3.11 Noise

This section provides an analysis of the potential noise impacts resulting from the proposed Lompoc Wind Energy Project (Project). The assessment of noise impacts uses specific terminology and fundamental descriptors and, in order to assist in a thorough understanding of the subsequent analysis, these terms are discussed in this section. Acoustics is the study of sound, and noise is defined as unwanted sound. Airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. The pitch or loudness of sound can determine whether a sound is of a pleasant or objectionable nature. Pitch, which is the height or depth of a tone or sound, is louder to humans when it is high pitched versus low pitched. The loudness of a sound is determined by a combination of the intensity of the sound waves with the reception characteristics of the ear.

Measurement scales are used to describe sounds. A decibel (dB) is a unit used to describe the amplitude of sound, and sound levels are calculated on a logarithmic, not linear, basis. The lowest sound level that an unimpaired human ear can hear is described as zero on the decibel scale. Due to the logarithmic nature of sound level increases, a 10-dB increase represents a tenfold increase in acoustic energy; whereas, a 20-dB increase represents a hundredfold increase in acoustic energy. Because a relationship exists between acoustic energy and intensity, each 10-dB increase in sound level can have an approximate doubling effect on loudness as perceived by the human ear.

Acoustical terms used in this subsection are summarized in Table 3.11-1.

The most common metric is the overall A-weighted sound level measurement (dBA) that has been adopted by regulatory bodies worldwide. The A-weighting network measures sound in a fashion similar to the way a person perceives or hears sound, thus achieving very good correlation in terms of evaluating acceptable and unacceptable sound levels.

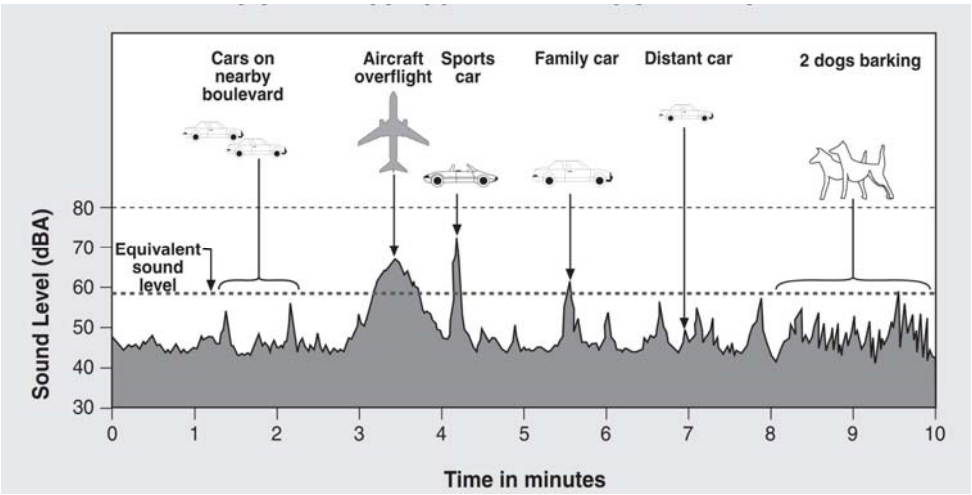
The measurement and analysis of sound can be a complex task. Consider typical sounds in a suburban neighborhood on a normal or "quiet" afternoon. Short durations of those sounds plotted on a graph would look very much like Table 3.11-2. As illustrated, the background, or residential sound level in the absence of any identifiable noise sources, is approximately 45 dBA. During roughly three-quarters of the time, the sound level is 50 dBA or less. The highest sound level, caused by a nearby sports car, is approximately 70 dBA, while an aircraft generates a maximum sound level of about 68 dBA.

One way to describe noise is to measure the maximum sound level (L_{max}) (for example, in the case represented in Table 3.11-2, the nearby sports car at 70 dBA). The L_{max} measurement does not account for the duration of the sound. Studies have shown that human response to noise involves the maximum level and its duration. For example, the aircraft in this case is not as loud as the sports car, but the aircraft sound lasts longer. For most people, the aircraft overflight would be more annoying than the sports car event. Thus, the maximum sound level alone is not sufficient to predict reaction to environmental noise.

TABLE 3.11-1
Definitions of Acoustical Terms

Term	Definition
Ambient Noise Level	The composite of noise from all sources resulting in the normal, existing level of environmental noise at a given location. The ambient level is typically defined by the L_{eq} level.
Background Noise Level	The underlying ever-present lower level noise that remains in the absence of intrusive or intermittent sounds. Distant sources, such as traffic, typically makeup the background. The background level is generally defined by the L_{90} percentile noise level.
Intrusive	Noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, tonal content, the prevailing ambient noise level as well as the sensitivity of the receiver. The intrusive level is generally defined by the L_{10} percentile noise level.
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
A-Weighted Sound Level (dBA)	The sound level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level, on an equal energy basis, during the measurement period.
Percentile Noise Level (L_n)	The noise level exceeded during n percent of the measurement period, where n is a number between 0 and 100 (e.g., L_{90})
Day-Night Average Level (L_{dn})	The energy average A-weighted noise level during a 24-hour day, obtained after the addition of 10 decibels between the hours of 10:00 p.m. and 7:00 a.m.

TABLE 3.11-2
Noise Metrics – Comparative Noise Levels



A-weighted sound levels can be measured or presented as equivalent sound pressure level (L_{eq}). This is defined as the average noise level, on an equal-energy basis for a stated period of time and is commonly used to measure steady-state sound or noise that is usually dominant. Statistical measurements are typically denoted by L_n, where n represents the percentile of time the sound level is exceeded. The measurement of L_{90} represents the noise level that is exceeded during 90 percent of the measurement period. Similarly, the L_{10} represents the noise level exceeded for 10 percent of the measurement period.

The response that people have to daytime and nighttime noise has been observed to vary. During the evening and nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night, and exterior noise becomes more noticeable. Furthermore, most people sleep at night and are sensitive to intrusive noises. To account for human sensitivity to evening and nighttime noise levels, the Day-Night Level (L_{dn}) was developed. The L_{dn} is a noise index that accounts for the greater annoyance attributed to noise during the evening and nighttime hours.

L_{dn} values are calculated by averaging hourly L_{eq} sound levels for a 24-hour period and apply weighting factors to evening and nighttime L_{eq} values. The weighting factor, which reflects the increased sensitivity to noise during nighttime hours, is added to each hourly L_{eq} sound level before the 24-hour L_{dn} is calculated. For the purposes of assessing noise, the 24-hour day is divided into two time periods, with the following weightings:

- Daytime: 7:00 a.m. to 10:00 p.m. (15 hours), weighting factor of 0 dB
- Nighttime: 10:00 p.m. to 7:00 a.m. (9 hours), weighting factor of 10 dB

The time periods are then averaged (on an energy basis) to compute the overall L_{dn} value. For a continuous noise source, the L_{dn} value is computed easily by adding 6.4 dB to the overall 24-hour noise level (L_{eq}). For example, if the expected continuous noise level from a power plant were 60.0 dBA, the resulting L_{dn} from the plant would be 66.4 dBA.

The community noise equivalent level (CNEL) metric is similar to the L_{dn} but with an additional 5-dB weighting factor between 7 p.m. and 10 p.m. CNEL and L_{dn} measures are frequently used interchangeably.

The effects of noise on people can be grouped into three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction
- Interference with activities such as speech, sleep, learning
- Physiological effects such as startling and hearing loss

In most cases, environmental noise produces effects in the first two categories only. However, workers in industrial plants might experience noise effects in the last category. No satisfactory way exists to measure the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard is due primarily to the wide variation in individual thresholds of annoyance and habituation to noise. Thus, an important way of determining a person's subjective reaction to a new noise is by comparison with the existing or "ambient" environment to which that person has adapted. In general, the more the level or the tonal (frequency) variations of a noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be, as judged by the exposed individual. When comparing sound levels

from similar sources (for example, changes in traffic noise levels), a 3-dBA change is considered a just-perceivable difference; 5 dBA is clearly perceivable, and 10 dBA is considered a doubling in loudness.

Table 3.11-3 shows the relative A-weighted noise levels of common sounds measured in the environment for various sound levels.

3.11.1 Existing Conditions

The Project would be located primarily on the rural, agricultural land on coastal ridges south of Lompoc. Vandenberg Air Force Base (VAFB) is located to the south and west of the site for the Lompoc Wind Energy Facility (LWEF), and private property is on the north and east. The primary existing land use is cattle grazing, although scattered residences are present on the LWEF site. These residences are considered to be participating residences because they are within the 2,950-acre Applicant-leased area. Private residences are located on nonparticipating properties outside the perimeter of the Project area and near the proposed power line route along San Miguelito Road and in the City of Lompoc. The closest private residences on nonparticipating properties are located more than 1,500 feet outside the perimeter of the wind turbine generator (WTG) area and more than 1,900 feet from a potential WTG location.

TABLE 3.11-3
Typical Sound Levels Measured in the Environment

Noise Source (at a Given Distance)	A-Weighted Sound Level in Decibels	Noise Environment	Subjective Impression
Shotgun (at shooter's ear)	140	Carrier flight deck	Painfully loud
Civil defense siren (100 feet)	130		Threshold of pain
Jet takeoff (200 feet)	120		Threshold of pain
Loud rock music	110	Rock music concert	Threshold of pain
Pile driver (50 feet)	100		Very loud
Ambulance siren (100 feet)	90	Boiler room	Very loud
Pneumatic drill (50 feet)	80	Noisy restaurant	Very loud
Busy traffic; hair dryer	70		Moderately loud
Normal conversation (5 feet)	60	Data processing center	Moderately loud
Light traffic (100 feet); rainfall	50	Private business office	Moderately loud
Bird calls (distant)	40	Average living room or library	Quiet
Soft whisper (5 feet); rustling leaves	30	Quiet bedroom	Quiet
	20	Recording studio	Quiet
Normal breathing	10		Threshold of hearing

According to results of studies presented by the Bureau of Land Management (BLM) in the document *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States*, in a typical rural environment the "background noise is expected to be approximately 40 dBA during the day and 30 dBA at night"(USDI, 2005). Furthermore, according to information on noise levels presented by the United States Environmental Protection Agency (EPA), background noise levels are generally near 35 dBA L_{dn} in wilderness areas; near 40 dBA L_{dn} in rural residential areas; and near 44 to 45 dBA L_{dn} in agricultural cropland (EPA, 1978).

Based on the referenced information and in the absence of actual noise measurements, existing background noise levels in the vicinity of the Project area are reasonably assumed to be approximately 40 dBA L_{dn}. Although the Project site is located outside the 60-L_{dn} aircraft noise contour, activities at VAFB periodically could result in higher ambient noise levels that exceed this estimate.

Ambient noise levels along the power line route vary since it traverses environments ranging from rural and open space to urban.

3.11.2 Regulatory Framework

No applicable state or federal noise regulations address community or environmental noise limits.

3.11.2.1 County of Santa Barbara

The Noise Element of the Santa Barbara County Comprehensive Plan indicates that in land use planning, 65 dBA L_{dn} is regarded as the maximum exterior noise exposure compatible with noise-sensitive uses unless noise mitigation features are included in Project designs. Noise-sensitive land uses are considered to include:

- Residential, including single- and multifamily dwellings, mobile home parks, dormitories, and similar uses
- Transient lodging, including hotels, motels, and similar uses
- Hospitals, nursing homes, convalescent hospitals, and other facilities for long-term medical care
- Public or private educational facilities, libraries, churches, and places of public assembly

3.11.3 Project Impacts, Mitigation, and Residual Impacts

3.11.3.1 Impact Assessment Methodology

The noise analysis is based on a conceptual layout of 80 WTGs located in the Applicant-defined WTG corridors; the WTGs would be microsited within these corridors based on environmental and technical considerations. With the exception of the VAFB property line, the WTGs would be set back from private property lines a distance equal to or greater than the height of the system (from the top of the concrete slab foundation to tip of a blade), which is between approximately 300 and 500 feet, depending on the type of WTG selected.

The turbines are anticipated to have a maximum sound power level of 112 dBA, except in the Larsen Corridor and a portion of the North Corridor, where the maximum sound power level would be limited to 106 dBA.[1] The conceptual layout is based on eight WTGs that have a sound power level of 106 dBA, and the remainder having a level of 112 dBA. The Applicant has provided confidential one-third octave band sound power level data for a turbine representative of those being considered for this Project, corresponding to a maximum sound power level of 104.3 dBA ± 1.0 dB. For this analysis, maximum sound power level was scaled up to 106 dBA or 112 dBA, as indicated on Figure 3.11-1.

Standard acoustical engineering methods were used in the noise analysis. The Cadna/A Noise Prediction Model (Cadna/A) is a sophisticated software program that enables complete noise modeling of complex industrial plants (Datakustik, 2007). The sound propagation factors used in the model have been adopted from International Organization for Standardization (ISO) 9613 (ISO, 1993) and Verein Deutscher Ingenieure (VDI) 2714 (VDI, 1988). Atmospheric absorption for conditions of 10 degrees Celsius (°C) and 70 percent relative humidity (conditions that favor propagation) was computed in accordance with ISO 9613-1, *Calculation of the Absorption of Sound by the Atmosphere.* Each WTG was considered to be a point source of noise at the hub height of 282 feet (note that changes in hub height do not significantly change the distance between the source and receiver and, therefore, do not greatly influence noise predictions.) Transformers are expected to have a National Electrical Manufacturers Association (NEMA) sound rating of 87 dBA. The high-voltage power lines associated with the Project would be 115 kilovolts (kV) or less. Audible noise from foul-weather corona is typically associated with higher-voltage transmission lines and is not anticipated to be present.

Wind speed typically increases notably with increasing height. As such, relatively calm conditions might be present at ground level while sufficient winds at hub height are present to generate power and noise. Under these conditions, wind-related background noise would be minimal and would not be effective in masking WTG noise heard at ground level.

For the noise modeling, each WTG was considered a point source at hub height over flat ground. The potential attenuation or shielding effects of topography or vegetation were not included in the model. Where the topography breaks the line of sight between a WTG and a receptor, reductions of between approximately 2 to 10 dBA can be expected. In addition, vegetation is not routinely taken into account unless 300 feet or more of dense forest is present. The model also assumed that all 80 WTGs would be operating at the same time at their maximum noise level. This results in a conservative hourly noise level that is assumed to be maintained over a 24-hour period to calculate the 24-hour average L_{dn}. These predictions are computed in terms of hourly L_{eq}. Under these assumptions, the 24-hour average L_{dn} is 6.4 dBA greater than the L_{eq}. The ISO 9613 standard assumes each receptor is downwind from each source or that the wind is flowing radially from each WTG in all directions at the same time. These assumptions result in a conservative, worst-case estimate. Depending on the daily variation in wind speeds, the L_{dn} may be 13 dBA lower than predicted (a 13 dBA reduction is calculated by assuming that the project would only operate at its maximum noise level for one hour and would not generate noise for the remaining 23 hours; if it operated at maximum noise level for 4 out of 24 hours, the reduction would be

[1] Sound power levels are to be determined in accordance with the latest revision of IEC61400-11: *Wind Turbine Generator Systems—Part 11: Acoustic Noise Measurement Techniques* (IEC, 2006)..

8 dBA; if it operated at maximum noise level for 8 out of 24 hours, the reduction would be 5 dBA; and if it operated at maximum noise level for 16 out of 24 hours, the reduction would be 2 dBA).

3.11.3.2 Thresholds of Significance

Section XI of Appendix G of the California Environmental Quality Act (CEQA) Guidelines (California Code of Regulations [CCR], Title 14, Appendix G) sets forth some characteristics that could signify a potentially significant impact. Specifically, a significant effect from noise could exist if a project would result in:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local General Plan or noise ordinance, or applicable standards of other agencies
- Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels
- Substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project
- Substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project

The County of Santa Barbara Environmental Thresholds and Guidelines Manual establishes the thresholds of significance for assisting in the determination of significant noise impacts under CEQA (County, 2006). These thresholds are summarized as follows.

- Noise from grading and construction activity proposed within 1,600 feet of sensitive receptors, including schools, residential development, commercial lodging facilities, hospitals or care facilities, generally would result in a potentially significant impact.
- A proposed development that would generate noise levels in excess of 65 dBA CNEL and could affect sensitive receptors generally would be presumed to have a significant impact.
- Outdoor living areas of noise-sensitive uses that are subject to noise levels in excess of 65 dBA CNEL generally would be presumed to be significantly affected by ambient noise. Also, significant impacts generally would occur where interior noise levels cannot be reduced to 45 dBA CNEL or less.
- A project generally would have a significant effect on the environment if it substantially increases the ambient noise levels for noise-sensitive receptors in adjoining areas. This generally could be presumed when ambient noise levels affecting sensitive receptors are increased to 65 dBA CNEL or more. However, a significant effect also could occur when ambient noise levels affecting sensitive receptors increase substantially but remain less than 65 dBA CNEL, as determined on a case-by-case basis.

For new projects in quiet rural areas, the last item addressing a substantial increase is the controlling noise criterion or threshold. Ambient noise measurements were not collected for this analysis. Nonetheless, assuming an existing background noise level of 40 dBA L_{dn} (as explained in Section 3.11.1), an increase of 10 dBA, resulting in an absolute threshold of 50 dBA L_{dn} at any nonparticipating residence is a reasonable threshold of significance.

Although a 10-dBA increase represents a doubling of perceived noise levels, outdoor noise levels at 50 dBA L_{dn} are still considered quiet, well below the sound levels considered to be requisite for protecting public health and welfare (EPA, 1978), and far below the County-established noise threshold (County, 2006).

Due to the 10-dBA penalty applied to nighttime noise levels in computing L_{dn}, an outdoor noise level threshold of 50 dBA L_{dn} translates to a steady or continuous noise level of 44 dBA hourly L_{eq} from the Project, which is consistent with the threshold established by Solano County for the Shiloh I Wind Plant Project (Ecology and Environment, Inc., 2005). WTG noise levels that exceed 44 dBA L_{eq} (1 hour) at nonparticipating residences would be considered significant.

Because Project participants (those residents within the 2,950-acre WTG area) do so willingly and receive benefit from the Project, the 65 dBA CNEL County threshold is applicable. This translates to a continuous noise level of 59 dBA L_{eq}. WTG noise levels that exceed 59 dBA L_{eq} (1-hour) at participating residences would be considered significant. The more stringent threshold (a 10-dBA increase over ambient levels) is applicable to nonparticipating residences.

The County noise thresholds are intended to provide flexibility, providing for more restrictive criteria to be developed on a case-by-case basis when a project potentially could result in a substantial increase in noise even if the resulting noise level would be below the 65 dBA general significance criteria (County, 2006, Section 12.B). The County believes establishing a more conservative threshold is reasonable and prudent to ensure that residents who are not part of the Project and who value their quiet rural setting are not affected by intrusive noise levels. In contrast, Project participants willingly enter into contracts to have turbines on their land; they are financially compensated by the Project; and their contracts include provisions for accepting a certain level of noise.

3.11.3.3 Project Impacts

Construction Impacts. Construction activities are expected to be typical of comparable large construction projects. The noise level would vary during the construction period, depending upon the construction phase and types of equipment in use.

The Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) represents the most complete and current assessment of noise from operation of heavy equipment. This data set was developed from the Central Artery/Tunnel (known as the Big Dig) project in Boston, Massachusetts, which began in the early 1990s and is the largest urban construction project ever conducted in the United States. The equipment evaluated in the RCNM is similar to that expected to be used in Project construction. As such, the RCNM database of measured noise levels at 50 feet and the predicted levels at 2,500 feet are presented in Table 3.11-4. The predicted levels are conservative because the only attenuating mechanism considered was divergence of the sound waves in open air (where a 6-dB reduction per doubling of distance is applied).

Impact No.	Impact Description	Phase	Impact Classification
NOI-1	Some types of construction equipment would generate short-term noise impacts (Class II) to nonparticipating residences less than 2,000 feet from a construction area.	Construction	Class II

Impact NOI-1: Short-term Construction Noise. Table 3.11-4 presents noise levels resulting from commonly used construction equipment at 50 feet and at 2,500 feet from the source. Approximately 74 residences are located within 1,600 feet of the power line corridor and, depending on the placement of individual poles, could be exposed temporarily to significant noise levels, including noise from helicopters used to install power poles. Some types of construction equipment (for example, a pile driver or pavement scarifier) likely would result in a significant increase in noise and vibration at the nonparticipating residences that are less than 2,500 feet from a construction area. These impacts would be significant but mitigable (*Class II*).

TABLE 3.11-4
Summary of Construction Equipment Noise Levels (dBA)

Equipment	Impact Device	Measured L_{max} (at 50 feet)	Predicted L_{max} (at 2,500 feet)
Auger Drill Rig	No	84	51
Backhoe	No	78	45
Boring Jack Power Unit	No	83	50
Clam Shovel (dropping)	Yes	87	54
Compactor (ground)	No	83	50
Compressor (air)	No	78	45
Concrete Mixer Truck	No	79	46
Concrete Pump Truck	No	81	48
Concrete Saw	No	90	57
Crane	No	81	48
Dozer	No	82	49
Drill Rig Truck	No	79	46
Drum Mixer	No	80	47
Dump Truck	No	76	43
Excavator	No	81	48
Front-End Loader	No	79	46
Generator	No	81	48
Generator (less than 25 kVA)	No	73	40
14-H Load Grader/Gradall	No	83	50

TABLE 3.11-4
Summary of Construction Equipment Noise Levels (dBA)

Equipment	Impact Device	Measured L_{max} (at 50 feet)	Predicted L_{max} (at 2,500 feet)
Grapple (on backhoe)	No	87	54
Heavy Truck (Water/Line/Flatbed)	No	74	41
Horizontal-Boring Hydraulic Jack	No	82	49
Impact Pile Driver	Yes	101	68
Jackhammer	Yes	89	56
Man Lift/Forklift	No	75	42
Mounted Impact Hammer (hoe ram)	Yes	90	57
Pavement Scarifier	No	90	57
Paver	No	77	44
Pickup Truck	No	75	42
Pneumatic Tools	No	85	52
Pumps	No	81	48
Rivit Buster/chipping gun	Yes	79	46
Rock Drill	No	81	48
Roller	No	80	47
Scraper	No	85	52
Shears (on backhoe)	No	96	63
Slurry Plant	No	78	45
Trencher/Slurry Trencher	No	80	47
Vacuum Excavator (Vac-truck)	No	85	52
Vacuum Street Sweeper	No	82	49
Vibrating Hopper	No	87	54
Vibratory Concrete Mixer	No	80	47
Vibratory Pile Driver	No	101	68
Welder / Torch	No	74	41

L_{max} – maximum A-weighted sound level

kVA – kilovolt amperes

Post-construction (Operations) Impacts. Residences along the power line corridor would not be exposed to increased noise levels. Operational noise levels at or near the LWEF site would depend on the make, model, size, and location of the WTGs selected for installation. Because this information is not finalized, a conceptual layout and set of potential WTGs were analyzed. The noise level contours are shown on Figure 3.11-1.

Impact No.	Impact Description	Phase	Impact Classification
NOI-2	Adjacent nonparticipating residences would be exposed to noise levels greater than 44 dBA Leq (50 dBA Ldn); and nine participating residences would be exposed to noise levels at or greater than 65 dBA Ldn.	Operations	Class II

Impact NOI-2: Long-term Wind Turbine Generator Noise. Predictions based on a "worst-case" analysis of WTG noise are presented in Table 3.11-5. These predictions show that five adjacent nonparticipating residences could be exposed to noise levels greater than 44 dBA L_{eq} (50 dBA L_{dn}). These predictions also show that four of the nine participating residences could be exposed to noise levels at or greater than 59 dBA L_{eq} (65 dBA L_{dn}). This level of Project-induced noise would result in significant, but mitigable impacts (*Class II).*

TABLE 3.11-5
Operational Noise Level Exposure for Adjacent Residences

Residence[a]	Distance to Nearest Turbine (feet)	Distance to Nearest Turbine Corridor (feet)	Predicted Sound Pressure Level L_{DN} (dBA)
R1	2,837	2,588	57.4
R2	3,666	3,497	51.5
R3	1,946	1,684	54.3
R4	2,188	1,742	52.0
R5	2,887	2,758	50.5
PR1	1,778	1,614	60.5
PR2	1,811	1,632	60.6
PR3	1,221	832	62.0
PR4	1,620	1,232	63.0
PR5	1,262	1,019	65.2
PR6	877	583	66
PR7	987	786	65.7
PR8	1,089	708	65
PR9	2,036	1,846	52

[a] R: Nonparticipating Residence
PR: Participating Residence

Infrasound (less than 20 hertz [Hz]) and low-frequency noise (between 10 and 200 Hz) have been raised as concerns on other wind projects. Infrasound and low-frequency noise emissions were characteristic of early downwind WTG models. The blades on modern WTGs are located upwind of the tower, thus avoiding blades passing through turbulence generated by the wind shadow behind the tower, which results in infrasound and low-frequency noise emissions that are not typically problematic. The primary noise from modern WTGs is the characteristic "swish-swish-swish" as the blades rotate. This

time-varying sound might be more noticeable or annoying than a constant or steady sound of the same average level. WTG noise would likely be most noticeable when wind speed aloft is sufficient to drive the WTGs, but insufficient to create enough wind noise at ground level to mask the WTG noise.

3.11.3.4 Applicant-proposed Mitigation Measure

The following Applicant-proposed mitigation measure is considered part of the Project description. The measure has been refined to reflect the *County Standard Conditions of Approval and Mitigation Measures* (Santa Barbara County, 2002), including adding plan requirements, timing, and monitoring actions that would be required.

Mitigation Measure A-NOI-1: WTG Maintenance. The Applicant shall maintain all WTGs in excellent working order to minimize operational noise impacts.

Plan Requirements: The Applicant shall provide maintenance records to the County, upon request, demonstrating that the WTGs are being maintained appropriately.

Timing: Condition will be enforced throughout the life of the Project.

MONITORING: County staff will enforce compliance with this condition (*Addresses Impact NOI-2).*

3.11.3.5 Additional Mitigation Measures

In addition to the Applicant-proposed mitigation measure, the following additional mitigation measures will be implemented to provide adequate protection for noise-sensitive receptors. To mitigate potential impacts to a less-than-significant level, the following mitigation measures will be incorporated into the Project.

Mitigation Measure NOI-1: Construction Hours. All Project construction activities shall be limited to between the hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise approved by the County. No construction activities are allowed on state holidays.

Plan Requirements: The Applicant shall include notes on the final plans requiring compliance with the construction time limits for blasting or pile driving. County staff will confirm that the notification is included on the final plans prior to issuance of the zoning clearance for the first phase of construction and prior to issuance of the zoning clearances for subsequent phases of the Project.

Timing: Conditions will be enforced throughout all construction periods.

MONITORING: County staff will inspect the site during construction to enforce compliance with this condition (*Addresses Impact NOI-1).*

Mitigation Measure NOI-2: Telephone Number for Noise Complaints. The Applicant shall establish a telephone number for use by the public to report any significant undesirable noise conditions associated with the construction and operation of the Project. If the telephone is not staffed 24 hours per day, the Applicant shall include an automatic answering feature, with date and time stamp recording, to answer calls when the phone is unattended. This telephone number shall be posted at the Project site during construction in

a manner visible to passersby and the number shall be maintained until the Project has been operational for at least 1 year.

Plan Requirements: The Applicant shall establish a phone number and required features prior to zoning clearance for the first phase of construction and prior to zoning clearances for subsequent Project phases.

Timing: Conditions will be enforced throughout all construction periods.

MONITORING: County staff will inspect the site during construction to enforce compliance with this condition (*Addresses Impacts NOI-1 and NOI-2).*

Mitigation Measure NOI-3: Noise Complaint Resolution Plan. Throughout the construction and operation of the Project, the Applicant shall document, investigate, and evaluate all complaints and attempt to resolve all legitimate Project-related noise complaints.

Plan Requirements: The Applicant shall submit a noise complaint resolution plan for approval by the County prior to zoning clearance for the first phase of construction and prior to zoning clearances for subsequent phases of the Project. The plan shall describe the specific steps that will be carried out by the Applicant in response to noise complaints. The final determination as to whether the response is adequate will be made by the County. The noise complaint forms will include instructions for filing the form with the Applicant and with the County.

Timing: Conditions will be enforced throughout all construction and operation periods.

MONITORING: County staff will review any forms submitted and ensure that complaints are being resolved. The County may require further noise analyses and require additional mitigation measures, if appropriate (*Addresses Impacts NOI-1 and NOI-2).*

Mitigation Measure NOI-4: Maintenance of Construction Equipment. Construction contractors shall be required to ensure that construction equipment is well tuned and maintained according to the manufacturer's specifications, and that the standard noise reduction devices on the equipment are in good working order.

Plan Requirements: The Applicant shall ensure that equipment is maintained in good working order during construction.

Timing: Conditions will be enforced throughout all construction periods.

MONITORING: County staff will inspect the site during construction to enforce compliance with this condition (*Addresses Impact NOI-1).*

Mitigation Measure NOI-5: Resident Notification. The Applicant shall notify residences within 1 mile of any unusually loud construction activities, including the use of helicopters, blasting or pile driving, at least 1 week prior to their scheduled occurrence. Such activities shall be limited to between the hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise approved by the County.

Plan Requirements: The Applicant shall provide proof of notification to the County 1 week prior to the schedule occurrence of loud construction activities. An example of the

notification shall be provided prior to zoning clearance for the first phase of construction and prior to zoning clearances for subsequent phases of the Project.

Timing: Conditions will be enforced throughout all construction periods.

MONITORING: County staff will review the notice and enforce compliance with this condition (*Addresses Impact NOI-1)*.

Mitigation Measure NOI-6: Acoustical Analysis. The LWEF will be designed and operated to ensure the noise level attributable to the Project does not exceed 44 dBA L_{eq} (1 hour) under normal operating conditions at any existing nonparticipating residences, or 59 dBA L_{eq} at participating residences. The Applicant shall submit to the County a detailed acoustical analysis of the final site layout and selected WTGs. All calculations or modeling input and output files shall be made available to the County. The analysis shall include all available vendor sound-level data (specified as either guaranteed or expected), including a site-specific analysis of how sound power levels increase with wind speed.

If a stall-controlled WTG is selected, sound power level data must be sufficient to estimate maximum sound levels under any stall condition because this could fall outside the range reported by IEC 61400-11 (IEC, 2006). Control strategies, if available, to reduce Project noise levels also shall be discussed and evaluated.

Plan Requirements: This requirement shall be shown on the final plans. The acoustical analysis and final layout and specification of WTGs shall be submitted to the County for review. County acceptance of the acoustical analysis and WTG layout does not constitute endorsement nor relieve the Applicant from ensuring the actual WTG operating noise levels are in compliance with the 44-dBA L_{eq} (1-hour) limit for nonparticipating residences, and 59 dBA L_{eq} at the participating residences.

Timing: The County shall approve the acoustical study and final WTG layout prior to zoning clearance for the first and all subsequent phases.

MONITORING: County staff will ensure that the final plans incorporate the WTG layout and turbine specifications, as used for the approved acoustical analysis (*Addresses Impact NOI-2)*.

Mitigation Measure NOI-7: Noise Monitoring and Control Plan. The Applicant shall prepare and submit a "Noise Monitoring and Control Plan" prior to zoning clearance.

Plan Requirements: The plan shall be authored and implemented under the direction of a County-approved professional acoustical engineer or an engineer who is certified by the Institute of Noise Control Engineering to determine the actual noise level generated by the Project at the participating and nonparticipating residences (provided the owners of the affected residences agree). The Applicant shall be responsible for all expenditures associated with this analysis, including County staff time. If the analysis finds that the noise generated by the WTGs exceeds 44 dBA L_{eq} (1 hour) at nonparticipating residences or 59 dBA L_{eq} at the participating residences, the Applicant shall develop and implement measures to reduce Project noise levels to comply with this level. The proposed mitigation measures shall be submitted to the County for approval before implementation. Post-mitigation noise monitoring may be conducted by the County's acoustical consultant. The Applicant shall also reimburse the County for these expenditures.

Timing: The County shall approve the plan prior to zoning clearance for the first and all subsequent development phases. The noise study shall commence within 3 months following startup of commercial operations.

MONITORING: County staff will enforce this condition (*Addresses Impact NOI-2).*

Mitigation Measure NOI-8: Maintenance Hours. Maintenance or other routine noise-generating operations activities within 1,600 feet of nonparticipating residences shall be limited to weekdays between the hours of 8:00 a.m. to 5:00 p.m. only, unless activities are for emergency repairs or as otherwise approved by the County.

Plan Requirements: This note shall be printed on all final plan sets for Project components that are within 1,600 feet of nonparticipating residences.

Timing: Conditions will be enforced throughout Project operational phases.

MONITORING: County staff will enforce this condition (*Addresses Impact NOI-2).*

3.11.3.6 Residual Impacts

With implementation of the Applicant-proposed mitigation measure A-NOI-1 and additional mitigation measures NOI-1 through NOI-8, the residual impacts of impacts NOI-1 and NOI-2 would be less than significant.