3. How did WSDOT evaluate the project's potential noise effects?

The noise analysts calculated the proposed project's potential construction and operational noise levels using the methods described in the Federal Highway Administration (FHWA) document *Highway Construction Noise: Measurement, Prediction and Mitigation* (U.S. Department of Transportation [USDOT] 1997) and the Roadway Construction Noise Model (RCNM) (USDOT 2006). In addition to the FHWA methods, the analysts also relied on professional experience with major construction projects in developing accurate information. The information provided includes descriptions of the types of construction activities required for this type of project, noise levels associated with specific construction equipment, and projections of overall construction-related noise and vibration.

Because the CTC site is an existing facility in an established industrial area, construction noise analysis is not required. Noise from CTC facility operations and hauling was reviewed qualitatively, without noise monitoring or modeling, because no noise-sensitive receivers are located within 1 mile of the site and noise levels would be well below state standards.

Noise Effects Criteria

The primary regulations for the noise analysis are in the Washington state noise control ordinance (Washington Administrative Code [WAC], Chapter 173-60, Maximum Environmental Noise Levels). The noise analysts examined the municipal codes for Grays Harbor County and the cities of Hoquiam and Aberdeen to determine whether any special noise ordinances or regulations existed. There are none related to project operation; however, the City of Hoquiam's code does place additional restriction on construction activities.

The state noise control ordinance would apply to operation of the Pontoon Construction Project; however, it does not apply to vehicles traveling on public roadways. The ordinance is divided into three land use types: residential, commercial and industrial. The proposed project sites would be considered industrial sites under the WAC. Exhibit 3 presents the ordinance's maximum allowable noise level requirements based on source and receiver land use. For example, the maximum allowable noise level from the alternative sites would be 60 dBA at residences and 65 dBA at commercial properties. After 10 p.m. and before 7 a.m., the noise levels shown in Exhibit 3 would be 10 dBA less, reducing the maximum allowable noise level at a residence, for example, to 50 dBA. All noise levels are measured at the property line.

All noise related to site construction between the hours of 7 a.m. and 10 p.m. Monday through Saturday is exempt from the limits in Exhibit 3. The regulations in Exhibit 3 would not go into effect until site construction was complete and project operations (that is, pontoon construction) begun. However, if construction of the project were to occur outside the hours of 7 a.m. to 10 p.m., or on Sunday, or on a legal holiday, the noise levels would have to be within the limits in Exhibit 3.

EXHIBIT 3
State Noise Control Ordinance Maximum Sound Levels

	Maximum Allowable Sound Level (dBA)[a]		
Land Use	**Residential**	**Commercial**	**Industrial**
Residential	55	57	60
Commercial	57	60	65
Industrial	60	65	70

[a] Between 10 p.m. and 7 a.m., these levels are reduced by 10 dBA.

In addition to the WAC, the City of Hoquiam has restrictions on construction activities in Chapter 3A.30.010(1)(d)(i) of the city code that limit the hours of construction to between 7 a.m. and 8 p.m.

It is unlikely that normal construction activities could be performed within these noise limits, given that the listed limits are reduced by 10 dBA during the night. Therefore, construction between the hours of 8 p.m. and 7 a.m. would require a noise variance from the City of Hoquiam for the Anderson & Middleton Alternative. Similarly, construction between the hours of 10 p.m. and 7 a.m. would require a noise variance from the City of Aberdeen for the Aberdeen Log Yard Alternative.

Besides the noise standards provided in Exhibit 3, there are exemptions for short-term noise exceedances, including those outlined in Exhibit 4, which are based on the minutes per hour that a noise limit is exceeded.

As an example, the short-term exemptions in Exhibit 4 would work as follows: during any 1-hour period, the noise levels can exceed the maximum allowable sound levels shown in Exhibit 3 by 5 dBA for up to 15 minutes during that hour. Therefore, the project could increase operational noise to 65 dBA for 15 minutes per-hour. Verification of sound level allowable exceedance can be performed using a sound level meter that is equipped with the ability to measure L_{xx} values described in the “How is noise quantified?” section.

For example, during a 1-hour measurement, an L_{25} of 85 dBA means the sound level was at or above 85 dBA for 15 minutes of that hour (25 percent of the time), which could be used to verify the 15-minute allowable exceedance criterion in the state’s code. Similarly, the 5-minute exceedance can be verified with the $L_{8.3}$, and the 1.5-minute exceedance verified with the $L_{2.5}$.

EXHIBIT 4
Exemptions to Exhibit 3 Criteria for Short-Term Noise Exceedances

Minutes Per Hour	Adjustment to Maximum Sound Level
15	+5 dBA
5	+10 dBA
1.5	+15 dBA

Reference Noise Levels

Equipment that would be required for project construction includes normal construction equipment that is used for many roadway and structural activities. Exhibit 5 lists equipment typically used for this type of project, the activities it would be used for, and the corresponding maximum noise level as measured at 50 feet under normal use. Although other types of equipment would be used, the equipment presented in Exhibit 5 are the loudest types that would be used for project construction.

4. Affected Environment

This section provides a summary of the existing noise levels and sources in the study area. It also explains proposed project noise monitoring, land use, and existing noise sources.

How did WSDOT collect information on noise?

The noise analysts collected information on the existing noise environment in the study area as a baseline for evaluating the potential noise effects of the project. The study area includes the residential areas near the build alternative sites and areas near potential haul routes for transporting materials to and from the sites.

The CTC facility is located in an established industrial area, surrounded on all sides by commercial, industrial, and shipping facilities. The nearest noise-sensitive properties are a group of single-family residences off Norpoint Way NE, approximately 1.25 mile from the CTC facility. In addition, the site also has nearby well-established haul routes and an existing level of heavy trucking because of the shipping facilities.

For the Anderson & Middleton and Aberdeen Log Yard Alternative sites, the analysts performed the noise study for several representative receiver locations near the study area and along haul routes in areas with the potential for increased noise related to construction or operation of the facilities. Potential increases in noise at the Grays Harbor National Wildlife Refuge were also considered. Detailed information on the effects of noise on wildlife can be found in the Ecosystems Discipline Report (WSDOT 2009b).

The analysts performed long-term (24-hour or greater) and short-term onsite noise monitoring. The long-term monitoring was used to establish the existing noise environment and to identify the existing peak noise hours. The short-term data were also used to establish the existing environment, and during the measurements the analysts were able to count traffic, check speeds, and identify existing noise sources. They also reviewed the existing land uses and identified topographical features that could have an effect on the transmission of noise. The analysts reviewed aerial maps and computer-aided drawings and contacted local governments, communities, and groups to get additional information, such as noise regulations, necessary for the noise analysis.

EXHIBIT 5
Typical Construction Equipment and Reference Maximum Noise Levels

Equipment	Typical Expected Project Use[a]	L_{max}[b,c]
Air compressors	Used for pneumatic tools and general maintenance, all phases	70 to 80
Backhoe	General construction and yard work	78 to 82
Concrete batch plant	Concrete for pontoon construction	83
Concrete mixer truck	Transfer of concrete from batch plant to location onsite	79 to 85
Concrete pump	Pumping concrete	82
Concrete saws	Concrete removal, utilities access	90
Crane	Materials handling, removal, and replacement	78 to 85
Dozer	Clearing and grubbing, material movement	82 to 85
Drill rig truck	Drilling test holes	79 to 84
Excavator	General construction and materials handling	82 to 86
Forklifts	Staging area work and hauling materials	72
Grader	Roadway grading	85
Haul trucks	Materials handling, general hauling	86
Jackhammers	Pavement removal	74 to 82
Loader	General construction and materials handling	80 to 86
Pavers	Roadway paving	88
Pile drivers	Support for structure and hillside	105 to 115
Power plants	General construction use, nighttime work	72
Pumps	General construction use, water removal	62
Pneumatic tools	Miscellaneous construction work	78 to 86
Service trucks	Repair and maintenance of equipment	72
Tractor trailers	Material removal and delivery	86
Utility trucks	General project work	72
Vibratory compactor	Compact soil and roads	80 to 83
Vibratory equipment	Shoring up hillside to prevent slides, soil compacting	82 to 88
Welders	General project work	76

[a] Typical maximum noise level under normal operation as measured at 50 feet from the noise source.

[b] Maximum noise level as measured at a distance of 50 feet from the noise source under normal operation.

[c] Noise levels presented are taken from the FHWA RCNM, measured data from similar projects, USDOT, or other construction noise sources.

The analysts followed the guidelines and procedures provided by the American National Standards Institute (ANSI) for community noise measurements for the long-term measurements and FHWA methods for the short-term monitoring. Noise measurement

locations were at least 10 feet from any solid structure to prevent acoustical reflections. The microphone was placed on a tripod 5 feet off the ground. The equipment used for noise monitoring was a Bruel & Kjaer Type 2238 sound level meter equipped with statistical analysis.

The meter was calibrated before and after the measurement periods using a Bruel & Kjaer Type 4231 sound level calibrator. The sound level meter receives a complete annual system calibration at a National Institute of Standards and Testing certified traceable calibration laboratory. All noise monitoring systems meet or exceed the requirements for ANSI Type 1 noise measurement systems.

What are the existing noise characteristics in the study area?

CTC Facility

The CTC facility is located within an approximately 3-square-mile area of land zoned as an industrial center on the Blair Waterway in the City of Tacoma. The CTC site is a fully constructed facility and is routinely used for industrial activities, including the building of pontoons. Therefore, WSDOT's proposed use of this site to build pontoons would not alter the character of the human and natural environment in the study area.

Although no noise level readings were taken at the site, site noise levels would likely be dominated by heavy truck traffic. Near the site are major import areas for automobiles and shipping containers in addition to a rail switching and loading yard. Daytime noise levels in established industrial areas like this typically range from 65 to 90 dBA with average hourly noise levels of 68 to 74 dBA L_{eq}. Two main routes go to and from the CTC site: East Portland Avenue to East 11th Street and Port of Tacoma Road. Both routes have direct access to I-5 without traversing any noise-sensitive areas. Typical average sound levels along the routes would likely range from 68 to 74 dBA L_{eq} with heavy truck pass-bys of 78 to 84 dBA L_{max}.

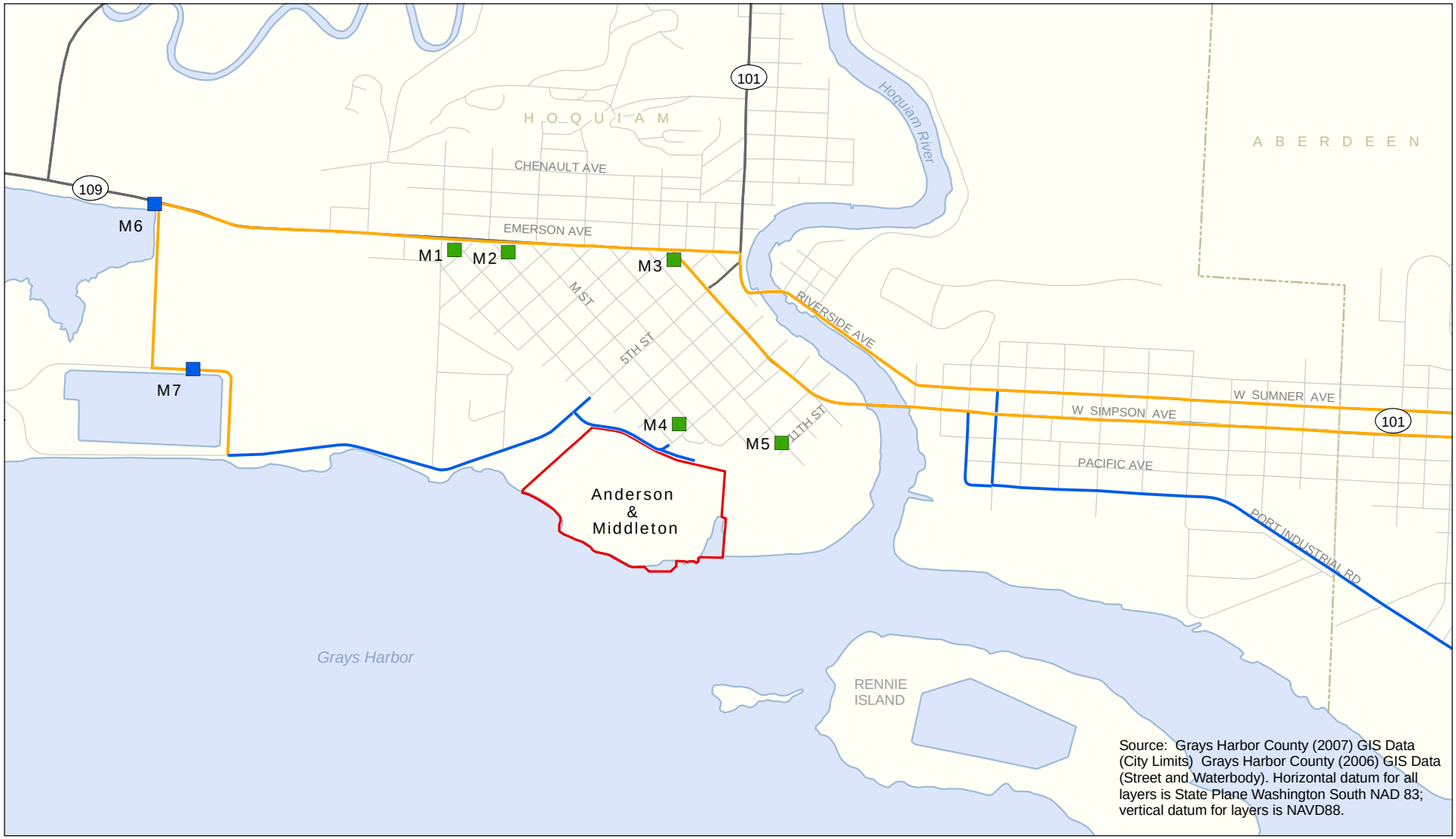
Anderson & Middleton Alternative

The Anderson & Middleton Alternative site is located on Grays Harbor near the mouth of the Hoquiam River and is an established industrial and commercial area. North of the site are the Puget Sound & Pacific Railroad line and Earley Industrial Way.

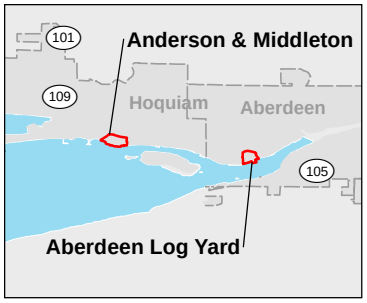
Land Use

Land use north of the railroad line is a mixture of residential and some commercial uses. Several single-family residences are located near the site from 4th to 7th Streets near N Street. Residences are also present on 8th and 9th Streets, although most buildings are shielded from the Anderson & Middleton site by other structures.

East of the site, nearby land is all zoned for industrial and commercial use but is currently unoccupied. Exhibit 6 shows potential haul routes to and from the site. These include U.S. Highway 101, State Route (SR) 109, Paulson Road, Airport Way, 5th Street, and Earley



Source: Grays Harbor County (2007) GIS Data (City Limits) Grays Harbor County (2006) GIS Data (Street and Waterbody). Horizontal datum for all layers is State Plane Washington South NAD 83; vertical datum for layers is NAVD88.



- Long-term noise monitoring location
- Short-term noise monitoring location
- Proposed project haul route common to all project sites
- Proposed project haul route: Anderson & Middleton
- Build Alternative Site
- City Limits

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Exhibit 6. **Noise Monitoring Locations for Anderson & Middleton Site**

Pontoon Construction Project

Washington State Department of Transportation

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Industrial Way. Land uses along the roadways include residential, commercial, and industrial uses. Although no schools are near the site, several schools are located along the proposed haul route. Hoquiam High School, Hoquiam Middle School, and Emerson Elementary are located on or near Emerson Street in the vicinity of Lions City Park. Central Elementary is located near the intersection of Emerson Street and Simpson Avenue, while Washington Elementary (30th Street and Cherry Street) is a block north and Hopkins Preschool Center (1313 Pacific Avenue) is a block south of the haul route.

Existing Noise Levels

The analysts measured ambient noise levels at seven locations near the Anderson & Middleton site and along potential access routes for the site, as shown in Exhibit 6. These included five short-term locations (15 to 20 minutes) and two long-term locations near the Grays Harbor National Wildlife Refuge. Short-term monitoring was performed on March 12, 2008, and the long-term data taken on October 14, 2008. The long-term locations were used for analysis of the alternative and to provide a baseline of noise levels near the Grays Harbor National Wildlife Refuge. Overall, measured sound levels ranged from 32 to 75 dBA L_{eq}, with daytime levels ranging from 36 to 75 dBA L_{eq}. The lowest levels were measured along Airport Way, west of Paulson Road, at the long-term site M7. Exhibit 7 provides the addresses of the monitoring location and lists the measured noise levels.

Major noise sources were determined to be local traffic and miscellaneous local noise sources from the nearby commercial and industrial land uses. At monitoring locations M1 through M3 (along Emerson Avenue), traffic is the dominant noise source. At location M3, a permanent pumping station also contributes to the noise in the area. At the two residential monitoring locations near the project alternative (sites M4 and M5), the only noise sources are local activities such as lawn care, occasional traffic, and some local commercial activities. As a result, daytime noise levels are in the mid- to lower range (about 50 L_{eq}).

EXHIBIT 7
Noise Monitoring Locations, Data, and Descriptions for Anderson & Middleton Alternative

Monitoring Location	Address	Type[a, b]	Duration	Noise Level (dBA L_{eq})
M1	Emerson Street at Adams Street	Short term	15 minutes	65
M2	Emerson Street at L Street	Short term	15 minutes	66
M3	Emerson Street at Lincoln Street	Short term	15 minutes	75
M4	K Street at 11th Street	Short term	15 minutes	57
M5	L Street at 9th Street	Short term	15 minutes	53
M6	Paulson Road at Highway 109	Long term	55 hours	38 to 63
M7	Airport Way, west of Paulson Road	Long term	55 hours	32 to 59

[a] Short-term data taken on March 12, 2008, between 2 and 5 p.m.

[b] Long-term data taken on October 14, 2008.

At the two long-term monitoring locations near the Grays Harbor National Wildlife Refuge, noise levels near SR 109 ranged from 38 dBA L_{eq} at night to 63 dBA L_{eq} during the day. Along Airport Way near the Hoquiam water treatment facility, noise levels diminished to 32 dBA L_{eq} at night with daytime hourly L_{eq} noise levels of up to 59 dBA. Short-term peaks along the shoreline currently reach up to 78 dBA during vehicle pass-bys and aircraft over-flights. Along SR 109, maximum noise levels reach up to 93 dBA L_{max} during heavy truck pass-bys. Exhibit 8 is a graph of the 55-hour measurements at sites M6 and M7 along the border of the wildlife refuge.

The analysis performed traffic counts concurrently at all short-term noise monitoring locations. Traffic volumes were highest near the intersection of Emerson and Lincoln Streets, with 178 passenger vehicles, 4 delivery trucks, and 17 dump trucks and long haul-type vehicles. Exhibit 9 summarizes the 15-minute traffic counts. Speeds throughout the study area were fairly constant at 30 miles per hour (mph), with an increase to 45 mph west of Hoquiam High School, increasing to 55 mph west of Paulson Road. Appendix A, Noise Modeling Details, provides details on noise monitoring performed for this analysis, and Appendix B, Traffic Volumes and Speeds, provides the traffic data.

Aberdeen Log Yard Alternative

The Aberdeen Log Yard Alternative site is located on the north shore of the Chehalis River in Aberdeen in an established industrial area. The 51-acre property is a log storage yard with limited current use. The site is bordered by Port Industrial Road to the north and East Terminal Road to the west.

Land Use

Land use directly north, east, and west of the site is primarily commercial and industrial. A railroad line is also north of the site. The nearest noise-sensitive properties are single-family residences located on Garfield Street approximately 470 feet northeast of the site. These residences are well shielded from the site by existing commercial structures. Some single-family residences are 500 feet north of the site along Market Street. As with the Garfield Street residences, these residences are also shielded from the site by existing commercial structures. Schools near the project area are Harbor High School located on North Williams near Morgan Street, A. J. West Elementary School on Bay Avenue near Martin Street, and Hopkins Preschool Center at the intersection of Division and Pacific Streets.

Exhibit 10 shows the potential haul routes for the Aberdeen Log Yard site: West Wishkah Street, West Heron Street, South Garfield Street, and East Terminal Road. Land use near many of these roadways is commercial. However, several single-family homes are located along West Wishkah and West Heron streets between Garfield and Park streets, in addition to residences past Park Street.

EXHIBIT 8
Long-Term Noise Monitoring Near Grays Harbor National Wildlife Refuge

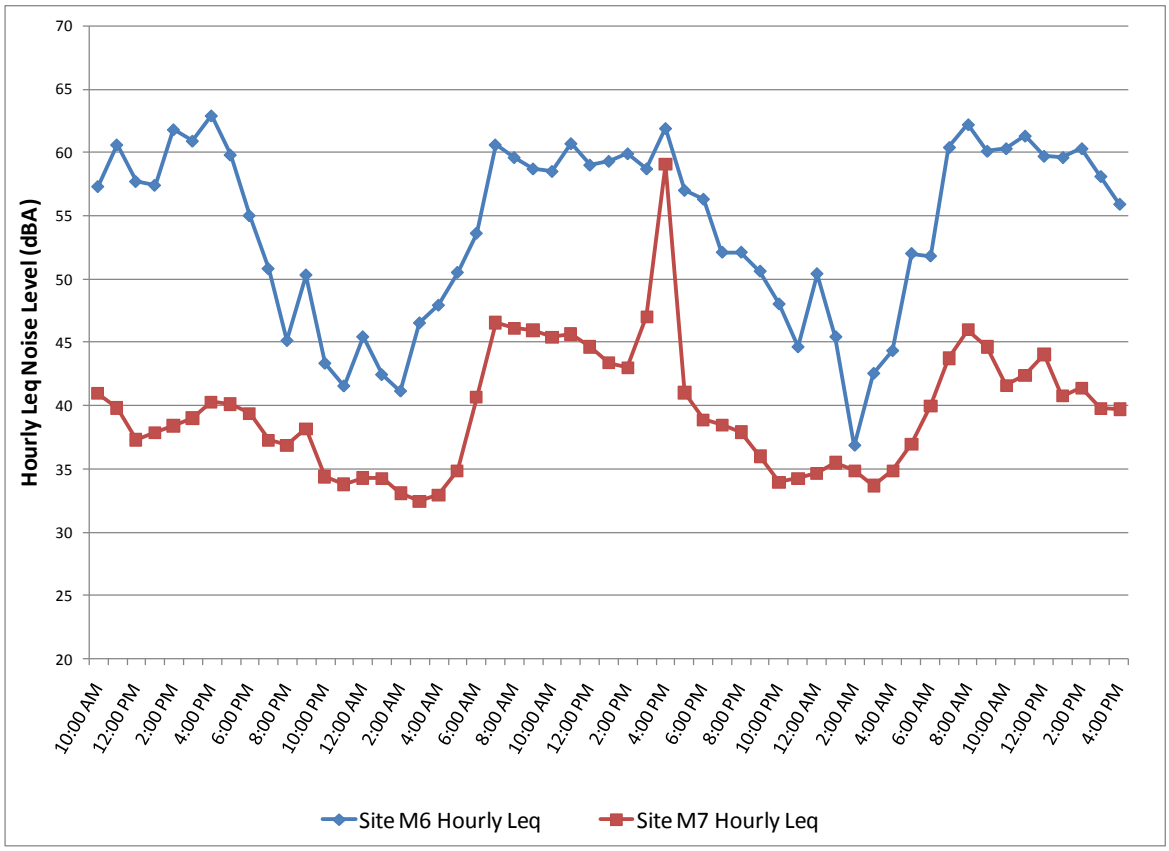
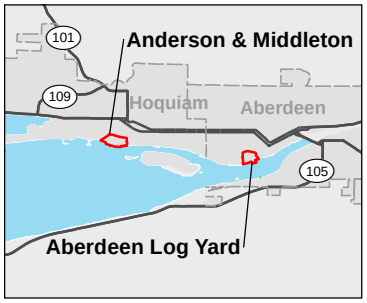


EXHIBIT 9
Traffic Counts and Descriptions at Short-Term Noise Monitoring Locations for Anderson & Middleton Alternative

Monitoring Location	Address	Cars	Medium Trucks	Heavy Trucks	Average Speeds
M1	Emerson Street at Adams Street	84	1	4	30 mph
M2	Emerson Street at L Street	103	5	4	30 mph
M3	Emerson Street at Lincoln Street	178	4	17	30 mph
M4	K Street at 11th Street	3	1	--	25 mph
M5	L Street at 9th Street	5	--	--	25 mph



Short-term noise monitoring location

Proposed project haul route common to all project sites

Proposed project haul route: Aberdeen Log Yard

Proposed project haul route: Anderson & Middleton

Build Alternative Site

City Limits

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Exhibit 10. **Noise Monitoring Locations for Aberdeen Log Yard Site**

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Existing Noise Levels

The analysts measured ambient noise levels at three locations near the Aberdeen Log Yard site, including two along potential haul routes and one along Market Street (Exhibit 10). The data were measured on January 29, 2009. Because of substantial truck traffic and acceleration noise near the Garfield Street couplet, noise levels near the site are fairly high for a residential area. Peak-hour noise levels of 67 to 68 dBA are typical for residents near Wishkah, Garfield, and Heron Streets. Along Market Street, which is shielded from the major roadways by existing commercial and residential structures, noise levels are much lower and typically would be expected to range from 50 to 55 dBA L_{eq}. Exhibit 11 is a summary of the noise monitoring data.

EXHIBIT 11
Noise Monitoring Locations, Data, and Descriptions for Aberdeen Log Yard Alternative

Monitoring Location	Address	Type[a]	Duration	Noise Level (dBA L_{eq})
M8	Market Street at Thornton Street	Short term	15 minutes	51.3
M9	Wishkah Street at Lincoln Street	Short term	15 minutes	67.3
M10	Garfield Street at Heron Street	Short term	15 minutes	67.6

[a] Short-term data taken on January 29, 2009, between 4 and 5:15 p.m.

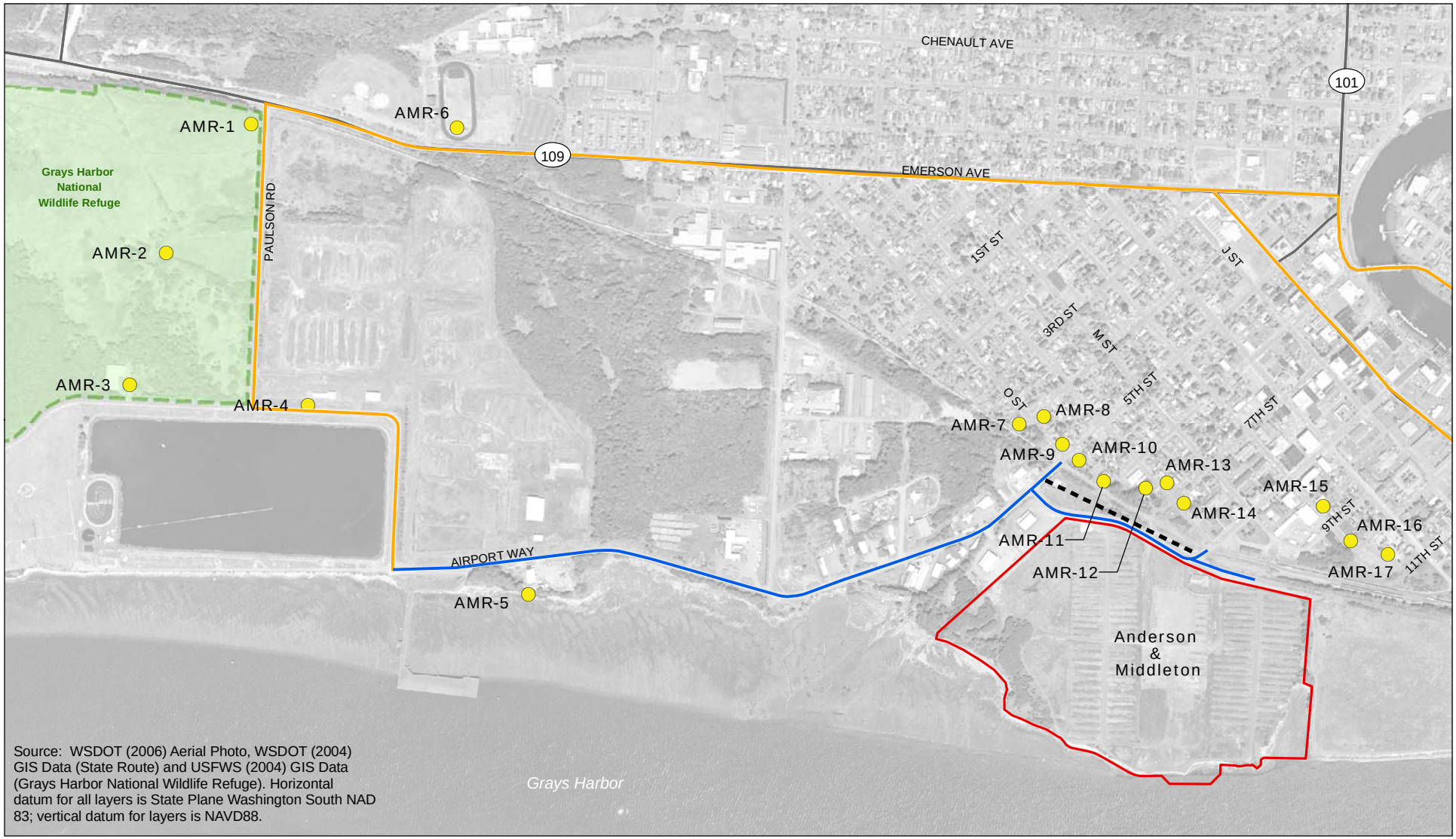
The analysts performed 15-minute traffic counts concurrently at all noise monitoring locations. As shown in Exhibit 12, which summarizes the traffic counts, the monitored portions of the potential haul route have a high existing frequency of heavy truck traffic. Speeds throughout the study area are fairly constant at 30 mph. Appendix A provides details on noise monitoring performed for this analysis, and Appendix B provides the traffic data.

EXHIBIT 12
15-Minute Traffic Counts and Descriptions for Aberdeen Log Yard Alternative

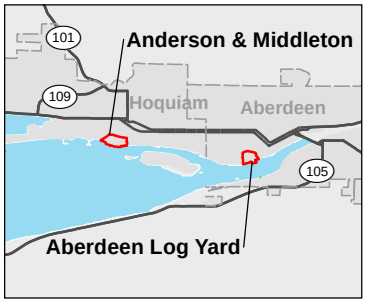
Monitoring Location	Address	Cars	Medium Trucks	Heavy Trucks	Average Speeds
M8	Market Street at Thornton Street	39	8	6	30 mph
M9	Wishkah Street at Lincoln Street	40	9	5	30 mph
M10	Garfield Street at Heron Street	0	0	0	30 mph

5. Potential Effects of the Project

For the Anderson & Middleton Alternative site, the analysts modeled noise levels at 17 locations along the haul routes and near the study area (Exhibit 13). Existing and future traffic noise levels were modeled at three locations within the Grays Harbor National Wildlife Refuge; two locations along Airport Way, including one on the shoreline; one



Source: WSDOT (2006) Aerial Photo, WSDOT (2004) GIS Data (State Route) and USFWS (2004) GIS Data (Grays Harbor National Wildlife Refuge). Horizontal datum for all layers is State Plane Washington South NAD 83; vertical datum for layers is NAVD88.



- Noise modeling location
- Noise wall
- Proposed project haul route common to all project sites
- Proposed project haul route: Anderson & Middleton
- Grays Harbor National Wildlife Refuge
- Build Alternative Site

N

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Exhibit 13. **Noise Modeling Locations for Anderson & Middleton Site**

Pontoon Construction Project

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location at Hoquiam High School; and eleven locations at residential uses north of the Anderson & Middleton site. Haul routes were also modeled along Emerson Road (SR 109) west of Adams Street at 20-foot increments from the roadway. Similar traffic noise modeling was performed along Adams Street in 20-foot increments.

For the Aberdeen Log Yard Alternative, noise levels were modeled at 11 residential locations near the project site (Exhibit 14). Six of the locations are in the Market Street residential area, just north of the site. The remaining five locations are along the potential haul routes on or near Garfield, Heron, and Wishkah Streets. The number of locations modeled for the Aberdeen Log Yard Alternative site is smaller than for the Anderson & Middleton Alternative site for two reasons: the Aberdeen Log Yard Alternative site has a smaller, more dense area that is expected to have a noticeable increase in noise from the project, and five of the modeling locations for the Anderson & Middleton Alternative site are related to the Grays Harbor National Wildlife Refuge and shoreline area.

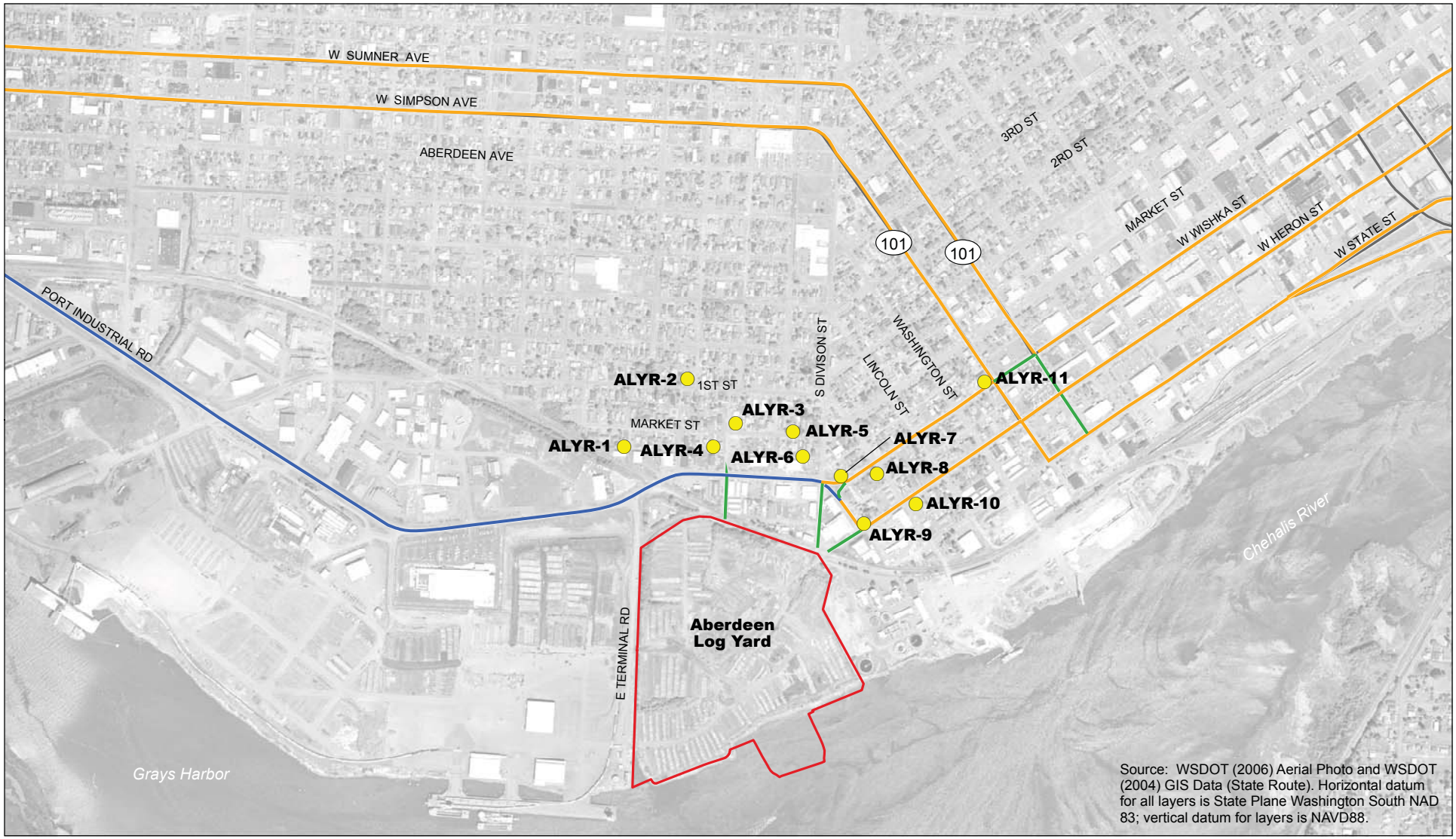
The analysts predicted construction and operational noise levels using information on planned hours of construction and operation, number of employees, and information on construction and operational equipment expected to be used at the site.

The RCNM was used to predict noise related to casting basin construction, and because typical construction equipment would also be used during operation, the model was also used for operation during pontoon construction. Input to the model included the distance between noise receivers and equipment at the site, shielding factors from existing buildings, and worst-case operation of equipment at the site.

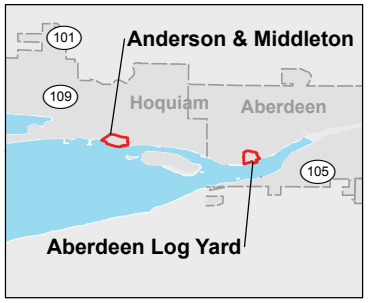
The analysts projected noise from haul routes using FHWA's Traffic Noise Model (TNM, version 2.5) (USDOT 2004). Several different model runs were used to obtain incremental differences between the existing conditions noise levels, construction noise levels, and operational noise levels. First, the existing traffic noise levels were predicted using existing traffic volumes, vehicle mixture (passenger cars and light trucks, delivery trucks, and tractor trailers and other heavy trucks), and posted speed limits. Next, noise levels during project construction were predicted by revising the traffic volumes and vehicle mixture with updated information from project traffic engineers. Finally, operational noise levels were predicted using updated traffic information predicted during normal operation of the facilities. Traffic noise models were run for several representative receivers near the site and along potential haul routes. The existing, construction, and operational traffic noise levels predictions were placed in tables for ease of comparison.

The analysts completed the following activities:

- Determined existing noise environment and site characteristics through onsite visits, noise monitoring, and noise modeling.
- Obtained the types of equipment used for construction and operations of the facilities from project engineers.



Source: WSDOT (2006) Aerial Photo and WSDOT (2004) GIS Data (State Route). Horizontal datum for all layers is State Plane Washington South NAD 83; vertical datum for layers is NAVD88.



- Noise modeling location
- Proposed project haul route common to all project sites
- Proposed project haul route: Aberdeen Log Yard
- Proposed project haul route: Anderson & Middleton
- Build Alternative Site

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Exhibit 14. **Noise Modeling Locations for Aberdeen Log Yard Site**

Pontoon Construction Project

Washington State Department of Transportation

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- Obtained reference noise levels for construction and operation equipment from the FHWA and other reference measurements.
- Identified noise sensitive receivers and selected a set of representative receivers for noise modeling.
- Used the FHWA RCNM to predict noise from construction and operation of the facilities.
- Determined traffic noise for hauling and personnel using the FHWA TNM, with input from project traffic engineers.
- Summarized noise levels in tables, with cumulative noise levels for construction and operation predicted using standard acoustical formulas.
- Compared construction and operational noise levels to the WAC and identified potential effects.

Mitigation for identified noise effects is discussed in Section 5.

How would construction of the casting basin temporarily affect noise?

Noise effects from casting basin construction and traffic during construction would be temporary, ending when project construction is complete. Equipment required to complete project construction is listed in Exhibit 5. The following subsections discuss construction and haul route noise for each site, followed by a discussion of pile-driving.

Anderson & Middleton Alternative

During construction of the Anderson & Middleton facility, noise levels could increase by up to 24 dBA over existing levels during peak construction hours with noise from the haul routes included. The expected high noise level increase is due to the following factors:

- The property currently only uses a small office onsite.
- Existing-condition noise levels in the area are low.
- Potential haul routes would be near residences.
- Residences are near the site and have little shielding from site construction.

Major contributors to construction noise include haul route noise and operation of the batch plant. Noise levels in the Grays Harbor National Wildlife Refuge are predicted to increase by 5 to 12 dBA during peak hauling along Paulson Road, ranging from 54 to 71 dBA. Noise levels at the Hoquiam High School athletic field and Emerson Elementary School are predicted to reach 69 dBA L_{eq} under the same circumstances, which is an increase of up to 6 dBA over the existing levels. Noise levels at Hoquiam Middle School are only predicted to increase by 1 to 2 dBA because of shielding and added distance from the haul route. As a result of high existing traffic on Emerson Ave near Central Elementary, noise levels are predicted to increase by 1 to 2 dBA during peak-haul hours. For residents located just north

of the site, noise levels are predicted to range from 57 to 66 dBA, with most noise resulting from operation of the batch plant and haul trucks.

Exhibit 15 provides a worst-case summary of noise for the 17 receivers shown in Exhibit 13. The noise analysts assumed the highest volume of traffic, both for haul trucks and passenger vehicles, and also assumed that the majority of construction equipment would be in use simultaneously. Because this rarely, if ever, would actually happen, the analysis can be considered a worst-case analysis and the levels in Exhibit 15 are the maximum potential sound levels. These construction activities would occur only during the day, and daytime construction is exempt from the levels in Exhibits 3 and 4; therefore, there would be no exceedances of the WAC criteria.

EXHIBIT 15
Predicted Noise Levels during Construction, Anderson & Middleton Alternative

	Noise Level (L_{eq})				
Modeling Location	**Existing (Traffic Noise)**	**Project Site Construction**	**Project Construction Traffic**	**Project Cumulative**	**Increase over Existing**
AMR-1	61	45	71	71	10
AMR-2	43	45	55	55	12
AMR-3	50	46	54	55	5
AMR-4	51	48	69	69	18
AMR-5	41	57	58	60	19
AMR-6	63	42	69	69	6
AMR-7	42	59	53	60	18
AMR-8	42	58	53	59	17
AMR-9	42	61	55	62	20
AMR-10	42	65	56	65	23
AMR-11	42	66	57	66	24
AMR-12	42	64	58	65	23
AMR-13	41	61	55	62	21
AMR-14	41	64	55	64	23
AMR-15	41	56	49	57	16
AMR-16	41	59	48	59	18
AMR-17	40	60	48	60	20

Aberdeen Log Yard Alternative

During construction of the Aberdeen Log Yard facility, noise levels could increase by up to 5 dBA over existing levels during peak construction hours with noise from the haul routes included. The primary noise source for the Aberdeen Log Yard Alternative would be noise from the haul routes. Noise from general construction at this site would be shielded from residences by existing commercial and industrial buildings.

Exhibit 16 provides a worst-case summary of noise for the 11 receivers shown in Exhibit 14. The noise analysis assumed the highest volume of traffic, both for haul trucks and passenger vehicles, and also assumed that the majority of construction equipment would be in use simultaneously. Because this rarely, if ever, would actually happen, the analysis can be considered a worst-case analysis and the levels in Exhibit 16 are the maximum potential sound levels. These construction activities would occur only during the day, and daytime construction is exempt from the levels in Exhibits 3 and 4; therefore, there would be no exceedances of the WAC criteria.

EXHIBIT 16
Predicted Noise Levels during Construction, Aberdeen Log Yard Alternative

	Noise Level (L_{eq})				
Modeling Location	**Existing (Traffic Noise)**	**Project Site Construction**	**Project Construction Traffic**	**Project Cumulative**	**Increase over Existing**
ALYR-1	55	60	59	62	7
ALYR-2	49	52	54	56	7
ALYR-3	53	59	58	61	8
ALYR-4	58	61	63	65	7
ALYR-5	54	59	59	62	8
ALYR-6	60	62	65	67	7
ALYR-7	66	60	72	72	6
ALYR-8	64	60	70	70	6
ALYR-9	69	60	75	75	6
ALYR-10	64	59	70	70	6
ALYR-11	67	49	72	72	5

Pile-Driving

Pile-driving could be required for construction of the pontoon site foundations and support dolphins. Pile-driving can produce maximum short-term noise levels of 105 to 115 dBA at a distance of 50 feet. Actual levels can vary and would depend on the distance and topographical conditions between the pile-driving location and the receiver location. Pile-driving is also exempt from the WAC code during daytime hours.

Information on the effects of pile-driving noise on fish and wildlife can be found in the Ecosystems Discipline Report (WSDOT 2009b).

How would pontoon-building operations affect noise?

CTC Facility

The CTC facility is an operating industrial facility located in a large industrial park. Because WSDOT's proposed use of this site to build pontoons is consistent with its current industrial purpose, the project would not produce substantial, unavoidable noise effects that would warrant analysis or mitigation measures. There would be no construction or operational effects at the CTC facility because it is already constructed and fully operational and exists in an area that is entirely industrial. The nearest noise-sensitive properties are more than 1 mile from the site.

Anderson & Middleton Alternative

Noise levels from general operation of the Anderson & Middleton Alternative site are predicted to range from 40 to 64 dBA L_{eq}. For most receivers near the site, operational noise levels would remain below the WAC regulations shown in Exhibits 3 and 4. Operational noise levels at several residences located near the site, however, are predicted to equal or exceed the WAC noise regulation levels during peak operational hours. Receivers AMR-10, AMR-11, AMR-12, and AMR-14 are all predicted to have maximum hourly noise levels of 62 to 64 dBA, exceeding the 60-dBA limit in the WAC.

Worst-case noise levels along the haul routes during normal operation are only predicted to increase by 1 to 6 dBA L_{eq} during peak-traffic noise hours. The noise-level increase at the Hoquiam High School athletic field is predicted to be 1 dBA L_{eq}. In the Grays Harbor National Wildlife Refuge, noise levels are predicted to increase by 2 dBA. An increase of 5 to 6 dBA is predicted along the haul route between the Anderson & Middleton site and Paulson Road. For residents located just north of the site, worst-case haul route noise levels are predicted to increase from 1 to 5 dBA, with the highest increase at receiver AMR-12.

Cumulative (traffic plus operations) noise levels for the Anderson and Middleton Alternative site are predicted to increase by up to 22 dBA over existing noise levels. The primary noise source causing the increase is operation of the batch plant and associated equipment. Haul route noise levels are also predicted to increase by 1 to 2 dBA along Emerson Street and up to 6 dBA along Adams Street during peak traffic hours. Exhibit 17 summarizes the predicted noise levels for operation of the proposed facility.

Aberdeen Log Yard Alternative

Operational noise levels north of the Aberdeen Log Yard site are predicted to range from 40 to 59 dBA L_{eq} in the nearby neighborhoods. Because the majority of noise-sensitive properties are somewhat shielded from the site by existing commercial and industrial structures, operational noise levels at those properties are expected to be within the WAC criteria.

EXHIBIT 17
Predicted Noise Levels during Project Operation, Anderson & Middleton Alternative

	Noise Level (L_{eq})				
Modeling Location	**Existing (Traffic Noise)**	**Project Site Operation[a]**	**Project Traffic Noise**	**Project Cumulative**	**Increase over Existing**
AMR-1	61	42	63	63	2
AMR-2	43	42	45	47	4
AMR-3	50	43	51	52	2
AMR-4	51	45	57	57	6
AMR-5	41	54	46	55	14
AMR-6	63	40	64	64	1
AMR-7	42	57	44	57	15
AMR-8	42	56	44	56	14
AMR-9	42	59	45	59	17
AMR-10	42	***63***	46	63	21
AMR-11	42	***64***	46	64	22
AMR-12	42	***62***	47	62	20
AMR-13	41	59	45	59	18
AMR-14	41	***62***	44	62	21
AMR-15	41	54	43	54	13
AMR-16	41	56	42	56	15
AMR-17	40	57	42	57	17

[a] Operational noise levels exceeding the WAC criteria are indicated by bold italic font.

Worst-case noise levels along the haul routes during normal operation are predicted to increase by only 1 to 2 dBA L_{eq} during peak-traffic noise hours. Because it typically takes a 3-dBA change in traffic noise level for an average person to notice a difference, no project-related traffic noise effects are predicted for the Aberdeen Log Yard Alternative.

Cumulative noise from the haul routes and site operation is predicted to result in overall noise level increases of 1 to 5 dBA at nearby noise-sensitive properties. Exhibit 18 summarizes the predicted noise levels for operation of the facility.

EXHIBIT 18
Predicted Noise Levels during Project Operation, Aberdeen Log Yard Alternative

	Noise Level (L_{eq})				
Modeling Location	**Existing (Traffic Noise)**	**Project Site Operation**	**Project Traffic Noise**	**Project Cumulative**	**Increase over Existing**
ALYR-1	55	58	56	60	5
ALYR-2	49	50	50	53	4
ALYR-3	53	56	54	58	5
ALYR-4	58	58	59	62	4
ALYR-5	54	56	55	59	5
ALYR-6	60	59	61	63	3
ALYR-7	66	58	67	67	1
ALYR-8	64	57	65	66	2
ALYR-9	69	57	71	71	2
ALYR-10	64	56	66	66	2
ALYR-11	67	46	68	68	1

How would the project affect noise in the long term?

Because the site would be in operation only for the time required to complete the pontoons for the SR 520 project (approximately 2 years), no long-term or permanent effect on area noise levels is predicted. Following completion of the pontoons, general site maintenance could result in slight increases in noise when compared with the existing noise environment.

It is also possible that the site could be leased for other industrial operations following completion of the pontoon construction; however, given the existing noise levels and land use in the area, no long-term effects are predicted.

How would the alternatives compare in their effects on noise?

During construction, increases in the noise levels at nearby noise sensitive residences would increase more under the Anderson & Middleton Alternative than they would under the Aberdeen Log Yard Alternative. The higher noise levels under the Anderson & Middleton Alternative would be due to the closer proximity of the residences and lack of shielding.

Operational noise from the two sites would be similar. The primary difference in predicted noise effects between the two sites relates to the proximity of noise-sensitive properties to the sites. The Anderson & Middleton Alternative site has noise-sensitive properties that are

closer to the site and also have no shielding from the site. The Aberdeen Log Yard Alternative site has established commercial and industrial buildings between the site and noise-sensitive properties, providing shielding and buffering from the site at the residences.

The result would be an overall lower noise level at noise-sensitive properties under the Aberdeen Log Yard Alternative than under the Anderson & Middleton Alternative. With mitigation, the noise exceedance of the Anderson & Middleton Alternative could be remedied, and the differences between the alternatives at residential properties would be less pronounced.

Because the Anderson & Middleton site is closer to the Grays Harbor National Wildlife Refuge, it is the only alternative that could have an effect on the refuge. It is unlikely that the Anderson & Middleton Alternative would have a long-term adverse effect on the Grays Harbor National Wildlife Refuge because the airport and SR 109 would remain the dominant noise sources near the Grays Harbor National Wildlife Refuge. Exhibit 19 provides a summary of the differences between the alternatives.

EXHIBIT 19
Noise Summary of Effects

	Anderson & Middleton Site	Aberdeen Log Yard Site
Casting basin construction	Noise levels could increase as much as 24 dBA over existing levels.	Noise levels could increase as much as 5 dBA over existing levels.
Pontoon-building operation	Noise levels could increase as much as 22 dBA over existing levels. Noise levels at several nearby residences would equal or exceed the state noise ordinance levels.	Noise levels could increase as much as 1 to 5 dBA over existing levels. No exceedance of state noise ordinance levels is expected.
Long-term	None.	None.
Marine berth	None.	None.
Unavoidable adverse*	Exceedances of state noise ordinance levels at several nearby residences.	None.

*Unavoidable adverse effects are effects that remain after avoidance and minimization measures are applied.

6. Mitigation

What measures would WSDOT propose to avoid or minimize negative effects?

This section discusses noise mitigation measures that could be used to minimize the effects of construction and operation at the build alternative sites. No noise effects are predicted from operation at the proposed CTC facility, so no noise mitigation should be necessary at that site.

Construction Noise Mitigation

WSDOT could implement several construction noise abatement methods, including operational methods, equipment choice, and acoustical treatments, to limit the effects of construction noise. All engine-powered equipment could be required to have mufflers installed according to the manufacturer's specifications, and all equipment could be required to comply with U.S. Environmental Protection Agency (EPA) equipment noise standards.

WSDOT could limit activities that produce the highest noise levels (such as hauling, loading spoils, jack-hammering, and using other demolition equipment) to the period from 7 a.m. to 7 p.m. As stated previously, maximum noise levels associated with pile-driving could reach 115 dBA at distances of 50 feet. Mitigation of the noise associated with pile-driving could include auguring rather than driving piles (however, using an augur is not likely to be feasible for this project), or limiting the time the activity can take place. Other less effective methods of reducing noise from pile-driving could include coating the piles, using pile pads, or using piston mufflers.

If construction-related complaints are received, a construction log could be kept for each of the construction areas. The log could contain general construction information such as the time an activity took place, type of equipment used, and any other information that may help with potential noise effects. Construction logs are helpful when determining noise sources associated with noise complaints.

A complaint hotline could also be established to investigate noise complaints and compare them to the construction logs. A construction monitoring and complaint program could help ensure that all equipment meets state, local, and any manufacturer’s specifications for noise emissions. Equipment not meeting the standards could be removed from service until proper repairs can be made, and the equipment retested for compliance. This procedure could apply to all haul trucks, loaders, excavators, and other equipment that would have extensive use at the construction sites and are major contributors to potential noise effects.

The following recommended noise mitigation measures could be included in the contract specifications:

- Require all engine-powered equipment to have mufflers installed according to the manufacturer's specifications.
- Require all equipment to comply with pertinent EPA equipment noise standards.
- Limit jackhammers, concrete breakers, saws, and other forms of demolition to daytime hours of 8 a.m. to 5 p.m. on weekdays, with more stringent restrictions on weekends.
- Minimize noise by regular inspection and replacement of defective mufflers and parts that do not meet the manufacturer’s specifications.
- Install temporary or portable acoustic barriers around stationary construction noise sources and along the sides of the temporary bridge structures where feasible.

- Locate stationary construction equipment as far from nearby noise-sensitive properties as possible.
- Shut off idling equipment.
- Reschedule construction operations to avoid periods of noise annoyance identified in complaints.
- Notify nearby residents whenever extremely noisy work would be occurring.
- Implement additional noise mitigation measures as more detail is developed for the actual construction processes.

Operational Noise Mitigation

WSDOT has developed mitigation measures for the Grays Harbor build alternatives that could be used to reduce noise levels predicted to exceed the WAC criteria for an established industrial site.

Anderson & Middleton Alternative

For the Anderson & Middleton Alternative site, operational noise levels are predicted to exceed the WAC criteria at receivers AMR-10, AMR-11, AMR-12, and AMR-14. The primary reason for the noise effect would be operation of concrete pumps, batch plant operation, and other heavy equipment. Noise mitigation for this area could include a noise wall or earth berm.

Using the methods provided in the FHWA *Highway Noise Barrier Design Handbook* found in the Highway Noise Barrier Design Package (USDOT 2000), potential barrier reductions were predicted for receivers AMR-7 through AMR-14. The prediction methods can also be found on the FHWA website (www.fhwa.dot.gov/environment/ab_noise.htm).

The analysis was performed using a 400-Hertz frequency bandwidth, which is slightly lower than the 500-Hertz frequency recommended by FHWA for highway noise. The lower frequency was used to account for the low-frequency noise associated with construction equipment. Distances between the proposed wall and noise sensitive sources were obtained from scaled aerial photos. Wall heights of 12 to 18 feet were considered, and the results of the predictions are provided in Exhibit 20.

All of the receivers are located north of the site along O Street and N Street. Construction of a berm or noise wall between the haul route (5th Street extension) and the affected receivers could reduce operational noise to within the WAC criteria. The berm or wall would have to be approximately 1,200 feet long, extending from the 5th Street extension to 8th Street. To bring the reduction in noise levels to within the WAC criteria, the recommended height for the wall or berm is 16 to 18 feet. The berm or wall could effectively reduce noise from both the haul route accessing the site and the batch plant. Exhibit 13 provides the location of the proposed wall or berm.

Aberdeen Log Yard Alternative

This alternative would cause no noise exceedances of the WAC criteria during project operation, so no noise mitigation would be necessary.

EXHIBIT 20
Predicted Operational Noise Levels with and without Mitigation, Anderson & Middleton Alternative

Modeling Location	Site Operational Noise Levels (dBA L_{eq})	Operational Noise Levels with Mitigation			
		12-Foot Wall	14-Foot Wall	16-Foot Wall	18-Foot Wall
AMR-7	57	54	52	52	51
AMR-8	56	52	51	50	50
AMR-9	59	56	54	54	53
AMR-10	***63***	***60***	58	58	57
AMR-11	***64***	***61***	59	59	58
AMR-12	***62***	58	57	56	55
AMR-13	59	56	55	53	53
AMR-14	***62***	58	57	56	55

Note: Operational noise levels exceeding the WAC criteria are shown in bold italic font.

How could the project compensate for unavoidable negative effects?

With mitigation, an exceedance of the WAC criteria from operation of the Anderson & Middleton Alternative could be mitigated. The Aberdeen Log Yard Alternative would have no exceedances of the WAC criteria. Therefore, there would be no unavoidable noise effects associated with the project, and no noise abatement would be required.

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