to noise sensitive properties. Applicant proposes this measure as a condition of approval for the Site Certificate.

X.2 BACKGROUND NOISE INFORMATION

Noise is measured in terms of sound pressure level. It is sometimes expressed in decibels (dB), which is a unit describing the amplitude of sound. In general, the dB scale is a logarithmic conversion of absolute air pressure to units that are more convenient and easier to understand.

To better approximate the sensitivity of the human ear to sounds of different frequencies, the A-weighted decibel scale is often used. Because the human ear is less sensitive to higher and lower frequencies, the A-weighted scale reduces the sound level contributions of these frequencies. When the A-weighted scale is used, the decibel levels are denoted as dBA. All noise levels referred to in this exhibit are stated as sound pressure levels in terms of dBA. The A-weighted scale is used in most ordinances and standards, including the applicable noise standards (OAR 340-035-0035) for this Facility.

To account for the time-varying nature of noise, the statistical noise descriptor Lxx is used in the OAR. The sound level descriptor Lxx is defined as the sound level exceeded "XX" percent of the time. For example, the L50 is the sound level exceeded 50 percent of the time. Therefore, during a 1-hour measurement, an L50 of 55 dBA means the sound level was 55 dBA or louder for 30 minutes of the hour.

Table X-1 provides typical noise levels for common noise sources. More detailed information on noise, including sample noise levels of typical sources and activities, is provided in Appendix X-1.

Table X-1 Typical Sound Levels for Common Sources (in A-Weighted Decibels)

Source/Location	Sound Level (dBA)
Threshold of Hearing	0
Motion Picture Studio–Ambient	20
Library	35
Chicago Suburbs—Nighttime Minimum	40
Wind in Deciduous Trees (2–14 mph)	3–61
Falling Rain (Variable Rainfall Rates)	41–63
Tomato Field on California Farm	44
Small Town/Quiet Suburb	47–53
Private Business Office	50
Light Traffic at 100 feet Away	50
Average Residence	50
Large Retail Store	60
Average Traffic on Street Corner	75
Inside Sports Car (50 mph)	80
Los Angeles - 0.75 Miles from Jet Landing	86

Table X-1 Typical Sound Levels for Common Sources (in A-Weighted Decibels)

Source/Location	Sound Level (dBA)
Inside New York Subway Train	95
Loud Automobile Horn (at 1 meter)	115

Source: EPA 1974; IEEE 1974; Miller 1978
Key:
dBA = A-weighted decibels
mph = miles per hour

X.3 PREDICTED NOISE LEVELS

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

Response:

X.3.1 Construction

Construction activity is exempt under OAR 340-035-0035(5)(g); therefore, this exhibit does not provide project-specific construction noise level predictions. However, to aid in the understanding of Facility construction, an analysis of construction noise is provided in Appendix X-1, and a summary of typical values is presented in Table X-2.

Table X-2 Typical Construction Noise Levels for Phases of Construction

Construction Phase	Loudest Equipment	Maximum Noise Level at 50 feet (dBA L_{max})
Clearing, grubbing, and earthwork	Bulldozer, Grader, Backhoe, Haul Trucks	88
Foundation and Base preparation for systems	Backhoe, Loader, Tractor Trailers, Crane	84
Support installation	Pneumatic impact pile drivers	94 – 101
Solar Array and Transmission Line Installation	Backhoe, Loader, Tractor Trailers, Crane	84

Source: FHWA (2006) Roadway Construction Noise Model
Key:
dBA = A-weighted decibels

X.3.2 Operation

The only noise-sensitive properties identified within approximately 1 mile of the site boundary were residential structures. Sixteen noise sensitive properties (residences) occur within 1 mile of the site boundary and one additional noise sensitive property (R-7) is about 1.1 miles from the site boundary (refer to Figure X-1). Applicant included R-7 in the analysis, even though it was outside of the 1-mile distance, because it was the closest residence at the southwest end of the site boundary. All noise sensitive properties are residences that appear to be occupied.

Table X-3 reports the predicted noise levels of Facility equipment during operation at the noise sensitive properties. Section X.4 includes a discussion and justification of the methods and assumptions used in the analysis, including a description of on-site field monitoring for existing background noise levels and the noise modeling software used to help determine compliance with the OAR 340-035-0035 standard.

Table X-3 Predicted Facility Operational Noise Levels at Noise Sensitive Properties

Noise Sensitive Properties[a]	Total Noise of Facility Equipment (dBA)[b]
R-1	33
R-2	28
R-3	30
R-4	31
R-5	31
R-6	28
R-7	22
R-8	21
R-9	23
R-10	27
R-11	28
R-12	22
R-13	23
R-14	21
R-15	27
R-16	28
R-17	28

Notes:

(a) As depicted on Figure X-1.

(b) Total noise sensitive property from all noise sources, calculated using noise modeling software SoundPlan Essential Version 4.1. Per OAR 340-35-0035(3)(b), prediction site is 25 feet from the building toward the noise source, or at a point on the noise sensitive property line that is nearest the noise source, whichever is greater.

Key:

dBA = A-weighted decibels

X.4 COMPLIANCE WITH NOISE REGULATIONS

OAR 345-021-0010(1)(x)(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.*

<u>Response</u>:

X.4.1 Methods and Assumptions Used in the Analysis

To verify compliance with the OAR 340-035-0035 standard, noise levels were predicted for the 17 representative noise sensitive properties depicted in Figure X-1 using SoundPlan Essential Version 4.1 noise modeling software and the expected operational noise levels of noise producing equipment. The calculations conducted by SoundPlan to model noise levels are based on and are compliant with the International Standards Organization (ISO) 9613-2 methods for outdoor propagation of noise sources, like those from solar facilities, wind farms, and other industrial sources. The software allows the input of geographical and topographical information and provides a true 3-D acoustical model for noise propagation. Input to the model included topographical information, the locations of primary Facility noise-producing equipment (see Table X-4 types and numbers of equipment), and locations of noise-sensitive properties within 1.1 miles of the facility.

Noise levels that will be generated by this Facility during operation—and by solar PV generating facilities in general—are inherently low. Much of the equipment that will be installed for the Facility will not produce any noise at all; however, some equipment, such as inverter/transformer units within the solar array, substation transformers, battery storage units, and the transmission line, have the potential to produce increased audible noise levels at nearby locations.

Operation noise levels for the inverter/transformer units, substation transformers, battery storage units, and transmission lines were obtained from several sources, including manufactures specifications, field measurements of similar equipment made at other existing facilities and data from other reports for similar projects, and information provided by the National Electrical Manufacturers Association ([NEMA]; 2013)(see Appendix X-1 for details). The 115-kV generation-tie (gen-tie) transmission line will potentially produce some corona noise, which can occur from electronic ionization of the air surrounding transmission lines. The level of corona noise produced is dependent on many factors, and for most small lines, like the 115-kV lines proposed, noise only occurs when there is a high level of moisture in the air. To maintain a conservative analysis and ensure that all potential impacts are identified, the analysis was performed assuming wet conditions that would result in corona noise production. Table X-4 identifies the types, numbers of, and estimated sound power levels of the noise generating equipment for the Facility during operation. Appendix X-1 provides complete details on the equipment proposed for the site and reference noise levels.

Table X-4 Operation Noise Sources and Reference Noise Levels

Equipment	Number of Units[a]	Sound Power Level (dBA)
Solar Array Invertor/Transformer[b]	159	87
Battery/Energy Storage Unit[c]	64	88
Collector Substation (34.5-kV to 115-kV)[d]	4	97
115 kV Transmission Line[e]	1	46
Step-up Substation (115-kV to 500-kV)[f]	1	105

Note:

a. Number of each type of noise-producing unit included in SoundPlan modeling.

b. Based on Power Electronics FS3000M Specification of < 79 dBA at 3 feet (see Attachment B Representative Equipment Specifications).

c. Based on General Electric Battery/Energy Storage Unit Specifications of <60 dBA at 3 meters (see Attachment B Representative Equipment Specifications). Audible noise may be produced by cooling systems and transformers.

d. Based on sound power level for a typical solar collector 35.5-kV to 115-kV power transformer of 97 dBA.(Boardman Solar Energy Facility 2017, Carty Generating Station 2018).

e. Based on typical corona noise levels provided in Appendix AA-1 of Exhibit AA of this Application for Site Certificate of: < 15 dBA for wet conditions at 50 feet and 0 dBA for dry conditions at 50 feet; for this analysis, the sound power of 46 dBA is based on the worst case level of 15 dBA at 50 feet.

f. Based on sound power level for a typical 115-kV to 500-kV step-up transformer of 97 to 105 dBA; the higher 105 dBA level was used to assure a conservative analysis (Carty Generating Station 2011)

Distances from the noise sources to each of the 17 representative noise sensitive properties were measured using computer-aided drafting (CAD) software with calibrated aerial photo overlays. All noise sensitive properties are approximately 1,000 feet or more from the site boundary in Area A, which will house the solar array inverter/transformer units, battery storage units, and up to four collector substations.

Noise sensitive properties are more than 2,500 feet from Area D, which will house the 115-to-500-kV step-up substation; and more than 200 feet from the 115-kV gen-tie transmission line corridor (refer to Figure X-1). Refer to Figure 1 in Appendix X-1 for the representative location of inverters use for the predicted noise calculations.

No additional attenuation was assumed for groundcover shielding, such as from trees or shrubs. In addition, the noise levels presented were calculated assuming wet conditions and include noise from the 115-kV transmission lines where applicable. Therefore, the noise levels presented are likely slightly higher than what would be expected from the actual installation. The results of the predicted noise calculations for Facility equipment are provided in Table X-3 and Table X-7 (refer to the “Total Noise of Facility Equipment” columns).

X.4.2 Ambient Noise Monitoring

To verify that the noise level increases at noise sensitive properties will comply with the standard, it was necessary to obtain existing ambient noise levels in the area surrounding the Facility site. Ambient noise refers to the existing background composite of noise from all sources near and far, as measured at a given location. To accomplish this, on-site noise monitoring was performed at two representative sites (see Figure X-1). The noise monitoring was performed on July 5 through July 7, 2018, using two noise monitoring systems and measuring at both sites simultaneously. Measurements were taken for at least 48 hours at each site. Weather was clear, and there was no precipitation during the measurement period. Site M-1 is near a cluster of residences located between Area D and the solar array in Area A, and was used to represent noise sensitive properties R-1 through R-7. Site M-2 is north of the solar array in Area A and was used to represent noise sensitive properties R-8 through R-17. Monitoring site M-2 is in an area with fewer residences and lower traffic volumes than monitoring site M-1. All measurement procedures complied with the procedures adopted and set forth in the *Sound Measurement Procedures Manual (NPCS-1)* (DEQ 1983). Table X-5 provides the minimum hourly L10 and L50 for each site over the 48-hour measurement period. Refer to Appendix X-1 for further details regarding methods and results of the ambient noise monitoring.

Table X-5 Lowest Measured Background Noise Levels

Monitoring Site	L10	L50
M-1	30	28
M-2	22	20

Note: Additional details for measured noise levels, see Appendix X-1
Key:
L10 = sound level exceeded 10 percent of the time
L50 = sound level exceeded 50 percent of the time

X.4.3 Compliance

Compliance with the OAR 340-035-0035 standard was determined using two criteria. The standard requires that no new industrial or commercial operational noise source located on a previously unused industrial or commercial site may:

- Exceed the levels specified in Table 8 (DEQ 2018), as measured at an appropriate measurement point, or
- Increase the ambient statistical noise levels, L10 or L50, by more than 10 dBA in any one hour, as measured at an appropriate measurement point.

The first step in determining compliance with the standard was to compare the predicted noise levels of Facility operational equipment at noise sensitive properties (Tables X-3 and X-7) with the maximum allowable noise levels for New Industrial and Commercial Noise Source in DEQ's "Table 8," which are reported here in Table X-6.

The most stringent noise level thresholds in the standard are L50 levels of 55 dBA for daytime hours and 50 dBA for nighttime hours (Table X-6). The predicted noise levels at the noise sensitive properties are all well below the thresholds and range from 21 to 33 dBA (Tables X-3 and X-7). Therefore, Facility operation will comply with this portion of the standard.

Table X-6 New Industrial and Commercial Noise Source Standards

Statistical Descriptor	Daytime (7 am to 10 pm) (dBA)	Night (10 pm to 7 am) (dBA)
L1	75	60
L10	60	55
L50	55	50

Source: OAR 340-035-0035 Table 8.

Key:
dBA = A-weighted decibels
L1 = sound level exceeded 1 percent of the time
L10 = sound level exceeded 10 percent of the time
L50 = sound level exceeded 50 percent of the time

The second step in determining compliance with the standard was to verify compliance with the maximum allowable increase of 10 dBA above ambient statistical noise level criterion for the L10 and L50 noise level descriptors. Estimated ambient noise levels at each of the noise sensitive properties are provided in Table X-7 (refer to the "Existing Background L50" column). Refer to Appendix X-1 for further details on recorded noise levels.

Table X-7 was prepared using the L50 ambient measured noise levels reported in Table X-5, and the Facility equipment noise level predictions from Table X-3, to summarize compliance with the 10 dBA maximum increase above ambient levels portion of the standard. Table X-7 provides the logarithmical sums of the measured minimum L50 noise levels (see the "Existing Background L50" column) and the predicted noise levels from operational equipment (see the "Total Noise of Facility Equipment" column) to arrive at the predicted total future noise levels (see the "Combined Noise" column).

To determine the potential change in noise levels above the existing ambient noise levels, the "Existing Background" values are subtracted from the "Combined Noise" values. Note that the L50 thresholds were selected for this analysis because they are the most stringent and most likely to result in non-compliance with the standard. As shown in Table X-7, predicted noise levels at all noise sensitive properties have L50 increases of 9 dBA or less; therefore, the future level are within the allowable 10 dBA increase from OAR 345-035-0035. Facility operations will comply with this portion of the standard.

Given the relatively flat topography within the site boundary and the surrounding areas, it is reasonable to presume that noise levels at properties farther away from the site boundary than the noise sensitive properties that were evaluated will also meet the OAR standard for operational noise.

Table X-7 Noise Level Compliance Summary

Noise Sensitive Property	Existing Background (ambient) L50 (dBA)[(a)]	Total Noise of Facility Equipment (dBA)[(b)]	Combined Noise (Background + Total Noise of Facility Equipment, dBA)[(c)]	Total Change in L50 Noise (dBA)[(d)]	Compliance with OAR 340-035-0035 Standard
R-1	28	33	34	+6	Yes
R-2	28	28	31	+3	Yes
R-3	28	30	32	+4	Yes
R-4	28	31	33	+5	Yes
R-5	28	31	33	+5	Yes
R-6	28	28	31	+3	Yes
R-7	28	22	29	+1	Yes
R-8	20	21	24	+4	Yes
R-9	20	23	25	+5	Yes
R-10	20	27	28	+8	Yes
R-11	20	28	29	+9	Yes
R-12	20	22	24	+4	Yes
R-13	20	23	25	+5	Yes
R-14	20	21	24	+4	Yes
R-15	20	27	28	+8	Yes
R-16	20	28	29	+9	Yes
R-17	20	28	29	+9	Yes

Notes:

(a) Background measured noise level: L50, using minimum M-1 for R-1 through R-7 and M-3 for R-8 through R-17.
(b) Total Noise from Facility operation equipment at noise sensitive properties, as reported in Table X-3.
(c) Total noise, background and Facility operations, predicted by logarithmically summing the background noise and Facility operational noise.
(d) Change in total noise at noise sensitive properties.

Key:

dBA = A-weighted decibels

L50 = sound level exceeded 50 percent of the time

OAR = Oregon Administrative Rules

X.5 PROPOSED NOISE REDUCTION MEASURES

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

<u>Response</u>:

Applicant's noise analysis demonstrates that operation of the Facility will comply with all applicable regulatory requirements of the OAR 345-035-0035 standard. Primarily, this is due to the inherently low noise levels associated with solar PV technology. In addition, Applicant is proposing the following measure designed specifically to further reduce noise produced by the Facility operation:

- Inverter/transformer unit set-back: inverter/transformers within the solar array will be placed at least 500 feet from the site boundary in areas in proximity to noise sensitive properties to increase the distance between the noise source and noise sensitive properties, resulting in lower overall noise levels outside of the site boundary.

As stated earlier, it is also important to note that this analysis was performed with no additional attenuation for groundcover, topographical shielding, or shielding from battery storage containers or the solar array systems. Furthermore, the noise predictions included the wet conditions for corona noise from the 115-kV gen-tie transmission line. Based on these factors, the predicted noise levels presented in this exhibit are likely more conservative and higher than what will occur during the actual Facility operation. Therefore, no additional noise reduction measures are necessary for operation of the Facility.

X.6 MONITORING NOISE DURING OPERATIONS

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

Response:

Given the low noise level predictions, on-site noise monitoring for compliance of the noise standard should not be required. The predicted noise levels of Facility operational equipment at the nearest noise sensitive properties range from 21 to 33 dBA. Noise levels of this magnitude are extremely low, and they are not expected to increase the existing ambient L50 by more than +1 to +9 dBA, with typical maximum operational noise levels of 21 to 33 dBA. Noise levels of 21 to 33 dBA are typically only found in very rural areas with little or no traffic, quiet libraries, and recording studios (see Table X-1).

X.7 NOISE-SENSITIVE PROPERTY OWNERS

OAR 345-021-0010(1)(x)(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: Table X-8 provides property information for all owners of noise sensitive properties within 1 mile of the site boundary along with R-7, located 1.1 miles from the site boundary.

Table X-8 Noise Sensitive Property Owners

Noise Sensitive Property Number (as shown on Figure X-1)	Map and Tax Lot	Owner Name	Owner Address	City	State	ZIP
R-1	26S15E000003200	Fine Troy D & Roberta K	83394 Connley Lane	Silver Lake	OR	97638
R-2	26S16E000005500	Forman Shane & Jacey	83136 Connley Lane	Silver Lake	OR	97638
R-3, R-4	26S16E000005300	Fine Harold L & Judy	83391 Connley Ln	Silver Lake	OR	97638
R-5	26S16E000005700	Fine Troy D & Roberta K	83394 Connley Lane	Silver Lake	OR	97638
R-6	26S16E000005601	Forman Shane & Jacey	83136 Connley Lane	Silver Lake	OR	97638
R-7	26S16E00007400	G & J Hanson Farms LLC	PO Box 69	Fort Rock	OR	97735
R-8	26S16E000001300	Runels Scott L & Margie B	PO Box 39	Fort Rock	OR	97735
R-9	26S16E000000900	Runels Scott L & Margie B	PO Box 39	Fort Rock	OR	97735
R-10	26S16E000001801	Stevenson John B & Joyce	PO Box 437	Christmas Valley	OR	97641
R-11	26S16E000002707	Runels Scott L & Margie B	PO Box 39	Fort Rock	OR	97735
R-12	26S16E000003400	Mauney Dennis & Pamela	PO Box 1031	Ferndale	CA	95536
R-13	26S16E000003500	Mauney Dennis & Pamela	PO Box 1031	Ferndale	CA	95536
R-14	26S16E000003800	Beasley Jesse Lee	2422 Lara CT.	Medford	OR	97504
R-15	26S16E000004401	Horton Leeroy & Nancy B	PO Box 784	Christmas Valley	OR	97641
R-16	26S16E000004400	Hogan David L & Rita F	2614 1ST St.	Tillamook	OR	97141
R-17	26S16E000002705	Horton Trust	PO Box 784	Christmas Valley	OR	97641

X.8 REFERENCES

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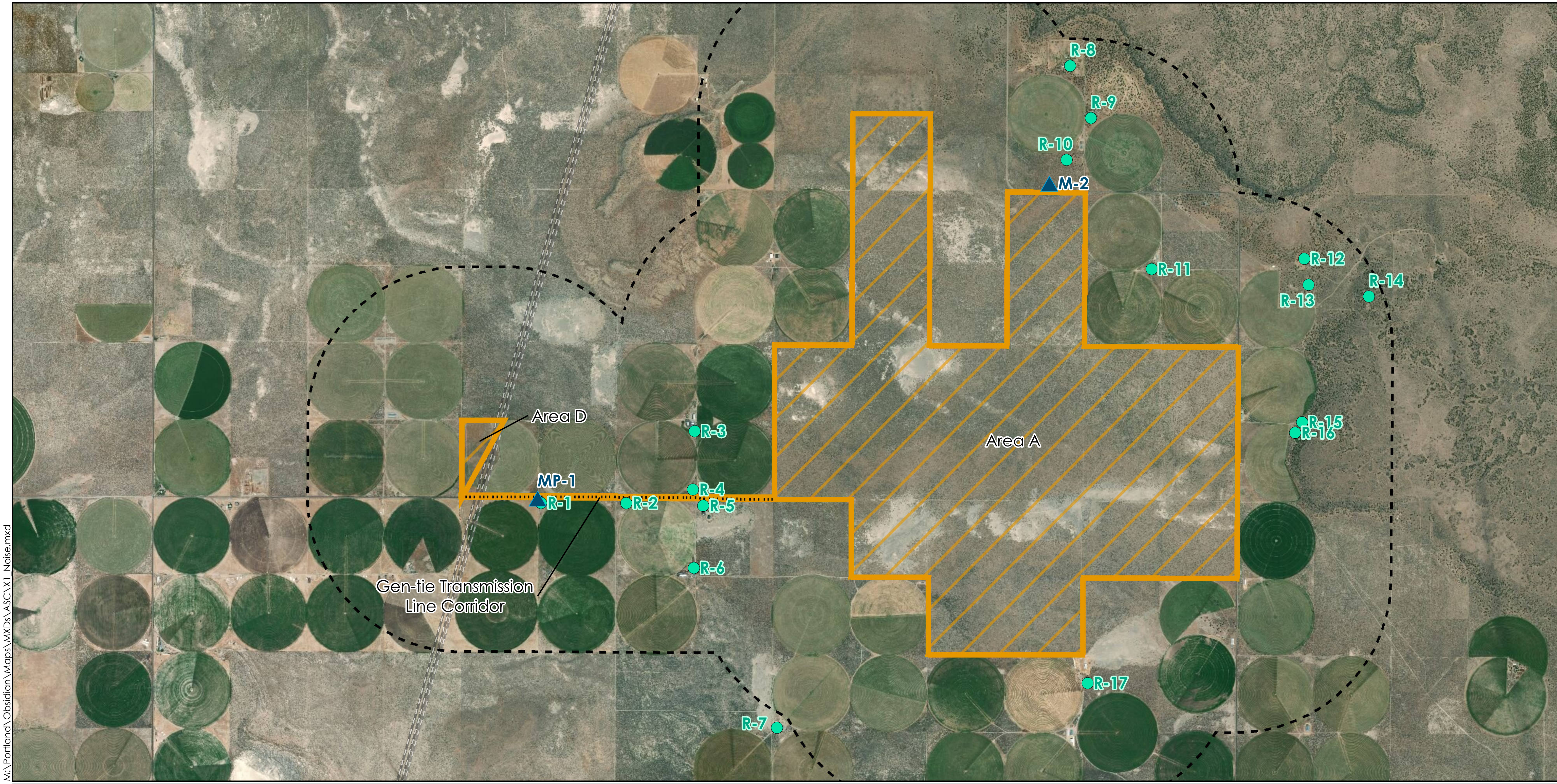

- Noise Sensitive Property (residence)
- Noise Monitoring Locations
- Gen-tie Transmission Line
- Site Boundary
- 1-Mile Buffer
- Bonneville Power Administration Transmission Line (500kV)
- PGE Transmission Line (500kV)

0 1 2 Miles

0 1 2 Kilometers

N

Figure X-1
Noise Sensitive Properties

Obsidian Solar Center

September 2018

Obsidian Solar Center LLC

Sources: Esri 2018

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Appendix X-1
Noise Study

Noise Analysis

Obsidian Solar Center

March 11, 2019

Prepared by:

Michael Minor & Associates
Portland, Oregon

Contents

Tables

Figures

Attachments

1. Introduction

This noise analysis was prepared at the request of Obsidian Solar Center LLC and its environmental consultant, Ecology and Environment, Inc. Obsidian Solar Center LLC proposes to construct the Obsidian Solar Center (the facility) in Lake County, Oregon. This report was prepared to demonstrate compliance with the Oregon Department of Environmental Quality (DEQ) noise regulations in OAR 340-035-0035. This report provides an analysis of noise emissions from the proposed facility during operation and compares them to the allowable limits in OAR 340-035-0035 to demonstrate compliance with DEQ regulations and the Oregon Energy Facility Siting Council (EFSC) requirements related to noise in OAR 345-021-0010(1).

1.1. Project Description

Obsidian Solar Center LLC proposes a photovoltaic (PV) solar power generation facility and related or supporting facilities located in Lake County, Oregon. The facility will consist of up to approximately 4,000 acres and provide a nominal alternating current generating capacity of up to 400 megawatts. This analysis is for the proposed full build-out of the PV modules and battery storage layout option (with battery enclosures dispersed across the facility).

Figure 1 provides a facility location overview. More information on facility construction and operation, locations of noise producing equipment, and locations of noise sensitive properties are provided in the following sections.

1.2. Introduction to Noise

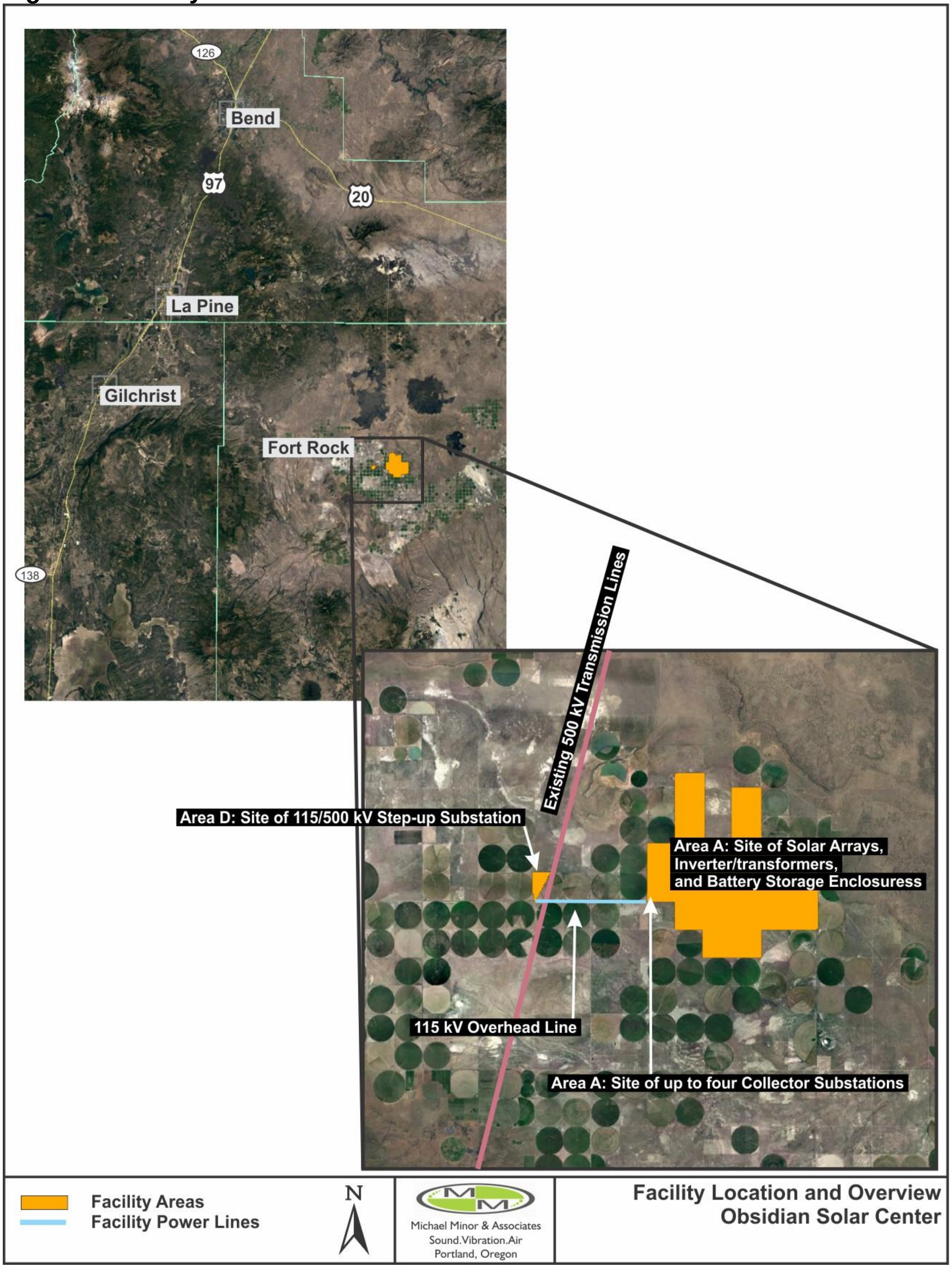
The human response to sound is subjective and can vary greatly from person to person. Factors that can influence individual response include the loudness, frequency, amount of background noise present, and nature of the work or activity (e.g., sleeping) and time. When sounds become unpleasant, or are unwanted, we tend to classify them as noise.

Noise is measured in terms of sound pressure level. It is expressed in decibels (dB), which are defined as 10 log P^2/P^2ref, where P is the root-mean-square (RMS) sound pressure and P_{ref} is the reference RMS sound pressure of 2 x 10^{-5} Newton per square meter. In general, the dB scale is a logarithmic conversion of absolute air pressure to units that are more convenient and easier to understand.

To better approximate the sensitivity of the human ear to sounds of different frequencies, the A-weighted decibel scale was developed. Because the human ear is less sensitive to higher and lower frequencies, the A-weighted scale reduces the sound level contributions of these frequencies. When the A-weighted scale is used, the decibel levels are denoted as dBA.

All noise levels referred to in this report are stated as sound pressure levels in terms of decibels on the A-scale (dBA). The A-scale is used in most ordinances and standards, including the applicable standards for this facility.

Figure 1. Facility Location and Overview



A 10-dBA increase in noise levels is judged by most people as a doubling of sound level. The smallest change in noise level that a human ear can perceive is about 3 dBA, and increases of 5 dBA or more are clearly noticeable. Normal conversation ranges between 44 and 65 dBA when speakers are 3 to 6 feet apart. Noise levels in a quiet rural area at night are typically between 30 and 35 dBA. Quiet urban nighttime noise levels range from 40 to 50 dBA. Noise levels during the day in a noisy urban area are frequently as high as 70 to 80 dBA. Noise levels above 110 dBA become intolerable and then painful, while levels higher than 80 dBA over continuous periods can result in hearing loss. Table 1 provides a scale of common noise sources and typical public responses.

Table 1. Sound Levels and Relative Loudness of Typical Noise Sources

Noise Source or Activity	Sound Level (dBA)	Subjective Impression	Relative Loudness (human judgment of different sound levels)
Jet aircraft takeoff from carrier (50 feet)	140	Threshold of pain	64 times as loud
50-hp siren (100 feet)	130		32 times as loud
Loud rock concert near stage, Jet takeoff (200 feet)	120	Uncomfortably loud	16 times as loud
Float plane takeoff (100 feet)	110		8 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Heavy truck or motorcycle (25 feet)	90		2 times as loud
Garbage disposal, food blender (2 feet), Pneumatic drill (50 feet)	**80**	**Moderately loud**	**Reference loudness**
Vacuum cleaner (10 feet), Passenger car at 65 mph (25 feet)	70		1/2 as loud
Large store air-conditioning unit (20 feet)	60		1/4 as loud
Light auto traffic (100 feet)	50	Quiet	1/8 as loud
Bedroom or quiet living room, Bird calls	40		1/16 as loud
Quiet library, soft whisper (15 feet)	30	Very quiet	
High quality recording studio	20		
Acoustic Test Chamber	10	Just audible	
	0	Threshold of hearing	

Sources: Beranek (1988) and EPA (1971)

1.3. Noise Level Descriptors

To account for the time-varying nature of noise, several noise metrics are useful. Commonly used noise descriptors include the Lmax, Lmin, Leq, and Lxx. The Lmax and Lmin are the greatest and smallest RMS (root-mean-square) sound levels, in dBA, measured during a specified measurement period. The equivalent sound pressure level (Leq) is defined as the average noise level, on an energy basis, for a stated time period (for example, hourly).

The sound level descriptor Lxx is defined as the sound level exceeded "XX" percent of the time. This description is one of the main noise level descriptors applicable to this facility, and is used in the DEQ noise regulations.

Three common examples of the Lxx include:

- L01: The sound level exceeded 1 percent of the time. This is a measure of the loudest sound levels during the measurement period. Example: During a 1-hour measurement, an L1 of 75 dBA means the sound level was 75 dBA or louder for 0.6 minutes, or 36 seconds.
- L10: The sound level exceeded 10 percent of the time. This is a measure of the louder sound levels during the measurement period. Example: During a 1-hour measurement, an L10 of 60 dBA means the sound level was 60 dBA or louder for 6 minutes.
- L50: The sound level exceeded 50 percent of the time. Example: During a 1-hour measurement, an L50 of 55 dBA means the sound level was 55 dBA or louder for 30 minutes.

1.4. Decibel Mathematics

An important factor to recognize is that noise is measured on a decibel scale, and combining two noises is not achieved by simple addition. For example, combining two 60 dB noises does not give 120 dB (which is near the pain threshold), but yields 63 dB which is lower than the volume at which most people listen to their televisions. For reference, if two noise sources are 10 dB apart, for example, 50 dB and 60 dB, the sum of the two noise levels will simply be the louder of the two, in this case 60 dB. This is to say that for similar noise sources that are 10 dB apart in magnitude, a person would only be able to hear the louder of the two sources.

Examples of simplified decibel addition, based on the difference between the two levels, are provided below for reference, as they will aid in the understanding of the facility noise impact analysis.

Difference between the two noise sources	Amount added to the higher of the two noise levels
0 to 1 dB	3 dB
2 to 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0 dB

2. Regulations

Regulations applicable to the operation of the proposed facility are taken from the DEQ Noise Control Regulations in OAR 340-35-0035, and EFSC requirements related to noise in OAR 345-021-0010(1).

2.1. Oregon DEQ Noise Control Regulations

DEQ Noise Control Regulations are applicable at noise sensitive properties. OAR 340-35-0015(38) defines a noise-sensitive property as property normally used for sleeping (e.g., residences) and also includes properties used for schools, churches, hospitals, or public libraries. Industrial or agricultural property use is not considered noise sensitive unless it includes one or more of the noise sensitive buildings described above.

The regulations are applicable at appropriate measurement locations. The appropriate measurements location on a noise sensitive property is defined in OAR 340-35-0035(3)(b), and is the farthest of the following two points:

1. Twenty-five feet toward the noise source from that point on the noise sensitive building that is nearest to the noise source; or
2. The point on the noise sensitive property line that is nearest the noise source.

The primary applicable noise regulation used for this analysis are taken from OAR 340-035-0035(1)(b)(B)(i*),* which states: *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, L10 or L50, by more than 10 dBA in any one hour, or exceed the levels specified below in Table 8, as measured at an appropriate measurement point, as specified in subsection (3)(b) of this rule* . The appropriate measuring points are defined above. Table 2 provides the levels specified in "Table 8" from the DEQ regulations.

Table 2. DEQ New Industrial and Commercial Noise Source Standards

Statistical Descriptor	New Noise Source (dBA)	
	7 am – 10 pm	10 pm – 7 am
L1	75	60
L10	60	55
L50	55	50

Source: OAR 340-035-0035, Table 8.

OAR 340-035-0035 further limits existing industrial noise sources that can be described as impact or impulse noise (e.g., blasting) as well as audible discrete tones or tonal noise. Impulse sounds are limited to 100 dB, peak response, between the hours of 7 am and 10 pm and 80 dB, peak response, between the hours of 10 pm and 7 am Tonal noise limits are established based on allowable octave band sound pressure levels in the range of frequencies between 31.5 and 8,000 hertz (Hz) as shown in Table 3.

Table 3. DEQ Median Octave Band Standards for Industrial and Commercial Noise Sources

Octave Band Center Frequency, Hertz (Hz)	Allowable Octave Band Sound Pressure Levels (dB)	
	7 am – 10 pm	10 pm – 7 am
31.5	68	65
63	65	62
125	61	56
250	55	50
500	52	46
1000	49	43
2000	46	40
4000	43	37
8000	40	34

Source: OAR 340-035-0035, Table 10.

Warning devices are exempt from OAR 340-035-0035 if not continuously operated for more than 5 minutes. Noise from construction sites and sounds created during construction or maintenance of capital equipment are also exempt from the OAR noise regulations.

2.2. EFSC Regulations Related to Noise

EFSC regulations related to noise in OAR 345-021-0010(1)(l) and (t) pertain to impacts on areas that meet EFSC criteria for protected areas and important recreational opportunities, respectively. OAR 345-021-0010(1)(l) requires information about the proposed facility's impact on nearby protected areas, providing evidence to support a finding by the Council as required by OAR 345-022-0040, including a description of significant potential impacts from noise resulting from facility construction or operation of the proposed facility, if any. OAR 345-021-0010(1)(t) requires information about the proposed facility's impact on nearby important recreational opportunities, providing evidence to support a finding by the Council as required by OAR 345-022-0100. Under both standards, EFSC must find that the design, construction and operation of a facility, taking into account mitigation, are not likely to result in a significant adverse impact on protected areas and important recreational opportunities. Unlike DEQ's standard, which does not apply to construction phase activities, EFSC's standards apply to both construction and operation.

3. Existing Conditions

The land use in the area is mainly undeveloped and farm lands. The facility area was investigated using aerial photos and on-site inspections, and 17 residential structures were identified within approximately 1 mile of the facility. Some residences identified are located on farm lands and are associated with farm operations. Per OAR 340-035-0015(38), these are evaluated as noise sensitive properties.

There are few existing noise sources in this area. Some of the major noise sources include farming activities, including tractors, irrigation and general maintenance, infrequent traffic along the area roadways, wildlife, and wind. Due to the close proximity of some noise sensitive properties to the proposed facility, existing ambient noise monitoring was conducted to establish the existing noise environment, with the purpose of demonstrating compliance with the allowable increase criteria provided in OAR 340-035-0035(1)(b)(B)(i).

3.1. Existing Ambient Noise Levels

Monitoring was conducted to establish the existing ambient noise levels in the study area to assure compliance with the allowable 10 dB increase in the L10 and L50 criteria. Previous studies for similar solar facilities have rarely identified non-compliances with the DEQ standards due to the inherently low noise levels from typical solar PV system operation. For this analysis, the study area included the areas up to 1.1 miles from the facility boundary, which includes all noise sensitive properties within 1 mile, and also the nearest noise sensitive properties southwest of the site boundary (1.1 miles away).

Two sites were selected for ambient noise monitoring: sites M-1 and M-2. Site M-1 is near a cluster of residences located just east of the solar array and west of the existing 500-kilovolt (kV) transmission line. Due to the limited number of residences, and very low volumes of traffic, site M-1 is representative of all residences in this immediate area. Site M-2 is to the north of the solar array, in an area with even fewer residences and lower traffic volumes than the area of M-1. This monitoring site was used to represent residences in the north and east sections of the study area.

Equipment used for the noise measurements were Bruel & Kjaer Type 2238 sound level meters. The sound level meters meet or exceed American National Standards Institute (ANSI) S1.4-1983 for Type 1 Sound Measurement Devices. All measurement procedures complied with those procedures adopted by the Commission and set forth in Sound Measurement Procedures Manual (NPCS-1) from the DEQ, and more recent methods from the ANSI procedures for community noise measurements. System calibration was performed before and after each measurement session with a Bruel & Kjaer Type 4231 sound level calibrator. The meters are calibrated by an accredited laboratory on an annual basis. The noise monitoring was performed on July 5 through July 7, 2018, using three systems, and performing monitoring at all three sites simultaneously. Weather was clear, and there was no precipitation during the measurement period.

Figure 2 provides an overview of the facility showing the locations of facility related equipment, noise sensitive properties (residences), and the two noise monitoring sites. Figures 3 and 4 provide photos of the monitoring equipment placement.

Figure 2. Facility Layout, Residences and Noise Monitoring LocationsFigure 3. Photos of Monitoring Site M-1

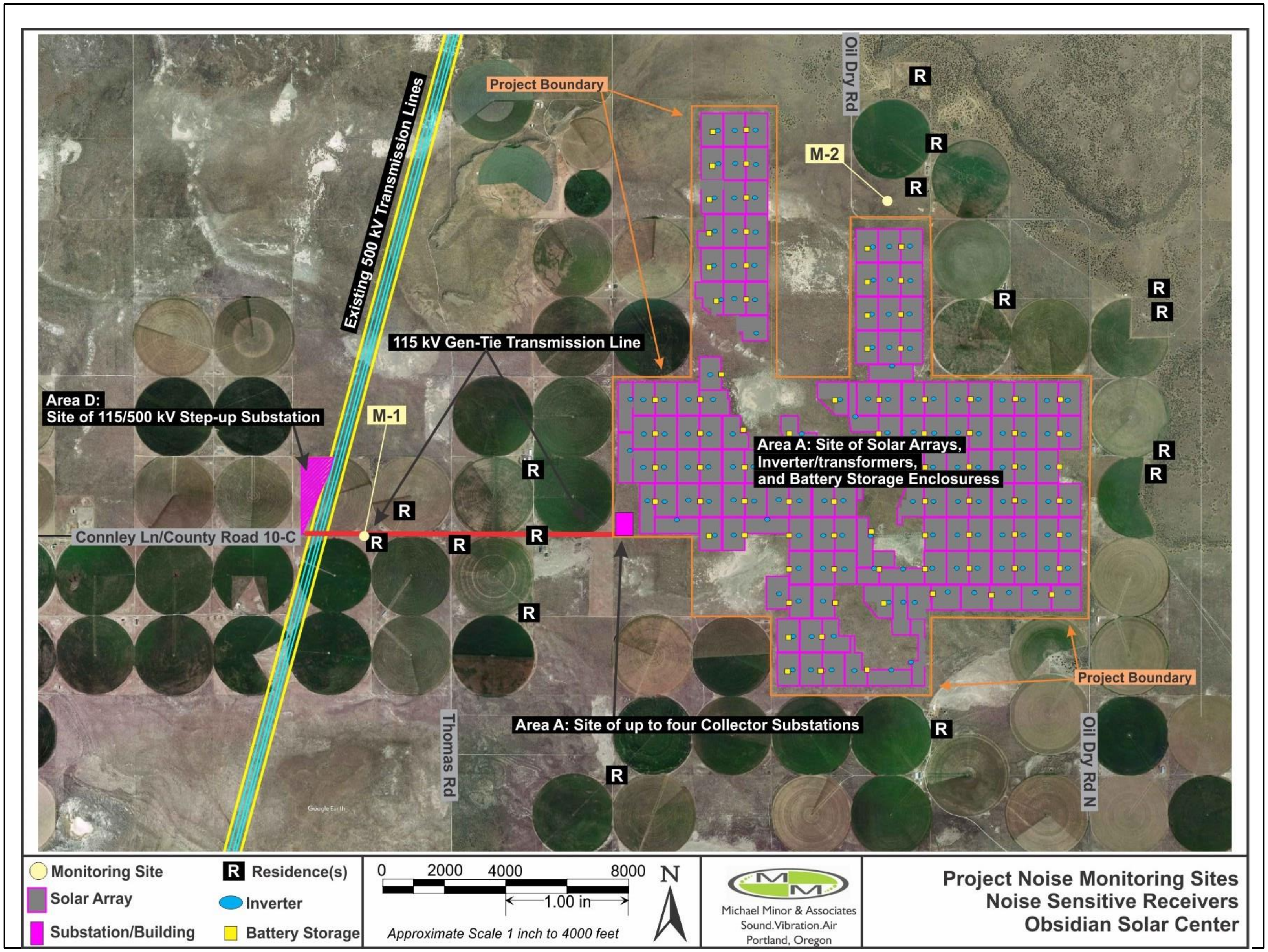


Figure 4. Photos of Monitoring Site M-2

Photo 1: Aerial View

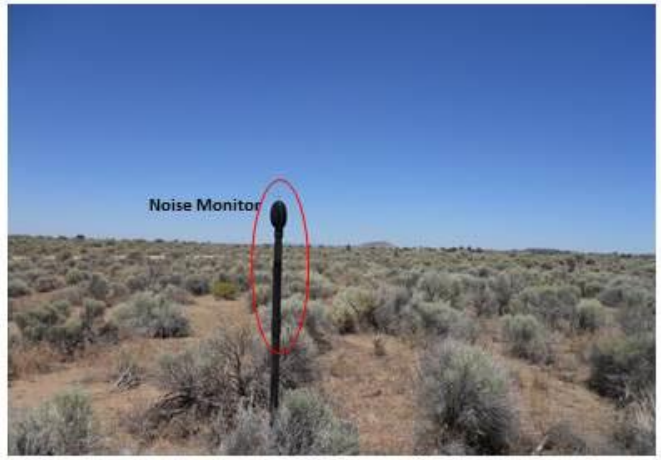


Photo 2: Looking North West

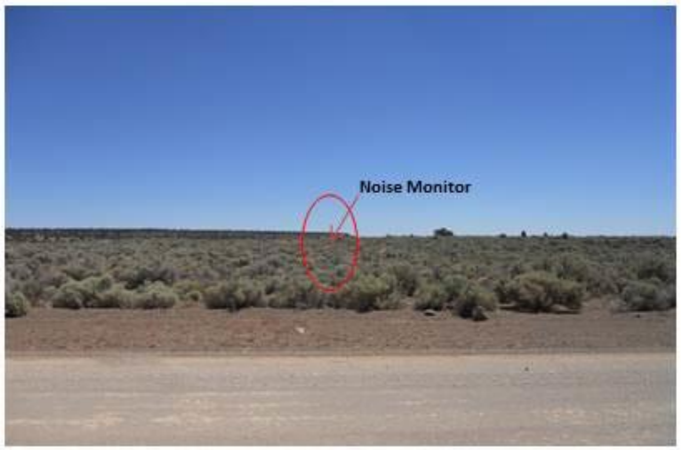


Photo 3: Looking North (from roadway)

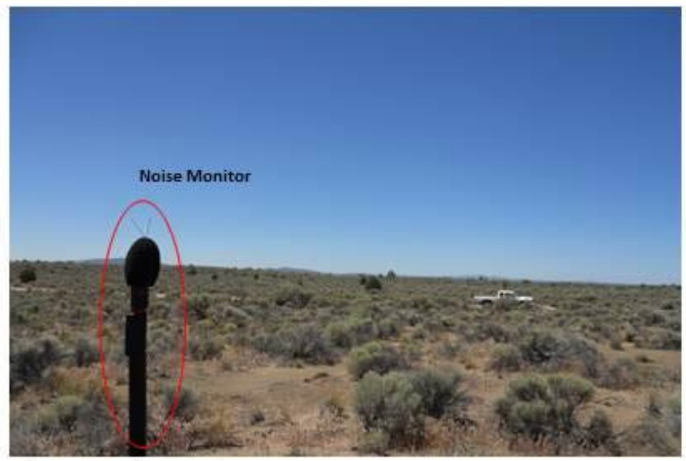


Photo 4: Looking South

Monitoring Location M-2
Oil Dry Rn N at County Road 5-12

Michael Minor & Associates
Sound.Vibration.Air
Portland, Oregon

Noise Monitoring Site Photos
Obsidian Solar Center

The overall measured L10 from both sites ranged 20 to 54 dBA, while the L50 ranged from 20 to 47 dBA. The average measured L10 was 38 dBA and the average L50 was 32 dBA. These are very low noise levels, and are found only in very rural areas far away from any arterial roadways, highways or other main transportation noise source, commercial or industrial land use.

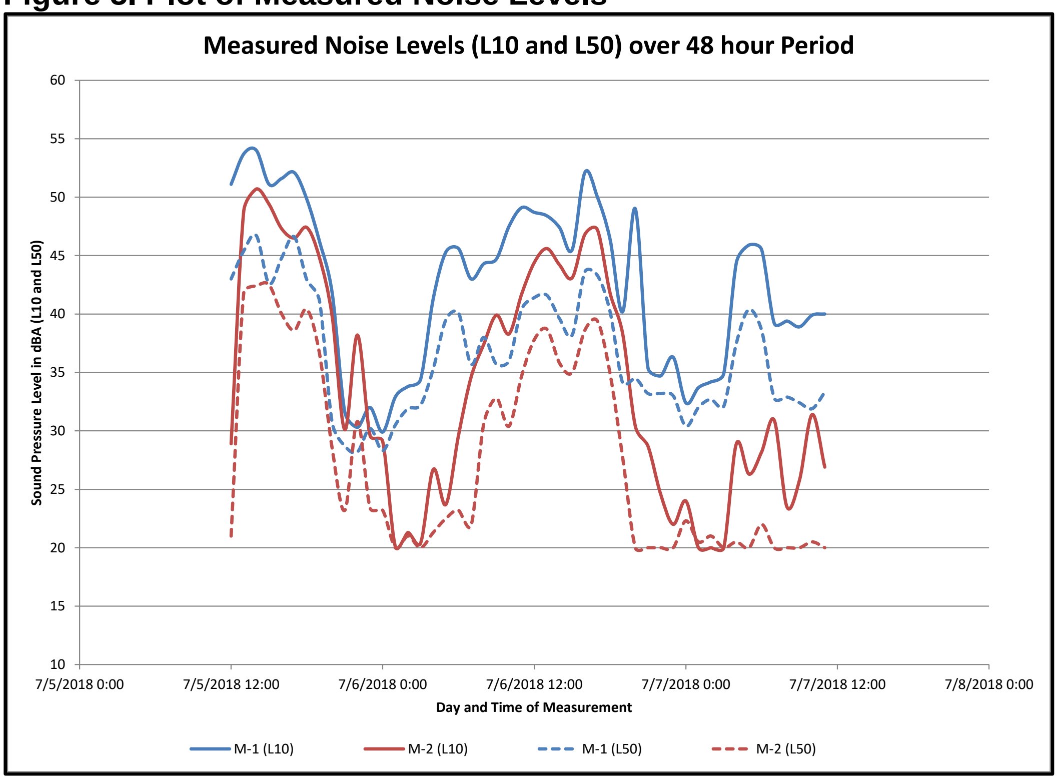
Noise levels measured at site M-1 ranged from 30 to 54 dBA L10, with an average L10 of 42 dBA. The L50 at M-1 ranged from 28 to 47 dBA, with an average of 37 dBA. Noise levels measured at site M-2 ranged from 20 to 51 dBA L10, with an average L10 of 34 dBA. The L50 at M-1 ranged from 20 to 43 dBA, with an average of 28 dBA. Table 4 provides the minimum (lowest) L10 and L50 values taken over the measurement period. Figure 5 is a plot of the L10 and L50 as measured over the 48 hours period. Tables with the complete L10, L50 and Leq measurements are provided in Attachment C for reference.

Table 4. Summary of Measured Minimum Background Noise Levels

Monitoring Site	L10 (dBA)	L50 (dBA)
M-1	30	28
M-2	22	20

Note: Measured noise levels are provided in Attachment C.

Figure 5. Plot of Measured Noise Levels



4. Facility Operation Equipment and Analysis Methods

There are several different pieces of equipment required for the operation of this type of facility. Much of the equipment will not produce any noise; however, some equipment, including inverters, transformers, battery/energy storage units, and transmissions lines have the potential to produce noise that could be noticeable over short distances off-site. Table 5 lists the sound power levels representing the standard performance of each of these components. The sound power levels are assigned based either on data supplied by manufacturers, or field measurements of similar equipment made at other existing facilities and data from other similar reports, including Boardman Solar Energy Facility (2017) and Carty Generating Station (2011 and 2018). Finally, the reference noise levels were reviewed against product design information found in the technical literature provided by the National Electrical Manufacturers Association ([NEMA]; 2013): *TR-1 2013, Transformers, Step Voltage Regulators and Reactors*. These sound power levels are used as a basis for the noise modeling as described in Section 5.

Table 5. Operation Noise Sources and Reference Noise Levels

Equipment	Number of Units[a]	Sound Power Level (dBA)
Solar Array Invertor/Transformer[b]	159	87
Battery/Energy Storage Unit[c]	64	88
Collector Substation (34.5-kV to 115-kV)[d]	4	97
115 kV Transmission Line[e]	1	46
Step-up Substation (115-kV to 500-kV)[f]	1	105

Note:

a. Number of each type of noise-producing unit included in SoundPlan modeling.
b. Based on Power Electronics FS3000M Specification of < 79 dBA at 3 feet (see Attachment B Representative Equipment Specifications).
c. Based on General Electric Battery/Energy Storage Unit Specifications of <60 dBA at 3 meters (see Attachment B Representative Equipment Specifications).
d. Based on sound power level for a typical solar collector 35.5-kV to 115-kV power transformer of 97 dBA.(Boardman Solar Energy Facility 2017, Carty Generating Station 2018).
e. Based on typical corona noise levels provided in Appendix AA-1 of Exhibit AA of this Application for Site Certificate of: < 15 dBA for wet conditions at 50 feet and 0 dBA for dry conditions at 50 feet; for this analysis, the sound power of 46 dBA is based on the worst case level of 15 dBA at 50 feet.
f. Based on sound power level for a typical 115-kV to 500-kV step-up transformer of 97 to 105 dBA; the higher 105 dBA level was used to assure a conservative analysis (Carty Generating Station 2011)

4.1. Noise Emitting Facility Equipment

The sections below provide more detailed descriptions of the types of equipment that would produce noise during normal facility operations.

4.1.1. Inverter/Transformer Units in the Solar Array

The facility will use Power Electronics FS3000M or similar solar inverter units with integrated transformers to convert from direct current to alternating current and then step it up to 34.5-kV within the solar array for transmission to the collector substations. The FS3000M units will also provide a two way connection with the battery storage units, charging the units with excess power and providing power back to the grid as needed. Manufacturer specifications for a solar inverter and integrated transformer with the required capacity, the Power Electronics FS3000M, report 79 dBA at 3 feet from the unit, which is equivalent to a sound power level of 87 dBA. These units would be located throughout Area A, as shown in Figure 2. Manufacturer specifications for the Power Electronics FS3000M are provided in Attachment B.

4.1.2. Battery/Energy Storage Units

The battery/energy storage units, similar to the RSU-4000 series produced by General Electric, will be used to store unused energy during daytime hours for power production during nighttime hours and other hours when power supply may be desired. The units consist of a set of batteries connected to a solar inverter/transformer unit described above, and have cooling systems and transformers that produce some audible noise. Manufacturer specifications for a representative General Electric RSU-4000 Energy Storage Unit list the typical sound level of > 60 dBA at 3 meters (approximately 10 feet), resulting in a probable maximum sound power level of 88 dBA. These units would be located throughout Area A, as shown in Figure 2. Specification for a General Electric RSU-4000 Energy Storage Unit and battery storage systems are provided in Attachment B.

4.1.3. Collector Substation Transformers (34.5-kV to 115-kV)

Four collector substations with transformers that would be located in the southwestern portion of Area A (see Figure 2), will be used to combine the energy from the solar arrays and step-up the voltage from 34.5-kV to 115-kV. Typical sound power levels from these types of collector transformer systems range from 94 to 97 dBA (Boardman Solar Energy Facility 2017, Carty Generating Station 2018). For this analysis, a sound power level of 97 dBA was used for each of the four collector substation transformers.

4.1.4. 115-kV Gen-tie Transmission Line

A 115-kV above ground generation tie (gen-tie) transmission line will transmit power from the four collector substations west to the 115-kV to 500-kV step-up substation. The 115-kV gen-tie transmission line can, under the right conditions, produce corona noise. Corona noise can occur from electronic ionization of the air surrounding transmission lines. The level of corona noise produced is dependent on many factors, and for most small lines, like the 115-kV lines proposed, noise only occurs when there is a high level of moisture in the air. For a transmission line of this configuration and voltage, the corona noise under dry conditions is typically not measurable, and under the wet conditions is typically less than 15 dBA. To be conservative, the 115-kV line was included in this analysis assuming a potential line noise source generation of 15 dBA at 50 feet.

4.1.5. Step-Up Substation Transformer (115-kV to 500-kV)

The power will be increased from 115-kV to 500-kV using a transformer at the step-up substation near the western end of the gen-tie transmission line. Based on measured levels and published data, the typical sound power level from these types of step-up transformer systems range from 97 to 105 dBA (Carty Generating Station 2011). For this analysis, a potential sound power level of 105 dBA was used for the step-up substation transformer.

4.1.6. Variance of Operation Equipment

Noise levels that will be generated by this facility during operation—and by solar PV generating facilities in general—are inherently low. As described, the primary noise producing equipment includes inverters, transformers, equipment used to operate and cool batteries, and in rare cases, the gen-tie transmission lines. The equipment sound power levels used in this analysis are all the maximum levels provided in manufacture specifications or found in other similar studies. Due to this, the analysis results are likely slightly higher than would actually be measured at a facility like the Obsidian Solar Center during normal operation. The resulting overall potential variance in the noise predictions is +0 dB and -2 dB or more (i.e., the levels will be no higher, but could be up to 2 dB or lower). This represents a conservative analysis of operational noise levels.

4.2. Other Noise Sources

In addition to the noise sources above, facility personnel will visit the site to perform routine maintenance and service the systems. Sources of noise will include service vehicles on public roadways and small hand tools used for equipment and service. Noise from these visits would occur infrequently and is not predicted to result in any measurable increase in the overall noise emitted from the site.

The 500-kV transmission lines that cross the facility (see Figure 2), as well as a 115-kV transmission line that parallels that gen-tie transmission line/Connley Lane, are existing noise sources. The level of energy provided by the solar facility would not be predicted to result in any increase in corona noise from the 500-kV or 115-kV lines; therefore, these lines were not included as noise sources in the analysis. However, noise from the 500-kV lines and any other existing transmission line and energy related noise sources would be included in the background noise level measurements taken near the site and provided in Section 3.

5. Noise Modeling

This section provides a summary of the methods and software used to predict the operational noise levels from the Obsidian Solar Facility.

5.1. Modeling Methods

Noise modeling was performed using SoundPlan Noise Modeling Software (Essential Version 4.1). The calculations conducted by SoundPlan to model noise levels are based on and are compliant with the International Standards Organization (ISO) 9613-2 methods for outdoor propagation of noise sources, like those from solar facilities, wind farms, and other industrial sources. The software allows the input of geographical and topographical information and provides a true 3-D acoustical model for noise propagation. Input to the model included topographical information from Google Earth, computer-aided drafting (CAD) information for the locations of facility equipment (transformers, inverters, and battery/energy storage units from Table 5), and locations of noise sensitive properties within 1.1-miles of the facility, which were identified using aerial images and from site visits.

Operational noise levels were predicted at 17 representative noise sensitive properties, including all that are within 1 mile of the site boundary, and one that is 1.1 miles from the site boundary. Noise sensitive property R-7, located at 1.1 miles from the facility, was included because it is the nearest residence on the southwest side of the proposed area of the facility with solar modules (i.e., Area A). All noise sensitive properties are residences that appear to be occupied.

The locations of these noise sensitive properties are depicted in Figure 6. The figure also depicts representative locations of the solar array inverters (with integrated transformers), battery/energy storage units, the 115-kV gen-tie transmission line, the four collector substations, the 500-kV step-up transformer and existing 500 kV transmission lines.

Additional noise modeling was performed for the closest "protected area" (as defined by OAR-345-021-0010(1)(l) and "important recreational opportunity" (as defined by OAR-345-021-0010(1)(t). The closest area to the facility meeting these definitions is the Devil's Garden Lava Bed, a natural area located approximately 4 miles north of the facility that is managed by the Bureau of Land Management. The additional modeling site was placed on the border of the Devil's Garden Lava Bed that is nearest to the Obsidian Solar Center facility.

Finally, the modeling software produced noise contour maps that cover an area large enough to include all areas where noise levels from facility operation equipment are equal to or lower than the lowest measured ambient noise levels of 20 dBA.

The combination of the predicted noise levels at all individual noise sensitive properties (residences) within 1.1 miles, noise level predictions at the Devil's Garden lava Bed, and production of noise contour maps provide a comprehensive analysis of potential operational noise from the facility.

This analysis also assumes the facility will be in constant operation, with power transmission during nighttime hours from the battery storage. This assumption was made because the lowest L50 noise levels were measured during nighttime and very early morning hours, during which time the solar panels will not produce any energy (see Attachment C). By assuming the batteries will discharge during these quiet periods, compliance can be confirmed during those periods with the lowest measured L50 noise levels. Also, because the analysis assumes constant facility operations, the L10 and L50 of noise generated from the site will be the same. This method also supports a "worst-case" analysis, as it is unlikely that all systems would be operating at capacity during nighttime hours.

5.2. Modeling Results

Table 6 reports the predicted noise levels of facility equipment during operation at the noise sensitive properties. Modeled noise levels for residences located to the west of the solar array, represented by noise sensitive properties R-1 through R-7, ranged from 22 to 33 dBA. The average noise levels among these seven noise sensitive properties were 29 dBA. Noise sensitive properties R-1, R-4, and R-5 have the highest predicted noise levels in this part of the study area due to the close proximity to the 115-kV to 500-kV step-up substation transformer for (R-1) and the set of four 34.5-kV to 115-kV collector substations (for R-4 and R-5). Receiver R-7 has the lowest predicted noise level in this part of the study area, and is also located farthest overall from the solar array, inverter/transformer units, batteries/storage, substations, and gen-tie transmission line.

Modeled noise levels for residences located to the east of the solar array, represented by noise sensitive properties R-8 through R-17, ranged from 21 to 28 dBA. The average noise level among these ten noise sensitive properties was 25 dBA. For the noise sensitive properties in this part of the study area, R-11, R-16, and R-17 have the highest predicted noise levels due to the close proximity to the nearby solar array invertor/transformer units and battery storage units. The lowest noise levels in this area were at receiver R-8 and R-14, which are farthest from the solar arrays in this part of the study area.

Figure 6. Noise Modeling Locations

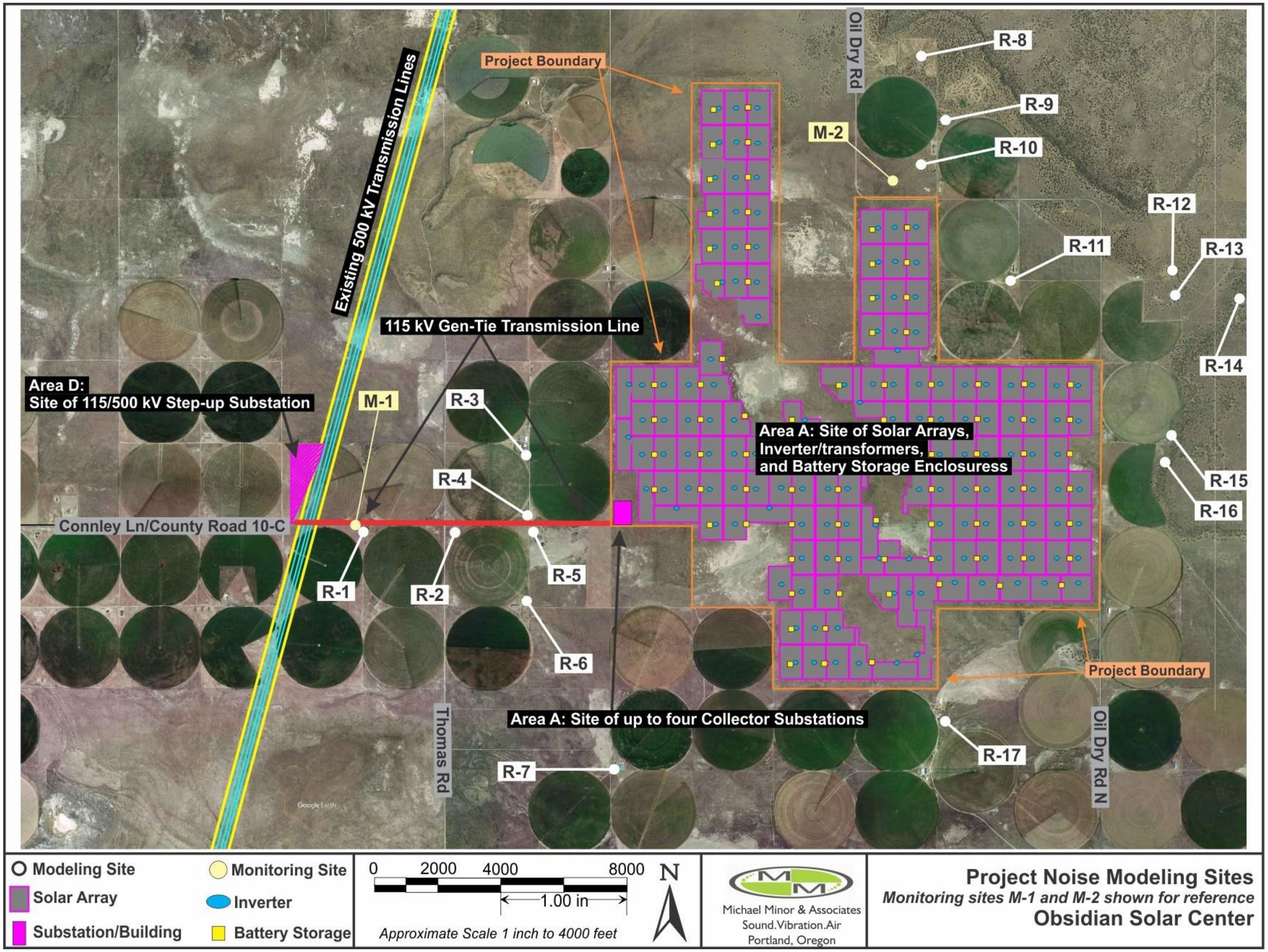


Table 6. Predicted Facility Operational Noise Levels at Noise Sensitive Properties

Noise Sensitive Properties[a]	Total Noise of Facility Equipment (dBA)[b]
R-1	33
R-2	28
R-3	30
R-4	31
R-5	31
R-6	28
R-7	22
R-8	21
R-9	23
R-10	27
R-11	28
R-12	22
R-13	23
R-14	21
R-15	27
R-16	28
R-17	28

Note:

a. As depicted in Figure 6.

b. Total noise from all noise sources calculated using SoundPlan. Per OAR 340-35-0035(3)(b), prediction site is 25 feet from the building toward the noise source, or at a point on the noise sensitive property line that is nearest the noise source, whichever is greater. SoundPlan outputs provided in Attachment D

It is important to note the overall noise levels predicted at the noise sensitive properties of 21 to 33 dBA is very low, and is comparable to the lowest background noise levels in very quiet rural areas. For comparisons, noise levels of 30 to 35 dBA are typical for the interior of a very quiet library, and noise levels of 20 to 30 dBA would typically only be found in a high-quality recording studio.

Computer outputs of the SoundPlan model are provided in Attachment D. Included in this attachment are sound levels at each of the 17 individual noise sensitive property locations (Figure D-1) and a plot of noise level contours from 20 dBA (background ambient) to 50 dBA in 5 dB increments plotted on an aerial background of the proposed facility and surrounding area (Figure D-2).

6. Compliance Analysis

To determine facility compliance with the OAR 340-035-0035 standards, two analyses are required. First, the noise levels from normal facility operation as reported in Table 6 need to be compared to the maximum allowable limits for a new industrial and commercial land use, as reported in Table 2. Therefore, the noise levels from the facility must be below 55 dBA during daytime hours and below 50 dBA during nighttime hours.

Second, the overall combined future noise levels, which is the existing noise levels plus the noise from facility operations, must be calculated to determine compliance with the maximum allowable increase of 10 dB over the existing L10 and L50 ambient noise levels.

Descriptions of these analyses are provided in Sections 6.1 for the facility noise levels and 6.2 for the overall future noise levels.

6.1. Maximum Allowable Noise Level Criteria

The predicted total noise levels of facility operations equipment at the noise sensitive properties range from 21 to 33 dBA (see Table 6). The most stringent criterion provided in the OAR standard is an L50 of 50 dBA during nighttime hours (Table 2). Because the most conservative combined predicted noise level at a noise sensitive property is 33 dBA (at R-1, see Table 6), the proposed facility will be in compliance with this portion of the OAR standard.

6.2. Maximum Allowable Noise Increase Criteria

In basic terms, to determine compliance with the 10 dBA maximum increase above ambient noise criterion, the predicted noise level data were “logarithmically summed” with the measured background noise level data to arrive at the combined noise levels (decibel mathematics is discussed in Section 1.4 for reference). Specifically, the measured existing background noise levels were subtracted from the combined noise levels to determine the increase above the ambient noise level. To be in compliance, this total must be 10 dBA or less above the measured background data. Table 7 provides the results of these calculations and provides compliance results.

Table 7 was produced using the L50 ambient measured noise levels reported in Table 4. The measured noise levels in Table 4 are for the hour with the lowest L50. Because the measured L50 levels are lower than the L10 levels at both monitoring sites, using the L50 levels is the most conservative method of analysis. Noise sensitive properties R-1 through R-7 used background data from M-2, and noise sensitive properties R-8 through R-17 use background data from M-2. The facility operational noise levels used for these calculations are taken from Table 6.

Table 7. Noise Level Compliance Summary					
Noise Sensitive Property[a]	Existing Background L50 (dBA)[b]	Total Noise of Facility Equipment (dBA)[c]	Combined Noise (Background + Total Noise of Facility Equipment, dBA)[d]	Total Change in L50 Noise (dBA)[e]	Compliance with OAR 340-035-0035 Standard
R-1	28	33	34	+6	Yes
R-2	28	28	31	+3	Yes
R-3	28	30	32	+4	Yes
R-4	28	31	33	+5	Yes
R-5	28	31	33	+5	Yes
R-6	28	28	31	+3	Yes
R-7	28	22	29	+1	Yes
R-8	20	21	24	+4	Yes
R-9	20	23	25	+5	Yes
R-10	20	27	28	+8	Yes
R-11	20	28	29	+9	Yes
R-12	20	22	24	+4	Yes
R-13	20	23	25	+5	Yes
R-14	20	21	24	+4	Yes
R-15	20	27	28	+8	Yes
R-16	20	28	29	+9	Yes
R-17	20	28	29	+9	Yes

Note:

a. *As depicted in Figure 6.*
b. *Background measured noise level: L50, using minimum M-1 for R-1 through R-7 and M-3 for R-8 through R-17.*
c. *Total noise from Facility operation at noise sensitive properties, as reported in Table 6.*
d. *Total noise, background and Facility operations, predicted by logarithmically summing the background noise and operational noise.*
e. *Change in total noise at noise sensitive properties, (existing levels to Facility operation).*

As shown in Table 7, predicted noise levels at all noise sensitive properties have L50 increases of 9 dBA or less; therefore, the future, combined noise levels are within the allowable 10 dBA increase from OAR 345-035-0035. Therefore, facility operations will also comply with this portion of the OAR standard.

The noise levels projections were performed using the most conservative available reference noise levels for each of the noise sources, and also include corona noise from the 115-kV transmission lines under wet conditions. This results in an estimated potential noise variance of +0 dB and -2 dB (or more) for the modeled predictions (i.e., the levels will be no higher, but could be 2 dB or more lower), which further demonstrates compliance with OAR 345-035-0035.

6.3. Properties Farther than 1.1 Miles from the Facility Site Boundary

Operational noise levels at the nearest portion of Devil's Garden Lava Bed—the closest area meeting OAR-345-021-0010(1) criteria for protected areas and important recreational opportunities—from the Obsidian Solar Center site boundary are predicted to be 0 dBA. This low noise level is due to the relatively large distance of the facility to the lava bed, of over 4 miles. Operational noise levels at areas more than 4 miles away will also be 0 dBA. The low noise produced from the facility and the large distance from the facility to the protected area/recreational opportunity are sufficient that the noise from operations would not be audible at the Devil's Garden Lave Bed or any other nearby protected areas/recreational opportunities.

To further aid in the understanding of the noise from facility operations, Attachment D provides three plots from the SoundPlan Software that are very useful. Included in this attachment are sound levels at each of the 17 individual noise sensitive properties (Figure D-1) and a plot of noise level contours from 20 dBA to 50 dBA in 5 dB increments (Figure D-2). Finally, Figure D-3 includes a plot of the noise level contours and a blue line depicting a 500 foot buffer from the facility site boundary.

7. Noise Mitigation Analysis

The predicted noise levels from facility equipment at the nearest noise sensitive properties range from 21 to 33 dBA. These levels are below the most stringent criteria under OAR 340-035-0035 maximum allowable noise level for new industrial and commercial uses (see Table 3). In addition, the total noise at the nearest noise sensitive properties, background + facility noise levels, are not predicted to increase by more than 9 dB, which is also in compliance with the OAR 340-035-0035 allowable increase criteria. Therefore, no noise mitigation measures—beyond those included in the facility design, including a 500-foot setback for inverters/transformer units and battery/energy storage units from the facility site boundary, as feasible—are required or recommended.

It is important to note that noise levels of this magnitude are extremely low, and operational noise levels of this magnitude are typically only found in very rural areas with little or no traffic, or in quiet libraries or recording studios (see Table 1).

Furthermore, as previously stated, the noise analysis was performed using the most conservative noise levels for all facility noise sources. Therefore, the noise levels presented are most likely slightly higher (by 2 dB or more) than what will be expected from the actual installation.

8. Construction Noise Analysis

Facility construction will take approximately two years to complete, and during this time construction noise may, at times, be noticeable at nearby residences. This section provides an analysis of the potential construction noise levels. Construction noise is exempt from the DEQ's noise regulations in OAR 340-035-0035. However, facility construction and operation must also demonstrate compliance with EFSC's noise requirements in OAR-345-021-0010(1). Specifically, Obsidian Solar Center must analyze potential impacts on protected areas and important recreational opportunities during construction and operation to demonstrate compliance with the standards.

8.1. Method of Analysis

Construction noise levels were estimated using the methods described in the Federal Highway Administration Highway Construction Noise: Measurement, Prediction and Mitigation, USDOT, 1997. The FHWA Roadway Construction Noise Model (FHWA RCNM) Version 1.1 was used for this analysis. Although this program was designed for highway noise, the type of equipment and equipment noise levels are generally the same as will be used for construction of this facility.

8.2. Construction Methods and Equipment

Equipment required to complete the facility includes common construction equipment that is used for typical roadway and infrastructure type activities. Table 8 provides a typical list of the types of equipment expected for this facility, the activities they would be used for, and the corresponding maximum noise level measured at 50 feet under normal use. Normally, these maximum noise levels only occur sporadically during construction while equipment is in heavy use. During periods of idle and light use, the noise levels produced would be much lower than those presented.

The loudest pieces of equipment that will be used for construction of the facility are the impact drivers to install the support posts that hold the solar panels. These are pneumatic pile drivers that are tracked or installed on the back of a truck or backhoe, and are smaller than the pile drivers typically used for structural supports of buildings and bridges. Even so, these units typically produce 94 to 101 dBA during the installation of the piles. Due to the unique noise from these sources they are not normally included in the overall noise levels prediction and analysis, but are analyzed separately. The equipment listed was derived from information found in the FHWA RCNM.

Table 8: Construction Equipment List, Use, and Maximum Noise Levels			
Equipment	**Impact[a]**	**Typical Expected Project Use[b]**	**Lmax[c, d]**
Air Compressors	No	Used for pneumatic tools and general maintenance	70 – 78
Back Hoe	No	Excavation, support holes, and general construction	78 – 82
Concrete Pumps	No	Pump concrete for structure bases	82
Cranes	No	Removal and installation of solar panels, overhead line and equipment placement	81
Dozer	No	Major earthwork and leveling	88
Grader	No	Level ground and earthwork	86
Haul Trucks	No	Materials handling, general hauling to and from site	86
Impact Pile Driver	Yes	Pneumatic pile driver used to install solar stand supports	94 – 101
Loader	No	Excavation, support holes, and general construction	80
Power Plants	No	General construction use for temporary power	78
Pumps	No	General construction use, water removal	77 – 81
Pneumatic Tools	No	Miscellaneous construction and system assembly	85
Service & Utility Trucks	No	Repair and maintenance of equipment	78
Tractor Trailers	No	Materials delivery and movement	84
Welders	No	General construction, materials modification and repair	74

Notes:

a. *Impact Equipment is equipment that generates impulsive noise. Impulse noise is defined as noise produced by the periodic impact of a mass on a surface, of short duration (generally less than one second), high intensity, abrupt onset and rapid decay, and often rapidly changing spectral composition.*
b. *Typical project uses for construction projects.*
c. *Typical maximum noise level under normal operation measured at 50 feet from the noise source.*
d. *Equipment noise levels are taken from the FHWA Construction Noise Model.*

8.3. Construction Noise Levels

Construction noise would be generated by heavy equipment used during major construction periods. Construction activities could occur as close as 50 feet from some noise sensitive properties along County Road 10-C (see Figure 6). Other noise sensitive properties are approximately 1,000 feet or more from the nearest expected construction activity. Estimates of maximum hourly noise levels at 50 feet for various stages of construction are provided in Table 9. These are the "worst case" noise levels and the average hourly noise levels would be substantially lower, with typical hourly L50 noise levels of 72 to 75 dBA. Maximum levels would occur during the installation of the support posts using a pneumatic pile driver, with maximum levels of 101 dBA at 50 feet.

Table 9: Estimated Peak Hour Construction Noise Levels		
Construction Phase	**Loudest Equipment**	**Maximum Noise Level at 50 feet (dBA L_{max})**
Clearing, grubbing and earthwork	Bulldozer, Grader, Backhoe, Haul Trucks	88
Foundation and Base preparation for systems	Backhoe, Loader, Tractor Trailers, Crane	84
Support installation	Pneumatic impact pile drivers	94 – 101
Solar Array and Transmission Line Installation	Backhoe, Loader, Tractor Trailers, Crane	84
Source: U.S. Department of Transportation. Highway Construction Noise: Measurement, Prediction, and Mitigation. 1977.		

The noise levels in Table 9 are similar to noise produced by a typical infrastructure project. These noise levels are also similar to the noise produced by some farming equipment already in use in this area. The measured noise levels at monitoring sites M-1 and M-2 included maximum (highest) short term noise levels of 86 dBA and 81 dBA, respectively, and frequently had measured levels above 70 dBA throughout the daytime and some nighttime hours.

Although the noise levels reported in Table 9 are relatively high, the construction phase will be temporary. In addition, the levels reported in Table 9 can be expected only when the equipment is within 50 feet of a receiver. These noise levels will decrease substantially at larger distances (i.e., 1,000 feet or more) that will occur between most noise sensitive properties and construction activities. Furthermore, as previously stated, the L50 levels will be substantially lower than the maximum levels in Table 9.

To provide a better understanding of how construction noise will decrease with distance from the facility site, two figures were prepared to illustrate predicted maximum noise levels and typical L50 noise levels to distances of 3,000 feet and 25,000 feet. Figures 7 and 8 illustrate how the pile driver maximum noise levels of 101 dBA at 50 feet, general construction equipment maximum noise level of 88 dBA at 50 feet, and the typical L50 construction noise level of 75 dBA at 50 feet reduce with distance from a noise source. Figure 7 illustrates the area from 50 feet to 3,000 feet from a noise source, and Figure 8 illustrates the area from 2,500 feet to 25,000 feet (4.7 miles). These figures also include the noise sensitive properties (R-1 through R-17) at the approximate distance from the nearest work site. Note that these plots do not include any topographical shielding and do not account for any ground effects, and both of these factors would provide additional attenuation of construction noise.

For the protected areas, which are all located greater than 4 miles from the nearest facility construction work area, worst case short-term noise levels of 48 dBA from intermittent pile driver use. For general construction equipment, worst case noise levels 35 dBA or less may occur during the heaviest construction activities, which are expected to be short-term. Typical general construction noise levels are expected to be near or below the ambient noise level of 20 dBA at distances of 4 miles or greater. Overall constructing noise levels at these distances would typically be below 20 dBA, and are not likely to be audible or result in any construction-related noise impacts to these areas.

Figure 7. Expected Construction Noise Levels versus Distance 50 to 3,000 feet

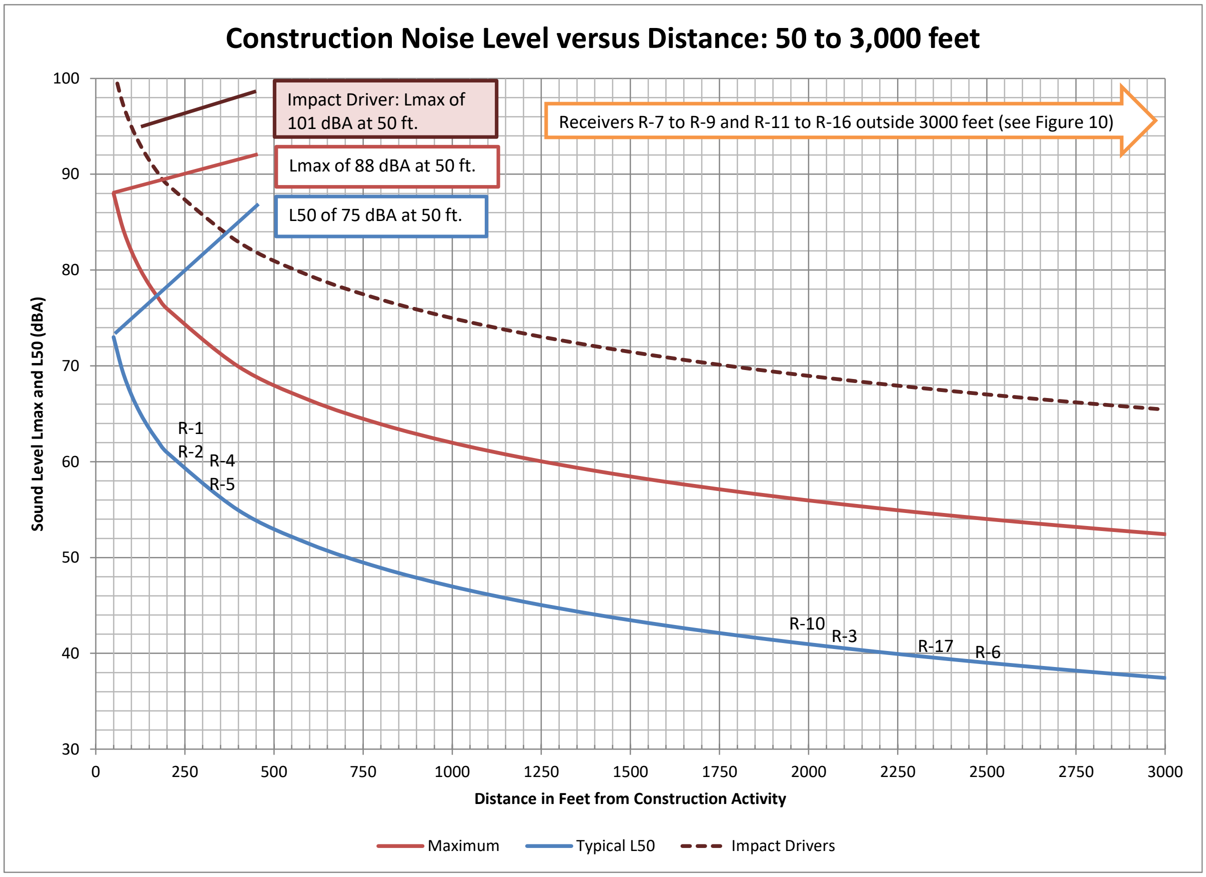
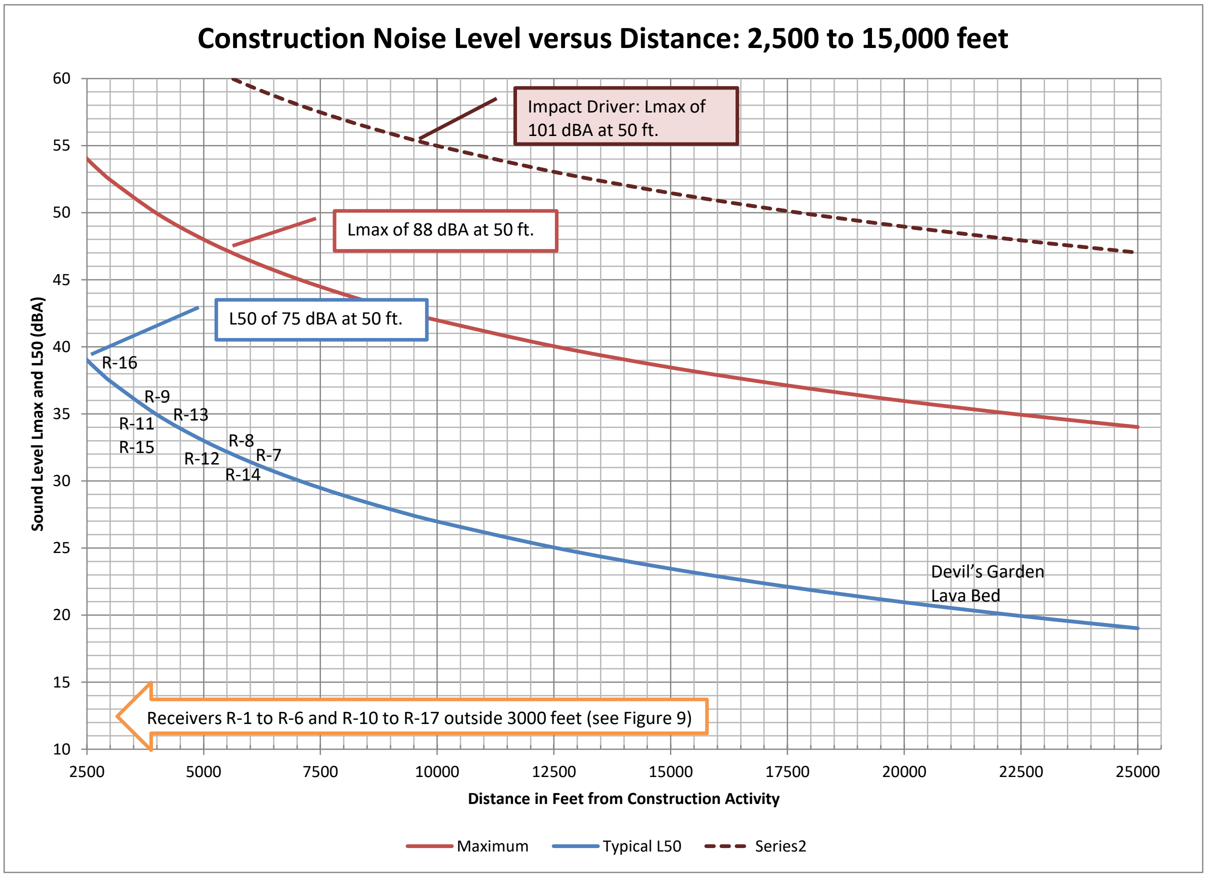


Figure 8. Expected Construction Noise Levels versus Distance past 3,000 feet



8.4. Construction Mitigation Measures

Several construction noise abatement methods can be implemented to limit potential impacts from noise. The contractor shall ensure that all engine-powered equipment have mufflers installed according to the manufacturer's specifications, and that all equipment complies with pertinent equipment noise standards of the U.S. Environmental Protection Agency.

If specific noise complaints are received during construction, one or more of the following noise mitigation measures, as directed by the project manager, could be considered and implemented:

- Locate stationary engine-powered construction equipment as far from nearby noise sensitive properties as possible.
- Shut off idling equipment.
- Reschedule construction activities to avoid periods of noise annoyance identified in the complaint.
- Notify nearby residents before extremely noisy work occurs.

- Restrict the installation of solar module support posts using the pneumatic pile driver to weekdays and Saturdays, during daytime hours of 8:00 am to 6:00 pm, and notify the residences near the site prior to performing the work.

Attachment A
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Attachment B
Representative Equipment Specifications

Power Electronics FS3000M Specifications

HEM

TECHNICAL CHARACTERISTICS

		MV CENTRAL STRING INVERTER
REFERENCE		FS3000M
OUTPUT	AC Output Power(kVA/kW) @50°C[1]	3000
	AC Output Power(kVA/kW) @25°C[1]	3300
	Operating Grid Voltage(VAC)[2]	34.5kV / 27.6kV / 24.94kV / 13.8kV / 12.47kV
	Operating Grid Frequency(Hz)	50Hz/60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi)[3]	0.5 leading ... 0.5 lagging adjustable / Reactive Power injection at night
INPUT	MPPt @full power (VDC)	849V-1310V
	Maximum DC voltage	1500V
	Number of inputs	4 per MPPt
	Number of MPPts	Up to 6
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	98% (preliminary)
	Max. Power Consumption (KVA)	30
CABINET	Dimensions [WxDxH] [ft]	20 x 6.5 x 7
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection [4]	IP54 / NEMA3R
	Permissible Ambient Temperature	-35°C[5] to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level)	1000m; >1000m power derating (Max. 4000m)
	Noise level [6]	< 79 dBA
CONTROL INTERFACE	Interface	Graphic Display
	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	GFDI and Isolation monitoring device
	General AC Protection	MV Switchgear
	General DC Protection	Fuses
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-01, UL62109-1, IEC62109-1, IEC62109-2
	Compliance	NEC 2017
	Utility interconnect	UL 1741SA-Sept. 2016 / IEEE 1547.1-2005

NOTES
[1] Values at 1.00•Vac nom and cos Φ=1. Consult Power Electronics for derating curves.
[2] Consult Power Electronics for other configurations.
[3] Consult P-Q charts available: $Q(kVAr)=\sqrt{S(kVA)^2-P(kW)^2}$.
[4] IP65 available. Consult Power Electronics.
[4] Heating resistors kit option below -20°C.
[5] Readings taken 1 meter from the back of the unit.

General Electric Power Battery/Energy Storage Units

Overview	Energy RSU-4000	Mid-Power	High-Power
Nameplate Energy Capacity (KWh.dc, usable)	4184	3700	2500
Individual Battery Racks	20	54	40
Maximum Power - Factory Installed (KW.dc)	1200	960	720
Maximum DC Current - Factory Installed (A)	1600	1280	960
Key Features			
Battery Management System	GE Blade Protection Unit (BPU)	Battery Supplier	
Compatible Inverters	GE RIU-2750MV	GE RIU-2750MV	
Inverter Connections	1	1 or 2	1 to 3
Solar DC Coupling	Yes (DC:AC Ratio <2.8)	-	-
Integrated PV Combiner	Optional	-	-
String Level Lockable Disconnect	Module & Rack Level	-	-
Augmentation Options for Lifecyle Management	Yes	-	-
DC Bus Control	DC-IQ Intelligent Bus	Inverter Controlled	
Battery LifeCycle Management	Digital Twin Life Optimization - Optional	Digital Twin Life Optimization - Optional	
Unit Validation	Factory Built and Tested	Project Commisioning	
Design life (years)	25	20	
Battery Information			
Battery Chemistry	Lithium-Ion, NCM	Lithium-Ion, NCM	Lithium-Ion, NCM
Battery Module Design	Energy	Mid-Power	High Power
Continuous C-Rate	<C/3	<1C	<2C
Pulse C-Rate	<C/3	<1.5C	<3C
Voltage Class	1500V	1000V	
Nominal DC Voltage (V)	1300	814	
Minimum DC Voltage (V)	770	612	
Mechanical Information			
Package Format	20' ISO w/Exterior Acces	40' ISO w/Ext. Access	
Dimensions (mm) (L X W X H)	6058 x 2438 x 2890 mm	12,200 x 2438 x 2890 mm	
Fully Integrated HVAC	Dual Self-Contained High Efficiency Units		
- Hot Climate Upgrade	+30% Cooling Capacity		
- Cold Climate Upgrade	+ Electric Heating Package		
Fire Suppression - Aerosol	Optional		
Installation	Pad/Pier		
Cable Entry	Bottom	Top	
Weatherization	NEMA 3R, IP 54		
Design Conditions			
Min Operating Temperature (C)	-40°C	-25°C	-25°C
Max operating Temperature (C)	50°C (55°C w/ hot climate upgrade)		
Maximum Altitude (m)	2000		
Maximum Relative Humidity (%)	95%, non-condensing		
Seismic Zone	UBC Zone-4		
Audible Noise	<60 db at 3m		
Certifications & Compliance			
Certifications	UN38.3, UL 1973, UL 508C, CE		
Compliance	UL1642, NFPA 70E		

Attachment C
Table of Field Measurements

DEQ Day/Night	Date/Time	L10 M-1	L10 M-2	L50 M-1	L50 M-2	Leq M-1	Leq M-2
Daytime Hours	7/5/2018 12:00	51.1	28.9	43	21	52.1	30.9
	7/5/2018 13:00	53.7	48.8	45.4	41.8	53.5	44.9
	7/5/2018 14:00	54	50.7	46.7	42.4	53.7	46.5
	7/5/2018 15:00	51.1	49.4	42.6	42.5	52.4	46.2
	7/5/2018 16:00	51.6	47.3	44.8	40	49.8	43.4
	7/5/2018 17:00	52.1	46.5	46.6	38.6	51.4	43.8
	7/5/2018 18:00	49.8	47.4	42.9	40.4	51	43.6
	7/5/2018 19:00	46.2	44.8	41.1	36.6	50.3	47.3
	7/5/2018 20:00	41.8	39.8	30.7	28.5	49	36.8
	7/5/2018 21:00	31.6	30.1	28.7	23.2	46	30.3
Nighttime Hours	7/5/2018 22:00	30.3	38.2	28.2	30.8	28.6	34.4
	7/5/2018 23:00	32	29.6	30.2	23.4	30.4	26.2
	7/6/2018 0:00	29.9	29.1	28.3	23.2	28.5	26.4
	7/6/2018 1:00	32.9	20.1	30.5	20	31.9	20.5
	7/6/2018 2:00	33.8	21.3	31.9	21	32.2	20.5
	7/6/2018 3:00	34.4	20.4	32.2	20	32.4	20.6
	7/6/2018 4:00	41.3	26.7	35.3	21.3	37.6	25.7
	7/6/2018 5:00	45.3	23.7	39.5	22.5	41.8	25.7
	7/6/2018 6:00	45.6	29.6	40.1	23.2	48.2	30.7
Daytime Hours	7/6/2018 7:00	43	34.6	35.7	21.9	44.5	39.8
	7/6/2018 8:00	44.3	37.4	38	30.6	51.2	36.2
	7/6/2018 9:00	44.7	39.9	35.7	32.8	54.9	39.9
	7/6/2018 10:00	47.5	38.3	36	30.4	51.7	36.5
	7/6/2018 11:00	49.1	41.7	40.4	34.7	54.2	39.4
	7/6/2018 12:00	48.7	44.4	41.4	37.8	52.2	40.9
	7/6/2018 13:00	48.4	45.6	41.6	38.7	51.4	42
	7/6/2018 14:00	47.4	44.2	39.6	35.8	45.7	43.9
	7/6/2018 15:00	45.5	43.1	38.2	35	48.4	41.5
	7/6/2018 16:00	52.1	46.8	43.6	38.6	52.6	43.7
	7/6/2018 17:00	50	47.2	43.3	39.4	49.2	44.3
	7/6/2018 18:00	46.4	41.8	40.2	34.9	49.8	38.2
	7/6/2018 19:00	40.2	38.3	34.1	27.7	46.8	37.5
	7/6/2018 20:00	49	30.4	34.5	20	50.2	32.9
	7/6/2018 21:00	35.4	28.7	33.2	20	43.2	35.4
Nighttime	7/6/2018 22:00	34.7	24.6	33.2	20	42.9	28.6

DEQ Day/Night	Date/Time	L10			L50			Leq	
		M-1	M-2		M-1	M-2		M-1	M-2
	7/6/2018 23:00	36.3	22		33	20		33.8	21.9
	7/7/2018 0:00	32.4	24		30.4	22.3		30.7	31.7
	7/7/2018 1:00	33.7	20		32	20.5		33	20
	7/7/2018 2:00	34.2	20		32.7	21		32.9	20
	7/7/2018 3:00	34.9	20		32.1	20		32.8	20.8
	7/7/2018 4:00	44.4	28.9		37.5	20.5		40.3	44.8
	7/7/2018 5:00	45.9	26.3		40.4	20		51.1	23.4
	7/7/2018 6:00	45.5	28.2		38.6	22		42.6	34.7
Daytime Hours	7/7/2018 7:00	39.2	30.9		32.8	20		53.4	33.1
	7/7/2018 8:00	39.4	23.5		32.9	20		48.9	25.9
	7/7/2018 9:00	38.9	25.8		32.4	20		51.2	30.3
	7/7/2018 10:00	39.9	31.4		31.9	20.5		51.8	35.3
	7/7/2018 11:00	40	26.9		33.3	20		52.8	31.2
	Min	**30**	**20**		**28**	**20**		**29**	**20**
	Max	**54**	**51**		**47**	**43**		**55**	**47**
	Average	**42**	**34**		**37**	**28**		**45**	**34**

Attachment D
SoundPlan Output Graphics

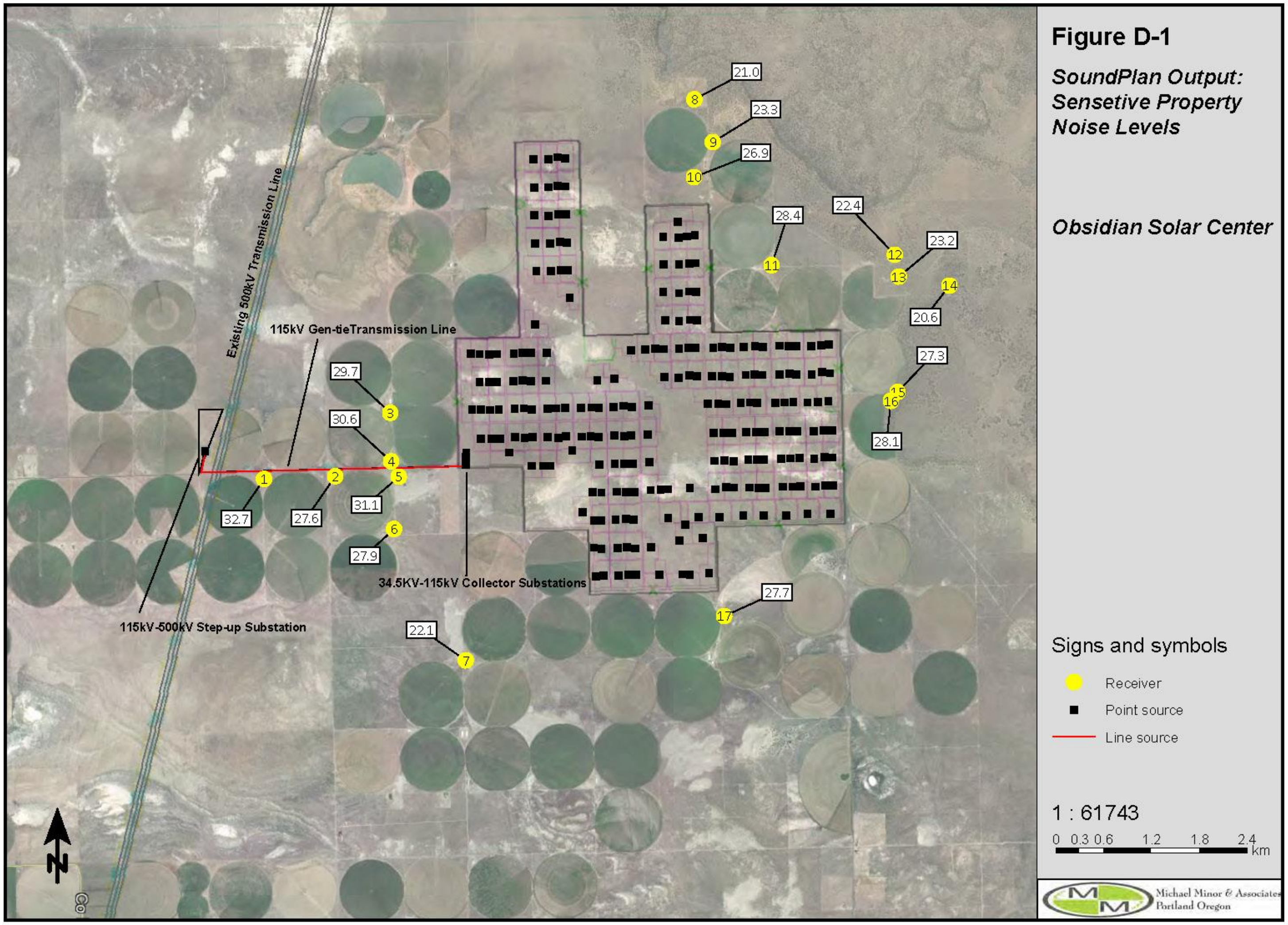


Figure D-1
SoundPlan Output: Sensetive Property Noise Levels
Obsidian Solar Center
Existing 500kV Transmission Line
115kV Gen-tieTransmission Line
34.5KV-115kV Collector Substations
115kV-500kV Step-up Substation
21.0
23.3
26.9
28.4
22.4
23.2
20.6
27.3
28.1
29.7
30.6
31.1
32.7
27.6
27.9
27.7
22.1
Signs and symbols
Receiver
Point source
Line source
1 : 61743
0 0.3 0.6 1.2 1.8 2.4 km
Michael Minor & Associates
Portland Oregon

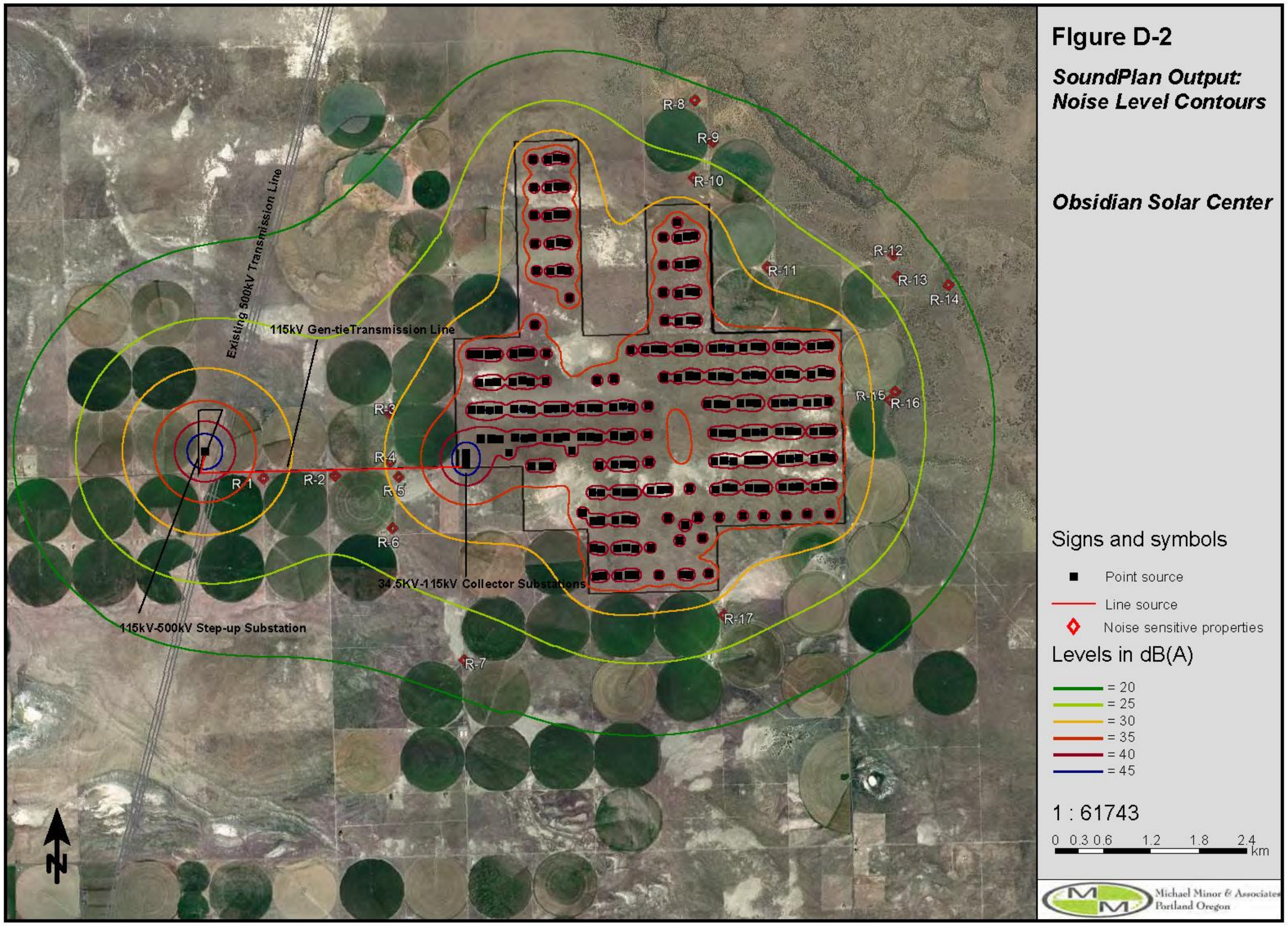
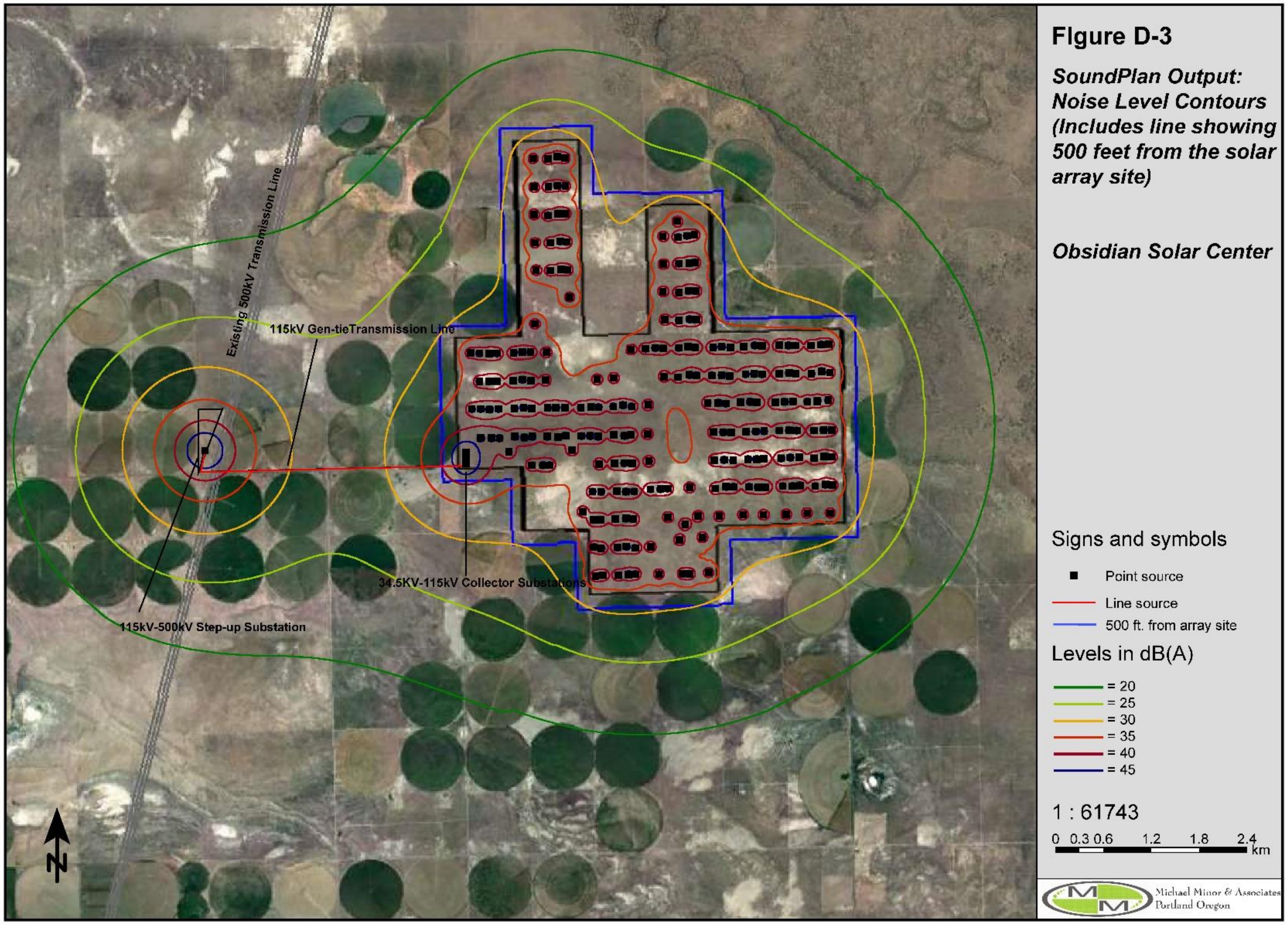


Figure D-2
SoundPlan Output: Noise Level Contours
Obsidian Solar Center
Signs and symbols
Point source
Line source
Noise sensitive properties
Levels in dB(A)
= 20
= 25
= 30
= 35
= 40
= 45
1 : 61743
0 0.3 0.6 1.2 1.8 2.4 km
Michael Minor & Associates
Portland Oregon
Existing 500kV Transmission Line
115kV Gen-tieTransmission Line
34.5KV-115kV Collector Substations
115kV-500kV Step-up Substation
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
R-9
R-10
R-11
R-12
R-13
R-14
R-15
R-16
R-17
N



Existing 500kV Transmission Line
115kV Gen-tieTransmission Line
34.5KV-115kV Collector Substations
115kV-500kV Step-up Substation
N
Figure D-3
SoundPlan Output: Noise Level Contours (Includes line showing 500 feet from the solar array site)
Obsidian Solar Center
Signs and symbols
Point source
Line source
500 ft. from array site
Levels in dB(A)
= 20
= 25
= 30
= 35
= 40
= 45
1 : 61743
0 0.3 0.6 1.2 1.8 2.4 km
Michael Minor & Associates
Portland Oregon