



ENVIRONMENTAL NOISE IMPACT REPORT

Enumclaw Recycling Center
Enumclaw, WA

[REVISION 3]

Prepared for:

Ron Shear
Buckley Recycle center, Inc.
P.O. Box 2330
Buckley, WA 98321
253-223-8586

Prepared by:

Joel Esselstrom, INCE
John Keiffer, INCE
SSA Acoustics, LLP
222 Etruria Street
Suite 100
Seattle, WA 98109

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PREPARED BY: Joel Esselstrom, Acoustical Consultant
John Keiffer, Senior Consultant

SIGNED:



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I. INTRODUCTION

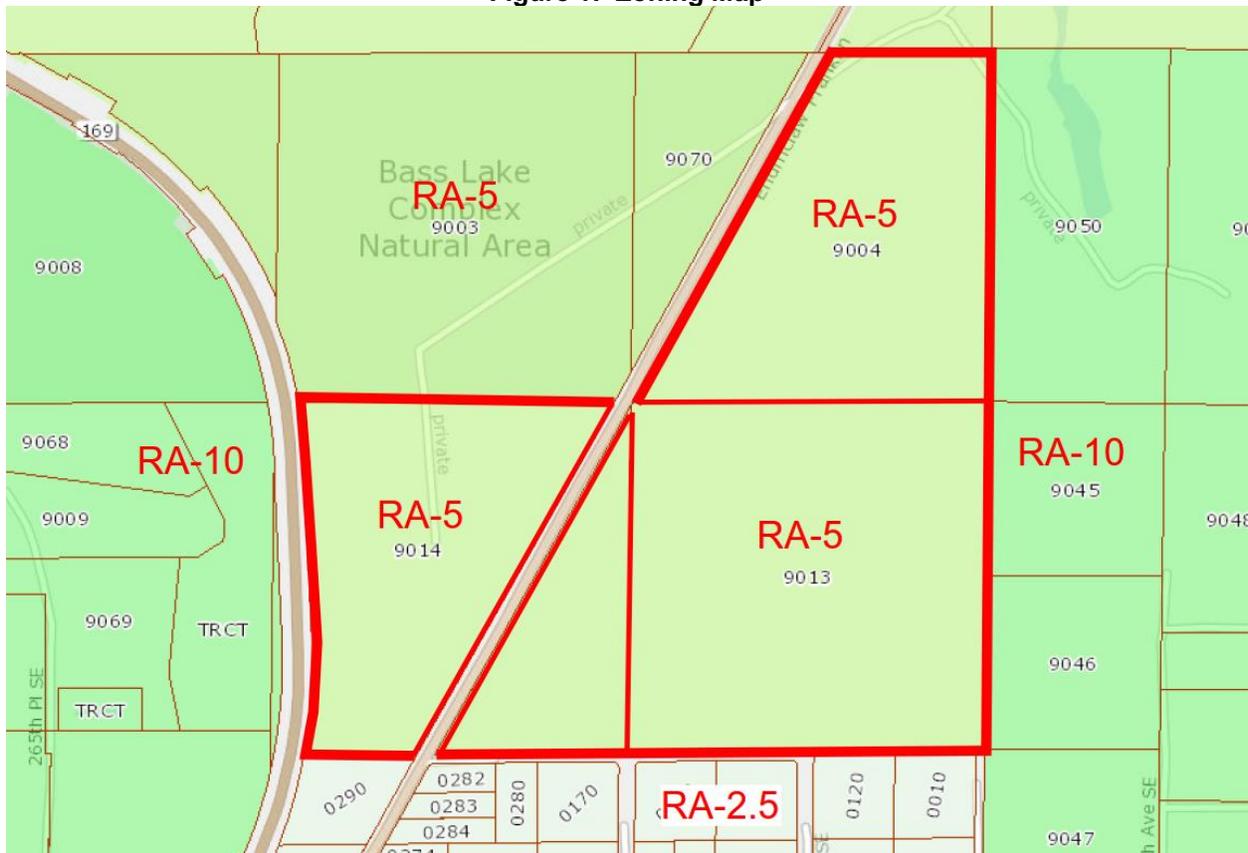
This report presents the environmental noise impact study and noise mitigation plan for the new Enumclaw Recycling Center (ERC) located in Enumclaw, Washington. The site is located along Enumclaw Franklin Road, just north of SE 380th Street. To understand the noise impact at the new ERC site, we evaluated the the equipment noise levels at the existing Buckley Recycling Center (BRC) site. The existing BRC site is located at 28225 West Valley Highway North, Auburn, Washington.

It is our understanding that BRC’s typical daily operations include moving and processing of organic materials such as soil, plant matter, or wood. These operations involve large equipment used for hauling, grinding and excavating. We have measured the individual noise levels from each of the machines planned for use at the new site location. As this report contains acoustical terms, please refer to the appendix for definitions and descriptors.

II. PROJECT SITE AND ZONING

The new site location, shown in Figure 1 below, falls within an RA-5 zoning jurisdiction, which is considered “Rural”. All surrounding properties are also considered “Rural”.

Figure 1: Zoning Map



III. NOISE REGULATIONS AND CRITERIA

Criteria 1 – King County

Per King County Code Chapter 12.86 the maximum permissible sound levels are established based on the zoning of the source and receiving properties. These include Rural, Residential, Commercial and Industrial zoning designations. The Leq noise limits from section 12.86.110, based on the source and receiving properties are shown in table 1 below.

Table 1: Maximum Permissible Noise Levels (Leq)

District of Sound Source	District of Receiving Property			
	Rural	Residential	Commercial	Industrial
Rural	49	52	55	57
Residential	52	55	57	60
Commercial	55	57	60	65
Industrial	57	60	65	70

As shown in Table 1, noise from a rural source property to a rural receiving property is limited to 49 dBA during daytime hours. Between the hours of 10:00 pm and 7:00 am during the week days and between the hours of 10:00 pm and 9:00 am on weekends, the noise limits in the table above are to be reduced to 39 dBA for rural or residentially zoned receiver properties to account for increased sensitivity during nighttime hours.

In addition to the Leq noise limits provided in Table 1, KCC limits the Lmax to 15 dBA over the allowable Leq. Based on the rural zoning of the site and receiving properties, the Leq and Lmax values are limited per the following:

**Table 2: Maximum allowable Noise limits per King County
For A Rural Source to a Rural Receiver Property**

	Daytime hours (7:00 AM to 10:00 PM)	Nighttime hours (10:00 PM to 7:00 AM)
Average (Leq)	49 dBA	39 dBA
Maximum (Lmax)	64 dBA	54 dBA

Per King County Code, noise associated with trucks and other vehicles operating on public roads is exempt from the limits provided above. The limits only apply to the specific on-site operations of the site.

Criteria 2 – State Environmental Protection Act (SEPA)

SEPA provides a checklist when evaluating a site for future noise exposure to the surrounding environment for the benefit of environmental health. SEPA requires consideration of the following:

b. Noise

1. What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other).
2. What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.
3. Proposed measures to reduce or control noise impacts, if any:

Criteria 3 – Washington State Department of Transportation

Noise associated with traffic for project related activities is currently exempt from noise limitations as stated per King County Code. However, noise impacts due to changes in operations can be evaluated based on the level of change in sound level and the level considered acceptable for the type of land use.

These criteria are better described in Washington State Department of Transportation's (WSDOT) guidelines for noise levels. The Federal Highway Administration (FHWA) Code of Federal Regulations (CFR) Title 23 Part 772 has been adopted as it relates to evaluating noise impacts associated with traffic noise. Title 23 Part 772: Procedures for Abatement of Highway Traffic Noise and Construction Noise defines traffic noise impacts as noise levels that approach or exceed the noise abatement criteria or when the predicted noise levels significantly exceed the existing noise levels. The noise abatement criteria are provided in the following table. For this project, considering impacts to the existing adjacent properties, activity category B is assumed applicable.

Table 3: FHWA Noise Abatement Criteria

Category	Leq(h)	L ₁₀ (h)	Description of Activity Category
A	57 (Exterior)	60 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	--	Undeveloped lands.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

IV. AMBIENT NOISE LEVELS

Existing ambient noise levels were measured at two different locations near the project site boundaries. Locations were chosen in an attempt to capture current ambient noise levels at the nearest receiving property lines adjacent to the site to understand the current noise without the impact of the new BRC site. Measurement location 1 and location 2 best represent the ambient noise levels for residential neighborhoods, given that one is located near the highway and one is located farther away. These levels will be compared to the predicted noise levels.

Measurements were conducted using Svantek 971 Sound Level Meters that conform to American National Standards Institute (ANSI) S1.4 for Type I instruments. All meters are with current calibration and have been locally calibrated prior to deployment at the site. Measurements were conducted between December 20 to December 21, 2016. Conditions during the measurement were overcast with no precipitation. Temperatures during the measurements were approximately 40 to 50 degrees Fahrenheit with wind speeds between 0 to 5 mph.

Figure 2: Measurement Locations



Table 4 summarizes the average Leq sound pressure levels at both measurement locations. The noise levels shown are considered the baseline sound levels for evaluation. The results of the 24-hour measurements are provided in a chart in the appendix.

Table 4: Measurement Results Summary

		Location 1	Location 2
Baseline Ambient Leq	Daytime	54	47
	Nighttime	47	39

Table 5: Regulations for Maximum Noise Levels

Noise Regulation		Location 1	Location 2
King County Limits	Daytime	49	49
	Nighttime	39	39

Location 1

Noise levels at Location 1 are primarily due to traffic activities associated with heavy trucks and cars passing along Enumclaw Franklin Road SE. Average daytime Leq sound pressure levels were at 54 dBA, which is 5 dBA above the 49 dBA King County daytime noise limit. Based on the FHWA guidelines in Table 4, this puts the neighborhood in Category A, which is defined as a generally quiet or serene environment.

Location 2

Noise levels at Location 2 are primarily due to local street traffic and other ambient noise from wind. This neighborhood is considered to be very quiet with average daytime Leq sound pressure levels were at 47 dBA, which is 2 dBA below the 49 dBA King County daytime noise limit. Based on the FHWA guidelines in Table 4, this also puts the neighborhood in Category A.

VI. PROPOSED OPERATIONAL EQUIPMENT

Sound levels from operational equipment at the existing BRC site were measured to make predictions to the surrounding properties at the new site location. Each piece of equipment was run and measured separately at a distance of 25'. The Leq and Lmax measurements and equipment descriptions are provided in Table 6 below.

The proposed ERC site will have similar operational equipment as well as hauling vehicles entering and leaving the site to drop off or pick up materials by way of Enumclaw Franklin Road SE. A traffic study has been conducted by Heath & Associates, Inc, which indicates that the Daily Traffic Volume (AWDT) for the ERC site is estimated to be 164 vehicle trips per day entering and leaving the site. Large or heavy trucks are expected to make up 20 percent of project traffic. According to the study the peak number of vehicles per hour is 22 vehicles entering and exiting the site. Therefore, the number of large or heavy trucks that will potentially be entering and leaving the site per hour is 4 – 5. It is understood that the ERC site can support up to 4 large heavy trucks at one time at the Phase I West area, and up to 1 Truck at the Phase I East area for storing materials. Therefore, our evaluation will use the sum noise level of 4 trucks or 1 truck, which is also included in the summed noise levels in Table 6.

Table 6: Reference Sound Pressure Levels of Equipment @ a distance of 25 feet, dBA

Equipment Description	Leq @ 25'	Lmax @ 25'	Phase 1 West Total Leq	Phase 1 East Total Leq
Diamond Z 1463 Stump Grinder	93	94	Yes	No
Retech Prospector Trommel Screen	84	88	Yes	No
John Deere 750C Dozer	82	85	Yes	No
Case Front Loader 1221E	78	79	No	Yes
Hitachi EX200 Excavator	76	80	Yes	No
John Deere 790E Excavator	76	80	Yes	No
Linkbelt LX330 Excavator	76	80	No	Yes
Heavy Truck (Limit 1 Truck)	80	84	No	Yes
Heavy Trucks (Sum of 2 trucks)	83	87	Yes	No
Total Noise Level from All Equipment Operating at Once			94 dBA	83 dBA

As shown in Table 6, the total sum noise level of operational equipment and heavy trucks is 94 dBA in the Phase 1 West area and 83 dBA in the Phase 1 East area. The Lmax values for the equipment are typically within a few decibels of the Leq levels. Therefore, the predicted Lmax levels are expected to be within the allowable 15 dBA exceedance of the Leq, as shown in Table 2.

VII. PREDICTED NOISE LEVELS FROM EQUIPMENT

Tables 7–8 show our calculations for predicted noise levels for operational equipment to the nearest property lines from the Phase 1 West and Phase 1 East areas. The potentially impact receiving properties include properties located to the south, west, and east. The undeveloped land directly to the north of the Phase 1 West area is the Bass Lake Natural Complex Area considered open space designated for passive recreation and will be included in the predictions.

Table 7: Phase 1 West: Predicted Equipment Noise Levels at Nearest Property Lines

Line	Application Factors (Phase 1 West)	South PL	West PL	North PL	East PL
1	Sum of all Equipment Noise Levels (dBA).	94	94	94	94
2	Distance Factor (DF) for nearest property lines (dBA). Inverse-Square Law (Free Field): $DF = 20 \cdot \log(d1/d2)$	-30 (794 ft)	-26 (500 ft)	-21 (280 ft to center of equip area)	-38 (2,000 ft)
3	Noise Attenuation from Container Wall or Earth Berm. HARRIS (Acoustical Measurements and Noise Control, p. 3.19)	-13 (24' Tall)	-13 (24' Tall)	-0	-0
4	Ground Effect Attenuation Factor for Porous Ground (ISO 9613-2-7.3, 1996)	-3	-3	-0	-4
5	Atmospheric Absorption Attenuation Factor (ISO 9613-2-7.2, 1996)	-1	-1	-0	-2
6	Foliage Attenuation Factor (ISO 9613-2-A.1, 1996)	-5 (300 ft)	-5 (300 ft)	-0	-5 (300 ft)
7	Equipment Location Factor: (ARI 275-97) Reflective surfaces adjacent to equipment.	--	--	+3	+3
8	New equipment Sound Pressure Level at receivers. (Add lines 1 – 7)	42 dBA	46 dBA	76 dBA	47 dBA

As shown in Table 7, the noise levels from operational equipment and heavy trucks at the Phase 1 West area are predicted to meet the 49 dBA daytime noise limit at the property lines.

The predicted noise levels to the west and east properties are close to the limit. However, since we are using a worst-case scenario, where all equipment is operating at once, actual noise levels to these properties will be considerably less most of the time. Chances of exceeding 49 dBA are very unlikely.

The noise levels could be as high as 77 dBA to the property line of the recreational open space to the north. An average distance of 280 feet was used to calculate the distance attenuation in order to estimate a more realistic impact to this property. Since the model uses a worst-case scenario, where all equipment is operating at once, actual noise levels will likely be considerably less most of the time. Furthermore, this particular parcel is densely covered in vegetation near the property line and is not likely to be used for recreational purposes. In our experience, we would not expect this to pose as a noise issue in the future.

Table 8: Phase 1 East: Predicted Equipment Noise Levels at Nearest Property Lines

Line	Application Factors (Phase 1 East)	South PL	West PL	NE PL	East PL
1	Sum of Equipment Noise Levels (dBA).	83	83	83	83
2	Distance Factor (DF) for nearest property lines (dBA). Inverse-Square Law (Free Field): $DF = 20 \cdot \log(d1/d2)$	-21 (275 ft)	-33 (1,178 ft)	-16 (160 ft)	-30 (780 ft)
3	Noise Attenuation from Container Wall or Earth Berm. HARRIS (Acoustical Measurements and Noise Control, p. 3.19)	-10	-0	-0	-0
4	Ground Effect Attenuation Factor for Porous Ground (ISO 9613-2-7.3, 1996)	-4	-5	-0	-4
5	Atmospheric Absorption Attenuation Factor (ISO 9613-2-7.2, 1996)	-0	-2	-0	-1
6	Foliage Attenuation Factor (ISO 9613-2-A.1, 1996)	-4 (200 ft)	-5 (300 ft)	-0	-5 (300 ft)
7	Equipment Location Factor: (ARI 275-97) Reflective surfaces adjacent to equipment.	--	--	--	--
8	New equipment Sound Pressure Level at receivers. (Add lines 1 – 7)	44 dBA	38 dBA	67 dBA	43 dBA

As shown in Table 8, the noise levels from operational equipment and heavy trucks at the Phase 1 East area are predicted to meet the 49 dBA daytime noise limit at the property lines.

The noise levels could be as high as 67 dBA to the property line of the recreational open space to the northeast. This is a worst-case scenario based on the shortest distance between the two areas. Most equipment operation will be farther away. Furthermore, this particular parcel is densely covered in vegetation near the property line and is not likely to be used for recreational purposes. In our experience, we would not expect this to pose as a noise issue in the future.

VIII. SEPA NOISE CONSIDERATIONS

SEPA provides a checklist of questions when evaluating a site for future noise exposure to the surrounding environment for the benefit of environmental health. SEPA requires consideration of the following:

1. Question:

What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other).

Answer:

Given the type of project and the rural surrounding environment, there is no potential noise impact to the project from surrounding sources.

2. Question:

What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Answer:

(a) The project would create an increase in traffic volume on nearby roads. Existing traffic on Enumclaw Franklin Road was tallied between 5:00 pm and 6:00 pm on a typical day and recorded a total of 14 vehicles travelling northbound and 9 vehicles travelling southbound past the project site. This is relatively low traffic volume and therefore new project site is expected to double this volume. In general, a doubling of traffic volume can increase the ambient noise levels by 3 dBA. The existing traffic study did not count any large trucks from 5:00 pm to 6:00 pm; however, a 1-hour count period may not be sufficient to capture all potential times of the day or times of the year that trucks may use Enumclaw Franklin Road. We will assume that the project will quadruple the amount of trucks on this road to be conservative. This would equate to about a 6 dBA increase in the traffic noise along Enumclaw Franklin Road. This increase is generally considered a "clearly noticeable" impact.

(b) Construction noise is not expected to be a major source of noise on the project site, given that no large structures are part of the project. The primary cause for construction noise will be the initial grading, construction of retention and filtration ponds, and construction of large berms around the site to block noise at the receiving property lines.

(c) Operational noise levels have been predicted to the nearest inhabited properties. Due to the noise barriers currently shown in the plan, as well as restricted areas for equipment, noise levels will meet the code requirements at all receiving property lines. Operational noise to the Bass Lake Complex Natural Area to the north and east of the site are expected to be above the code limit by a significant amount; however, this particular parcel is densely covered in vegetation and is not likely to be used for recreational purposes. In our experience, we would not expect this to pose as a noise issue. If required by KCC, noise could be reduced by 10 dBA with the implementation of a noise barrier north of the Phase I West area. Since the predicted noise levels are a worst-case scenario, we would recommend evaluating the actual impact once the ERC is in operation.

(d) The ERC hours of operation will be limited to 7:00 am - 10:00 pm during the week days and to 9:00 am - 10:00 pm on weekends. All other times require that noise levels are reduced to 39 dBA at receiving property lines, which is not possible given the limitations on the effectiveness of the mitigation plan.

3. Question:

Proposed measures to reduce or control noise impacts, if any:

Answer:

Proposed noise mitigation measures are addressed in the following section of this report.

IX. MITIGATION PLAN

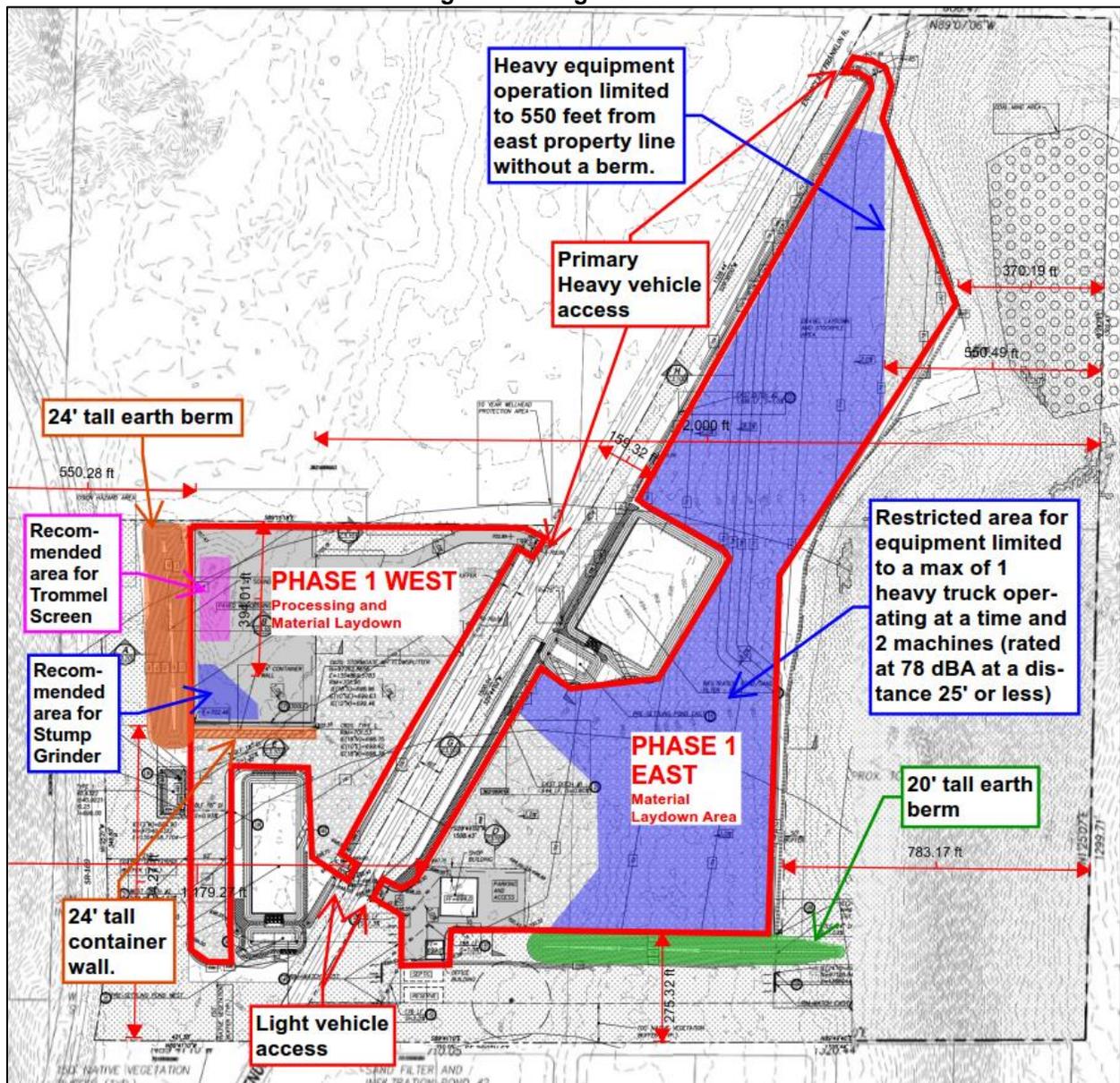
As a supplement to the plans for the ERC project, we have provided the following requirements in order to be sure that the planned berms or barriers provide sufficient noise reduction and that equipment areas will not exceed the predicted noise levels.

Mitigation Plan Requirements:

1. Construct a container wall to the west and south of the Phase I West processing area as shown in Figure 4. Use organic material such as wood chips against the side of the container to absorb sound energy that might otherwise reflect to the other property lines. This material can be piled up against the containers or held against the container with a wire mesh to create a 12" deep vertical layer. Avoid gaps between the containers by sealing up air space with soil. Another option is to construct a 24' earth berm instead of a container wall, as currently shown in the plans. The current plan shows a large berm at these areas.
2. The Phase 1 West area is the only area that shall hold the Diamond Z Stump grinder. It is important that this piece of equipment be positioned up against the wall or berm on the west and south sides. It should not be stationed in the middle of an open area. Figure 4 shows the recommended area for the stump grinder equipment to be positioned in a corner. This maximizes the noise reducing qualities of the earth berm.
3. The Phase 1 West area is the only area that shall hold the Retech Prospector Trommel Screen. It is important that this piece of equipment be positioned up against a wall or berm. It should not be stationed in the middle of an open area. Figure 4 shows the recommended area for this equipment.
4. Regular use of operation equipment for the Phase 1 West area shall not be closer than 500 feet to the nearest receiving property lines to the west, and 800 feet to the nearest property lines to the south in order to provide sufficient noise attenuation from distance. Equipment used for laydown of material may be used closer to these receiving property lines.
5. The site access for the Phase I West and Phase I East areas shall be 400' from the property lines to the south. The primary access for heavy trucks should be the north access driveways, while south access driveways should be used primarily for lighter vehicles.
6. Construct an earth berm between the proposed Phase 1 East equipment operation area and the residential neighborhood to the south. The berm shall be no less than 20' tall.
7. Regular use of operation equipment for the Phase I East must not be less than 275 feet to the south property line and not less than 550 feet from the east property line to provide sufficient noise attenuation from distance.
8. In order to not require a berm on the east side of the Phase I East area, this area will be limited at a laydown and stock pile area. No processing is allowed in this area. Equipment will be limited to 1 heaving truck operating at a time, and 2 machines operating at a time. Allowable machines include equipment that is rated at 78 dBA or less when measured at a distance of 25 feet.
9. Maintain all existing vegetation buffers around the site as much as possible.
10. Certain events such as the slamming of dump truck gates can cause impact noise that can be as high as 100 dBA at 25 feet for less than one second. Therefore, it will be important to instruct drivers not to do so with posted signage.
11. Hours of operation will be limited to 7:00 am - 10:00 pm during the week days and to 9:00 am - 10:00 pm on weekends. All other times require that noise levels are reduced to 39 dBA or less at

receiving property lines, which is not possible for all receivers given the limitations on the effectiveness of the mitigation plan.

Figure 4: Mitigation Plan



X. SUMMARY

This concludes our environmental noise impact evaluation and mitigation plan for the proposed new Enumclaw Recycling Center. It will be necessary to adopt additional noise mitigating measures for reducing the impact to the receiving property lines.

Furthermore, the predicted noise impact to the adjacent receiving property lines is based on a worst-case scenario model, where it is assumed that all equipment is operating simultaneously and on the portion of the site nearest the property lines. The actual noise impact to these properties will be considerably less during day to day operations.

XI. APPENDIX: DESCRIPTORS

Sound is measured as a sound level in units of decibels (dB). Environmental sound as with most sound is measured as an A-weighted sound level (dBA). The A-weighting is a standard frequency weighting system based on the sensitivity of human hearing at various frequencies, particularly the greater sensitivity at mid and high frequency compared to lower frequencies.

People normally experience sound levels between 30 and 90 dBA. The lower level may be associated with a quiet bedroom or office and the higher value a loud vehicle, radio or power tool. Normal conversation has a noise level between 50 and 60 dBA.

Each 10 dB increase in sound level corresponds to a tenfold increase in sound energy but is judged by a listener as approximately a doubling of loudness. The smallest discernable changes in sound level are 2 to 3 dB. Changes of 5 dB are clearly noticeable.

Table 9: Perception of Noise Increases

Change in Sound Level (dB)	Change in Apparent Loudness
1	Imperceptible (except for tones)
3	Just barely perceptible
5	Clearly noticeable
10	About twice (or half) as loud
20	About 4 times (or one-fourth) as loud

Sound levels from two or more sources are combined using logarithmic addition, not by directly adding the levels. When two levels are combined, the louder level dominates. For instance, when 50 dBA is combined with 50 dBA the result is 53 dBA. However, when 50 dBA is combined with 40 dBA the result is 50.4 dBA, a negligible difference in terms of environmental noise.

Normally, sound levels increase the closer the receiver is to the noise source. The amount of sound level reduction with distance can be predicted based on the physical dimensions of the source and the distance to the listener. For small sources, sound levels decrease by 6 dB for every doubling of distance. For instance, if the sound level 50 feet from a source is 60 dBA, the sound level 100 feet from the source will be approximately 54 dBA.

Other factors may affect the sound level from a source at a particular listener including the presence of hills, berms and other barriers, and trees and ground foliage located between the source and listener. Because sound fluctuates over time, several A-weighted sound level descriptors are used to characterize the sound. In this report, the following descriptors are used:

Decibel

A basic metric for describing the amplitude of sound. A division of a uniform scale based on 10 times the logarithm to the base 10 of the relative value being compared to a reference value.

A-Weighting Decibel (dBA)

The A-weighting system is a specific filter that corresponds to the frequency response of the human ear.

Equivalent Sound Level (Leq)

This 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 event.

Lmax

The maximum sound level measured by a sound level meter over a given period of time. They are based on the time-weighted sound level in dB.