Ueland Tree Farm Mineral Resource Development
Noise Study

Kitsap County, Washington

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1.0 EXECUTIVE SUMMARY

The proposed Ueland Tree Farm (UTF) Mineral Resource Development would include on-site excavation and processing activities, a concrete batch plant, trucks exporting material, and a train unloading/loading facility. The potential for noise impacts due to these activities and equipment is greatest due to activities in or near Gravel Mine "A" and due to trucks traveling on Leber Lane, the primary access route to the site. The noise analysis considered sound levels at 18 receptors representing sensitive receiving locations (e.g., residences or proposed future residences) in the vicinity of Gravel Mine "A".

There are two general methods for assessing noise impacts: 1) by comparing sound *levels* produced by on-site equipment with applicable local noise limits, and 2) by characterizing the potential sound level *increases* due to a project. This noise study considered both methods for assessing impacts.

With the mitigation proposed as part of the project (i.e., berms, equipment location, and operating hours), the majority of modeled levels are well below Kitsap County's daytime noise limit of 55 dBA. The applicable noise limit of 55 dBA is the strictest limit set by the County and is the same limit applied to residential uses affecting residential receivers. At receptor locations nearest Gravel Mine "A" (representing proposed future development on property currently owned by UTF), the modeled sound levels of 52 to 54 dBA are higher than at other modeled receptor locations but still easily comply with the County noise limit of 55 dBA.

For assessing potential impacts due to project-related sound level increases, both the hourly (L_{eq}) and the daily (L_{dn}) sound levels were considered. Neither Kitsap County nor Washington State has identified an increase in sound level that would be considered significant under SEPA. Therefore, hourly increases were characterized using WSDOT impact criteria, and daily increases were characterized using the Federal Transit Administration (FTA) noise impact criteria.

As mentioned above, impacts were characterized due to *hourly* increases using WSDOT impact criteria. WSDOT considers an increase of 10 dBA or more in a peak traffic hour sound level

(when compared to existing sound levels) as a "substantial" increase and an increase of 30 dBA or more a "severe" impact. Calculated hourly sound level increases of 10 dBA or more could potentially occur during several hours of a peak operating day at ten of the eighteen modeled receptor locations (five of the ten on property owned by UTF). At three of the receptor locations (all owned by UTF and all adjacent to the site access route or Leber Lane), the predicted hourly increases of at least 10 dBA could potentially occur during every hour of a peak operating day and could be as high as 21 dBA at one location. Such increases generally are considered substantial and capable of resulting in adverse noise impacts. (A 10-dBA increase would typically be perceived as a doubling of loudness while a 20-dBA increase would be perceived as a quadrupling of loudness.) However, all predicted increases are less than the 30 dBA increase that would be considered a severe impact by WSDOT and would not result in significant impacts under WSDOT criteria.

Calculated increases in the day-night sound levels (L_{dn}) range from 0 to 12 dBA. Using FTA noise impact criteria, the increases would be characterized as resulting in moderate impacts at six receptor locations (four of the six on property owned by UTF) and a severe (i.e., significant) noise impact at one location. However, because the severe impact would occur at a residential property owned and controlled by the mine owner, UTF, a significant impact can be avoided.

In conclusion, although adverse noise impacts are identified at several residential residences due to hourly and daily sound level *increases,* none of the impacts are expected to be significant.

2.0 INTRODUCTION

The Ueland Tree Farm (UTF) Mineral Resource Development (Mine) is a proposed surface mine west of the City of Bremerton, Washington. (UTF) owns approximately 1,716-acres of commercial forest land in unincorporated Kitsap County. The UTF mineral resource project proposes development of commercial sand, gravel, and basalt mineral surface mines on the site. Under the proposal, areas totaling approximately 152-acres of the site would be developed for surface mining and associated activities, not including connecting access roads.

Development plans consist of two gravel mines, three basalt quarry areas, and a concrete batch plant. The two proposed sand and gravel mines are designated Gravel Mine "A" and Gravel Mine "B". The three primary quarry areas are designated Quarry Areas "A", "B", and "C".

The mineral development plan would be implemented over an estimated 50-year period, with Gravel Mine "A" and Quarry Area "A" beginning in the first phase of the project. Quarry Areas "B" and "C" would be developed following completion of mining activity in Quarry Area "A". No more than one quarry would be developed and operated at any given time. Anticipated annual production for the mineral resource project is estimated at a maximum of 400,000 tons of aggregate. It is estimated that if value-added businesses are developed, they may generate approximately 20,000 tons of topsoil and 20,000 cubic yards of concrete.

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION TO NOISE AND NOISE DESCRIPTORS

Noise is sometimes defined as unwanted sound. This report makes no such distinction, and the terms noise and sound are used more or less synonymously.

The human ear responds to a very wide range of sound intensities. The decibel (dB) scale used to describe and quantify sound is a logarithmic scale that provides a convenient system for considering the large differences in audible sound intensities. On this scale, a 10-dB increase represents a perceived doubling of loudness to someone with normal hearing. Therefore, a 70-dB sound level will sound twice as loud as a 60-dB sound level. People generally cannot detect sound level differences (increases or decreases) of 1 dB in a given noise source. Although differences of 2 or 3 dB can be detected under ideal laboratory conditions, such changes are difficult to discern in an active outdoor noise environment. A 5-dB change in a given noise source or environment would likely be perceived by most people under normal listening conditions.

As mentioned above, the dB scale used to describe noise is logarithmic. On this scale, a doubling of sound-generating activity (i.e., a doubling of the sound energy) causes a 3-dB increase in average sound produced by that source, not a doubling of the loudness of the sound (which requires a 10-dB increase). For example, if traffic along the road is causing a 60-dB sound level at some nearby location, doubling the traffic on this same road would increase the traffic-related sound level at this same location to 63 dB. Such an increase might not be discernible in a complex acoustical environment.

When addressing the effects of noise on people, it is necessary to consider the "frequency response" of the human ear, or how well people hear sounds of different frequencies. Sound-measuring instruments are therefore often programmed to "weight" sounds based on the way people perceive different frequencies. The frequency-weighting most often used to evaluate environmental noise is A-weighting, and measurements using this system are reported in "A-weighted decibels" or dBA. All sound levels discussed in this evaluation are reported in A-weighted decibels.

For a given noise source, a number of factors affect the sound transmission from the source, which in turn affects the potential noise impact. Important factors include distance from the source, frequency of the sound, absorbency and roughness of the intervening ground surface, the presence or absence of obstructions and their absorbency or reflectivity, and the duration of the sound. The degree of impact on humans also depends on who is listening and on existing sound levels. Typical sound levels of some familiar noise sources and activities are presented in **Table 1**.

Federal regulatory agencies and some local jurisdictions use the equivalent sound level (L_{eq}) and the day-night sound level (L_{dn}) to evaluate noise impacts. The L_{eq} is the sound level that if held constant over a specified time period would have the same sound energy as the actual, fluctuating sound that occurred over that time interval. As such, the L_{eq} can be considered an energy-average sound level. When using L_{eq}, it is important to identify the time period being considered. $L_{eq(24)}$, for example, is the equivalent sound level for a 24-hour period. The day-night sound level, L_{dn}, is similar to the $L_{eq(24)}$, except that a 10 decibel penalty is added to sound levels between 10 p.m. and 7 a.m. to account for potential sleep interference.

Table 1. Sound Levels Produced by Common Noise Sources

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

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.

3.2 REGULATORY OVERVIEW

The project site is located in unincorporated Kitsap County and could affect residential receivers in both the County and in the adjacent City of Bremerton. Therefore, relevant noise criteria for this evaluation include the Kitsap County and City of Bremerton noise regulations and noise guidelines or criteria established by federal agencies.

3.2.1 Kitsap County Noise Rules

Relevant noise criteria for this evaluation are included in the Kitsap County Code (KCC) Chapter 10.28. The County code establishes limits on the levels and durations of noise crossing property boundaries. The "maximum permissible" noise levels are the limits for a regulated noise source at its boundary with other land uses, not the total of the project and background sound levels. Allowable sound levels depend on the Environmental Designation for Noise Abatement (EDNA) of the source of the noise and the EDNA of the receiving property (**Table 2**). Kitsap County identifies the EDNAs as follows:

- Class A EDNAs (Residential) – Class A EDNAs shall include the following: all single-family residential zones; all multiple-family residential zones; residential mobile home zone; agricultural zone; forestry zone; undeveloped land zone.
- Class B EDNAs (Commercial) – Class B EDNAs shall include the following: business neighborhood zone; business general zone; commercial zone; light manufacturing zone.
- Class C EDNAs (Industrial) – Class C EDNAs shall include the following: manufacturing zone.

Table 2. Kitsap County Maximum Permissible Environmental Noise Levels (dBA)

EDNA of Noise Source	EDNA of Receiving Property		
	Class A (Day/Night)[(a)]	Class B	Class C
Class A	55/45	57	60
Class B	57/47	60	65
Class C	60/50	65	70

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

Source: KCC 10.28.040

The Kitsap County noise limits can be exceeded for certain periods of time: up to 5 dBA for no more than 15 minutes in any hour, up to 10 dBA for no more than 5 minutes of any hour, or up to15 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 a statistic called an interval "L_n." For example, the hourly 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 5

and 1.5 minutes in an hour, respectively. At no time can the allowable sound level be exceeded by more than 15 dBA, represented by an L_{max} noise limit.

Kitsap County's noise code identifies a number of noise sources or activities that are exempt from the maximum permissible sound levels described in KCC 10.28.040 and also specifically excluded as a public disturbance (KCC 10.28.145). The following sources are among those exempt from these provisions:

- sounds created by blasting between the hours of 7 a.m. and 10 p.m.
- sounds from temporary construction sites, except when affecting Class A EDNAs between the hours of 10 p.m. and 7 a.m.
- sounds created by motor vehicles on public roads
- sounds created by motor vehicles operated *off* public roads, except when sounds are received at Class A EDNAs
- sounds created by warning devices (such as back-up alarms on vehicles) when not operated continuously for more than 5 minutes per incident

3.2.2 Bremerton Municipal Code

Chapter 6.32 of the Bremerton Municipal Code (BMC) contains noise regulations similar to those in the Kitsap County Code Chapter 10.28, except that the BMC identifies noise source and receiving properties as "Districts" instead of EDNAs. BMC Chapter 6.32.010(c) defines District I as residentially-zoned properties, District II as properties zoned for commercial or business use, and District III as properties zoned for industrial use. Therefore, District I properties would be similar to Class A EDNAs, District II similar to Class B EDNAs, and District III similar to Class C EDNAs as applied in the Kitsap County Code. The noise limits defined in both codes are the same, including the allowed short-term increases each hour. The exemptions mentioned in the section for Kitsap County also apply in the City of Bremerton.

3.2.3 Federal Highway Administration (FHWA) Noise Criteria

The Federal Highway Administration (FHWA) has adopted noise standards that apply to traffic noise associated with its projects. *These standards do not apply to this project* because they are intended for use along roads controlled by state or federal agencies that are being structurally altered by a project or action. However, the FHWA traffic noise limits and the Washington state implementation of these rules through state policies are discussed below to provide readers a perspective on the noise levels discussed below related to traffic sources.

The FHWA identified noise criteria and established procedures for evaluating road improvement projects in its Federal-Aid Highway Manual (U.S. Department of Transportation, 1982b). The FHWA defines a traffic noise impact as a predicted traffic noise level approaching or exceeding 67 dBA at exterior locations associated with residential uses, or when the predicted traffic noise levels substantially exceed the existing noise levels. FHWA leaves the definition of "approach" to the states. The Washington State Department of Transportation (WSDOT) defines "approaching" the FHWA limits as sound levels within 1 dBA of the criterion level (i.e., 66 dBA for residential properties). WSDOT defines "substantially exceeding" existing noise levels as an increase greater than 10 dBA, with an increase of 10 to 14 dBA classified as a Tier I impact, an increase of 15 to 29 dBA as a Tier II impact, and an increase of 30 dBA or more as a "severe" noise impact.

3.2.4 Federal Transit Administration (FTA) Noise Impact Criteria

The FTA describes its noise impact criteria for transit projects in the manual entitled *Transit Noise and Vibration Impact Assessment* (FTA 2006). These criteria apply to government-funded transit projects, so *they do not directly apply to this project*. However, these criteria are presented here to provide a basis for assessing potential noise impacts due to project-related increases in sound levels when compared to the existing levels.

FTA transit noise impact criteria are based on the land use category of the receiving properties. The criteria for lands with sensitive nighttime uses (i.e., sleeping) are based on the day-night sound level (L_{dn}). (The L_{dn} is defined above in the section on **Introduction to Noise and Noise Descriptors**.) Residential uses and locations where quiet is the basis for use are referred to as Land Use Category 2 when applying the FTA criteria.

FTA noise impact criteria are based on comparing expected project-related noise to existing sound levels (**Figure 1**). Under these criteria, receiving locations with low existing sound levels can be exposed to greater increases in overall noise, due to the addition of project noise, before an impact occurs. Conversely, locations with higher existing sound levels can be exposed to smaller increases in overall noise before an impact occurs. For example, residential locations with an existing sound level of L_{dn} 40 dBA would not be considered severely impacted unless there would be a 15-dBA increase caused by project noise, while residential locations with an L_{dn} 60 dBA baseline would be considered severely impacted by less than a 5-dBA increase.

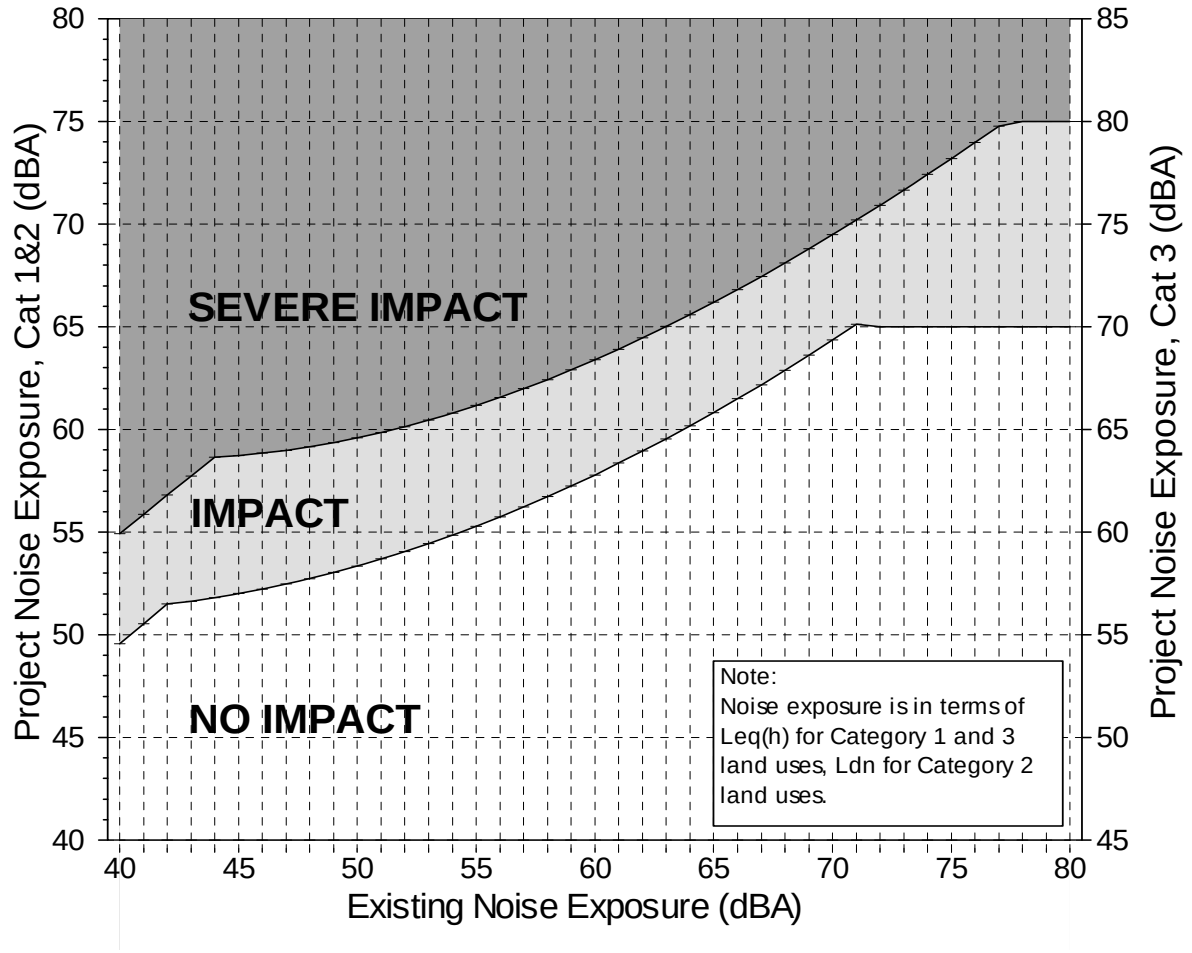

Figure 1. FTA Noise Impact Criteria

3.3 ZONING AND LAND USES

The proposed mine site is located in unincorporated Kitsap County near the Bremerton city limits. The surface mine would be on land owned by Ueland Tree Farm that is currently used for commercial forestry. The project property is zoned Rural Wooded or Forest Resource Lands, which are both identified as Class A EDNAs in the Kitsap County Code.

Land uses in the project vicinity consist of residential uses, lands used for forestry, undeveloped forested lands, a railroad, and a transmission line easement. The sensitive receivers (i.e., homes) nearest the proposed operations are north and east of the site. The residences north of the site and west of Leber Lane are in unincorporated Kitsap County and are zoned Rural Residential (1 DU/5 Ac). Residences north of the site but east of Leber Lane (as well as residences due east of the site) are in the City of Bremerton on land zoned Low Density Residential (R-10). All of these nearby residences are Class A EDNA (or District I) receiving properties.

Class A EDNA noise sources affecting Class A (or District I) receiving properties are subject to a 55-dBA noise limit during daytime hours (between 7 a.m. and 10 p.m.) and a 45-dBA noise limit at night, with the allowed short-term increases described previously. Because the proposed facility would operate only between 7:30 a.m. and 5 p.m., the daytime noise limits apply for this assessment.

3.4 EXISTING SOUND LEVELS

On August 21 and 22, 2007, ENVIRON International Corporation (ENVIRON) personnel (then working for Geomatrix Consultants) measured long-term (~24-hour) and short-term (15 minute) sound levels at locations in the project vicinity representing sensitive residential uses. The measurements were taken using Larson Davis 820 Type I sound level meters that had been factory certified within the previous 12 months and field calibrated immediately prior to the measurements. The microphones of the meters were fitted with wind screens and set approximately 5 feet above the ground (at a typical listening height).

ENVIRON personnel measured long-term (~24-hour) sound levels at two locations in the project vicinity representing nearby residential uses. The sound levels during the long-term measurements were recorded in one-hour intervals to identify hourly sound levels at residences both near Northlake Way and further from Northlake Way. Although the meters were unattended for the majority of the measurement period, area noise sources were noted during the setup and retrieval of the meters.

ENVIRON personnel also measured short-term (i.e., 15-minute) sound levels at locations adjacent to the proposed primary access route to the site (i.e., Leber Lane) to gauge the existing influence of traffic noise on residences near the access routes. The measured sound levels were recorded in 15-minute intervals. The short-term measurements were attended during the entire measurement period, and noise sources were noted.

The measured sound levels at each location are summarized in **Table 3**. The long-term measurements are shown as hourly sound levels during either daytime (i.e., 7 a.m. to 10 p.m.) or nighttime (i.e., 10 p.m. to 7 a.m.) hours. Descriptions of the sound level measurement (SLM) locations and notable noise sources are included at the bottom of the table. Detailed tabulations of the hourly measured sound levels during the long-term measurements are provided in **Attachment A**. The long-term and short-term measurement locations are also displayed in **Figure 2**.

Table 3. Existing Sound Levels (dBA)

SLM	Date	Time	L_{eq}	L_{max}	L_2	L_8	L_{25}	L_{90}	L_{dn}
Long-Term Measurements (Hourly levels over at least 24 hours)									
LT-1	8/21-8/22/07	Day	38-51	55-77	43-61	40-57	37-44	32-38	45-46
		Night	32-42	45-60	36-48	34-44	32-42	29-38	
LT-2	8/21-8/22/07	Day	49-54	64-71	56-60	53-58	50-56	37-44	54
		Night	41-52	60-70	51-58	45-56	37-54	33-41	
Short-Term Measurements (15 minutes)									
ST-1	8/21/07	12:02	48	59	54	52	49	37	NA
ST-2	8/21/07	12:06	55	69	63	60	56	40	NA
ST-3	8/22/07	13:34	49	61	56	53	50	43	NA
County Noise Limits		Day	NA	70	65	60	55	NA	NA
		Night	NA	60	55	50	45	NA	

Notes:

The L_{eq} is the "energy-averaged" sound level. The L_{90} is the sound level exceeded 90% of the time and is often considered representative of the background sound level. The Lmax, L_2, L_8, and L_{25} correspond to the L_{max}, $L_{2.5}$, $L_{8.3}$, and L_{25} State noise limit levels that are defined previously in this report in the discussion of the regulatory noise limits.

"Day" refers to the hours between 7 a.m. and 10 p.m. "Night" refers to the hours between 10 p.m. and 7 a.m.

LT-1: Taken at the Delazerda residence at 4817 NW Grover Lane, representing residences north and northwest of the proposed mine site that are located farther from Northlake Way. Noise sources noted during setup and retrieval of the equipment included dogs, a rooster, activity at nearby residences, and distant traffic.

LT-2: Taken at the Cates residence at 4847 Leber Lane NW, between the residence and Northlake Way. This SLM represents residences north and northeast of the proposed mine site that are located near Northlake Way. The primary noise source noted during setup and retrieval of the equipment was traffic on Northlake Way. Other noise sources included distant pile driving and birds.

ST-1: A 15-minute measurement taken at 4847 Leber Lane NW, the Cates property of LT-2. This SLM was taken adjacent to the driveway in a location near one of the potential access road alignments. The dominant noise source at this location was traffic on Northlake Way. Other sources included birds.

ST-2: A 15-minute measurement taken at 4792 Leber Lane NW, a residence owned by UTF. The access road would result in a realignment of Leber Lane NW that would most affect this residence. The dominant noise source at this location was traffic on Northlake Way. Other sources included birds.

ST-3: A 15-minute measurement taken at 4823 Leber Lane NW, the Totemeier residence, representing residences on Leber Lane NW potentially affected by using Leber Lane NW as the primary truck access route to the site. The dominant noise source at this location was traffic on Northlake Way. Other sources included birds.

Sources: Geomatrix Consultants, Inc., 2007

As can be seen in **Table 3** and **Attachment A**, the measured existing sound levels during daytime hours typically comply with the applicable noise limits, except for occasional short-term events. The nighttime sound levels often exceeded the nighttime noise limits.

4.0 IMPACTS OF THE PROPOSED ACTION

Noise from the proposed surface mine site would be generated by short-term construction activities and long-term operation of the mine and related activities. Both sorts of noise are discussed below.

4.1 CONSTRUCTION IMPACTS

Excavation and grading in preparation of the site and construction of the miscellaneous structures, berms, walls, and roads would require the use of large equipment, often operating near residences. This equipment could be working in locations not protected by existing topography, and noise from these activities would be clearly audible at the nearest receivers, particularly during construction of the access roads. The noise levels would depend on the type of equipment being used and the amount of time it is in use.

Table 4 shows the typical range of noise levels for construction equipment that could be used during the construction of this project. Sounds from construction equipment (a point source) decrease about 6 dBA for each doubling in distance from the source. Estimated construction equipment sound levels at various distances are displayed in **Table 4**.

Table 4. Typical Construction Equipment Noise

Construction Activity	Estimated Leq			Types of Equipment	Range Of Noise Levels		
	50 feet	200 feet	800 feet		50 feet	200 feet	800 feet
Clearing	83	71	59	Bulldozer	77-96	65-84	53-72
				Dump Truck	82-94	70-82	58-70
Grading	75-88	63-76	51-64	Scraper	80-93	68-81	56-69
				Bulldozer	77-96	65-84	53-72
Paving	72-88	60-76	48-64	Paver	86-88	74-76	62-64
				Dump Truck	82-94	70-82	58-70
Source: U.S. Environmental Protection Agency, 1971							

As shown in **Table 4**, sound levels near some construction equipment and activities would exceed noise levels recommended for residential land uses. However, sounds originating from temporary construction activities are exempt from the County noise limits during daytime hours (i.e., between 7 a.m. and 10 p.m.). Also, construction activities are expected to occur only

during daytime hours to minimize potential noise impacts. Therefore, construction-related noise is not expected to result in significant noise impacts.

4.2 OPERATIONAL IMPACTS

The impact assessment for operational noise was based on computer modeling of expected sources within the context of the proposed project site and vicinity. This section describes the noise sources considered and other details of the analytical process.

4.2.1 Gravel Mine "A"

Long-term operational noise would be generated by equipment excavating, screening, crushing, and washing the material, by a concrete batch plant, by a train unloading facility and associated conveyor system, and by trucks exporting the material offsite. All of the sources, including the train facility, were assumed to operate only during daytime hours, generally between 7 a.m. and 5 p.m. ENVIRON personnel estimated noise from expected on-site sources based on published data or on previous measurements of similar equipment operating at existing facilities. These sources are representative of the types of equipment expected to operate at UTF (i.e., typical equipment used at a moderately sized mine). The noise sources considered in the calculations are discussed below. Typical sound levels of the mining and processing equipment are displayed in **Table 5**.

Front-end Loaders – Loaders are used to extract the material from the mining area, feed the processing and wash plants and the concrete batch plant, cleanup and organize stockpiles, and load trucks for export off the site. Three loaders were considered in the modeling; one excavating on the floor of the pit, one loading trucks for export near the processing and wash plants, and one working near the concrete batch plant. ENVIRON personnel used a sound level measurement of a CAT 980F (measured previously for another project) to represent the loader sound levels at this facility.

Processing Plant – Processing plants typically incorporate screens, crushers, and conveyors. The processing plant would be located in the approximate middle of the floor of the pit. ENVIRON personnel used an average of crusher sound levels measured previously for other projects to represent the proposed facility.

Wash Plant – The wash plant washes dirt and dust from the excavated material and would be located near the processing plant. ENVIRON personnel used a sound level

measurement of a wash plant operating in Clallam County (measured previously for another project) to represent the plant sound levels at this facility.

Concrete Batch Plant – The batch plant consists of a material hopper, silo, and trucks. The primary source of noise is typically from trucks revving while being filled and revving while fully mixing the material. Several locations were considered for the batch plant. ENVIRON personnel used a previous sound level measurement of a concrete batch plant to represent the plant/truck sound levels at this facility.

Train Loading/Unloading Facility – Trains using this facility would consist of belly-dumping rail cars unloading material into an underground hopper. The primary noise sources associated with these types of facilities are the locomotive noise and the train arrival and departure. However, noise from the operation and movement of the railroad cars is exempt from the noise limits, is not controlled by the developer, and provides no opportunity for noise mitigation. Therefore, noise from the movement of the trains was not included in this analysis. Other sources associated with material delivery by train include an air release associated with the opening and closing of the material doors, clanking sounds of the doors opening and closing, the material dropping onto the underground conveyor, and operation of the conveyors themselves. ENVIRON personnel used sound levels of a similar train delivery system (measured previously for another project) for this analysis.

Conveyor System – Conveyors would transport material between the pit and the rail loading facility. The conveyor system would include a material transfer point. ENVIRON personnel used sound level measurements of a conveyor and material transfer point (measured previously for another project) to represent the sound levels at this facility.

Trucks - Trucks would travel on-site to pick up material or concrete for off-site delivery. An hourly truck volume of 12 trucks in and 12 trucks out per hour was used in this analysis. ENVIRON personnel used the FHWA Traffic Noise Model (TNM) to estimate the hourly sound levels (L_{eq} and L_{25}) from trucks on both the on-site and off-site access roads.

Table 5. Summary of Source Noise Levels (L_{25}, dBA)

Equipment	Sound Level at 100 feet
Front-End Loader	75
Processing Plant	82
Wash facility	81
Concrete Batch Plant	78
Train Loading/Unloading Facility	68
Conveyor Transfer Point	59
Conveyor	46
Trucks	Varies

Because the noise from surface mine operations is typically fairly constant over the course of an hour, the County noise standard that would be most limiting would be the hourly L_{25} limit. In order to more closely relate the calculated sound levels with the County's noise limits, ENVIRON personnel used the measured L_{25} of each source when this information was available. However, not all of the equipment sound level information was available as an L_{25}. Because the noise generated by surface mine operations tends to be fairly continuous over the course of an hour, the sound levels of these operations described by the L_{eq} and L_{25} would be very similar. So in instances where L_{25} data were not available, ENVIRON personnel used the L_{eq} to represent an L_{25}.

In addition to the equipment identified above, a dozer would be used for clearing areas prior to excavation. Operation of the dozer would occur during construction/preparation of a mining cell and would not be included in day-to-day operation of the facility. Therefore, the dozer was not included in our analysis.

4.2.1.1 Noise Models

A topographic map of the Gravel Mine "A" site and the vicinity (used in the noise models described below) was "constructed" using a drawing containing the existing topography of the site and surrounding areas, a drawing of the project site and expected mining contours, and aerial photographs of the site and vicinity. Sophisticated noise models were used to predict the sound levels from the proposed on-site operations and from the on-site and off-site haul trucks at the "receptor" locations shown in **Figure 2**. These receptors represent the potentially most affected sensitive receivers near the proposed facility. The models used for this analysis are described below.

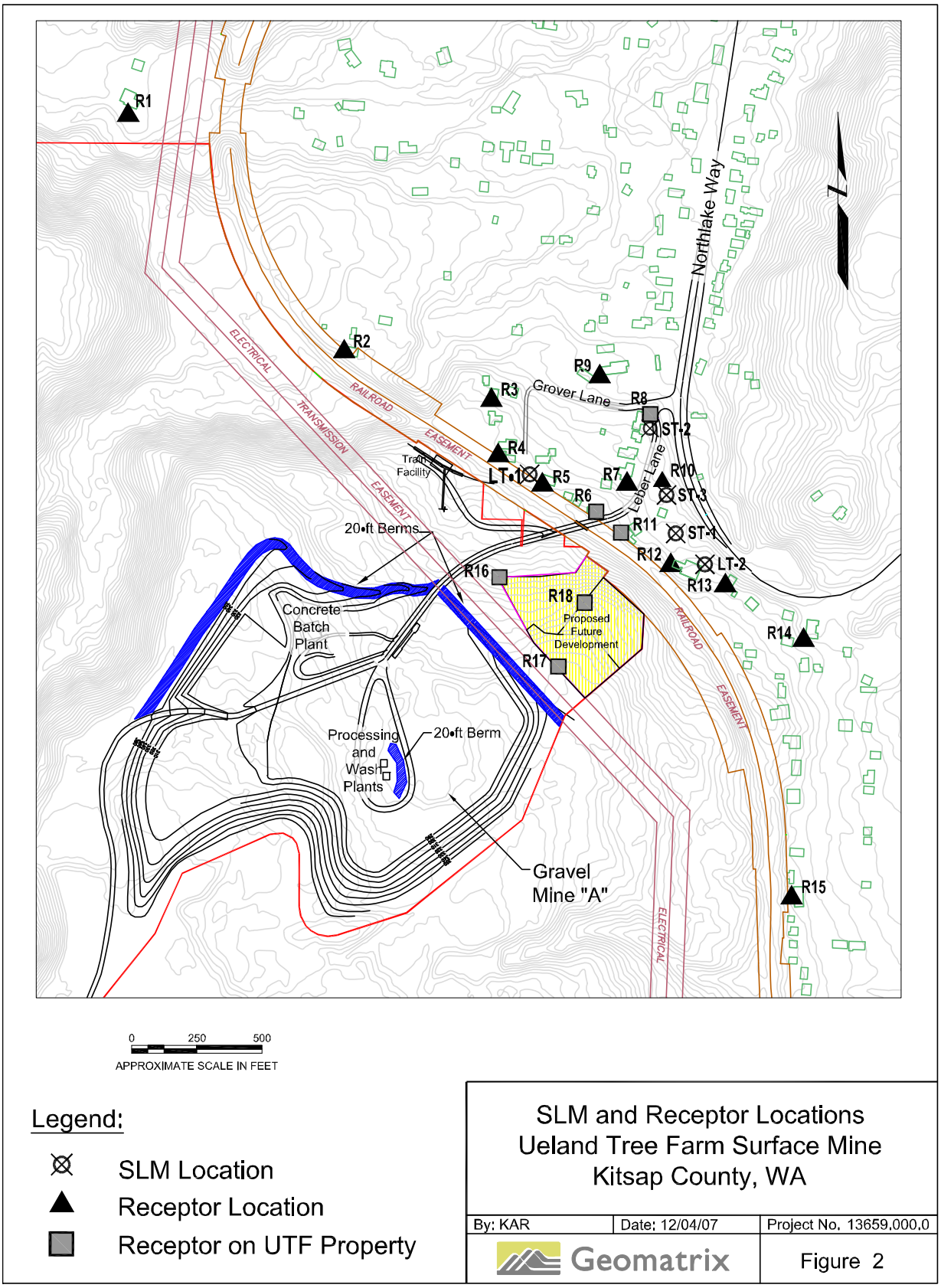

Figure 2. SLM and Receptor Locations

Cadna/A

Noise anticipated to be generated by equipment at the proposed surface mine (except trucks) was evaluated at nearby receivers using the Cadna/A noise model. Cadna/A is a computer program that calculates sound levels after considering the noise reductions or enhancements caused by distance, topography, ground surfaces (including water), atmospheric absorption, and meteorological conditions in compliance with ISO-9613-2:1996. The modeling includes the following steps: (1) characterizing the noise sources based on frequency-specific measurements of representative equipment; (2) creating 3-dimensional maps of the site and vicinity to enable the model to evaluate effects of distance and topography on noise attenuation, and (3) assigning the equipment sound levels to the appropriate locations on the site. As described previously, ENVIRON personnel used equipment sound levels from our data archives for this analysis.

Traffic Noise Model (TNM)

ENVIRON personnel used the FHWA Traffic Noise Model (TNM) to estimate the hourly sound levels (both L_{eq} and L_{25}) from trucks on the on-site and off-site access roads. TNM considers roadway and receptor geometry, traffic volumes and speeds, the types of vehicles on the road (i.e., heavy duty trucks), and topographic features affecting sound propagation. From these data, the model calculates hourly equivalent sound levels (L_{eq}) due to vehicle traffic. Because there are so few trucks anticipated to access the site during any one hour period, the truck noise would not be fairly continuous, and the hourly L_{eq} and hourly L_{25} would not be similar. Therefore, to estimate the applicable L_{25} limit as set by Kitsap County (applicable to on-site truck noise only), the results of TNM were adjusted to convert the model-calculated hourly L_{eq}s into the approximate hourly L_{25}.[1]

The truck noise modeling and calculations estimated the hourly sound for a truck volume of 12 trucks in and 12 trucks out per hour. ENVIRON personnel assumed a speed of 25 mph for trucks on both the on-site and off-site portions of the access road. However, it is expected that trucks would actually travel a lower speed on portions of the access road, particularly when in the pit or traveling up a steep grade.

[1] Converting the model-calculated hourly L_{eq} from multiple trucks into the hourly L_{25} required extensive additional calculations to estimate the duration of truck noise along each section of the road. This was accomplished using TNM to estimate heavy-duty truck noise for small segments of the roadway due to one truck. The access road was modeled as 32 separate segments. For each small segment, TNM calculated the hourly L_{eq} for one truck, and this hourly L_{eq} was converted to a short-term event L_{eq}, using the length of time it would take for a truck traveling 25 mph to traverse the length of the segment. The number of seconds at each sound level was then multiplied by the estimated number of trucks accessing the site each hour, and the resulting sound levels were used to estimate the hourly L_{25}.

4.2.1.2 Predicted Sound Levels of On-Site Equipment and Trucks

As described above, ENVIRON personnel modeled the expected pit equipment sound levels at the residential receptor locations potentially affected by the proposal (shown as R1 through R18 in **Figure 2**). The modeling included a 20-foot high berm around the northern half of the excavation boundary and a 20-foot high semi-permanent stockpile/berm on the eastern side of the processing and wash plant area.

The calculated sound levels displayed in **Table 6** represent the L_{25} sound levels from the pit equipment at each receptor location. The calculated levels assume all activities (i.e., train loading/unloading activity, excavation, material processing, concrete production, and a truck volume of 12 trucks in and out) in a single hour. This scenario represents the worst-case (i.e., loudest) sound levels that would be expected at Gravel Mine "A."

The calculated levels shown below are L_{25}s and include only on-site equipment and trucks. Noise from trucks traveling on off-site (i.e., public) roadways are exempt from the Kitsap County noise limits. Noise from trucks on off-site roadways is included later in this report when discussing potential cumulative increases in sound levels due to the project.

As can be seen in **Table 6**, the predicted sound levels from the proposed UTF comply with the Kitsap County daytime noise limits under full worst-case operation.

Table 6. Predicted Hourly Sound Levels from On-site Equipment (L_{25}, dBA)

Receptor	On-site Equipment	On-site Trucks	Total	County Noise Limit[(a)]
R1	33	21	34	55
R2	41	35	42	55
R3	47	40	48	55
R4	49	43	50	55
R5	43	44	46	55
R6-UTF	45	41	47	55
R7	43	39	44	55
R8-UTF	42	41	44	55
R9	41	40	44	55
R10	43	37	44	55
R11-UTF	42	32	43	55
R12	38	28	38	55
R13	38	31	39	55
R14	36	28	37	55
R15	26	11	26	55
Receptors in Proposed New Development on UTF Property				
R16-UTF	52	45	53	55
R17-UTF	53	46	54	55
R18-UTF	51	47	52	55

[(a)] The Kitsap County noise limits apply only to the levels of project-related noise, not to either the existing ambient sound levels or to the change in levels that a project may cause.

4.2.1.3 Cumulative Increases in Sound Levels

In addition to assessing compliance with the County noise limits, ENVIRON personnel assessed increases in both the hourly and daily sound levels in order to characterize potential noise impacts due to the project. The cumulative sound levels include all project-related noise, including noise from off-site trucks associated with the project, and also include existing ambient sound levels.

Existing ambient sound levels were identified based on the existing measured sound levels in conjunction with distance of the receptor from the primary noise source in the vicinity (i.e., Northlake Way). The range of hourly existing sound levels (L_{eq}s) between 7 a.m. and 5 p.m. are displayed in **Table 7**. **Table 8** displays the existing day-night sound levels (L_{dn}s).

Increases in Hourly Levels (L_{eq})

After predicting the L_{25}s to determine potential future compliance with Kitsap County's noise limits, ENVIRON personnel added together the calculated L_{eq} sound levels of the pit equipment and the on-site and off-site haul trucks to determine the overall hourly L_{eq} during peak operations. ENVIRON personnel then calculated increases over the existing hourly sound levels as shown in **Table 7**.

Table 7. Hourly Sound Level Increases (L_{eq}, dBA)

Receptor	Existing Levels[(a)]	Project-Related Levels			Cumulative Levels	Calculated Increases
		On-site Equipment	On and Off-site Trucks	Total		
R1	33-45	33	30	35	37-46	0-4
R2	36-48	41	40	43	44-49	1-8
R3	38-50	47	47	50	50-53	3-12
R4	38-50	49	49	52	52-54	4-14
R5	39-51	43	52	53	53-55	4-14
R6-UTF	45-48	45	63	63	64	15-18
R7	49-52	43	59	59	60	8-11
R8-UTF	54-57	42	62	62	63	6-8
R9	47-49	41	51	52	53-54	4-6
R10	48-51	43	58	58	58	8-10
R11-UTF	47-49	42	59	59	59	10-12
R12	48-51	38	50	50	52-54	3-4
R13	51-54	38	49	49	53-55	1-2
R14	50-52	36	41	42	50-53	0-1
R15	36-48	26	23	27	37-48	0-1
R16-UTF	38-50	52	58	59	59	10-21
R17-UTF	38-50	53	45	54	54-55	6-16
R18-UTF	39-51	51	52	54	55-56	5-16

[(a)] The range of levels is shown for the hours between 7 a.m. and 5 p.m.

To put the predicted change in noise levels in perspective, consider that WSDOT considers an increase of 10 dBA or more in a peak traffic hour sound level as a "substantial" increase and an increase of 30 dBA or more a "severe" impact. Increases of 10 dBA or more could occur at ten of the eighteen modeled receptor locations during at least several hours of a peak operating day, and these increases would be "substantial" according to WSDOT. At three of the receptor

locations (R6, R11, and R16, all owned by UTF), the predicted hourly increases of at least 10 dBA could potentially occur during every hour of a peak operating day and could be as high as 21 dBA at R6. It should be noted that a 10-dBA increase would be perceived by most people as a doubling of loudness while a 20-dBA increase would be perceived as a quadrupling of loudness. Such changes in sound levels could be perceived as a project-related noise impact. However, all of the increases are less than the 30 dBA considered a severe impact by WSDOT and would not result in significant impacts under WSDOT policy.

Increases in Daily Levels (L_{dn})

To calculate the day-night sound level associated with the project, ENVIRON personnel assumed the peak hourly levels would occur continuously from 7 a.m. to 5 p.m. (The proposed hours of operation are from 7:30 a.m. to 5 p.m.) This assumption results in conservative (i.e., overpredicted) calculated L_{dn}s since some sources would operate only for short-periods (i.e., the train loading/unloading facility) and because it is unlikely that the hourly truck volume of 12 trucks in and out would continue over the full work day. The resulting calculated L_{dn}s and potential worst-case increases over existing levels are displayed in **Table 8**.

Using FTA noise impact criteria, the project would result in adverse noise impacts at six receptor locations in the project vicinity, four of the six on property owned by UTF. However, most of the impacts would be considered moderate. The exception is at receptor R6, where the increase would be characterized as severe (i.e., potentially significant) using FTA impact criteria. Because R6 is on property owned and controlled by UTF, a significant noise impact can be avoided.

Table 8. Daily Sound Level Increases (L_{dn}, dBA)

Receptor	Existing Level[(a)]	Impact Level[(b)]		Predicted Level[(c)]	Cumulative Level[(d)]	Increase	Impact?[(b)]	
		Moderate	Severe				Moderate	Severe
R1	39	49	54	31	40	1	N	N
R2	42	51	56	40	44	2	N	N
R3	44	52	59	46	48	4	N	N
R4	44	52	59	48	50	5	N	N
R5	45	52	59	49	50	6	N	N
R6-UTF	48	53	59	60	60	12	**Y**	**Y**
R7	52	54	60	55	57	5	**Y**	N
R8-UTF	58	56	62	58	61	3	**Y**	N
R9	50	53	60	48	52	2	N	N
R10	51	54	60	54	56	5	**Y**	N
R11-UTF	50	53	60	55	56	6	**Y**	N
R12	51	54	60	47	53	1	N	N
R13	54	55	61	46	55	1	N	N
R14	53	54	60	38	53	0	N	N
R15	42	52	57	24	42	0	N	N
R16-UTF	44	52	59	55	55	12	**Y**	N
R17-UTF	44	52	59	50	51	7	N	N
R18-UTF	45	52	59	51	52	7	N	N

[(a)] Ldn calculated from measured/calculated existing sound levels over a 24-hour period
[(b)] Based on FTA noise impact criteria and applied ***only*** to predicted level of project-related noise
[(c)] Project-related noise only, and includes both on-site and off-site truck traffic
[(d)] Includes existing and predicted project-related noise

4.2.2 Gravel Mine "B" and Quarry Areas

Equipment expected to operate in Gravel Mine "B" would include a dozer for site preparation, loaders for excavating material and loading hoppers, and a conveyer system for transporting material to Gravel Mine "A" for processing and export. The excavation equipment in Gravel Mine "B" would be further from potentially-affected residences than Gravel Mine "A," so lower sound levels and fewer noise impacts would be expected with excavation in this area. Consequently, activity in this area was not considered further in this assessment.

Equipment expected to operate in the proposed quarry areas include a rock drill to prepare holes for blasting, explosives/blasting (approximately once per month), three excavators to sort material, two loaders, a dozer for clearing and land preparation, and a conveyor belt system to transport material from the quarries to Area A for processing and export. This equipment would

operate quite a bit further from the nearest residences than the equipment identified for Gravel Mine "A", so off-site sound levels from this equipment would be lower than with Gravel Mine "A." Therefore, noise from the quarrying operations was not considered further in this analysis. The exception is blasting noise, which could be loud but infrequent and of short duration. Blasting noise is exempt from the applicable noise limits. A discussion of potential blasting noise impacts follows.

4.2.3 Blasting Noise

Daytime blasting is exempt from the Kitsap County noise limits if it occurs between 7 a.m. and 10 p.m. (KCC 10.28.145). However, blasting noise would be clearly audible to most residents in the vicinity of the site.

Noise from blasting measured by ENVIRON personnel for a previous project documented a sound level of approximately 91 dBA at a distance of 1,000 feet from the blast. The residences nearest the potential blasting zone for the proposed project are over 4,000 feet away. Blasting sound levels at that distance would be approximately 79 dBA due to distance attenuation only (i.e., not including any reduction due to intervening terrain and/or vegetation). Given the distance, terrain, and forested nature of the site and surrounding properties, blasting noise would likely be in the low 70s dBA or less at the residences nearest the proposed quarry areas.

Although such sound levels would likely be noticeable if they occurred in the absence of other noise sources (i.e., passing traffic, lawn maintenance activities, etc.), there would be no potential for hearing loss or structural damage. In addition, the short duration of each noise event coupled with the infrequency of such events (approximately once every month) would greatly reduce any potential for noise impacts from blasting. It should also be noted that it is in the operator's best interest to maximize the efficiency of each blast, which results in more energy being transmitted into the ground and less into the air. More efficient blasts (which save the operator money) result in lower blast-related sound levels at distant locations. Therefore, blasting noise is not expected to result in significant adverse noise impacts.

5.0 MITIGATION

5.1 CONSTRUCTION NOISE MITIGATION

Construction activities would occur only during daytime hours to minimize potential adverse noise impacts. Therefore, mitigation measures are not warranted or proposed.

5.2 OPERATIONAL NOISE MITIGATION

5.2.1 Proposed Mitigation

Several mitigation measures have been included in the design of the project. These measures were included in the analysis discussed above. They are as follows:

- The pit would operate only during the day, between approximately 7:30 a.m. and 5 p.m.
- An earthen berm, approximately 20 feet tall, would be constructed around the northern half of the Gravel Mine "A" excavation boundary.
- A 20-foot high semi-permanent stockpile or berm would be constructed east of the processing and wash plants.
- The concrete batch plant would not be located near the entrance to Gravel Mine "A" but would be located further from the entrance.
- The train loading/unloading facility would be used only during daytime hours.

5.2.2 Additional Mitigating Factors

Following are several additional mitigating factors that could reduce the impacts identified above.

First, the impacts identified in this report are a result of calculated increases in sound levels over the existing levels. At the proposed future development nearest the excavation boundary of Gravel Mine "A" (represented by receptor locations R16, R17, and R18), the calculated increases may not be experienced by residents if the future residences are constructed after activities at the mine commence.

Second, many of the nearby impacted residences are on property owned by UTF, including R6, which was identified as being potentially severely impacted due to possible worst-case increases in the L_{dn} at this location. Noise impacts are a subjective response and may be influenced by relationships with a noise producer. For those residents leasing property from UTF, the lease would be written to allow the residents to move if they feel overly affected by noise related to the pit. This gives control over the impact to both UTF and to the residents, helping to avoid significant impacts.

Finally, the projected project-related sound levels are less than 55 dBA at all nearby residential locations. A daytime level of 55 dBA is the strictest noise limit established by Kitsap County

and Washington State, is the same limit applied to residential noise sources affecting residential receiving properties, and is considered a protective sound level for residential uses.

6.0 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

Although the overall increase in L_{dn} identified at receptor location R6 is identified as "severe" using FTA noise impact criteria, the mitigating factors described in section 5.2.2 would serve to avoid significant noise impacts.

7.0 REFERENCES

United States Department of Transportation, Federal Highway Administration (FHWA). *FHWA Traffic Noise Model, Version 2.5 User's Guide*. 2004.

United States Department of Transportation, Federal Transit Administration (FTA). *Transit Noise and Vibration Impact Assessment*. May 2006. FTA-VA-90-1003-06

United States Environmental Protection Agency (EPA). *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*. 1971. NTID300.1.

Washington State Department of Transportation. *Traffic Noise Analysis and Abatement Policy and Procedures.* 2006.

8.0 ATTACHMENT A - LONG-TERM MEASUREMENT RESULTS

SLM LT-1 4817 NW Grover - Delazerda Residence							
Date	**Time**	**L_{eq}**	**L_{max}**	**L_2**	**L_8**	**L_{25}**	**L_{90}**
21-Aug	11:00:00	38.9	71.4	43.3	40.3	38.3	32.8
21-Aug	12:00:00	39.7	65.1	45.3	40.8	37.2	32.2
21-Aug	13:00:00	51	71.5	60.9	57.4	40.4	32.2
21-Aug	14:00:00	45	76.5	47	40.3	37.1	32.3
21-Aug	15:00:00	40.2	62.2	48.3	41.3	38.1	33.2
21-Aug	16:00:00	39.7	61.6	48.5	41.4	37.7	32.7
21-Aug	17:00:00	43.1	64.9	51.8	44.7	39.1	35
21-Aug	18:00:00	42.7	65.8	50.9	43.7	38.9	32.3
21-Aug	19:00:00	42.8	67.8	53	43.4	39.7	36.2
21-Aug	20:00:00	40.2	65.4	47	41.9	38.7	34
21-Aug	21:00:00	38.3	54.7	45.3	40.6	38.1	34.4
21-Aug	22:00:00	37.7	53.1	43.5	40.2	37.9	34.1
21-Aug	23:00:00	35.4	51.7	40.5	37.7	35.8	32
22-Aug	0:00:00	32.8	53.5	38.6	34.9	32.8	29
22-Aug	1:00:00	31.5	46.9	35.8	34.1	32.1	28.6
22-Aug	2:00:00	33.3	45.7	37.9	36.1	34.1	29.8
22-Aug	3:00:00	34.3	46	39.1	37	35.2	30.4
22-Aug	4:00:00	36.2	44.6	39.9	38.6	37.3	31.5
22-Aug	5:00:00	39.2	56.8	43.9	40.7	39.2	35.7
22-Aug	6:00:00	42	59.5	48.4	43.9	42.4	37.9
22-Aug	7:00:00	40.3	58	43.8	41.6	40.4	37.9
22-Aug	8:00:00	40.3	56.5	48	42.8	39.4	34.9
22-Aug	9:00:00	47.5	70.5	53.4	43.5	39.5	35
22-Aug	10:00:00	42.7	70.5	50.3	45.3	41.7	36.2
22-Aug	11:00:00	44.4	61.9	52.6	49.2	43.6	37.3
22-Aug	12:00:00	43.9	68.1	51.2	46	42.4	35.9
22-Aug	13:00:00	43.4	71.8	50.6	44.8	41.8	38
	L_{dn}	45-46					

SLM LT-2 4847 Leber Lane - Cates Residence							
Date	**Time**	**L_{eq}**	**L_{max}**	**L_2**	**L_8**	**L_{25}**	**L_{90}**
21-Aug	11:00:00	52.5	68.2	59.8	56.6	53.3	42.1
21-Aug	12:00:00	52.1	65.2	59.4	56.5	53.3	37.8
21-Aug	13:00:00	51.8	66.8	59.3	55.9	53	37.3
21-Aug	14:00:00	52.1	64.1	59.4	56.4	53.4	39.8
21-Aug	15:00:00	53.2	65.8	60.1	57.1	54.4	42
21-Aug	16:00:00	54.2	70.5	59.8	57.9	55.6	43.9
21-Aug	17:00:00	53.8	65.9	59.5	57.7	55.2	42.6
21-Aug	18:00:00	52.3	68.5	58.4	56.4	53.9	39.3
21-Aug	19:00:00	51.4	67.2	57.8	55.4	52.8	40.7
21-Aug	20:00:00	50.1	67.4	57	54.6	51.3	37.7
21-Aug	21:00:00	48.6	63.7	55.8	53.2	49.7	36.5
21-Aug	22:00:00	46.3	63.5	54	51.4	46.8	35.6
21-Aug	23:00:00	44.3	62.7	52.8	49.9	43	34.1
22-Aug	0:00:00	42.6	59.7	52.8	47.8	37.3	33.1
22-Aug	1:00:00	42.7	69.4	51.3	46.3	38.1	33
22-Aug	2:00:00	41	64.5	50.6	44.9	38.2	33.2
22-Aug	3:00:00	43.6	61.6	53.5	48.3	38.7	33.5
22-Aug	4:00:00	45.1	62	54.3	50.5	42.3	34.3
22-Aug	5:00:00	49.1	62	56.8	54.3	50	37.1
22-Aug	6:00:00	52.2	69.8	58.4	56.2	53.5	41.1
22-Aug	7:00:00	52.2	65	58.6	56.3	53.6	41
22-Aug	8:00:00	51.7	67.4	58.8	55.9	52.7	40.2
22-Aug	9:00:00	51.8	65.5	59.1	56	52.7	41.5
22-Aug	10:00:00	51.3	65.8	58	55.3	52.5	42.3
22-Aug	11:00:00	51.4	64	58	55.4	52.6	41.9
22-Aug	12:00:00	52.6	69.8	59.8	56.7	53.3	42.5
	L_{dn}	54					