3.9 NOISE

3.9.1 Affected Environment

3.9.1.1 Introduction to Noise Terminology and Descriptors

Noise can be characterized as excessive or unwanted sound. The human ear responds to a very wide range of noise intensities. The decibel scale used to describe noise is a logarithmic rating system that accounts for the large differences in audible sound intensities. This scale accounts for the human perception that loudness doubles with an increase of 10 decibels (dB). Therefore, a 70-dB sound level will sound twice as loud as a 60-dB sound level. People generally cannot detect differences of 1 dB. Although differences of 2 or 3 dB can be detected under ideal laboratory situations, they are difficult to discern in an active outdoor noise environment. A 5-dB change would likely be perceived under normal listening conditions.

Because of the logarithmic scale used to describe noise, a doubling of the strength of a noise source produces a 3-dB increase in average noise. For example, two adjacent, discrete noise events occurring simultaneously would result in a 3-dB increase over the sound level produced by only one event. Such an increase would not be perceived as a doubling in noise *loudness*, which requires a 10-dB increase.

When addressing the effects of noise on people, it is necessary to consider the frequency response of the human ear, or those frequencies that people hear best. Sound measuring instruments are therefore often designed to “weight” sounds based on the way people hear. The frequency-weighting most often used to evaluate environmental noise is A-weighting because it best reflects how humans perceive sound. Measurements from instruments using this system are reported in “A-weighted decibels,” or dBA.

Noise levels are decreased by distance, by obstructions such as buildings or terrain, by atmospheric absorption, and by absorption by the ground and vegetation. Sounds from line sources (e.g., fairly continuous roadway traffic) decrease by approximately 3 dBA for each doubling of the distance from the source. Sounds from point sources (e.g., a single wind turbine) decrease by 6 dBA when the distance from the source is doubled.

Several descriptors are used in this section to describe various noise levels. An indication of average noise levels is provided by a noise descriptor known as the equivalent sound level (L_{eq}). The L_{eq} is the level of a constant sound that has the same sound energy as the actual fluctuating sound. As such, it can be considered an energy-average sound level. In discussing sound level measurements and predictions, it is important to identify the time period being considered, because most sound-energy criteria address sound-energy averages over some time period. The L_{dn} is a 24-hour L_{eq} with a 10-decibel penalty added to sound levels that occur between 10 p.m. and 7 a.m. to account for potential disturbance of people trying to sleep. The L_{90} is the level exceeded 90% of the time during a measurement, and this level can be used to represent the background level that is almost always present during a given period of time. Continuous noise sources such as wind farms have the potential to affect the local background noise environment.

Sound levels associated with a range of common noise sources are shown in **Table 3.9-1**.

Table 3.9-1
Sound Levels Produced by Common Noise Sources

Thresholds/ Noise Sources	Sound Level (dBA)	Subjective Evaluations	Possible Effects on Humans[a]
Human Threshold of Pain Carrier jet takeoff at 50 feet	140	Deafening	Continuous exposure to levels above 70 can cause hearing loss in most people
Siren at 100 feet Loud rock band	130		
Jet takeoff at 200 feet Auto horn at 3 feet	120		
Chain saw Noisy snowmobile	110		
Lawn mower at 3 feet Noisy motorcycle at 50 feet	100	Very Loud	
Heavy truck at 50 feet	90		
Pneumatic drill at 50 feet Busy urban street, daytime	80	Loud	
Normal automobile at 50 mph Vacuum cleaner at 3 feet	70		Speech Interference
Air conditioning unit at 20 feet Conversation at 3 feet	60	Moderate	
Quiet residential area Light auto traffic at 100 feet	50		Sleep Interference
Library Quiet home	40	Faint	
Soft whisper at 15 feet	30		
Slight rustling of leaves	20	Very Faint	
Broadcasting Studio	10		
Threshold of Human Hearing	0		

[a] Source: EPA, 1974

Note that both the subjective evaluations and the physiological responses are continuums without true threshold boundaries. Consequently, there are overlaps among categories of response that depend on the sensitivity of the noise receivers.

3.9.1.2 Regulatory Overview

Washington State Noise Limits

The project site is located in unincorporated Kittitas County. Kittitas County has not adopted independent noise standards. Consequently, the applicable environmental noise limits for this evaluation are those established by the Washington Administrative Code (WAC 173-60).

WAC 173-60 establishes limits on sounds crossing property boundaries based on the Environmental Designation for Noise Abatement (EDNA) of the sound source and the receiving properties. Individual local jurisdictions may assign specific zoning or land use designations to each EDNA through ordinance or resolution. In the absence of such declarations, as in Kittitas County, WAC 173-60-030 establishes that the EDNA "of any property shall be based on the following typical uses, taking into consideration the present, future, and historical usage, as well as the usage of adjacent and other lands in the vicinity."

- Class A EDNA – Lands where people reside and sleep. They typically include residential property; multiple family living accommodations; recreational facilities with overnight accommodations such as camps, parks, camping facilities, and resorts; and community service facilities including orphanages, homes for the aged, hospitals, and health and correctional facilities.

- Class B EDNA – Lands involving uses requiring protection against noise interference with speech. These typically will include commercial living accommodations; commercial dining establishments; motor vehicle services; retail services; banks and office buildings; recreation and entertainment property not used for human habitation such as theaters, stadiums, fairgrounds, and amusement parks; and community service facilities not used for human habitation (e.g., educational, religious, governmental, cultural and recreational facilities).

- Class C EDNA –Lands involving economic activities of a nature that noise levels higher than those experienced in other areas are normally to be anticipated. Typical Class A EDNA uses generally are not permitted in such areas. Typically, Class C EDNA include storage, warehouse, and distribution facilities; industrial property used for the production and fabrication of durable and nondurable man-made goods; and agricultural and silvicultural property used for the production of crops, wood products, or livestock.

The WAC noise rules contain some leeway in the classification of the appropriate EDNA, and various jurisdictions interpret the noise rules differently. For example, Benton County, which is also subject to the WAC rule, mandates that, regardless of zoning, farms or ranches with residences are considered Class C receivers, and other nearby residences with no farming or ranching uses are considered Class A receivers. The Washington Energy Facility Site Evaluation Council (EFSEC), in its overview of the proposed Kittitas Valley Wind Power project, identified differing use areas of single properties, essentially "breaking up" the properties into separate EDNAs, with the agricultural portions of the surrounding properties considered Class C receivers and the residences considered Class A receivers.

Because Kittitas County does not have an ordinance or resolution making all properties zoned for agricultural uses Class C EDNAs, regardless of their actual or probable use, this analysis uses the present land use to determine the EDNA of the receiving properties. Accordingly, properties clearly used for agricultural or silvicultural purposes are identified as Class C receiving properties. Those properties primarily used for residential purposes with no clearly visible farming or ranching activities, are identified as Class A receiving properties.

The allowable environmental noise level limits for the three EDNA classifications are displayed **in Table 3.9-2**. The state noise rule allows these limits to be exceeded for certain periods of time: 5 dBA for no more than 15 minutes in any hour, 10 dBA for no more than 5 minutes of any hour, and 15 dBA for no more than 1.5 minutes of any hour. Sometimes these exceptions are described in terms of the percentage of time a certain level is exceeded, using statistical noise descriptors (L_ns). For example, L_{25} represents a sound level that is exceeded 25 percent of the time, or 15 minutes in an hour. Similarly, $L_{8.33}$ and $L_{2.5}$ are the sound levels that are exceeded 8.33 and 2.5 percent of the time, or 5 and 1.5 minutes in an hour, respectively. At no time can the allowable sound level be exceeded by more than 15 dBA. The applicable L_n noise limits for a Class C EDNA noise source affecting different types of receiving properties are displayed in **Table 3.9-3.**

Table 3.9-2
Washington State Environmental Noise Limits (dBA)

EDNA of Source Property	EDNA of Receiving Property		
	Class A Day/Night	Class B	Class C
Class A	55/45	57	60
Class B	57/47	60	65
Class C	60/50	65	70

The limitations for noise received in Class A EDNAs are reduced by 10 dBA during nighttime hours (10 p.m. to 7 a.m.).

Source: WAC 173-60-040.

Table 3.9-3
Applicable L_n Noise Limits for Class C EDNA Noise Sources

EDNA of Source Property	L_n Limits			
	L_{25}	$L_{8.3}$	$L_{2.5}$	L_{max}
Class A[a]	60/50	65/55	70/60	75/65
Class B	65	70	75	80
Class C	70	75	80	85

[a] The limits for noise received in Class A EDNAs are reduced by 10 dBA during nighttime hours (10 p.m. to 7 a.m.), and are shown for Day/Night.

Source: WAC 173-60-040 (b) and (c).

Because the noise generated by the proposed wind turbines is unlikely to vary significantly over an hourly period (i.e., there would be no short-term peaks), the allowances for short-term increases in the noise level limits would rarely apply. Thus, the most stringent noise limit for the proposed wind turbine project (a Class C source) would be an L_{25} of 70 dBA at nearby Class C EDNAs (i.e., agricultural and ranching properties), an L_{25} of 65 dBA at nearby Class B EDNAs, or an L_{25} of 60 dBA between 7 a.m. and 10 p.m. and 50 dBA between 10 p.m. and 7 a.m. at nearby Class A EDNAs.

WAC 173.60.050 exempts temporary construction noise from the state noise limits shown in **Table 3.9-2**.

Environmental Protection Agency Guidelines

While the U. S. Environmental Protection Agency (EPA) has no regulations governing environmental noise, the EPA has conducted extensive studies to identify the effects of certain sound levels on public health and welfare. The U.S. EPA "Levels Document" identifies sound levels "requisite to protect the public health and welfare with an adequate margin of safety" (U.S. EPA 1974). For example, EPA suggests an L_{dn} of 55 dBA for outdoor areas where a noise level of "quiet" is a basis for the use of that area. Partly because neither the cost nor feasibility of achieving these noise levels was taken into consideration in the EPA study, these suggested noise levels are guidelines, not regulations or standards.

In April 1973, the local EPA Region X office published a document titled, "Environmental Impact Statement Guidelines." This document discusses potential impacts from noise increases in terms of expected community response to the introduced noise source. This regional EPA guideline document suggests the following potential community responses to ranges of noise increases:

- Up to 5 dBA increase – few complaints if gradual increase
- 5 to 10 dBA increase – more complaints, especially if conflict with sleeping hours
- Over 10-dBA increase – substantial number of complaints

According to the EPA Region X document, generally no mitigation is required if the increase is less than 5 dBA. Some mitigation should be considered for increases of 5 to 10 dBA. Increases greater than 10 dBA would be considered serious and would warrant close attention. Again, these are EPA guidelines without the force of law, but they serve as useful indicators for potential noise impacts of projects undergoing environmental review. The 1973 document does not indicate either the time interval (e.g., hourly or daily) or the noise metric (e.g., L_{eq} or L_{max}) to which these impact/mitigation thresholds should be applied. Therefore, these guideline recommendations are applied in this revised noise analysis to the predicted cumulative hourly levels (L_{eq}/L_{25}), with some reservations as to their usefulness and applicability.

3.9.1.3 Existing Sound Environment – Desert Claim Project Area

The project area is located in a rural area consisting primarily of agricultural, ranching and low-density residential uses. The predominant sources of existing noise on and near the project site include agricultural activities, traffic on local roadways, occasional overhead aircraft (including helicopters), birds, and livestock. At some locations, wind is also a major source of noise during periods with higher wind speeds.

To characterize the existing noise environment in the project vicinity, long-term sound level measurements (SLM) were taken at four locations in July and August 2003. Measurements were also taken at an additional location in June and July 2004, to better characterize ambient sound levels near the eastern part of the project area in response to comments on the Draft EIS and to help evaluate the modified project layout. These measurements were taken over a weeklong period in order to characterize typical fluctuations in the sound levels due to varying wind conditions; ambient sound levels typically increase with higher wind speeds. The measurements were taken using four Larson Davis 820 Type I integrating sound level meters with microphones placed on tripods in acoustically neutral environmental shrouds approximately 5 feet above the ground and connected to the sound level meters with extension cables. The meters were field-calibrated prior to and immediately following the measurements.

Weather conditions during the measurement period were generally hot and dry, with highly varying wind speeds. Although the meters were not attended for the entire measurement, noise sources were noted during setup and retrieval of the meters. A summary of the sound level measurement (SLM) results is displayed in **Table 3.9-4**, and detailed information regarding the measured levels is included in **Appendix F**. Charts displaying the variation of the background sound levels with changing wind speeds are also included in **Appendix F**. The SLM locations are displayed in **Figure 3.9-1**.

As is shown in **Table 3.9-4,** the existing L_{dn}s at two of the sound level measurement locations (i.e., SLM2 and SLM3) are quite high, apparently due to numerous hours of high winds increasing the ambient sound levels. However, the measured sound levels seem inordinately high for the highest wind speeds (i.e., wind speeds greater than 20 mph) and appear to have been somewhat influenced by wind affecting the measurement equipment. The equipment manufacturer indicates that with wind speeds greater than 20 mph some vibration of the microphone might occur, resulting in somewhat higher measured sound levels. Regardless of the high measured levels during high wind, the range of background sound levels (i.e., the L_{90}s) indicates that at times it is very quiet in the project vicinity.

The occurrence of high winds had much less influence on the measured sound levels at SLM1 and SLM4, although the figures included in **Appendix F** clearly indicate that the ambient sound at these locations is also dependent upon the wind.

3.9.1.4 Existing Sound Environment – Wild Horse Site (Alternative 1)

The Wild Horse site is located in a rural area with a low population density. The closest distance between a residence and a wind turbine location (see **Figure 2-15**) is over 2 miles. The Wild Horse site and the prospective interconnect points for Alternative 1lie on privately owned land. Grazing is the predominant existing use of the site, and existing sources of human-caused noise are minimal. On-site sound monitoring data have not been collected, but the existing sound environment is likely to be quite quiet.

3.9.1.5 Existing Sound Environment – Springwood Ranch Site (Alternative 2)

Existing sound levels in the vicinity of the project site for Alternative 2 were not measured for this EIS. Given the existing low-density land uses in the area, however, it is likely that the predominant sound source in the southern portion of the site is I-90, and that farther from the freeway the sound levels are relatively low (i.e., it is fairly quiet). Other than I-90, traffic on the local roads probably represents the primary human-caused sound source in the area most of the time. Operation of agricultural equipment on the site and in nearby areas likely creates intermittent, localized noise.

Potentially sensitive receivers for this site include scattered developed sites near Taneum Creek to the south of the site; nearby residences to the east along the Thorp Highway; school and residential uses within the nearby community of Thorp; and the Sunlight Waters residential/recreational community near the northwest corner of the site. The potential receivers in Thorp and Sunlight Waters would be classified as Class A EDNAs, while those in the rural areas (such as near Taneum Creek) would be classified as Class C EDNAs.

Table 3.9-4
Range of Measured Existing Sound Levels (dBA)

Location	Days	Time	L_{eq}	L_{max}[a]	L_2[b]	L_8[c]	L_{25}[d]	L_{90}[e]	L_{dn}
SLM1	7/31-8/4/03	Daytime	30-56	50-85	26-55	33-60	40-65	21-42	57
		Nighttime	23-60	43-80	22-59	24-65	28-70	20-46	
SLM2	7/31-8/5/03	Daytime	33-67	51-83	27-68	33-71	42-74	21-59	68[f]
		Nighttime	30-68	57-83	24-68	26-72	33-68	22-58	
SLM3	7/31-8/5/03	Daytime	29-67	46-82	27-68	32-71	36-73	21-59	68[f]
		Nighttime	28-68	41-81	26-69	29-73	34-76	22-59	
SLM4	7/31-8/5/03	Daytime	31-53	46-82	31-52	33-56	35-60	30-41	51
		Nighttime	30-56	40-83	30-50	30-54	31-58	29-41	
SLM5	6/30 - 7/2/04	Daytime	32-67	51-83	37-75	34-71	31-68	29-54	59
		Nighttime	29-57	41-76	31-65	30-62	30-57	29-43	

Daytime hours are between 7 a.m. and 10 p.m., nighttime hours are between 10 p.m. and 7 a.m. L_{dn}s were computed for the entire measurement period.

SLM1: On the Frable property, representing residences near the northernmost parcel. Existing noise sources included minimal traffic on the nearby dirt road and birds.

SLM2: On the Roan property near meteorological station 0219, representing residences just north of the western parcel. Existing noise sources included distant traffic, cows, and occasional aircraft.

SLM3: In an empty field south of Reecer Creek Road and east of Lower Green Canyon Road. This measurement represents residences surrounding the southern half of the western parcels. Existing noise sources included distant traffic, birds, and a helicopter working in the distance (only observed during the equipment deployment).

SLM4: On the Femrite property, representing residences near the eastern parcels. Existing noise sources were scarce and included crickets and birds.

SLM5: On the Morrison property, representing residences east of the easternmost parcels, near Wilson Creek Road. Existing noise sources were scarce and included cows, birds, and distant traffic.

[a] L_{max} = maximum sound level.

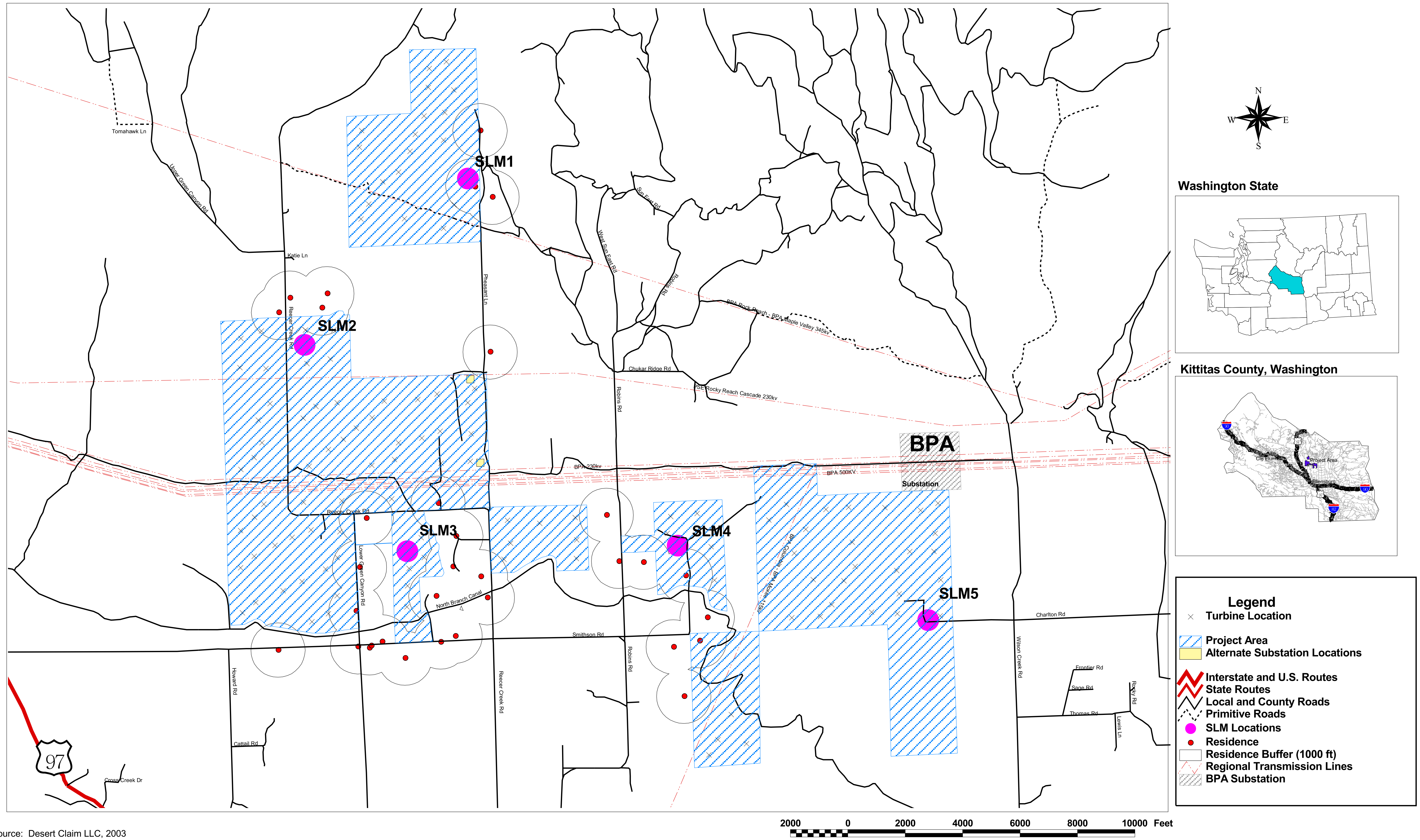
[b] The L_2 sound level roughly equivalent to the $L_{2.5}$ noise descriptor (i.e., the sound level exceeded 2.5 percent of the time, or 1.5 minutes of an hour).

[c] The L_8 sound level roughly equivalent to the $L_{8.33}$ noise descriptor (i.e., the sound level exceeded 8.33 percent of the time, or 5 minutes of an hour).

[d] The L_{25} is a sound level exceeded 25 percent of the time.

[e] The L_{90} is a sound level exceeded 90 percent of the time and is often considered a background sound level.

[f] The calculated L_{dn} sound level included numerous hours of measured sound levels with winds greater than 20 mph. Since the measured sound levels with wind speeds at or greater than 20 mph were likely influenced by sound level meter equipment being affected by the wind, the actual L_{dn}s are likely somewhat lower than 68 dBA.



Source: Desert Claim LLC, 2003

Huckell/Weinman Associates, Inc. HWA

Kittitas County
Desert Claim Wind Power Project EIS

Figure 3.9-1
Sound Level Measurement Locations

3.9.2 <u>Environmental Impacts of the Proposed Action</u>

3.9.2.1 Construction

During construction, there would be temporary increases in sound levels near active areas of construction and along roadways used for construction vehicles. The increases in noise levels would depend on the type of equipment being used, and the amount of time it is in use. Typical construction equipment could include bulldozers, graders, concrete and gravel haul trucks and cranes. Typical sound levels for these and other types of equipment are shown in **Table 3.9-5**.

Much of the construction equipment would operate at least 1,000 feet from the nearest residences, due to the siting of the wind turbines 1,000 feet or further from residences. Based on the typical attenuation of sound over distance (6 dBA per doubling of distance), construction equipment noise levels 1,000 feet from active construction areas would often fall within the state daytime noise limits for residential receivers (i.e., 60 dBA) and would easily meet the state noise limits for agricultural/industrial receivers (i.e., 70 dBA). Construction noise is exempt from the state noise limits between 7 a.m. and 10 p.m.

Table 3.9-5
Typical Construction Equipment Noise (dBA)

Activity	**Range of Hourly Leqs**		
	At 100 feet	**At 1,000 feet**	**At 5,000 feet**
Clearing	77	57	43
Grading	69-82	49-62	35-48
Paving	66-82	46-62	32-48
Erection	66-78	46-58	32-44
Types of Equipment	**Range of Noise Levels**		
	At 100 feet	**At 1,000 feet**	**At 5,000 feet**
Bulldozer	71-90	51-70	37-56
Dump Truck	76-88	56-68	42-54
Scraper	74-77	54-57	40-43
Paver	80-82	60-62	46-48
Crane	69-79	49-59	35-45
Generators	65-76	45-56	31-42
Compressors	68-75	48-55	34-41

The range of sound levels of the various types of equipment and activities stems from the variety of types of equipment that may be used for particular tasks as well as the different sound levels that may be produced by different operational modes of the same equipment. For example, some equipment will make more noise when handling heavy loads than when simply idling.

Source: EPA, 1971, modified by MFG, Inc., 2002

As indicated in **Section 2.2.3.8**, use of explosives might be necessary for installation of rock anchors if bedrock were encountered at selected turbine locations. The surficial geology of the project area consists predominantly of alluvial and glacial outwash deposits, with very limited outcroppings of basalt bedrock (see **Section 3.1.1.3** and **Appendix A**, particularly **Figures A-1** and **A-2**). Therefore, the potential for encountering bedrock and associated need for blasting would be limited to a small number of turbine locations. Blasting would occur during the turbine foundation portion of the construction schedule (relatively early in the construction process) and only during daytime hours. Blasting noise could be audible at a considerable distance from the construction site, and (if it occurred) would be noticeable at a substantial number of residences near the project area. Sound levels from blasting at receptor locations would not be extreme, however, and the occurrence would be low in frequency, intermittent and confined to a period of 1 to 2 months. WAC 173.60.050 exempts temporary construction noise, including noise from blasting, from the State noise limits between the hours of 7 a.m. and 10 p.m.

The large distances between much of the project area and potentially affected residences, the temporary nature of construction, and the restriction of construction activities to daytime hours would serve to minimize potential noise impacts from construction activities. Based on the anticipated noise levels and the timing aspects of these impacts, construction noise impacts are expected to be insignificant.

If project construction occurred in phases, the effect on the level of noise impacts would be to extend the total duration of temporary disturbance from project construction, but to reduce the intensity or magnitude of impacts for any individual phase. Construction noise impacts would still be temporary, localized and low in magnitude, and overall project impacts during construction would remain insignificant in a phased-construction scenario.

3.9.1.2 Operation

The primary long-term noise sources associated with wind energy projects are the wind turbine generators. The Desert Claim project would entail erecting and operating 120 wind turbine generators located on multiple parcels encompassing 5,237 acres. While electrical equipment in substations also typically can produce various types of noise, the alternative substation locations identified for the project are both located more than 1,000 feet from the nearest potential receptors. Therefore, a perceptible increase in sound levels at the receptors nearest the substation is not expected, and operational noise from the substation is expected to be within the applicable noise limits.

Impact Assessment Criteria

The potential for noise impacts depends on many factors, including the existing sound environment, the expectations and attitude of a listener toward the noise source, the character of the sound, the control of the receiver over the noise source, whether the receiver perceives a loss of property value or other detriment due to the noise source, and whether the receiver might benefit from the project. Because all these factors affect the potential for impacts from any given noise source, universally applicable noise impact levels have not been defined. For purposes of estimating the potential for noise impacts from the proposed project, the following general categories of "low," "medium," or "high" noise impacts have been defined and applied in this analysis.

The following impact criteria were used to assess predicted noise impacts to residential receivers in Class A EDNA's (residential). Impacts that are rated high are considered to be "significant" in magnitude in the context of SEPA (per WAC 197-11-794), while those rated as medium or low are not considered to be significant. Because the wind turbine generators may operate at any time of day or night, the impact criteria were defined based on noise received during nighttime hours.

- Low – Predicted project-related continuous noise levels of 50 dBA or less *and* predicted cumulative hourly sound level increases (in L_{eq}) less than 5 dBA. In this situation, the overall sound levels would remain below the levels typically deemed acceptable for residential uses and the increases in sound levels, while clearly perceptible if at the top end of the range, would be less than most agencies consider a major noise change.

- Medium – Predicted project-related continuous noise levels of 50 dBA or less *and* predicted cumulative hourly sound level increases (in L_{eq}) of 5 to 10 dBA. In this situation, the overall sound levels would remain below the levels typically deemed acceptable for residential uses, but the increases would be both clearly perceptible and at the top end of the range approaching a doubling in loudness where most agencies consider a major noise change.

- High (Significant) – Predicted project-related continuous noise levels greater than 50 dBA, *or* predicted cumulative hourly sound level increases (in L_{eq}) greater than 10 dBA. In this situation, the overall sound levels would exceed the levels typically deemed acceptable by the State of Washington for residential uses during nighttime hours, or the increases would represent more than a doubling in loudness over the existing condition.

The following impact criteria were used to assess predicted noise impacts to residential structures located in Class C EDNA's (agricultural). Because the wind turbine generators may operate at any time of day or night, the impact criteria were defined based on noise received during nighttime hours.

- Low – Predicted project-related continuous noise levels less than 50 dBA, *and* predicted cumulative hourly sound level increases (in L_{eq}) less than 5 dBA. In this situation, the overall sound levels would remain below the levels typically deemed acceptable for residential uses, and the increases in sound levels, while clearly perceptible if at the top end of the range would be less than most agencies consider a major noise change.

- Medium – Predicted project-related continuous noise levels from 50 – 59 dBA, *or* predicted cumulative hourly sound level increases (in L_{eq}) of 5 to 10 dBA. In this situation, the overall sound levels would reach or exceed the levels typically deemed acceptable for residential uses, or the increases would be both clearly perceptible and at the top end of the range approaching a doubling in loudness where most agencies consider a major noise change.

- High (Significant) – Predicted project-related continuous noise levels 60 dBA or higher, *or* predicted cumulative hourly sound level increases (in L_{eq}) greater than 10 dBA. In this situation, the overall sound levels would exceed the high end of the range of levels typically deemed acceptable for residential uses, and the increases would represent more than a doubling in loudness over the existing condition.

In defining the impact criteria for residences located in Class C EDNAs, high noise impacts were defined at a noise level lower than allowed by the WAC limits. This approach is reasonable because WAC sets a 24-hour noise limit for Class C EDNA receiving properties of 70 dBA. At the same time, WAC 173-60-030 also provides that typical Class A EDNA uses generally are not permitted in such areas, and most studies/literature and federal and local noise limits state that a sound level of 70 dBA occurring 24-hours a day is too high to protect residential uses. For example, if a noise source were to operate to the full extent of the WAC noise limit, the resulting hourly L_{eq} would be approximately 2 dBA higher than the identified maximum permissible level. This would allow a Class C noise source affecting a Class C receiver to emit up to an hourly L_{eq} of 72 dBA, 24 hours a day. An hourly L_{eq} of 72 dBA over a 24-hour period would result in a day-night sound level (L_{dn}) of 78 dBA, which, as is discussed in more detail below, is considered unacceptable for residential uses by most (if not all) federal, international, and local jurisdictions. Therefore, the WAC noise limit of 70 dBA for Class C receivers would not sufficiently protect residential uses from high noise impacts, and a lower level was deemed appropriate for determining when high impacts might occur. The various levels described below were considered in lieu of the 70-dBA WAC noise limit for residences located on Class C EDNA receiving properties.

The first level considered was the U.S. EPA-recommended level (L_{dn}) of 55 dBA, a guideline level intended to protect residents from noise impacts with an adequate margin of safety. This level was determined to be too low because the margin of safety used was 5 dBA, implying that EPA found that an L_{dn} of 60 dBA would likely be protective for most locations where quiet is a basis for use (i.e., residences), and because it would have essentially limited noise from the project to 49 dBA, which is more stringent than most local and federal limits. (An L_{dn} adds 10 dBA to nighttime sound levels between 10 p.m. and 7 a.m. to account for sleep sensitivity.) This EPA guideline was not adopted for regulatory use because neither the cost nor feasibility of achieving this level was considered. Also, numerous residents in the project vicinity are currently exposed to sound levels exceeding this recommended limit.

The second level considered was the 66 dBA sound level specified by the Washington State Department of Transportation (WSDOT) as a peak hourly L_{eq} at which traffic noise impacts could be expected. However, this level was set with the expectation that off-peak traffic noise would be much lower than peak-hour traffic noise, and that nighttime levels would generally be much quieter. Therefore, a continuous sound level of 66 dBA was deemed inappropriate and too high for protection of residents.

The third level considered are the Department of Housing and Urban Development (HUD) standards for new residential projects. HUD considers residential developments in locations with existing L_{dn}s of 65 dBA or lower "acceptable," locations with existing L_{dn}s of 65-75 "normally unacceptable," and locations with existing L_{dn}s of 75 dBA or more as "unacceptable." As noteded above, the WAC noise limits for a Class C EDNA noise source affecting a Class C EDNA receiving property could result in an L_{dn} of 78 dBA, which HUD considers unacceptable for residential uses. An L_{dn} of 65 dBA corresponds to a continuous 24-hour sound level of 59 dBA; therefore, hourly levels of 59 dBA and below would be considered "acceptable" and levels 60 dBA and above would be considered unacceptable. Consequently, a continuous level of 60 dBA was selected as the limit at which high noise impacts could be expected.

The EPA (1973) guidelines for environmental impact statements were used to characterize potential impacts due to cumulative sound level increases. This document states that sound level increases of 5 dBA would be expected to result in some community complaints, while increases greater than 10 dBA would likely result in a substantial number of complaints. Therefore, a 5 to 10 dBA increase is characterized as a medium impact, and a greater than 10-dBA increase is characterized as a high or significant impact.

Methodology

The noise impact analysis presented in the Draft EIS has been updated to reflect the modified proposal described in **Section 2.2**, including the wind turbine model identified by the applicant. GE Wind Energy (GEWE), the manufacturer of the wind turbine model proposed for use in the Desert Claim project, provides project developers with a warranty concerning the noise performance of the model. The warranty specifies maximum sound power levels for each wind turbine generator at varying wind speeds, based on official field measurements of noise from GEWE 1.5 sl turbines (GEWE Engineering 2004). According to the GEWE warranty, the maximum sound power level of each proposed turbine is 104 dBA for wind speeds of 7 meters/second (m/s) (measured at a height of 10 meters) or greater, as measured at the turbine hub height (65 meters). For a wind speed of 4 m/s, the specified sound power level of each turbine is 97.5 dBA. During the warranty period, the manufacturer warrants that noise measured at the hub height shall not exceed this level; if it did, the manufacturer would remedy this situation consistent with the warranty.

The ambient sound levels in the project vicinity also vary with different wind speeds. Therefore, the potential noise impacts from the wind turbines would differ with various wind speeds. Two wind speed scenarios were considered in the analysis:

- <u>Wind Speeds of 4 m/s</u> **-** The wind turbines are expected to commence operation at approximately 3 to 4 m/s (7-9 mph) winds. The sound power levels of wind turbines with 3 to 4 m/s wind speeds are expected to be lower than the sound level at the reference 8 m/s (18 mph) wind speed. However, at these lower wind speeds the ambient sound levels are also lower, and wind turbine noise may be considered more intrusive than at higher wind speeds where it may be masked as the wind creates more noise.

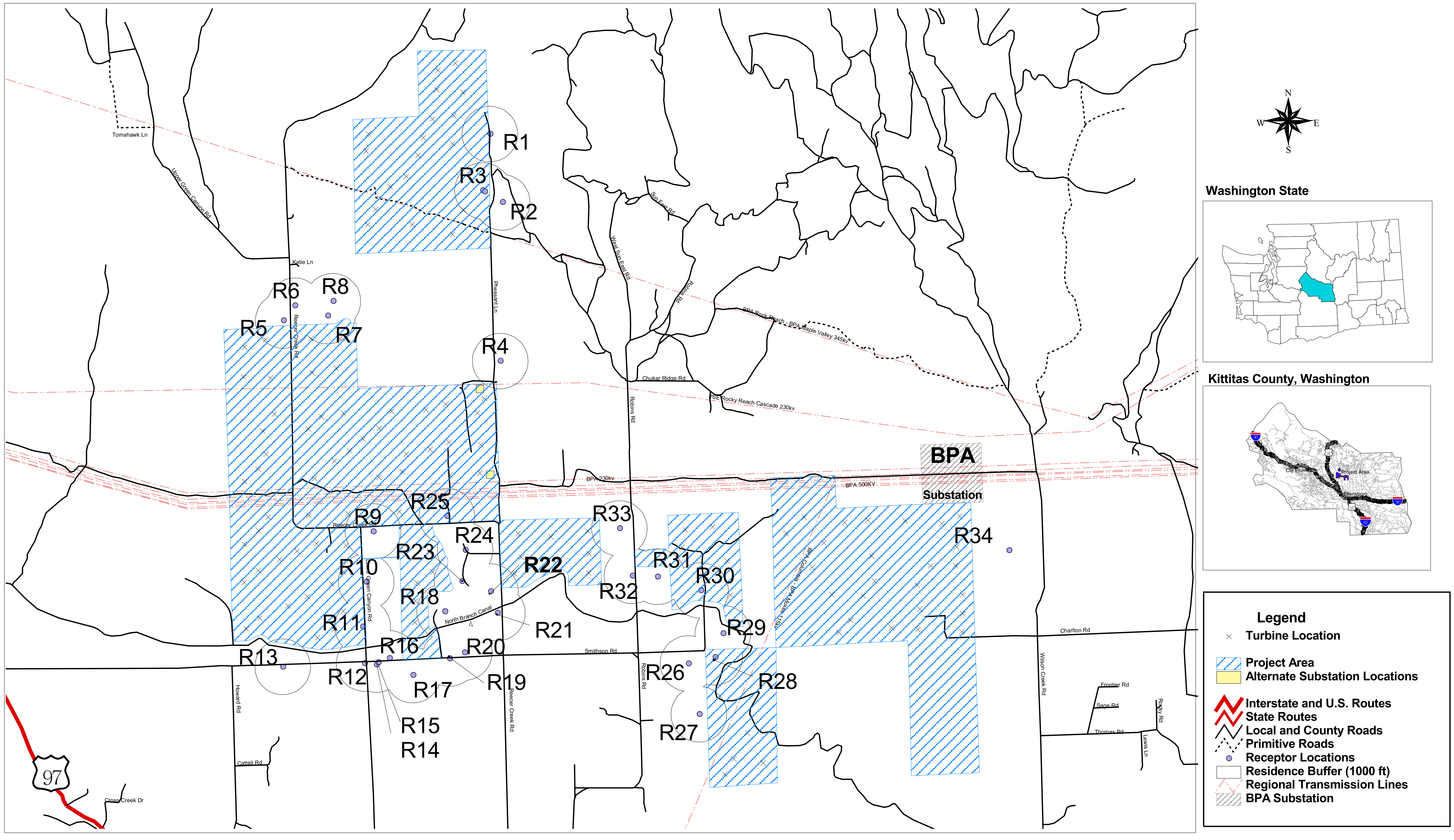
- <u>Wind Speeds of 8 m/s</u> – At wind speeds of 8 m/s (18 mph), the background sound levels would be expected to increase to where they would begin to mask the sound levels of the turbine noise.

The predicted sound power levels of the wind turbines were not provided for a specific noise descriptor (e.g., hourly L_{eq}, L_{90}), but are used here to represent an hourly L_{eq} or L_{25} sound level. Because L_{eq} and L_{25} would be expected to be very similar for wind turbine noise, the L_{eq} and L_{25} are used interchangeably in this analysis. The predicted sound levels can be considered similar to the L_{25} descriptor for comparison with the state noise limits. Also, the predicted sound levels can be considered similar to the L_{eq} for comparison with the measured ambient sound levels (L_{eq}s) when predicting potential sound level increases due to the project.

The noise modeling for the Desert Claim Wind Project was conducted using WindPRO, a computer model designed for assessing impacts of wind energy facilities. Details regarding the WindPRO model are included in **Appendix F**. WindPRO was used to predict sound levels at residential receptor locations, primarily locations within 1,000 feet of the project boundary. One receptor east of the easternmost project boundary also is included, although it is just beyond the 1,000-foot turbine setback. This receptor was included because there were no other receptors east of the project for which impacts were assessed. (Due to the number of residences in the project vicinity, the analysis focused only on the closest residences with the most potential to receive noise impacts from the project.) The receptor locations for the sound level predictions are shown in **Figure 3.9-2**. The noise model results for all receptor locations defined, including the more distant locations, are provided in **Appendix F, Exhibit 4**.

<u>Modeled Noise Contours</u>

Predicted noise contours generated by the model are displayed in **Figure 3.9-3.** The noise contours and receptors depicted in **Figure 3.9-3** include additional individual receptor locations that are not listed in subsequent predictions of sound levels at receptor locations. These additional receptor locations displayed in the graphic are situated at greater distances and are expected to receive lesser impacts than the specific receptor locations included in the following discussion.

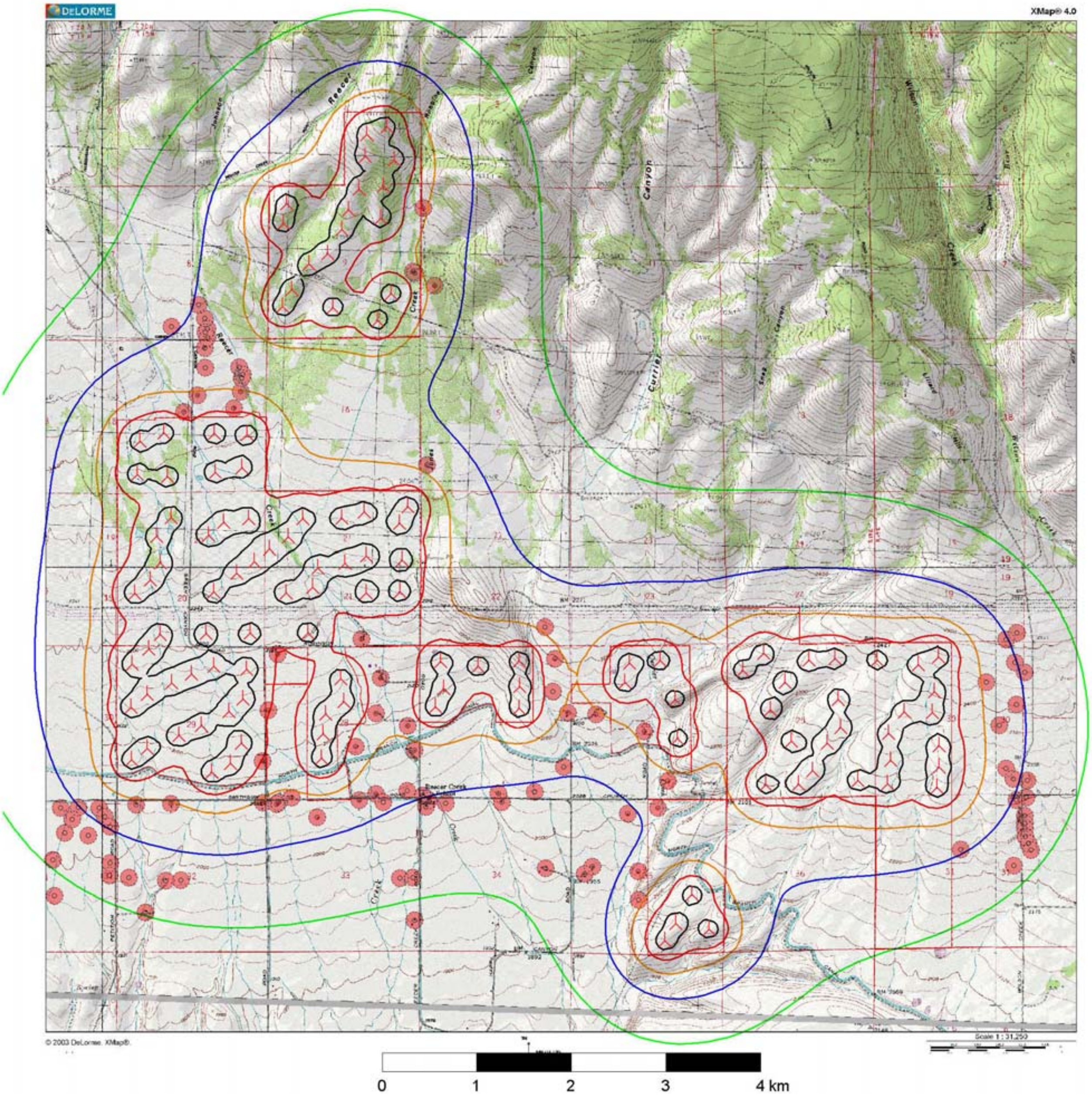


Source: Desert Claim LLC, 2003

Huckell/Weinman Associates, Inc.
HWA

Kittitas County
Desert Claim Wind Power Project EIS

Figure 3.9-2
Sound Level Prediction Receptor Locations



Map: 030905 Figure 12 , Print scale 1:55,000, Map center UTM NAD27 Zone: 10 East: 685,077 North: 5,222,087

New WTG   Noise sensitive area

Height above sea level from active line object

35 dB(A)   40 dB(A)   45 dB(A)   50 dB(A)   55 dB(A)

Source: Wind Engineers, Inc.

Huckell/Weinman Associates, Inc. HWA	**Kittitas County Desert Claim Wind Power Project EIS**	**Figure 3.9-3** **Modeled Noise Contours**

Sound Level Prediction Results

Using the methodology described above, wind turbine sound levels at 34 receptor locations near the project were predicted for the two wind scenarios. The predicted wind turbine sound levels and project-related sound level increases are displayed in **Table 3.9-6**. The existing sound levels shown in the table are the average measured hourly sound levels (L_{eq}) for wind speeds ranging from 3 to 4 m/s (shown in the 4 m/s column) and from 7 to 9 m/s (shown in the 8 m/s column). WindPRO predicted sound levels of the wind turbines for wind speeds of 8 m/s. To represent potential noise impacts from the turbines operating under less windy conditions, the levels provided for the wind speed of 8 m/s were adjusted downward by subtracting 6.5 dBA from the modeled levels to correspond to the specified sound level provided by the manufacturer for a wind speed of 4 m/s. The predictions indicate that project operation could increase sound levels at receptor locations by up to 7 dBA at wind speeds of 4 m/s, and that 8 of 34 receptors could experience project-related sound level increases of 5 dBA or more under this wind condition. Two receptors could experience sound level increases of 5 dBA or more at wind speeds of 8 m/s, while no increase was predicted for 16 receptors and the increase would be from 1 to 3 dBA for 12 other receptors.

Based on the impact criteria defined previously, the predicted noise impacts at all of the receptor locations at both wind speeds evaluated were determined to be either low or medium; none of the results were determined to be high impacts. The SEPA rules define significant as "a reasonable likelihood of more than a moderate adverse impact" (WAC 197-11-794). Therefore, the noise impacts associated with operation of the project would be insignificant. The resulting classifications of noise impacts (i.e., low, medium, and high) using the impact criteria defined above are displayed in **Table 3.9-7**.

Most of the receptor locations analyzed in this study represent residential structures located on Class C EDNA (i.e., agricultural) properties with an applicable 24-hour noise limit of 70 dBA. However, **Table 3.9-6** shows that the predicted wind turbine sound levels with wind speeds of approximately 4 m/s or less are at or below the more stringent 50-dBA nighttime noise limit applied to Class A receivers (i.e., residential properties) at all of the agricultural residences. At most of the receptor locations near the northern and western parcels, the predicted sound level increases resulting from the project with 4 m/s winds also are below 5 dBA, and thus the expected noise impacts would be low. At receptors R9 through R11, (**Figure 3.9-2)** the predicted sound level increases of 5 to 6 dBA with 4 m/s winds would represent medium noise impacts. For receptor locations near the eastern parcels, the predicted sound level increases of 5 to 7 dBA at receptors R27 and R30 through R33 represent medium noise impacts.

With wind speeds of 8 m/s, the predicted sound levels at virtually all of the receptor locations near the northern and western parcels (i.e., R1 through R25) remain below 50 dBA with predicted increases below 5 dBA, indicating low noise impacts. The exception is receptor R10, with a predicted wind turbine sound level of 50.1 dBA. This receptor location would receive medium impacts under the proposed design. None of the receptor locations near the northern and western parcels are expected to experience noise increases of 5 dBA or more in this case.

With wind speeds of 8 m/s, the predicted wind turbine sound levels at all receptor locations near the eastern parcels remain below 50 dBA, meeting the more stringent WAC noise limit for Class A receivers. However, the background sound levels in the vicinity of the eastern parcels do not increase as much with 8 m/s wind speeds as in other regions of the project vicinity, and the predicted increases over background sound levels tend to be higher at these agricultural residences (R26 through R33). Therefore, the estimated increases at two of the eight receptor locations (R30 and R33) are 5 dBA or greater and would constitute a medium noise impact.

Table 3.9-6
Predicted Sound Levels (dBA)

Receptor	EDNA	WAC Noise Limit[a]	Sound Levels at ~ 4 m/s				Sound Levels at ~ 8 m/s			
			Existing	Project Only	Overall	Increase	Existing	Project Only	Overall	Increase
Near Northern Parcel, represented by SLM1										
R1	Class C	70	39	40	42	3	47	46	49	3
R2	Class A	50	39	37	41	2	47	43	48	2
R3	Class C	70	39	40	43	4	47	47	50	3
North of Western Parcels, represented by SLM2										
R4	Class C	70	44	37	45	1	58	44	59	0
R5	Class C	70	44	42	46	2	58	48	59	0
R6	Class C	70	44	39	45	1	58	46	59	0
R7	Class C	70	44	42	46	2	58	49	59	0
R8	Class C	70	44	39	45	1	58	45	59	0
Vicinity of Western Parcels, represented by SLM3										
R9	Class C	70	40	43	45	5	57	50	57	1
R10	Class C	70	40	44	45	6	57	***50.1***	57	1
R11	Class C	70	40	43	45	5	57	50	57	1
R12	Class C	70	40	38	42	2	57	44	57	1
R13	Class C	70	40	38	42	2	57	45	57	0
R14	Class C	70	40	37	42	2	57	44	57	0
R15	Class C	70	40	37	42	2	57	44	57	0
R16	Class C	70	40	38	42	2	57	44	57	0
R17	Class C	70	40	35	41	1	57	42	57	0
R18	Class C	70	40	42	44	4	57	48	57	1
R19	Class C	70	40	36	41	2	57	42	57	0
R20	Class C	70	40	35	41	1	57	42	57	0
R21	Class C	70	40	37	42	2	57	44	57	0
R22	Class C	70	40	40	43	3	57	47	57	0
R23	Class C	70	40	41	43	4	57	48	57	1
R24	Class C	70	40	41	43	4	57	47	57	0
R25	Class C	70	40	41	43	4	57	48	57	1
West of Eastern Parcels, represented by SLM4										
R26	Class C	70	34	33	37	2	42	40	44	2
R27	Class A	50	34	37	39	5	42	44	46	4
R28	Class C	70	34	34	37	3	42	41	45	2
R29	Class C	70	34	37	39	4	42	43	46	4
R30	Class C	70	34	40	41	7	42	47	48	6
R31	Class C	70	34	38	40	5	42	44	46	4
R32	Class C	70	34	38	39	5	42	44	46	4
R33	Class A	70	34	40	41	6	42	46	48	5
East of Eastern Parcels, represented by SLM5										
R34	Class C	70	38	35	39	2	55	41	55	0

Table 3.9-6
Predicted Sound Levels (dBA)

Receptor	EDNA	WAC Noise Limit[a]	Sound Levels at ~ 4 m/s				Sound Levels at ~ 8 m/s			
			Existing	Project Only	Overall	Increase	Existing	Project Only	Overall	Increase

Notes:
[a] The WAC noise limit shown applies only to project-related noise, not to the overall sound levels (i.e., project + background). Also, because the wind turbines could operate any time of the day, the WAC noise limit shown for Class A receivers is the more stringent nighttime noise limit.
"Existing" denotes the average measured existing Leq.
"Project Only" denotes the predicted wind turbine sound levels at individual receptor locations (L25/Leq).
"Overall" denotes the cumulative sound levels, i.e., measured existing levels plus project levels.
"Increase" denotes the difference, due to the proposed project, between the overall sound levels and the existing sound levels.
Shaded cells indicate sound level increases of 5 dBA or more. ***Bold/italicized*** numbers are predicted wind turbine (project-only) sound levels that exceed 50 dBA.
Apparent discrepancies in the calculated increases are due to rounding of the levels to whole numbers.

Table 3.9-7
Noise Impact Determination

Receptor Location	Receiving EDNA	Impact Determination with Wind Speeds of			
		~ 4 m/s		~ 8 m/s	
		Impact due to Level	Impact due to Increase	Impact due to Level	Impact due to Increase
Near Northern Parcel, represented by SLM1					
R1	Class C	Low	Low	Low	Low
R2	Class A	Low	Low	Low	Low
R3	Class C	Low	Low	Low	Low
North of Western Parcels, represented by SLM2					
R4	Class C	Low	Low	Low	Low
R5	Class C	Low	Low	Low	Low
R6	Class C	Low	Low	Low	Low
R7	Class C	Low	Low	Low	Low
R8	Class C	Low	Low	Low	Low
Vicinity of Western Parcels, represented by SLM3					
R9	Class C	Low	Medium	Low	Low
R10	Class C	Low	Medium	Medium	Low
R11	Class C	Low	Medium	Low	Low
R12	Class C	Low	Low	Low	Low
R13	Class C	Low	Low	Low	Low
R14	Class C	Low	Low	Low	Low
R15	Class C	Low	Low	Low	Low
R16	Class C	Low	Low	Low	Low
R17	Class C	Low	Low	Low	Low
R18	Class C	Low	Low	Low	Low
R19	Class C	Low	Low	Low	Low
R20	Class C	Low	Low	Low	Low
R21	Class C	Low	Low	Low	Low
R22	Class C	Low	Low	Low	Low
R23	Class C	Low	Low	Low	Low
R24	Class C	Low	Low	Low	Low
R25	Class C	Low	Low	Low	Low
West of Eastern Parcels, represented by SLM4					
R26	Class C	Low	Low	Low	Low
R27	Class A	Low	Medium	Low	Low
R28	Class C	Low	Low	Low	Low
R29	Class C	Low	Low	Low	Low
R30	Class C	Low	Medium	Low	Medium
R31	Class C	Low	Medium	Low	Low
R32	Class C	Low	Medium	Low	Low
R33	Class C	Low	Medium	Low	Medium
East of Eastern Parcels, represented by SLM5					
R34	Class C	Low	Low	Low	Low

The predicted WindPRO sound levels on which the predictions displayed in **Table 3.9-6** are based have a ±1.5 dBA uncertainty, meaning that the actual sound levels could be up to 1.5 dBA more or less than the predicted levels. This uncertainty was not applied to the sound levels shown in **Table 3.9-6** nor to the resulting assessment of the degree of impacts displayed in **Table 3.9-7**. Inclusion of the ±1.5 dBA uncertainty inherent in the WindPRO modeling results could result in noise impacts that are slightly higher or lower than indicated in the predictions. If the predicted levels with an 8 m/s wind were uniformly increased by 1.5 dBA, the resulting sound levels could result in additional medium impacts due to overall levels exceeding 50 dBA at R7, R9, and R11. If the predicted levels with a 4 m/s wind were uniformly increased by 1.5 dBA, the resulting sound levels could result in additional medium impacts due to increases of 5 dBA or more at R18.

The model analysis and sound level predictions address the magnitude and extent of the potential operational noise impacts from the project. The timing aspects of those impacts are also relevant to interpreting the significance of the impacts. While operating wind turbines do produce noise from various sources, the turbine noise is expected to be distinctly audible (i.e., distinguishable from other sources) only a relatively small percentage of the year. The turbines are expected to produce distinctly audible noise approximately 22 percent of the time on an annual basis (i.e., about 1,900 hours). This would occur at times when the wind speed would be sufficient to operate the turbines, but not high enough to mask the turbine noise (see **Section 2.2.4.5** for additional discussion).

During the majority of the year, estimated to be 78 percent of the time, the turbines would not produce distinctly audible noise. There are two conditions under which the turbines would not produce distinctly audible noise. First, the turbines would not produce any noise when they are not operating. This is expected to be approximately 40 percent of the time, which means that there are approximately 3,500 hours during the year when the turbines would be idle and not producing power or noise. Second, the turbines would not produce any distinctly audible noise in high wind conditions (i.e., winds at or above approximately 18 mph or 8 meters/second) because at these speeds the wind noise would mask the turbine noise. Wind speeds are expected to be 18 mph or greater approximately 38 percent of the time on an annual basis. Combining the periods of no operation and high winds yields the expected result that the turbines would not produce distinctly audible noise 78 percent of the time, or approximately 6,800 hours per year. Conversely, the turbines would produce audible noise approximately 2,000 hours per year.

Potential Low-Frequency Noise

Although not specifically addressed in the State of Washington noise regulations, low-frequency sound that could disturb residents near the wind turbines has been identified as a concern. Historically, low frequency noise from wind turbines has been produced by the flow of air over the blades or around the nacelle or tower. However, as wind turbine technology has matured, several methods of reducing this type of noise have emerged. The following noise-reducing methods are outlined in the document, "Permitting of Wind Energy Facilities" distributed by the National Wind Coordinating Committee (NWCC 2002):

1) Orienting rotors on the "upwind" side of the turbine tower avoids the low-frequency sounds associated with the passage of the blades through the tower's wind shadow, as occurs on "down-wind" machines.

2) Tubular towers and modern nacelles are streamlined, and produce little or no sound with the passage of the wind.

3) As blade airfoils have become more efficient, more of the wind is converted into rotational torque and less into acoustic noise.

The Desert Claim project would use the “upwind” turbine design, in which the rotor is turned into the wind to place the generator and tower behind the blades. Also, the proposed tower and nacelle designs are more streamlined than those used in older turbine designs.

In order to characterize turbine noise at a location 1,000 feet downwind from a wind turbine, including the presence of high levels of low-frequency noise, MFG staff made a site visit to an operating wind farm that uses a type of turbine (a 1.5-MW unit with a 65-meter hub height) very similar to that proposed for the Desert Claim project. (A description of the site visit is included in **Appendix F, Exhibit 2**.) During the visit, turbine noise was evaluated at a distance 1,000 feet downwind from the turbines, both inside and outside of a vehicle. Also, turbine noise was evaluated for varying wind speeds occurring overnight, including both strong winds and light winds. Although turbine noise was audible at 1,000 feet downwind of the turbine when the winds were not gusting, there were no perceptible high levels of low-frequency noise from the turbines under any of the wind conditions, either inside or outside of the vehicle. Given this observation and the turbine/tower design features described above, low-frequency noise impacts from operation of the Desert Claim project are not anticipated.

Potential Tonal Noise

In addition to excessive low frequency noise, tonal noise also may be disturbing to residents near the wind turbines. Tonal noise is defined as noise at discrete frequencies. It can be caused by both mechanical sources and aerodynamic sources.

Tonal noise due to mechanical sources is typically associated with the rotation of mechanical equipment. Pure tones tend to be emitted at the rotational frequencies of shafts and generators and the meshing frequencies of the gears. The behavior of the tonality differs between turbine types and models based on how they are designed and manufactured by each turbine supplier. Furthermore, the tonality can vary significantly between tests of the same turbine model at different locations, even when the primary equipment is the same. Therefore, tonality cannot be accurately predicted prior to installation of a unit in a specific location. However, turbines can be and are designed to minimize mechanically-induced tonal noise. To reduce the potential for tonal noise, turbine manufacturers typically use various measures including special finishing of gear teeth, using low-speed cooling fans and mounting components in the nacelle instead of at ground level, adding baffles and acoustic insulation to the nacelle, using vibration isolators and soft mounts for major components, and designing the turbine to prevent noises from being transmitted into the overall structure. GEWE uses this approach in producing the 1.5 sl turbine model.

Aerodynamic noise is generated by the passage of air over the moving blades. Tonal components of aerodynamic noise may be generated by airflow over blunt trailing edges, or flow over slits and holes. Efforts to reduce tonal aerodynamic noise may include modifications to the blade design, e.g., the use of specially modified blade trailing edges.

Sound level information provided by the manufacturer for the proposed turbines specified that the measured tonality of the turbine was below the value defined as an audible tone in the standard IEC 61400-11:2002.

Also, as described above in the discussion of low-frequency noise and more fully in **Appendix F**, MFG staff made a site visit to an operating wind farm to characterize the types of noise produced by wind turbines. Turbine noise was evaluated for the existence of tones and pulses at a distance 1,000 feet downwind from the turbines, both inside and outside of a vehicle. During the overnight visit, winds of varying speeds were evaluated. With heavy winds, an aerodynamic swishing noise was clearly audible outside at the base of a turbine but was not noticed 1,000 feet downwind from the turbine. With moderate wind speeds, a low-level pulsing hum was slightly detectable 1,000 feet downwind of the turbine inside the vehicle, but no pure tones were measured. The pulsing hum was not noticeable inside the vehicle later under different wind conditions. With light winds, strong tones were noticed at the base of the turbine, but these tones were not perceived 1,000 feet downwind of the turbine.

Given the information provided by the turbine manufacturer and the results of this site visit, the potential for significant tonal noise impacts from the Desert Claim project is low. As discussed above, however, it is conceivable that individual turbines might produce tonal noise due to mechanical defects or unique site characteristics. Although it is difficult to predict the occurrence of tonal noise, the presence of tonal components could result in a greater prevalence of significant noise impacts than might otherwise occur, even assuming that the overall sound levels were the same. Typically, a 5-decibel penalty is imposed on noise with tonal content to account for the higher level of annoyance associated with tonal noise. Therefore, if the proposed Desert Claim wind farm produced tonal noise audible at a neighboring residence, significant noise impacts could occur at noise levels 5 decibels lower than the noise limits specified as expected to cause a significant noise impact. In other words, a sound level increase of 5 dBA with noticeable tonal components would be considered a high noise impact, and therefore significant.

3.9.3 Impacts of the Alternatives

3.9.3.1 Alternative 1: Wild Horse Site

Construction noise impacts for Alternative 1 would be very similar to those described for the proposed action. Based on the minimal existing development within 2 miles of the Wild Horse site, few if any local residents would experience construction noise and no significant impacts would occur.

Assessment of the potential operational noise impacts of Alternative 1 is based on noise analysis conducted for the Wild Horse Wind Power Project proposed by Zilkha Renewable Energy. A three-dimensional noise model was developed using CADNA/A, a sophisticated program developed by DataKustik, GmbH, Munich, Germany. The algorithms in CADNA/A are based on the International Standard ISO–9613-2 “Attenuation of Sound During Propagation Outdoors.” Octave band sound power levels (determined in accordance with IEC 61400) for the wind turbines and topographic information from the USGS were input into the model. Although the exact turbine model to be used for the proposed Wild Horse Project has not been determined yet, conservative values for the type of equipment being considered for this project were used in the analysis.

The modeling results developed for the Wild Horse project indicate operation of wind turbines under Alternative 1 would comply with the WAC 173-60 requirements to not exceed 50 dBA at all Class A receivers (residential) and 70 dBA at all Class C EDNA (industrial/agricultural) property boundaries. Audible noise from the high-voltage transmission interconnection and substation equipment would comply with the same requirements. No long-tern noise impacts would be expected to result from operation of Alternative 1.

3.9.3.2 Alternative 2: Springwood Ranch Site

Construction of Alternative 2 would result in noise impacts similar to those described for construction of the proposed action. The on-site sources of those impacts would be confined to a somewhat smaller area compared to the proposed action, because the conceptual plan for Alternative 2 involves a smaller wind energy facility. The extent (distance traveled) of construction noise impacts would be similar, as would the duration of the construction period.

Potential noise impacts from operation of a wind power project at the Springwood Ranch site were not modeled for this EIS, due to the lack of on-site monitoring data and the conceptual nature of the project plan for this alternative. The noise attenuation relationships reflected in the predicted noise results for the proposed action would generally be applicable to Alternative 2, however. While there are some terrain differences between the sites, contours of operational noise under Alternative 2 would likely be similar to those indicated in **Figure 3.9-3**. As discussed in **Section 3.9.2.2**, operational noise levels at any receptors within 1,000 feet of the Springwood Ranch site would likely meet the 50-dBA nighttime noise limit applied to Class A receivers, and predicted sound level increases at such locations would likely be no more than 5 to 7 dBA. Based on **Figure 3.9-3**, the 45-dBA noise contour would likely extend approximately 0.3 mile (1,600 feet) from the outermost turbines on the site, while the 40-dBA contour would be about 0.7 mile (3,700 feet) distant.

Given the conceptual layout for Alternative 2 indicated in **Figure 2-16**, sensitive receivers in Thorp and along the Thorp Highway would be approximately 1.5 miles or more away from the nearest turbines and would not be affected by operational noise under Alternative 2. The nearest receivers to the Springwood Ranch site would be scattered farmsteads and rural residences near Taneum Creek to the south of the site; scattered rural residences near the junction of SR 10 and the Thorp Highway to the east of the site; and residences in the Sunlight Waters community near the northwest corner of the site. Two receptor locations near Taneum Creek appear to be within 1,000 feet of the nearest turbine sites, while several other receptors in this area are at least 2,000 feet distant. One receptor location near SR 10 and the east bank of the Yakima River is approximately 2,000 feet from the nearest turbine location, while other residences near the junction of SR 10 and the Thorp Highway are about 4,000 feet or more distant.

Several residences along the eastern edge of Sunlight Waters are within approximately 500 feet of one or two turbine locations in the northwestern corner of the Alternative 2 layout. These residences could be subject to operational noise in excess of the 50-dBA limit, and/or noise level increases in the vicinity of 10 dBA. These residences are on the upwind side of the Alternative 2 site, so identification of likely noise impacts would require site-specific noise analysis. Nevertheless, it is possible that Alternative 2 might result in significant noise impacts to Sunlight Waters residences unless the turbines in question were relocated or eliminated.

3.9.3.3 No Action Alternative

Under the No Action Alternative, the Desert Claim Wind Power Project would not be constructed. Existing sound levels from the site include agricultural and livestock production activities, which would continue in the future with or without the Proposed Action. No known noise impacts currently occur from these agricultural activities, and none would be anticipated to occur in the future.

3.9.4 Cumulative Impacts

Cumulative impacts for all elements of the environment are addressed in **Chapter 4**.

3.9.5 Mitigation Measures

Several noise mitigation measures have been incorporated in the proposed project design. These measures include the following:

- Obtain and enforce a warranty from the selected turbine manufacturer that the maximum continuous sound power level produced by each turbine under all wind conditions would not exceed 104 dBA measured at the hub height.
- Establish minimum setbacks from individual wind turbines to nearby residences of 1,000 feet. This setback has been included in the project design.
- Provide sufficient spacing between wind turbine towers to minimize array and wake losses (i.e., energy losses created by turbulence between and among the turbines).
- Orient rotors on the “upwind” side of the turbine tower to avoid the low-frequency sounds associated with the passage of the blades through the tower’s wind shadow.

With these design features incorporated in the proposed action, no significant noise impacts were identified through the analysis of predicted sound levels at receptor locations. Because a number of local residents would experience some increased noise under some conditions and because there is a degree of uncertainty associated with the impact predictions, however, some additional noise mitigation measures would be appropriate for consideration. Specific applicable measures could include:

- Implement a noise-monitoring program under which baseline (pre-project) and with-project noise conditions would be determined and documented.
- Establish a process for recording, responding to, evaluating and resolving noise complaints that might arise during project operation.

3.9.6 Significant Unavoidable Adverse Impacts

The analysis of predicted noise levels indicated that low noise impacts would occur at almost all receptor locations near the project at higher wind speeds (8 m/s). Medium noise impacts were identified at two of the agricultural residences in the project vicinity at higher wind speeds, either due to overall sound levels exceeding 50 dBA or due to projected sound level increases of 5 to less than 10 dBA. At lower wind speeds (4 m/s), all receptors would experience low impacts based solely on the with-project noise level, although impacts for almost one-fourth of the receptors (8 of 34) were characterized as medium due to the level of increase over the existing condition. No high (i.e., significant, for purposes of SEPA analysis) adverse impacts were identified for any receptor location under either wind condition. The analysis also concluded that low-frequency noise impacts were not anticipated and that the potential for significant impacts from tonal noise is low. Based on the above conclusions, the Desert Claim project would not result in significant unavoidable adverse noise impacts. Adoption of mitigation measures involving noise monitoring and a noise-complaint resolution process would provide additional assurance that noise impacts in operation would not exceed allowable levels.