

APPENDIX D

**SOUND ANALYSIS FOR SKAMANIA QUARRY; SKAMANIA COUNTY, WASHINGTON
PREPARED BY BRC ACOUSTICS & AUDIOVISUAL DESIGN
DATED SEPTEMBER 9, 2020**

SOUND ANALYSIS

for

**SKAMANIA QUARRY
SKAMANIA COUNTY, WASHINGTON**

Submitted to:

**J. L. Storedahl & Sons, Inc.
2233 Talley Way
Kelso, WA 98626**

Prepared by:

Ioana Park, P.E.

BRC Acoustics & Audiovisual Design

**1932 First Avenue, Suite 620
Seattle, WA 98101
p: 206.270.8910
www.brcacoustics.com**

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1. INTRODUCTION

This report describes sound levels associated with proposed mining, aggregate processing, and transportation activities at the proposed Skamania Rock Quarry in Skamania County, Washington. The report presents noise-emission characteristics of the proposed noise sources, calculated sound levels due to mining and processing at the proposed quarry and aggregate transportation off site, and evaluation with respect to noise criteria.

2. PROJECT SITE AND SURROUNDING LAND USES

A vicinity map of the proposed Skamania Quarry, surrounding properties, and sound analysis locations are shown in Figure 2-1.

The site of the proposed Skamania Quarry is located in unincorporated Skamania County, Washington, northwest of the town of Skamania. The project site is on Skamania County Parcel 02060000400000. Properties to the east, north, and west, are unoccupied forest land.

The nearest residential properties are at least ¼ mile to the southwest and southeast of the site perimeter.

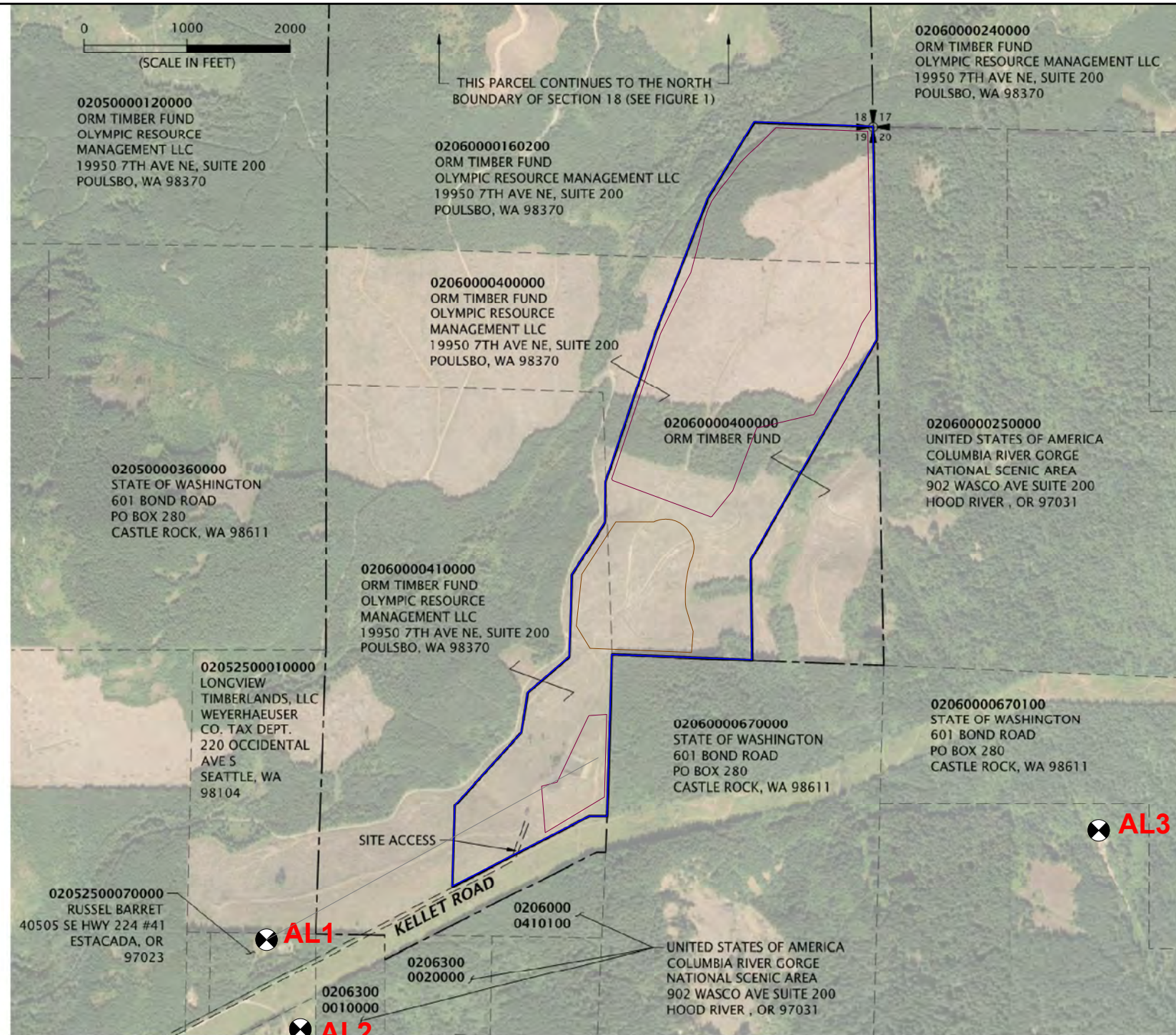
3. SOUND LEVEL DESCRIPTORS AND CRITERIA

3.1 Sound Level Descriptors

Sound is measured as sound level in units of decibels, dB. Environmental sound is often measured as A-weighted sound level in dBA. The A-weighting is a specific weighting filter in a sound level meter that corresponds to human hearing sensitivity at the various sound frequencies. People normally experience sound levels between about 30 and 90 dBA, depending on their activity. For example, a loud nearby vehicle, radio or power tool may produce 80 to 90 dBA, normal conversation is about 50 to 60 dBA, and a bedroom or quiet office is about 30 to 40 dBA.

Each 10-dB increase in sound level corresponds to a tenfold increase of sound energy, but is judged by a listener as only a doubling of loudness. The smallest changes in sound level considered clearly noticeable are about 3 to 5 dB.

Sound levels from two or more sources are combined using logarithms, not by adding the levels. When two levels are combined, the louder level predominates, and the combined level is the louder level plus 0 to 3 dBA. Some examples: 50 dBA combined with 50 dBA is 53 dBA; 50 dBA combined with 40 dBA results in 50.4 dBA, which is rounded off to 50 dBA since fractions of a dB are negligible from the point of view of human hearing.



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Figure 2-1

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Skamania Quarry Sound Analysis

Project Site and Sound-Analysis Locations

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Because sound levels fluctuate over time, several A-weighted sound level descriptors are used to characterize the sound over time. In this Analysis, the following descriptors are used:

- Leq** **Equivalent sound level, Leq**, is the most commonly used descriptor for measuring fluctuating sound. The Leq is the level of a constant sound that, over a given time period, contains the same amount of sound energy as the measured fluctuating sound.

- Lmax** **Maximum sound level, Lmax**, is the highest instantaneous sound level for a given sound source, event, or time period. Because the Lmax in a neighborhood will, unlike Leq, typically have large fluctuations from hour to hour and day to day, Lmax is seldom used to measure noise impact, except in cases where brief high-level sound is causing an impact such as sleep disturbance.

3.2 Skamania County Noise Regulations

Relevant Skamania County regulations are contained in Section 8.22 – *Noise Regulations* of the Skamania County Code (SCC). Permissible sound levels are based on the Environmental Designation for Noise Abatement (EDNA) of source and receiving properties.

The Skamania Quarry is considered Class C EDNA (“*lands involving economic activities of such a nature that higher noise levels ... are normally to be anticipated*”). Surrounding properties occupied by residences are considered Class A EDNA (“*Lands where human beings reside and sleep*”).

The primary limits for noise produced at Class C EDNA properties and received at EDNA Class A properties are modeled after State of Washington noise limits (WAC 173-60) and are contained in Table 3-1.

TABLE 3-1 STATE OF WASHINGTON PERMITTED SOUND LEVELS FOR EDNA CLASS C NOISE SOURCES AND CLASS A RECEIVERS	
Time of Day	Limit on Continuous Sound Sources (dBA)
Daytime (7 a.m. to 10 p.m.)	60
Nighttime (10 p.m. to 7 a.m.)	50

In any one-hour period, the basic noise limits may be exceeded by 5 dBA for a total of 15 minutes or by 10 dBA for a total of 5 minutes or by 15 dBA for a total of 1.5 minutes. This represents a limit on the hourly Lmax (not to be exceed for more than 1.5 minutes per hour) of 75 dBA during the day and 65 dBA at night. This allowed exceedance applies, for example, to single pass-bys from trucks.

Skamania County Code 8.22.110.E exempts sounds created by blasting and/or mining operations from the noise limits if the operations occur during the daytime. The exemption for mining operations does not appear in WAC 173-60. Therefore, the noise limits listed in Table 3-1 are applied in this analysis.

The noise limits in Table 3-1 apply to mining and processing equipment at the site and to trucks operating within the project property. Noise from traffic on public roads is exempt from the noise limits of Table 3-1, according to SCC 8.22.130.G and WAC 476-60-050(4)(a). Relevant guidelines for project-related traffic noise on public roads are presented in the following section.

3.3 Federal Highway Administration (FHWA) and Washington State Department of Transportation (WSDOT) Criteria

Noise from project-related traffic on off-site public roads is exempt from Skamania County noise limits presented in Table 3-1. However, potential noise impacts from off-site aggregate trucks may be evaluated using criteria based on Title 23 of the Code of Federal Regulations Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, (23 CFR 772) and its interpretation by WSDOT.

The FHWA regulations define noise impacts as those levels that approach or exceed the Noise Abatement Criteria. The FHWA Noise Abatement Criterion is an exterior peak-hour Leq of 67 dBA for residential land use and 72 dBA for commercial land use. The peak-hour is defined as the highest hourly sound level in a typical 24-hour period.

The FHWA document also defines impacts as substantial increases over existing sound levels. The FHWA directs individual State Departments of Transportation (DOTs) to define the meaning of “approaching” the abatement criteria and to establish the amount of sound increase that represents a substantial increase.

The application of the FHWA document by the Washington State Department of Transportation *Traffic Noise Policy and Procedures* (2020). According to the WSDOT policy, a sound level is considered to approach the 67-dBA criterion if it is within 1 dBA of the criterion. The WSDOT policy defines a substantial increase as an increase of 10 dBA or more over existing sound levels.

FHWA and WSDOT criteria for residential receivers are applied to receiver locations at the same setback from the road as the residences.

Based on FHWA and WSDOT policies, project traffic sound will be considered an impact when either of the following occurs:

1. Predicted sound levels are 66 dBA or greater.
2. Predicted sound increases are equal to or greater than 10 dBA.

It should be noted that WSDOT requires a noise study for projects that require FHWA approval. These are Type 1 (qualifying highway projects, which entail changes to a roadway) and Type 2 (retrofit for the purpose of noise abatement) projects. Since the Skamania Quarry does not represent a roadway construction or improvement project and therefore does not require a traffic noise analysis, this study of traffic-noise impacts does not follow all the steps mandated for projects requiring FHWA approval. Specifically, the process of validating the noise model, which requires measuring sound levels while counting vehicle movements, has been omitted. In this analysis, the FHWA and WSDOT criteria are considered as recommendations.

4. PROPOSED OPERATIONS AND SOUND EMISSIONS

4.1 Proposed Operations

The description of proposed operations is based on the project Reclamation plans and cross-sections prepared by GeoDesign, Inc., dated February 2019. Proposed operations at the Skamania Quarry include material extraction, on-site transportation by truck and conveyor, crushing, screening, and load-out. Mineral extraction would be effected by drilling, blasting, and truck-loading. Loaders are used for truck load-out. Crushing and screening are conducted in the center-west portion of the site (west half of the area designated R-3 in Figure 4 of the project Reclamation Plan).

Along with the above listed activities, additional noise-generating activities ancillary to the operation of an active surface mine include stockpiling and equipment maintenance.

Rock and aggregate would be transported off site using a private access road from Kellet Road, entering the site from the south. According to the project Transportation Impact Study, site trip generation during the a.m. or p.m. peak hour could reach 100 one-way truck trips (50 round trips) per hour.

Proposed hours of operation are 7 a.m. to 4:30 p.m.

Minimum 30-foot wide native vegetative buffers would remain undisturbed along the entire perimeter of the project site.

4.2 Equipment Sound Emissions

Reference sound levels for proposed equipment were obtained from the BRC Acoustics database. Source sound levels normalized to a reference distance of 50 feet are shown in Table 4-1.

TABLE 4-1 REFERENCE SOUND LEVELS OF PROPOSED EQUIPMENT	
Source	Sound Level at 50 Feet Leq, dBA
Loader	78
Dump truck	78
Screen	83
Crusher	84
Crusher	82
Rock drill	84

5. CALCULATED SOUND LEVELS AND EVALUATION

5.1 Methodology for Sound Modeling

Sound-level calculations of proposed on-site activities were performed using the CadnaA program, which is based on International Standard ISO 9613 for the prediction of environmental noise. The model takes into account the sound power level, directivity, location, and height of the noise source, distance, ground cover and topography between the noise source and receiver, atmospheric conditions, and location and height of the receiver.

Table 5-1 lists the modeled scenarios and assumptions regarding location of equipment during proposed future activities.

**TABLE 5-1
 NOISE MODELING SCENARIOS FOR PROPOSED OPERATIONS**

Variant	Topographical Conditions	Scenario Description	Sound Source Locations
01	Segment M-1/R-1 at existing elevations;	Start of mining in Segment M-1 at existing elevations	Loader, truck, and rock drill at center of Segment M-1, elevation ~2300'
	Segment R-3 at existing elevations;	Start of processing and load-out operations in Segment R-3, existing elevations	<ul style="list-style-type: none"> Two crushers, screening plant, loader near center of Segment R-3, elevation ~2180' 100 one-way truck trips on the access road
	Segment M-2/R-2 at existing elevations	No activities in Segment M-2/R-2	None
02	Segment M-1/R-1 at final elevations (2060'-2120');	Conclusion of mining in Segment M-1/R-1 at final elevations	Loader, truck, and rock drill at south end of Segment M-1/R-1, elevation ~2060';
	Segment R-3 at existing elevations	Continuation of processing and load-out operations in Segment R-3, existing elevations	<ul style="list-style-type: none"> Two crushers, screening plant, loader near center of Segment R-3, elevation ~2180' 100 one-way truck trips on the access road
	Segment M-2/R-2 at existing elevations	No activities in Segment M-2/R-2	None
03	Segment M-1/R-1 at final elevations (2060'-2120');	No activities in Segment M-1/R-1	None
	Segment R-3 at final elevations (2060'-2160')	Continuation of processing and load-out operations in Segment R-3 at final elevations	<ul style="list-style-type: none"> Two crushers, screening plant, loader in Segment R-3, elevation ~2160' 100 one-way truck trips on the access road
	Segment M-2/R-2 at existing elevations	Start of mining in Segment M-2/R-2 at existing elevations	Loader, truck, and rock drill near center of Segment M-2/R-2, elevation ~2260'
04	Segment M-1/R-1 at final elevations (2060'-2120');	No activities in Segment M-1/R-1	None
	Segment R-3 at final elevations (2060'-2160')	Continuation of processing and load-out operations in Segment R-3 at final elevations	<ul style="list-style-type: none"> Two crushers, screening plant, loader in Segment R-3, elevation ~2160' 100 one-way truck trips on the access road
	Segment M-2/R-2 at final elevations (2220')	Conclusion of mining in Segment M-2/R-2 at final elevations	Loader, truck, and rock drill near center of Segment M-2/R-2, elevation ~2220'

5.2 Sound Analysis Locations

For the purpose of analyzing sound levels from proposed operations, three sound-analysis locations were selected to represent occupied properties and structures that may be affected by project sounds. The analysis locations are listed in Table 5-2 and shown in Figure 2-1.

Analysis Location	Description
AL1	Second-story window of residence on Parcel 020-525-0007-0000
AL2	First-story window of residence on Parcel 020-525-0008-0000
AL3	Second-story window of residence on Parcel 020-629-0004-0000

5.3 Calculated Sound Levels

Calculated Leq sound levels from proposed mining, processing, and on-site transportation operations are shown in Table 5-3. The table also shows applicable State of Washington noise limits.

5.4 Evaluation

As shown in Table 5-3, calculated Leq sound levels from proposed mining and processing activities at the Skamania Quarry meet State of Washington daytime and nighttime noise limits at all analysis locations.

**TABLE 5-3
 CALCULATED SOUND LEVELS (dBA)
 FROM PROPOSED OPERATIONS
 WITHOUT ADDITIONAL NOISE MITIGATION**

BRC Ref.	Scenario Description	Sound Levels at Analysis Locations		
		1	2	3
01	Leq during start of mining Segment M-1/R-1 and of processing in Segment R-3	39	37	37
	Leq from start of processing in Segment R-3	33	31	33
	Leq from continuing material hauling on access route, 100 one-way trips per hour	37	35	31
	Leq from start of mining Segment M-1/R-1	10	10	33
02	Leq during conclusion of mining Segment M-1/R-1 and continuation of processing	39	36	37
	Leq from continuing processing in Segment R-3	33	31	33
	Leq from continuing material hauling on access route, 100 one-way trips per hour	37	35	31
	Leq from conclusion of mining Segment M-1/R-1	28	10	34
03	Leq during continuation of processing and start of mining Segment M-2/R-2	42	39	37
	Leq from continuing processing in Segment R-3	34	32	31
	Leq from continuing material hauling on access route, 100 one-way trips per hour	37	35	25
	Leq from start of mining Segment M-2/R-2	39	35	35
04	Leq during continuation of processing and conclusion of Segment M-2/R-2	42	39	32
	Leq from continuing processing in Segment R-3	34	32	31
	Leq from continuing material hauling on access route, 100 one-way trips per hour	36	34	25
	Leq from conclusion of mining Segment M-2/R-2	39	35	24
State of Washington daytime noise limits for Leq		60	60	60
State of Washington nighttime noise limits for Leq		50	50	50

6. NOISE MITIGATION MEASURES

The proposed Skamania Quarry incorporates minimum 30-foot wide native vegetative buffers along the entire perimeter of the project site. This noise mitigation measure was taken into account in the results presented in Section 5.3.

As presented in Section 5.4, calculated sound levels from proposed mining, processing, and on-site transportation activities at the Skamania Quarry are expected to meet applicable State of Washington noise limits at surrounding properties. As a result of these findings, no additional noise mitigation measures are required for on-site activities.

7. PROJECT-RELATED TRAFFIC NOISE

Information regarding traffic generated by the project was obtained from the Transportation Impact Study prepared by DKS on February 19, 2020. Aggregate trucks traveling from Mabee Mines Road would access and exit the site from the west on Kellet Road and enter at the south of the quarry. Project traffic would travel on Salmon Falls Rd between Mabee Mines Rd and Evergreen Highway (SR-14).

The quarry is expected to generate up to 250 daily round trips (250 trips into the site and 250 trips leaving the site) during peak season and economic conditions. General hours of operation would be from 7 a.m. to 4:30 p.m. Employees traveling in their personal vehicles would arrive to the site around 6:30 a.m. to prepare for a 7:00 a.m. start and leave by 5 p.m. A few employees would perform maintenance services until 5:30 p.m. Employees traveling in dump trucks would arrive around 7:00 a.m. and leave around 4:30 p.m.

The Transportation Impact Study assumed that 20 percent of the 500 daily vehicle trips would occur during the a.m. peak hour and 20 percent would occur during the p.m. peak hour. This results in 100 (50 in/50 out) a.m. peak-hour trips and 100 (50 in/50 out) p.m. peak-hour trips. The a.m. and p.m. peak hours are considered 7 to 8 a.m. and 5 to 6 p.m., respectively. The a.m. peak trips would be all 50 trucks, while the p.m.-peak volume would consist of 40 truck and 10 passenger vehicle trips.

Sound produced by the trucks while on the quarry site is subject to the same criteria as the rest of the equipment operating at the quarry, and was included in the sound level calculations listed in Section 5 of this report. Sound from aggregate trucks on public roads is not subject to the State of Washington sound limits shown in Table 3-1. However, sound impacts from off-site project-related truck traffic may be evaluated with respect to the FHWA and WSDOT criteria discussed in Section 3.3.

To evaluate potential noise impacts from off-site truck traffic, three sound-analysis locations were added to the locations listed in Table 5.2. These residences, listed in Table 7-1 as Analysis

Locations T1 to T3, are not in the vicinity of the quarry but could be exposed to noise from off-site project traffic. Analysis Locations T1 to T3 were selected to represent residential property along the project truck route along Mabee Mines Road and Salmon Falls Road. The analysis locations were approximately 100 feet from the road centerlines, which is shown to be a typical residential setback on Skamania County GIS maps of the area.

Analysis Location	Description
T1	Residence at 592 Mabee Mines Road, between Salmon Falls Road and Quarry, Parcel 010-503-0001-0300
T2	Residence at 632 Salmon Falls Road, between Mabee Mines Road and Canyon Creek Rd., Parcel 010-503-3003-0000
T3	Residence at 481 Salmon Falls Road, between Canyon Creek Road and SR-14, Parcel 010-503-3011-0000

Calculations of traffic sound levels were conducted using the FHWA model for calculating traffic noise, TNM version 2.5. The calculations were conducted for the p.m. peak traffic hour of 5 to 6 p.m. The p.m. peak hour was selected because the percent increase in truck volumes over existing conditions on the roads was found to be slightly higher for the p.m. peak than the a.m. peak hour. Traffic was assumed to travel at the speed limit of 35 mph.

Results of the Traffic Sound Analysis are presented in Table 7-2.

Scenario Description	Sound Levels at Analysis Locations		
	T1	T2	T3
Year 2019 existing volume total/trucks	47	49	51
Year 2022 without project total/trucks	47	49	51
Year 2022 with project total/trucks	60	61	61
FHWA Noise Abatement Criterion	67	67	67

*Note: Sound levels shown in **Boldface** exceed the FHWA substantial-increase criterion of 10 dBA*

As shown in Table 7-2, the calculated p.m.-peak traffic sound levels with the project exceed the calculated sound levels for Year-2019 existing conditions or Year-2022 conditions without the project by up to 13 dBA at Location T1 and by up to 12 dBA at Location T2. Increases of 10

dBA or more are considered substantial by WSDOT criteria and are considered noise impacts according to FHWA criteria outlined in Section 3.3 of this report.

During the Year 2022 with the project, the calculated sound levels do not approach or exceed the FHWA Abatement Criterion of 67 dBA at the Sound Analysis Locations.

In a project requiring FHWA approval, the finding of a substantial noise increase would be followed by an evaluation of feasibility or reasonableness of constructing noise barriers on the affected road segments. The evaluation would consider factors such as the number of residences affected by the project or benefiting from noise-abatement barriers, amount of noise reduction achievable, and cost.

It should be reiterated that the FHWA Noise Abatement Criterion and the sound-increase criteria are used only as guidelines in this analysis. They are intended for road-building or road-improvement projects and are not a requirement for other, non-roadway projects.

8. SUMMARY AND CONCLUSIONS

The findings of the Sound Analysis are summarized as follows:

- Calculated Leq sound levels from proposed mining and processing activities at the Skamania Quarry meet State of Washington daytime and nighttime noise limits at all sound analysis locations.
- Calculated p.m.-peak traffic sound levels with the project exceed the calculated sound levels for Year-2019 existing conditions or Year-2022 conditions without the project by up to 13 dBA at Location T1 and by up to 12 dBA at Location T2. Increases of 10 dBA or more are considered substantial by WSDOT criteria and are considered noise impacts according to FHWA criteria. The FHWA Noise Abatement Criterion and the sound-increase criteria are used only as guidelines in this analysis. They are intended for road-building or road-improvement projects and are not a requirement for other, non-roadway projects.
- During the Year 2022 with the project, the calculated sound levels do not approach or exceed the FHWA Abatement Criterion of 67 dBA at the Sound Analysis Locations.

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