3.11 NOISE

This section describes the noise environment of the La Center Interchange and Ridgefield Interchange Sites. The issues that are addressed include: acoustical terminology, typical noise levels, Federal and Washington State noise abatement criteria, and existing noise levels.

3.11.1 ACOUSTICAL BACKGROUND AND TERMINOLOGY

Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and hence are called sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, called Hertz (Hz).

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel (dB) scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure), as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the scale is that changes in decibels correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighing network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels in decibels.

Community noise is commonly described in terms of the "ambient" noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}) over a given time period (usually one hour). The L_{eq} is the foundation of the Day-Night Average Level (L_{dn}) noise descriptor and shows very good correlation with community response to noise. **Table 3.11-1** contains definitions of acoustical terminology used in this section. **Table 3.11-2** shows examples of noise sources that correspond to various sound levels.

TABLE 3.11-1
ACOUSTICAL TERMINOLOGY

Term	Definition
Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term "ambient" is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of noise.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound. A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
L_{eq}	The average (on an energy basis) A-weighted noise level during the measurement period.
Noise	Unwanted sound.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Source: C2MHill, 2005; AES, 2006.

TABLE 3.11-2
TYPICAL A-WEIGHTED SOUND LEVELS OF COMMON NOISE SOURCES

Loudness Ratio	Decibels (dBA)	Description
128	130	Jet aircraft take-off at 100 feet
64	120	Threshold of pain
32	110	Riveting machine at operators position
16	100	Shot-gun at 200 feet
8	90	Bulldozer at 50 feet
4	80	Diesel locomotive at 300 feet
2	70	Commercial jet aircraft interior during flight
1	60	Normal conversation speech at 5-10 feet
1/2	50	Open office background level
1/4	40	Background level within a residence
1/8	30	Soft whisper at 2 feet
1/16	20	Interior of recording studio

Source: CH2Mhill, 2005; AES, 2006.

The L_{dn} is based upon the average noise level over a 24-hour day, with a +10 decibel weighting applied to noise occurring during nighttime hours (10:00 p.m. to 7:00 a.m.). The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. L_{dn}-based noise standards, with the nighttime penalty, are commonly used to assess noise effects associated with traffic, railroad and aircraft noise sources.

3.11.2 REGULATORY SETTING

Noise criteria used in this study include the Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC) for the assessment of noise consequences related to surface traffic, and the noise impact criteria established by the Washington State Department of Transportation (WsDOT) noise policy. These criteria are discussed below.

FEDERAL NOISE ABATEMENT CRITERIA

The FHWA establishes NAC for various land uses that have been categorized based upon activity. Land uses are categorized on the basis of their sensitivity to noise as indicated in **Table 3.11-3**. The FHWA NAC are based on peak traffic hour noise levels. FHWA considers a traffic noise impact to occur if predicted peak-hour traffic noise levels "approach" or exceed the NAC or "substantially exceed" existing levels (WsDOT defines "approach" as within 1 dBA of the NAC and "substantial" as an increase greater than 10 dBA resulting in at least 50 dBA L_{eq} as discussed below).

TABLE 3.11-3
FEDERAL NOISE ABATEMENT CRITERIA

Activity Category	Leq (h), dBA*	Activity Category Description
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	---	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

NOTE: *Hourly A-weighted sound level, decibels (dBA).

Source: FHWA, 1992.

The categories considered applicable to the project alternatives are the 67 dB L_{eq} exterior noise level standard for Residences and Motels (Category B), and the 52 dB interior noise level standard applied to those same uses (Category E).

STATE OF WASHINGTON NOISE REGULATIONS

Once the Federal government acquires the property in trust for the Tribe, the parcels would not be subject to State noise regulations. However, State standards are often more stringent than Federal standards and thus are discussed here. As indicated above, WsDOT considers traffic noise impacts to occur if predicted peak-hour traffic noise levels "approach" 1 dBA of the NAC or "substantially exceed" existing levels by greater than 10 dBA resulting in at least 50 dBA L_{eg}. Therefore, the values in **Table 3.11-3** should be reduced by 1 dBA in accordance with WsDOT guidance, thus the absolute criteria for Activity Category B would be 66 dBA.

Noise levels generated from construction and operation of a proposed project are evaluated against regulatory standards established by the State of Washington in Chapter 173-60 of the Washington Administrative Code (WAC). WAC 173-60 establishes maximum permissible environmental noise levels.

These levels are based on the environmental designation for noise abatement (EDNA), which is defined as "an area or zone (environment) within which maximum permissible noise levels are established." There are three EDNA designations (WAC 173-60-030), which roughly correspond to residential, commercial/recreational, and industrial/agricultural uses as found throughout the alternative project sites. As used in this section, "noise-sensitive areas" are equivalent to Class A EDNA areas.

- Class A: Lands where people reside and sleep (such as residential).
- Class B: Lands requiring protection against noise interference with speech (such as commercial/recreational).
- Class C: Lands where economic activities are of such a nature that higher noise levels are anticipated (such as industrial/agricultural).

Table 3.11-4 summarizes the maximum permissible levels applicable to noise received at noise-sensitive areas (Class A EDNA) from a commercial facility (Class B EDNA), such as the project alternatives.

The following are exempted from the limits presented in **Table 3.11-4** (WAC 173-60-050):

- Construction noise (including blasting) between the hours of 7 a.m. and 10 p.m.

- Motor vehicles when regulated by 173-62 WAC ("Motor Vehicle Noise Performance Standards" for vehicles operated on public highways).
- Motor vehicles operated off public highways, except when such noise affects residential receivers.
- Noise from electrical substations is exempted from the nighttime limits (173-60-050(2)(a) WAC).

TABLE 3.11-4
MAXIMUM PERMISSIBLE NOISE LEVELS (DBA) FROM A CLASS B EDNA*

	Class A EDNA Receiver	
	Daytime	Nighttime
Statistical Descriptor	(7 a.m. – 10 p.m.)	(10 p.m. – 7 a.m.)
L_{eq}	57	47
L_{25}	62	52
$L_{16.7}$	67	57
$L_{2.5}$	72	62

NOTE: *State of Washington Noise Regulations (WAC 173-60-040). Standard applies at the property line of the receiving property sources.

Source: CH2MHill, 2005; AES, 2006.

LOCAL

Once the Federal government acquires the property in trust for the Tribe, the land would not be subject to local regulatory authority for noise. However, since excess noise generated on Tribal land may affect citizens residing off Tribal lands, the Tribe would coordinate with local authorities with regards to the potential noise complaints arising from off-Tribal lands.

3.11.3 EXISTING NOISE LEVELS

Existing noise levels were measured over a period of at least one weekday and one weekend day at both alternative project sites (CH2MHill, 2005) (DEIS Vol. III, **Appendix U**). Additional short-term (20 minutes or less) measurements were collected at two residential locations near the La Center Interchange Site. Measurement equipment consisted of Larson Davis 824 sound level meters equipped with ½-inch microphones. An acoustical calibrator was used to calibrate the sound level meter before and after use. All instrumentation satisfies the Type I (precision) requirements. Monitoring locations (Map ID # M1, M2, M3, and M4) are shown on **Figure 3.11-1** and **Figure 3.11-2**. Measurements of existing short-term ambient noise levels (including traffic) (locations M1 and M2) are summarized in **Table 3.11-5**. Existing long-term ambient noise level measurements (including traffic) (locations M3 and M4) are shown in Tables 3-6 and 3-7 of the Noise Technical

Figure 3.11-1

Figure 3.11-2

Report (DEIS Vol. III, **Appendix U**). The existing traffic noise levels were also modeled based on traffic counts included in the traffic study (Parsons Brinckerhoff, 2006a) (DEIS Vol. II, **Appendix T**).

TABLE 3.11-5
SUMMARY OF NOISE LEVEL MEASUREMENTS FOR LOCATIONS M1 AND M2

						Northbound[1]			Southbound[2]		
Map ID	**Location Notes**	**Date**	**Start Time**	**L_{eq} (dBA)**		**Autos**	**Medium Trucks**	**Heavy Trucks**	**Autos**	**Medium Trucks**	**Heavy Trucks**
M1	Near I-5	03-Aug	8:20	62	Freeway	1929	129	288	2103	72	252
					NW 31st	24	0	6	36	0	0
M2	NW 41st	03-Aug	9:30	55	NW 41st	16	12	8	20	0	4

Source: CH2MHill, 2005.

COMPARISON WITH FHWA TRAFFIC NOISE MODEL PREDICTIONS

In addition to documenting existing traffic noise levels, the purpose of the traffic noise level measurements is to verify that FHWA's Traffic Noise Model (TNM) Version 2.5 accurately predicts traffic noise levels in the project area. Existing roadway geometry, number of vehicles counted during the noise measurement periods, and existing terrain features with potential for shielding were entered into the model. **Table 3.11-6** presents a summary of measured noise levels compared to levels predicted by the TNM using the counted traffic volumes.

TABLE 3.11-6
MEASURED AND EXISTING TRAFFIC NOISE LEVELS

Map ID	**Location Notes**	**Measured L_{eq} (dBA)**	**Modeled L_{eq} (dBA)**	**Modeled minus Measured**
M1	Near I-5	62	65	3
M2	NW 41st	55	58	3

Source: CH2MHill, 2005.

The difference between the measured and modeled noise levels are within the ±3 dBA allowed by FHWA. This close agreement verifies the accuracy of the noise prediction model for those areas, and its qualification to be utilized in the following section to make predictions regarding the existing peak-hour traffic noise levels at both the La Center Interchange and the Ridgefield Interchange Sites.

MODELED EXISTING PEAK-HOUR TRAFFIC NOISE LEVELS

Existing peak-hour traffic noise levels were modeled at a total of 22 noise receiver locations, including the noise monitoring locations M1 and M2. **Figure 3.11-1** and **Figure 3.11-2** present the modeled noise receiver locations. Modeling locations were selected to be representative of the general project area. The noise modeling was based on existing roadway geometry and peak-hour

traffic data obtained from the *Final Cowlitz Indian Tribe Casino Project Traffic Impact Study* prepared by Parsons Brinckerhoff (2006a) (DEIS Vol. II, **Appendix T)**. **Table 3.11-7** presents the existing noise level modeling results and compares them to the NAC. The FHWA would consider a traffic noise impact to occur if noise levels approached or exceeded the 67 dB L_{eq} exterior noise level standard for Category B, which is applicable to the project alternatives. WsDOT defines "approach" as within 1 dBA of the NAC. Therefore, on this project, the controlling criterion is a traffic noise level of 1 dBA less than the NAC of 67 dBA, or 66 dBA.

As indicated in **Table 3.11-7**, one location (Map ID 14) at the La Center Interchange Site, and two locations (Map ID 18 and 20) at the Ridgefield Interchange Site meet or exceed the NAC controlling criterion for existing traffic noise levels.

TABLE 3.11-7
MODELED EXISTING TRAFFIC NOISE LEVELS

Map ID	Land Use	WsDOT NAC	Existing (2005) L_{eq} dBA	Exceeds WsDOT NAC
La Center Interchange Site				
1	Residence	66	64	No
2	Residence	66	62	No
3	Residence	66	51	No
4	Residence	66	52	No
5	Residence	66	50	No
6	Residence	66	49	No
7	Residence	66	50	No
8	Residence	66	49	No
9	Residence	66	47	No
10	Residence	66	45	No
11	Residence	66	47	No
12	Residence	66	48	No
13	Residence	66	54	No
14	Residence	66	**68**	Yes
15	Residence	66	54	No
16 (M1)	Residence	66	65	No
17 (M2)	Residence	66	55	No
Ridgefield Interchange Site				
18	Residence	66	**66**	Yes
19	Residence	66	63	No
20	Residence	66	**67**	Yes
21	Residence	66	62	No
22	Residence	66	57	No

Source: CH2MHill, 2005.