Prepared for:

Lakeside Industries

Prepared by:

Ramboll US Corporation
Lynnwood, Washington

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LAKESIDE – MAPLE VALLEY ASPHALT PLANT

NOISE ASSESSMENT REPORT

RAMBOLL

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1. INTRODUCTION

Ramboll US Corporation (Ramboll) was asked to consider the noise implications of siting an asphalt plant facility on a site near Maple Valley in unincorporated King County, Washington. The facility is proposed to primarily operate during daytime hours, but occasional nighttime operations would be expected. Therefore, Ramboll considered the potential for the facility to comply with both daytime and nighttime noise limits. The methods and preliminary results are provided below.

The noise analysis considered potential noise impacts at properties adjacent to the site boundary or in the vicinity of the site. The following report reviews noise terminology, regulatory criteria applicable to the project, and the methods and findings of the analysis.

2. NOISE LEVEL TERMINOLOGY AND HUMAN HEARING

The human ear responds to a very wide range of sound intensities. The decibel scale (dB) used to describe sound is a logarithmic rating system which accounts for the large differences in audible sound intensities. This scale accounts for the human perception of a doubling of loudness as an increase of 10 dB. Therefore, a 70-dB sound level will sound about twice as loud as a 60-dB sound level. People generally cannot detect differences of 1 dB; in ideal laboratory situations, differences of 2 or 3 dB can be detected by people, but such a change probably would not be detectable in an average outdoor environment. A 5-dB change would probably be perceived under normal listening conditions.

When addressing the effects of noise on people, it is useful to consider the frequency response of the human ear. Sound-measuring instruments are therefore often programmed to weight measured sounds based on the way people hear. The frequency-weighting most often used is A-weighting because it approximates the frequency response of human hearing and is highly correlated to the effects of noise on people. Measurements from instruments using this system are reported in "A-weighted decibels" or dBA. All sound levels in this evaluation are reported in A-weighted decibels.

Distance from the source, the frequency of the sound, the absorbency of the intervening ground, obstructions, and duration of the noise-producing event all affect the transmission and perception of noise. The degree of this effect also depends on who is listening and on existing sound levels.

3. AFFECTED ENVIRONMENT

3.1 King County Noise Regulations

The site and surrounding properties are located in unincorporated King County and are subject to the noise limits outlined in Chapter 12.86 of the King County Code (KCC 12.86).

KCC 12.86 establishes "maximum permissible" sound levels based on the district (i.e., zoning) of the noise source and the receiving properties. The applicable noise limits for source properties affecting nearby receiving properties are displayed in **Table 1**.

Table 1. King County Maximum Permissible Sound Levels (dBA)

District of Sound Source	District of Receiving Property Within King County			
	Rural Day/Night	Residential Day/Night	Commercial	Industrial
Rural	49 / 39	52 / 42	55	57
Residential	52 / 42	55 / 45	57	60
Commercial	55 / 45	57 / 47	60	65
Industrial	57 / 47	60 / 50	65	70

The limitations for noise received in Rural and Residential Districts are reduced by 10 dBA between 7 AM and 10 PM weekdays and between 9 AM and 10 PM weekends.

Source: KCC 12.86.110

The sound level limits identified in **Table 1** are based on the energy-average sound level over a given time period, or "L_{eq}". In addition, the sound level cannot exceed a level 15 dBA higher than the levels displayed in **Table 1**, represented by the L_{max} or maximum sound level.

3.2 Land Uses and Zoning

The site is zoned Industrial and is considered an Industrial district under KCC 12.86. The surrounding properties are zoned for rural/rural-residential use (RA-5) and are considered Rural receiving properties. The applicable noise limits for and industrial noise source affecting rural receivers are 57 dBA during daytime hours (between 7 AM and 10 PM) and 47 dBA at night (between 10 PM and 7 AM).

3.3 Existing Sound Levels

In November 2017, Ramboll measured day-long sound levels in the vicinity of the proposed site. Measurements were taken at two locations on November 20 and 21, 2017 to determine noise levels representative of existing conditions at nearby receiving properties. The first measurement (SLM1) was taken south of the site to represent the residential community to

the south. SLM2 was taken north of the site and north of SR169 to represent the Cedar Grove Natural Area and areas relatively near the highway.

The measurements were taken using Larson Davis Class 1 sound level meters (Model LxT). The meters had been factory certified within the previous 12 months and were 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).

The measured sound levels are summarized in **Table 2**, and the sound level measurement locations are depicted in **Figure 1**. Details of hourly sound level measurements can be found in Appendix A.

Table 2. Measured Existing Sound Levels (dBA)

Location	Time of Day [a]	Range of Hourly Sound Levels (dBA) [b]	
		L_{eq}	L_{max}
SLM1	Day	54-59	64-79
	Night	48-59	58-68
SLM2	Day	59-64	67-75
	Night	54-63	66-83

[a] "Day" refers to the hours between 7 AM and 10 PM and "Night" to the hours between 10 PM and 7 AM.

[b] The L_{eq} is the "energy-averaged" sound level. The L_{max} is the-highest measured sound level.

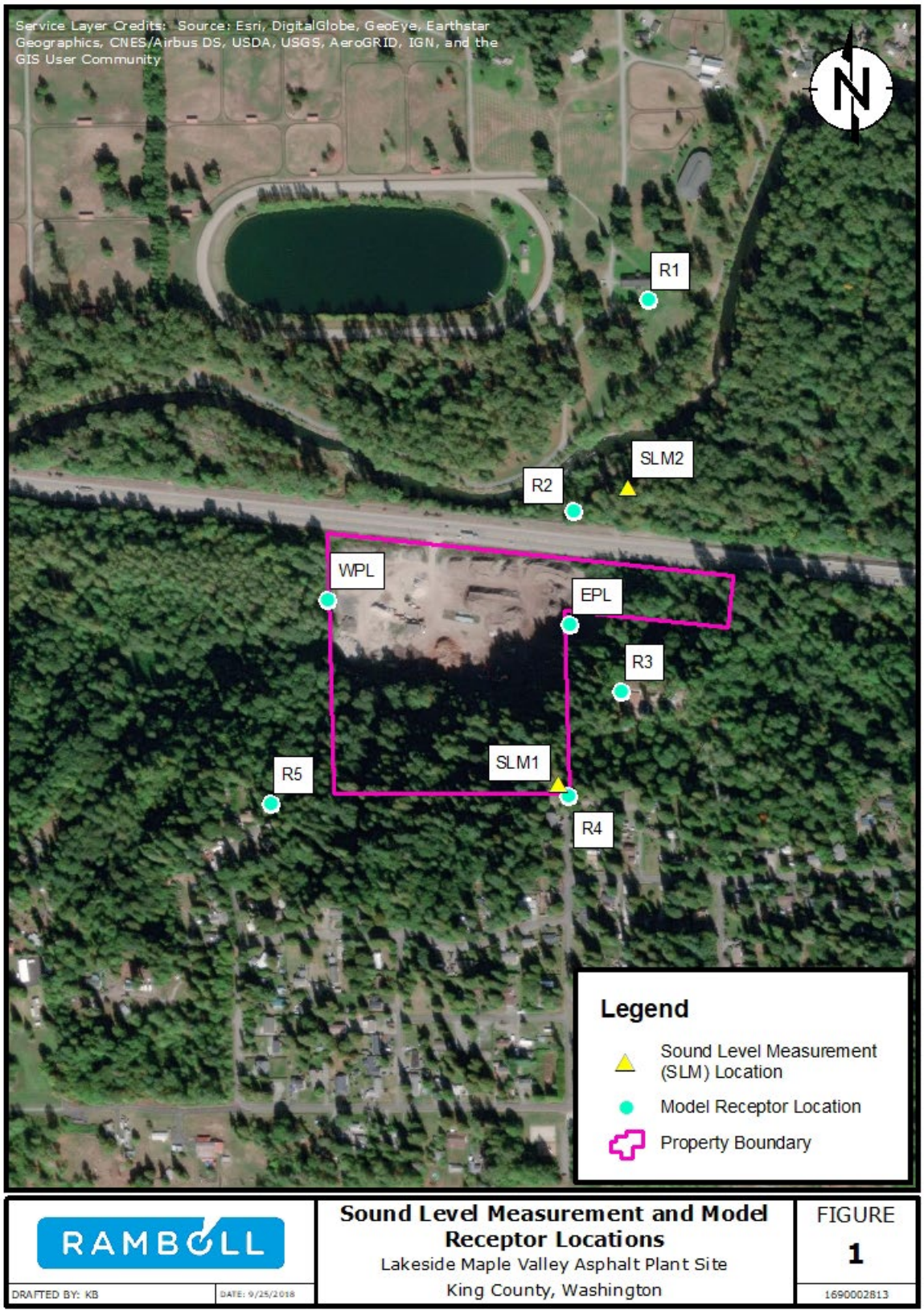

Figure 1. Sound Level Measurement and Model Receptor Locations

4. OPERATIONAL NOISE IMPACT

4.1 Noise Sources

Noise sources associated with the facility are expected to include the asphalt burner and mixing drum, conveyors, vibrating screens, front-end loader, and trucks. While most of these sources would operate in a fixed location, the loader would travel between material stockpiles and various hoppers, and the trucks would travel around on-site roadways. In addition, a recycled asphalt pavement (RAP) crusher is proposed for the Maple Valley site, which would operate from time to time only during daytime operations.

To characterize the noise from the equipment identified above, Ramboll collected sound level data of similar equipment operating at an existing facility in Covington, Washington. The sound levels used in our noise assessment are identified in **Table 3**.

Table 3. Summary of Primary Noise Sources

Noise Source		Number of Sources	Sound Level at 50 feet (dBA)	Data Source
Asphalt Plant	Burner	1	70	1
	Drum	1	65	1
Conveyors		5	61	1
Material Shakers		2	69	1
Loader		1	73	2
RAP Crusher		1	81	3
Trucks	Passby	20/hr Day, 10/hr Night	69	3
	Idle		67	3

Data Sources:

1. Measurements taken of equipment at Lakeside's Covington facility
2. Sound level of CAT 950M or 962M provided by vendor as a sound power level of 107 dBA operating at maximum fan speed
3. Archived sound level data from measurements taken by Ramboll personnel

4.2 Noise Model Used

Noise modeling of on-site sources was completed using the CadnaA noise model. CadnaA is a computer tool that calculates sound levels after considering the noise reductions or enhancements caused by distance, topography, varying ground surfaces, atmospheric absorption, and meteorological conditions. The model uses algorithms that comply with the international standards in ISO-9613-2:1996.

The modeling process includes the following steps: (1) characterizing the noise sources, (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 equipment and activity sound levels to appropriate locations on the site. CadnaA then constructs topographic cross sections to calculate sound levels in the vicinity of a project site.

4.3 Modeling Assumptions

The noise modeling was conducted through several iterations due to changes in site plans, proposed equipment improvements, and the addition of noise barriers suggested by Ramboll's earlier modeling results. The resulting equipment and mitigation/barrier assumptions included in this noise assessment follow:

- All equipment could operate concurrently over a full hour.
- During daytime operations, up to 20 trucks per hour could enter, load, and depart the facility.
- During nighttime operations, up to 10 trucks per hour could enter, load, and depart the facility.
- The truck load-out area, and the approach and departure to the load-out area, will be enclosed
- RAP crushing will be restricted to daytime hours only.
- The asphalt burner (with silencer) and drum will be same as, or similar to, equipment operating in Covington.
- The front-end loader will be similar to a CAT 950M or CAT 962M.
- The front-end loader would operate for a full hour during daytime operations but for 45 minutes or less during nighttime operations.
- On-site components and noise barriers would be similar to those depicted in **Figure 2**.

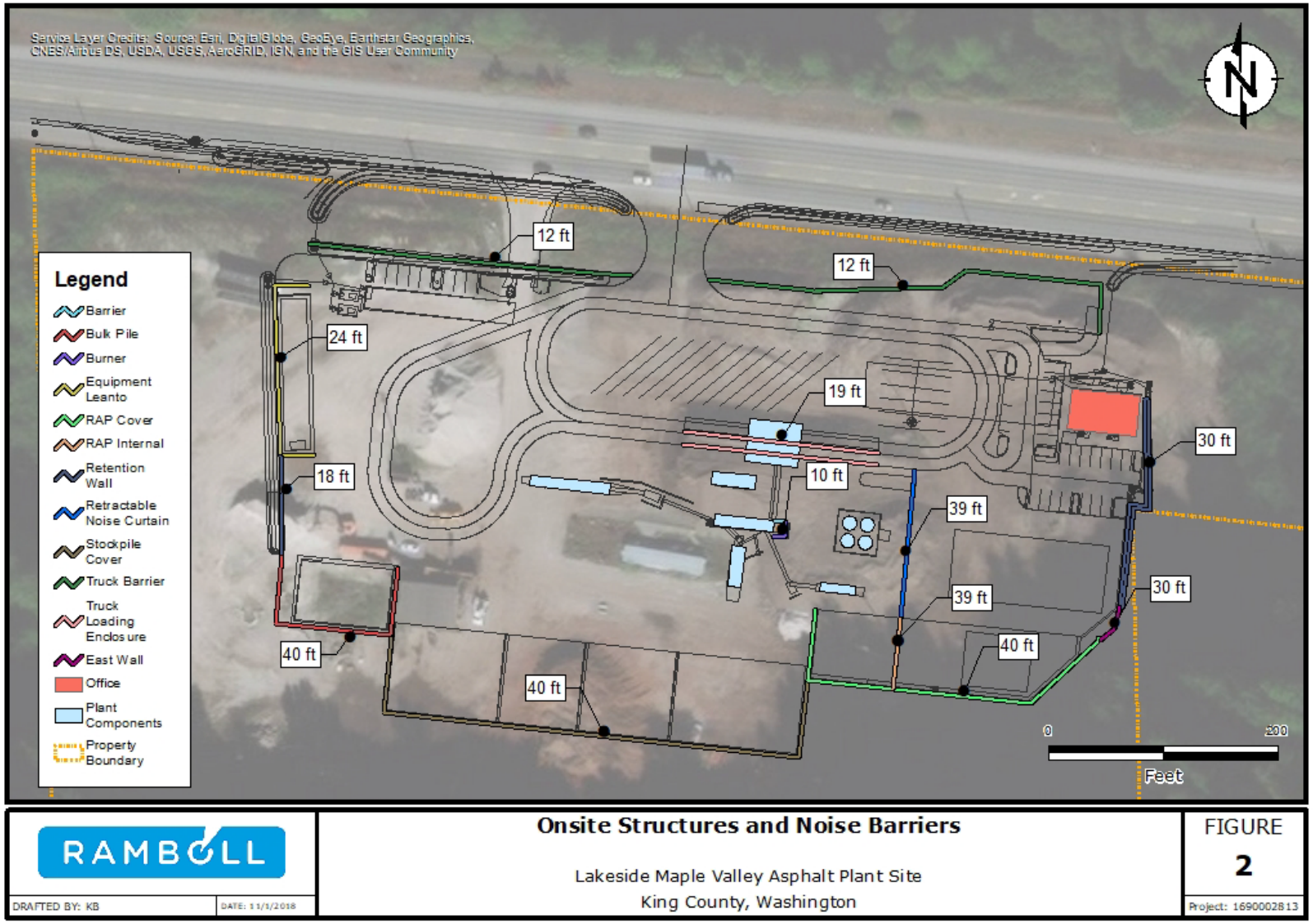

Figure 2. On-site Structures and Noise Barriers

4.4 Noise Assessment Results

Ramboll considered both the compliance of the facility with the noise limits and the potential impacts from projected increases over existing sound levels. These are discussed separately below.

4.4.1 Compliance of On-Site Sources with Noise Limits

Using the equipment sound levels and modeling assumptions identified above, Ramboll modeled the facility's daytime and nighttime operations at receptor locations representing the nearest sensitive receivers to the site and the most affected property boundaries. The specific receptor locations included in the model are displayed in **Figure 1** and described as follows:

R1 – Nearest residence north of site and SR169

R2 – Cedar Grove Natural Area

R3 – Newly constructed residence east of site, on hillside

R4 – Nearest residences southeast of site

R5 – Nearest residence southwest of site

EPL – Eastern property line

WPL – Western property line

The model-calculated sound levels are identified in **Table 4** for daytime and nighttime operations.

Table 4. Model-calculated Sound Levels (Leq, dBA)

Receptor	Facility Sound Level		Noise Limit [a]
	Daytime	Nighttime	
R1	43	35	57 / 47
R2	49	42	57 / 47
R3	47	46	57 / 47
R4	43	42	57 / 47
R5	38	38	57 / 47
EPL	47	36	57 / 47
WPL	48	47	57 / 47

[a] The noise limits are displayed for Day/Night periods

As shown in **Table 4**, the model-calculated sound levels at the nearest sensitive receivers to the facility and at the property boundaries comply with the applicable noise limits during both daytime and nighttime operations.

In addition to identifying the sound levels at the specific receptor locations shown in **Table 4**, Ramboll produced noise contour figures for daytime and nighttime operations to assess the likelihood of compliance in all areas surrounding the site. Daytime noise contours are displayed in **Figure 3** and nighttime operations in **Figure 4**. Review of the figures shows that the facility is expected to comply with daytime and nighttime sound levels at all nearby properties, both developed and undeveloped.

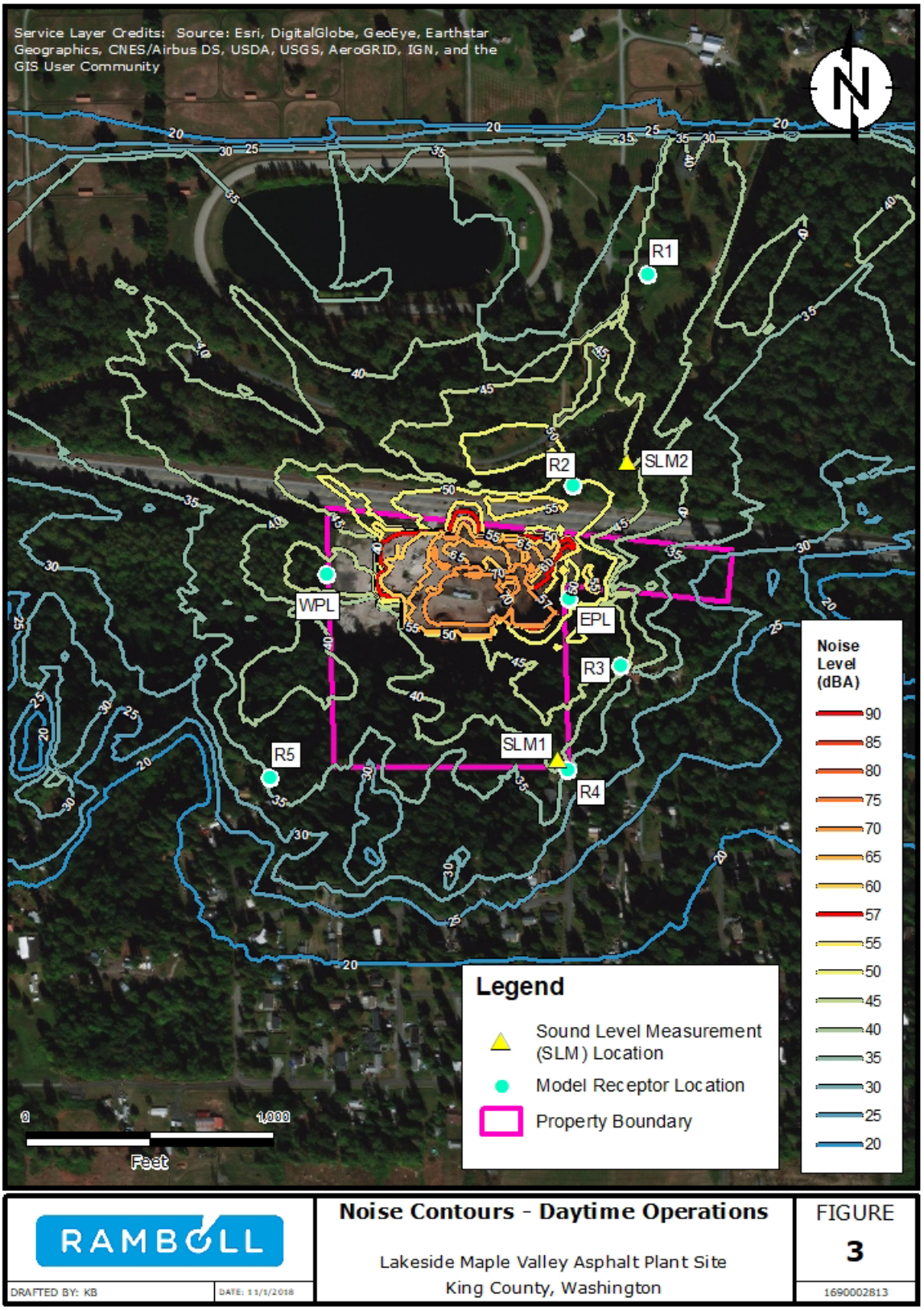

Figure 3. Noise Contours – Daytime Operations

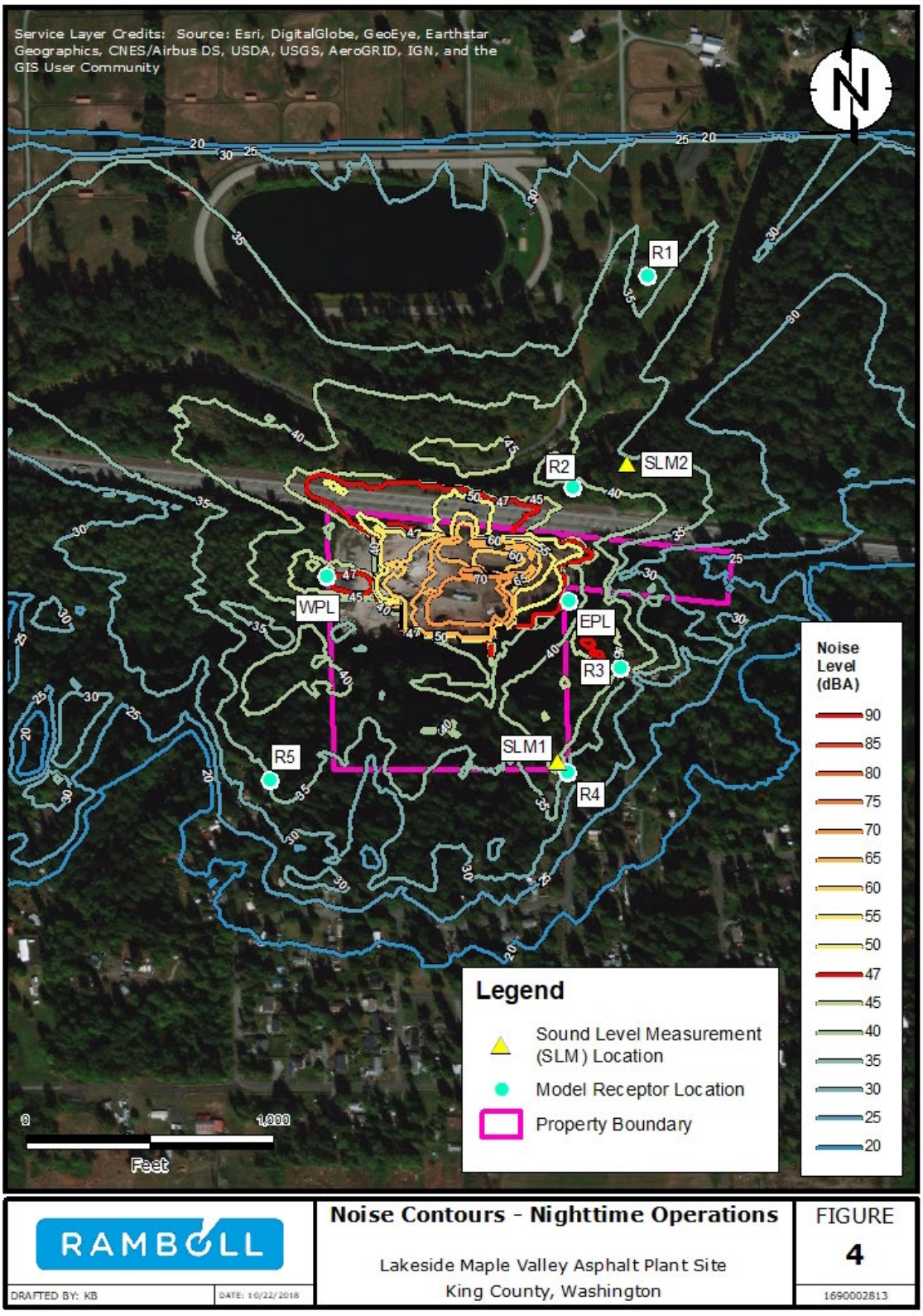

Figure 4. Noise Contours – Nighttime Operations

4.4.2 Increases Over Existing Noise Levels From Project Sources

In addition to evaluating the potential compliance of on-site sources, Ramboll considered potential noise impacts caused by project-related increases over existing background sound levels. For this assessment, Ramboll added the model-calculated sound levels for daytime and nighttime operations to the measured existing sound levels during each period to identify the cumulative levels and potential project-related increases. For this assessment we considered potential increases at existing sensitive receivers and not at undeveloped properties, because there would be no receivers in the undeveloped areas to experience any potential increase. The results are displayed in **Table 5**.

To represent the existing background sound levels, Ramboll used the lowest measured hourly Leq during the daytime and nighttime hours for each period. This is a conservative approach, since the existing levels during most hours would be higher than identified in **Table 5**, and potential increases due to the project would be less than identified for most hours of the day.

Table 5. Calculated Increases over Existing Levels (Leq, dBA)

Receptor	Existing[a]	Project	Cumulative[b]	Increase
Daytime				
R1	54	43	54	0
R2	59	49	59	0
R3	54	46	55	1
R4	54	42	54	0
R5	54	38	54	0
Nighttime				
R1	48	35	48	0
R2	54	42	54	0
R3	48	46	50	2
R4	48	42	49	1
R5	48	38	48	0

[a] The existing sound levels shown are the lowest measured hourly Leq for the daytime (7 AM to 10 PM) and nighttime (10 PM to 7 AM) periods.

[b] Cumulative levels represent the existing measured sound levels + the modeled project-related sound levels.

As can be seen in **Table 5**, potential project-related increases over existing sound levels during the quietest existing daytime and nighttime hours range from 0 to 2 dBA. Increases

of 2 dBA or less are not easily discernible in active outdoor environments and would represent a minimal impact.

5. CONCLUSIONS

With the noise assumptions identified above and construction of the plant components and barriers shown in **Figure 2**, model-calculated sound levels in the project vicinity comply with both the daytime and nighttime noise limits established by King County.

At existing sensitive receivers (i.e., residences and the Cedar Grove Natural Area), project-related increases over background sound levels would be 0-2 dBA, which would result in minimal impacts.

APPENDIX A: SOUND LEVEL MEASUREMENT DATA

Table A- 1. Measured Sound Levels at SLM1 (dBA)

Date	Time	L_{eq}	L_{25}	$L_{8.3}$	$L_{2.5}$	L_{max}	L_{90}
20/11/2017	14:00:00	58.5	59.4	60.8	61.8	69.6	55.0
20/11/2017	15:00:00	57.4	58.2	59.6	60.8	79.1	54.4
20/11/2017	16:00:00	58.9	59.7	60.5	61.3	73.2	56.5
20/11/2017	17:00:00	58.0	59.0	60.0	60.6	65.3	54.9
20/11/2017	18:00:00	56.3	57.5	59.0	60.1	64.3	51.7
20/11/2017	19:00:00	54.7	56.0	57.8	59.1	63.6	50.1
20/11/2017	20:00:00	54.1	55.3	57.2	58.2	66.0	49.2
20/11/2017	21:00:00	55.0	56.4	58.2	59.2	64.4	49.5
20/11/2017	22:00:00	53.9	55.2	57.2	58.5	62.2	48.6
20/11/2017	23:00:00	51.5	52.8	54.6	56.0	58.9	46.4
21/11/2017	00:00:00	49.5	50.8	53.1	54.9	60.1	43.5
21/11/2017	01:00:00	48.0	49.0	51.6	53.3	58.0	43.4
21/11/2017	02:00:00	48.1	49.1	51.5	53.6	63.5	43.3
21/11/2017	03:00:00	50.4	51.7	53.8	55.2	59.4	45.1
21/11/2017	04:00:00	54.7	56.1	57.6	58.4	60.5	49.9
21/11/2017	05:00:00	57.6	58.4	59.3	60.0	64.8	55.1
21/11/2017	06:00:00	58.6	59.3	60.2	61.6	67.7	56.3
21/11/2017	07:00:00	58.7	59.3	60.3	61.4	71.7	56.7
21/11/2017	08:00:00	58.8	59.5	60.6	61.5	71.0	56.4
21/11/2017	09:00:00	58.4	59.3	60.6	61.9	71.4	55.4
21/11/2017	10:00:00	57.4	58.2	59.6	61.0	74.2	54.2
21/11/2017	11:00:00	57.7	58.4	59.8	61.2	72.7	54.8
21/11/2017	12:00:00	57.5	58.4	59.9	61.1	67.8	54.0
21/11/2017	13:00:00	57.7	58.7	60.0	61.0	70.4	54.4

Table A- 2. Measured Sound Levels at SLM2 (dBA)

Date	Time	L_{eq}	L_{25}	$L_{8.3}$	$L_{2.5}$	L_{max}	L_{90}
20/11/2017	14:00:00	63.1	64.3	65.9	67.1	74.2	58.9
20/11/2017	15:00:00	62.5	63.7	65.5	66.8	71.9	57.9
20/11/2017	16:00:00	63.5	64.6	65.7	66.5	69.5	60.0
20/11/2017	17:00:00	62.6	63.6	64.9	65.9	68.1	58.3
20/11/2017	18:00:00	61.2	62.5	64.4	65.8	71.9	55.2
20/11/2017	19:00:00	59.5	60.7	62.8	64.3	68.4	53.5
20/11/2017	20:00:00	59.0	60.3	62.4	63.8	73.4	52.9
20/11/2017	21:00:00	59.5	61.0	63.1	64.2	66.7	53.1
20/11/2017	22:00:00	58.5	59.9	62.0	63.5	67.1	52.3
20/11/2017	23:00:00	56.4	57.5	60.1	61.9	66.2	51.5
21/11/2017	00:00:00	54.8	55.7	58.3	60.5	68.3	51.0
21/11/2017	01:00:00	53.8	53.8	57.5	59.5	66.3	50.8
21/11/2017	02:00:00	54.0	54.1	57.4	59.6	65.8	50.8
21/11/2017	03:00:00	55.9	56.9	60.0	61.9	66.6	51.1
21/11/2017	04:00:00	59.8	61.3	63.4	64.4	68.3	53.1
21/11/2017	05:00:00	62.5	63.6	64.6	65.5	69.7	58.4
21/11/2017	06:00:00	63.3	64.0	65.1	66.2	83.0	60.4
21/11/2017	07:00:00	63.2	64.1	65.4	66.6	69.5	60.1
21/11/2017	08:00:00	63.6	64.4	66.0	67.4	73.1	59.8
21/11/2017	09:00:00	63.3	64.4	66.1	67.2	71.9	58.7
21/11/2017	10:00:00	63.4	64.5	66.4	67.9	74.6	58.6
21/11/2017	11:00:00	63.7	64.9	66.8	68.0	75.3	58.8
21/11/2017	12:00:00	63.4	64.7	66.5	67.6	72.2	58.3
21/11/2017	13:00:00	63.5	64.8	66.4	67.5	72.8	58.2