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Sumner School District

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SUMNER HIGH SCHOOL MODERNIZATION

NOISE STUDY

RAMBOLL

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1. INTRODUCTION

This report documents the noise analysis performed by Ramboll US Corporation (Ramboll) as part of the environmental review of Sumner School District's proposed High School Modernization Project. The Project would be a modernization of the existing Sumner High School located on Main Street in Sumner, Washington. The nearest neighboring residential properties to the Project are adjacent to the northwestern property boundary.

The analysis of the modernization considered potential noise impacts at residences near the proposed Project from cooling equipment, an emergency generator, and school buses during the peak arrival and drop-off hour.

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 Sumner Noise Regulations

The Project site and surrounding property are located in the City of Sumner, Washington. As such, the sound level limits established in the Sumner Municipal Code (SMC) are applicable to this project and found in SMC Chapter 8.14, *Noise Control*. SMC 8.14.050 establishes limits on sounds crossing property boundaries based on the EDNA, or Environmental Designation for Noise Abatement, of the sound source and the receiving properties. Section 8.14.060 of the SMC defines the EDNAs A, B, and C as generally conforming to zoning designations for residential, commercial/office/institutional, and industrial uses, respectively.

The applicable noise limits for each district source and receiver combination are listed in Table 1.

Table 1: City Maximum Permissible Sound Levels (dBA)

EDNA of Sound Source	EDNA of Receiving Property		
	Class A Day / Night	EDNA B	EDNA C
EDNA A	55 / 45	57	60
EDNA B	57 / 47	60	65
EDNA C	60 / 50	65	70

The limitations for noise received in a Class A EDNA are reduced by 10 dBA during nighttime hours, defined as between 10 PM and 7 AM.

Source: SMC 8.14.050

The "maximum permissible" environmental noise levels in Table 1 may be exceeded for short periods as defined in WAC 173-60-040 (adopted by reference in SMC 8.14.050). The allowed short-term increases are as follows: 5 dBA for no more than 15 minutes in any hour, or 10 dBA for no more than 5 minutes of any hour, or 15 dBA for no more than 1.5 minutes of any hour. These allowed short-term increases can be described in terms of noise "metrics" that represent the percentage of time certain levels are exceeded. For example, the hourly L_{25} metric represents the sound level that is exceeded 25 percent of the time, or 15 minutes in an hour. Similarly, the $L_{8.3}$ and $L_{2.5}$ are the sound levels exceeded 5 and 1.5 minutes in an hour, respectively. The maximum permissible levels are not to be exceeded by more than 15 dBA at any time, and this limit is represented by the L_{max} noise metric.

3.2 Land Uses and Zoning

The proposed Project would be located on the existing Sumner High School site on property zoned Low Density Residential 12000 (LDR-12). Adjacent residential properties surrounding the site to the north are zoned Medium Density Residential. Both the school site and surrounding receiving properties would be characterized as Class A EDNAs, based on the zoning of the properties.

The applicable noise limits for a Class A EDNA noise source affecting a Class A receiver are 55 dBA during daytime hours (7 AM to 10 PM) and 45 dBA during nighttime hours (10 PM to 7 AM). Allowable short-term increases to the above levels are as described previously.

3.3 Existing Sound Levels

In September 2017, Ramboll measured day-long sound levels on-site and in the vicinity of the school. Measurements were taken at two locations on September 12 and 13, 2017 to determine noise levels representative of existing, ambient conditions at nearby residences. Measurements were taken near the northern boundary (SLM1) and the northwestern boundary (SLM2) 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 are found in Appendix A.

Table 2: Measured Existing Background Sound Levels (dBA)

Location	Time of Day [a]	Range of Hourly Sound Levels (dBA) [b]				
		L_{eq}	L_{25}	$L_{8.3}$	$L_{2.5}$	L_{max}
SLM1	Day	51 - 62	49 - 58	53 - 63	57 - 70	75 - 94
	Night	45 - 57	45 - 55	46 - 57	48 - 64	60 - 84
SLM2	Day [c]	46 - 59	46 - 54	49 - 59	51 - 65	66 - 89
	Night	45 - 57	43 - 56	45 - 57	47 - 62	66 - 86

[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 Leq is the "energy-averaged" sound level. The Lmax is the-highest measured sound level. The L2.5, L8.3, and L25 levels are defined previously in this report in the discussion of the regulatory noise limits.

[c] The sound levels measured at SLM2 as identified in the table do not include the levels measured between 10 AM and noon. The levels during these hours were louder than expected, potentially due to anomalous events or activities occurring very near the microphone.

These measurements were taken from September 12 to 13, 2017.

Traffic on local roads was the most consistent, dominant noise source. Other noise sources included school-related noises, dogs, birds, and typical residential noise sources (e.g. lawn movers).

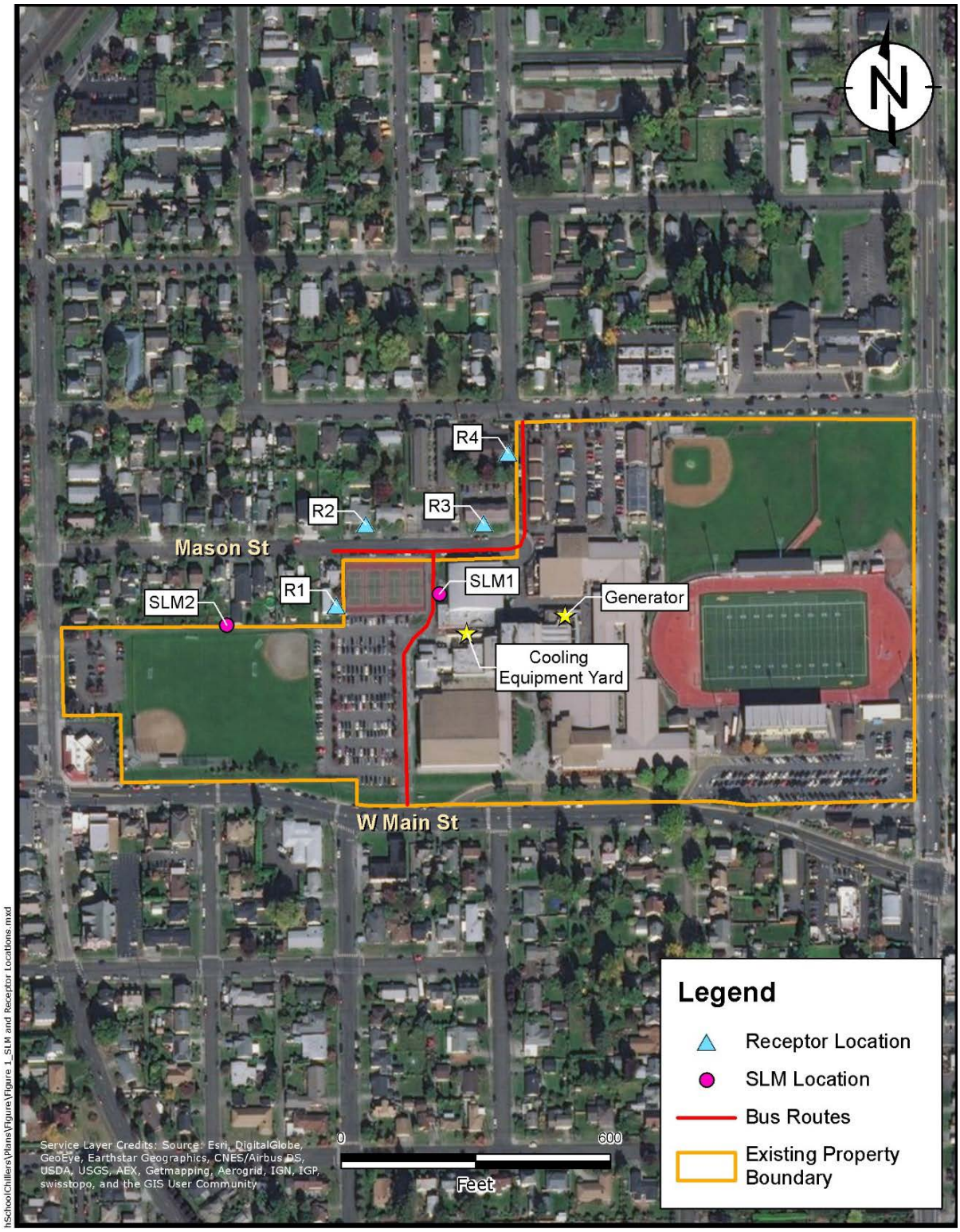

Figure 1. Sound Level Measurement and Model Receptor Locations

4. OPERATIONAL NOISE IMPACT

4.1 Noise Sources

Potential sources of traffic noise associated with the Project include buses traveling on-site to drop-off or pick-up students. Potential stationary sources include an existing chiller and a cooler located in an equipment yard that will be slightly modified and a new emergency generator. These noise sources are described more completely below.

4.1.1 On-Site Traffic

On-site traffic would include school buses accessing and traveling on the site. Most noise from on-site traffic would be emitted by school buses arriving at the site to drop off students at the school in the morning. Up to five (5) small buses would arrive at the site via Main Street and travel north through an on-site route. In addition, twelve (12) full-size buses would travel in the arrival hour along Mason Street to the bus drop-off area. After drop-off, all buses would depart via a route on the western side of the northern parking lot. A 6-foot high solid fence is proposed to be constructed along the westerly portion of the northern parking lot.

This assessment was completed under the assumption that the morning arrivals would occur between 7 and 8 AM. For the purposes of this analysis, the morning arrival period was evaluated because it represents peak level of activity.

4.1.2 Cooling System

The existing air-cooled chiller and dry cooler provide cooling. The chiller is a York 530-ton unit with an estimated sound level of 76 dBA at 30 feet. The dry cooler is a Gunter unit with an estimated sound level of 66 dBA at 33 feet.

The chiller and dry cooler are located in an existing equipment yard comprised of 12-foot high walls along the west, east, and south sides of the enclosure, and the pool building acting as the northern wall. The modernization would remove the pool building, which would be replaced by a 14-foot high wall.

Absorbent material would be applied to the interior face of the northern wall of the equipment yard similar to what is in place today. The existing chain link gate in the western wall of the cooling equipment yard would be replaced by a solid door, augmented by solid material up to height of the 12-foot wall. In addition to the above measures, 8-inch holes will be cut into the bottom of the west, east, and south walls to increase airflow to the cooling equipment and maximize efficient operation.

In compliance with the School District's Energy Use Policy, the chiller and cooler are set to achieve occupied temperature no earlier than 60 minutes prior to occupied time and for an

hour after the high school is closed. With a start time of 7:25 AM, operation of the chiller and cooler could occur prior to 7 AM, which is subject to the nighttime noise limit.

Between 6 and 7 AM, only the dry cooler would be operated. This scenario is referred to as "Early Morning Cooling." Operation of both the dry cooler and the chiller could occur between 7 AM and 10 PM, referred to as "Full Cooling."

4.1.3 Emergency Generator

An emergency generator is proposed to provide power to the high school during a power outage. The sound level used in the analysis was based on a Cummins 100DSGAA generator housed in a sound-attenuated enclosure and using a Level 3 exhaust muffler (i.e., an F233 configuration). The generator would emit a sound level of approximately 75 dBA at 23 feet.

The emergency generator would be located in the service area, with the approximate location identified in **Figure 1**.

As noted, the primary purpose of the generator would be to provide power to the high school during a power outage. However, the generator would be tested/operated occasionally (e.g., once a month) for up to an hour to ensure that it remains in good working condition. Testing would be limited to daytime hours only. Although noise from emergency operation of the generator would be exempt from the noise limits, noise from testing of the generator would be subject to the daytime noise limits identified earlier in this report (see Section 3.1).

4.2 Analysis Methods

Noise modeling of on-site sources (bus traffic, cooling equipment, and generator testing) 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. For point sources of noise, such as the chiller, cooler, and emergency generator, the model uses algorithms that comply with the international standards in ISO-9613-2:1996. For traffic noise emissions, the CadnaA model used for this analysis is equipped with the US Federal Highway Administration (FHWA) Traffic Noise Model (TNM) standard.

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.

The noise model included a 14-foot high wall on the north side of the cooling equipment yard, absorbent material applied to the interior of the equipment yard wall in the eastern half of the cooling equipment yard, a solid door (with wall above up to 12 feet) replacing the existing chain-link gate in the western wall of the cooling equipment yard, and openings in the bottom of the west, south, and east cooling equipment yard walls to allow for adequate airflow. The model also included a 6-foot high solid fence along the westerly portion of the northern parking lot.

4.3 Noise Assessment Results

4.3.1 Compliance of On-Site Sources with Noise Limits

Model-calculated results of the early morning cooling, morning arrival, full daytime cooling system, and daytime cooling concurrent with generator testing operations are presented in Table 3.

Table 3: Calculated Sound Levels of On-site Sources (Leq, dBA)

Receptor	Early Morning Cooling[a]	AM Arrival[b]	Full Cooling System[c]	Generator Testing [d]	Noise Limit[e]
R1	42	49	48	48	55/45
R2	40	48	47	48	55/45
R3	43	51	48	49	55/45
R4	39	53	44	44	55/45

Notes:

[a] This scenario assumes operation of the dry cooler only between 6 and 7 AM. This event would be subject to the *nighttime* noise limit.

[b] The AM Arrival scenario assumed that 5 small buses and 12 full-size buses would arrive and depart in a one-hour period. This scenario also includes the operation of the full cooling system (dry cooler and chiller). These events would occur between 7 and 8 AM and would be subject to the *daytime* noise limit.

[c] This scenario assumes operation of the cooling system (dry cooler and chiller) only during most of the day. Therefore, this event would be subject to the *daytime* noise limit.

[d] This scenario assumes generator testing occurs concurrent with operation of the full cooling system (dry cooler and chiller) anytime between 8 AM and 5 PM. These events would be subject to the *daytime* noise limit.

[e] The noise limits shown are for daytime/nighttime hours. Daytime hours are from 7 AM to 10 PM. Nighttime hours are from 10 PM to 7 AM.

Source: Ramboll

As shown in Table 3, none of the operating scenarios are expected to exceed the applicable noise limits.

4.3.2 Increases Over Existing Noise Levels From Project Sources

In addition to evaluating the potential compliance of on-site sources with the noise limits, Ramboll considered potential noise impacts caused by project-related increases over existing background sound levels. While noise from buses traveling off-site is not subject to the noise limits, it is included here to provide a complete assessment of the potential for impacts due to project-related increases over existing sound levels.

Potential project-related increases during AM Arrival are displayed in **Table 4**. The project-related levels shown in **Table 4** are higher than the levels identified for AM Arrival in **Table 3** because they include noise from buses while traveling both on-site and off-site. As noted above, noise from buses traveling on public roads (i.e., off-site) are not subject to the noise limits. The levels identified in **Table 3** were restricted to on-site operations in order to assess compliance with the noise limits.

As shown in **Table 4**, noise from relocation of the bus routes and drop-off areas is expected to result in increases ranging from 1 to 3 dBA at the nearest residences to these sources. Similar levels and increases would be expected during PM Departure. Increases of 3 dBA would be expected to be barely noticeable and would result in minimal impacts.

Table 4: Sound Level Increases: AM Arrival (Leq, dBA)

Receptor / SLM		AM Arrival			
		Existing Background	Project [a]	Total [b]	Increase
R1/SLM2		53	52	55	3
R2	SLM1	58	53	60	1
R3		58	58	61	3
R4		58	54	60	1

Notes:

The above values are rounded to the whole number, and any apparent calculation errors are a result of the rounding.

[a] Model-calculated sound levels of both on-site and off-site buses and all cooling equipment.

[b] Total sound levels (i.e., the existing background measured levels plus project-related levels).

Source: Ramboll

Increases from on-site equipment operations (during hours with no buses) are displayed in **Table 5**.

Cooling system noise, both early morning and full, would result in minimal increases over existing ambient levels and would not be expected to be discernable.

Testing of the generator could result in increases of up to 5 dBA over ambient levels, which would likely be noticeable. However, this would only occur if generator testing occurred between 9 and 10 AM, the quietest hour of the day. Generator testing during other hours would result in lower increases over ambient levels. Regardless, generator testing would occur infrequently and for only one hour or less, minimizing any potential impacts.

Table 5. Sound Level Increases: On-site Equipment (Leq, dBA)

Receptor / SLM		Early Morning Cooling [a]				Full Cooling System [b]				Generator Testing [c]			
		Existing Background	Project [d]	Total [e]	Increase	Existing Background	Project [d]	Total [e]	Increase	Existing Background	Project [d]	Total [e]	Increase
R1/SLM2		55	42	55	0	54	48	55	1	46	50	51	5
R2	SLM1	55	40	55	0	59	47	59	0	51	52	54	4
R3		55	43	56	0	59	48	59	0	51	49	53	2
R4		55	39	55	0	59	44	59	0	51	44	52	1

Notes:

The above values are rounded to the whole number, and any apparent calculation errors are the result of the rounding.

[a] Early Morning Cooling between 6 and 7 AM would be restricted to use of the dry cooler only. The existing sound level is the measured hourly Leq between 6 and 7 AM.

[b] Full Cooling System operations were assumed to potentially occur between 7 AM and 10 PM and would include both the chiller and dry cooler. The existing sound level shown is the measured period Leq between 7 AM and 10 PM, using a conservative assumption that the cooling system could potentially operate continuously throughout the day.

[c] Testing of the new generator was assumed to occur for no more than one hour anytime between 8 AM and 5 PM, concurrent with operation of the full cooling system. The existing, background sound level represents the lowest measured hourly Leq between 8 AM and 5 PM.

[d] Model-calculated sound levels of the new project-related sources.

[e] Total sound levels (i.e., the existing background levels plus project-related levels).

Source: Ramboll

5. CONCLUSIONS

The proposed modernization would result in changes to the operation of existing noise sources that could affect the surrounding community, including on-site traffic, cooling equipment, and an emergency generator.

With construction of a 6-foot solid fence along the westerly portion of the northern parking lot, noise from on-site buses during the AM arrival (7 to 8 AM) is expected to comply with the noise limits applicable during daytime hours. In addition, noise from both on-site and off-site buses would result in increases of between 1 and 3 dBA at the nearest properties, resulting in a minimal potential for noise impacts.

Operation of the dry cooler between 6 and 7 AM is expected to comply with the nighttime noise limit, and operation of the full cooling system between 7 AM and 10 PM is expected to comply with the daytime noise limit. Furthermore, operation of the cooling system (either full or partial) would result in virtually no increase over the existing sound levels.

Operation of the full cooling system in conjunction with testing of a new emergency generator during daytime hours is expected to comply with the daytime noise limit. Furthermore, the resulting increases over existing background sound levels of between 1 and 5 dBA at the nearest residential properties would result in minimal potential for noise impacts.

In summary, the proposed modernization project is not expected to result in substantial noise 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}
2017/09/12	11:00:00	54.1	51.1	57.1	62.0	79.4	46.4
2017/09/12	12:00:00	57.2	50.0	54.8	61.1	94.3	45.2
2017/09/12	13:00:00	59.7	51.4	56.5	66.4	87.8	47.4
2017/09/12	14:00:00	61.9	58.4	63.2	69.5	88.1	50.8
2017/09/12	15:00:00	59.0	56.0	60.1	65.1	84.7	50.8
2017/09/12	16:00:00	60.7	55.6	60.6	67.7	85.5	50.7
2017/09/12	17:00:00	61.0	56.3	60.7	67.5	84.9	50.5
2017/09/12	18:00:00	59.4	53.7	58.7	64.8	85.0	49.4
2017/09/12	19:00:00	57.8	53.3	57.0	63.5	84.1	49.9
2017/09/12	20:00:00	60.9	55.4	57.0	63.9	87.1	52.1
2017/09/12	21:00:00	53.4	52.6	54.4	57.3	81.0	49.2
2017/09/12	22:00:00	57.4	52.3	56.0	64.2	84.3	48.3
2017/09/12	23:00:00	54.7	50.2	51.7	60.2	80.4	46.0
2017/09/13	00:00:00	51.9	46.3	47.4	49.6	79.8	44.3
2017/09/13	01:00:00	53.1	45.7	47.8	56.6	80.4	43.5
2017/09/13	02:00:00	47.4	45.3	46.4	48.0	72.9	43.4
2017/09/13	03:00:00	45.4	46.0	47.0	48.2	60.5	43.4
2017/09/13	04:00:00	48.6	47.5	49.6	52.9	70.1	44.6
2017/09/13	05:00:00	50.5	50.9	52.4	54.7	64.4	47.3
2017/09/13	06:00:00	55.3	55.3	56.8	59.7	73.7	50.2
2017/09/13	07:00:00	58.4	52.6	57.3	63.2	84.9	47.3
2017/09/13	08:00:00	54.4	51.9	57.8	62.5	76.1	45.3
2017/09/13	09:00:00	50.6	48.5	52.6	57.8	75.1	45.5
2017/09/13	10:00:00	52.0	48.9	52.6	58.4	83.8	45.3

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}
2017/09/12	12:00:00	50.1	47.7	52.0	58.0	77.9	42.8
2017/09/12	13:00:00	51.7	47.9	52.6	58.8	80.1	43.1
2017/09/12	14:00:00	58.5	51.9	59.4	65.3	89.5	46.0
2017/09/12	15:00:00	53.9	49.8	54.2	61.0	80.0	45.9
2017/09/12	16:00:00	55.4	49.9	55.6	62.6	86.1	45.7
2017/09/12	17:00:00	53.8	49.4	54.4	60.1	80.8	45.6
2017/09/12	18:00:00	56.3	49.7	55.1	61.2	86.4	45.0
2017/09/12	19:00:00	51.3	49.5	53.3	57.7	74.5	45.5
2017/09/12	20:00:00	55.3	51.5	53.7	60.6	83.3	48.1
2017/09/12	21:00:00	53.5	49.9	52.2	57.3	85.0	46.6
2017/09/12	22:00:00	57.0	49.5	54.3	61.9	86.2	45.2
2017/09/12	23:00:00	55.7	48.2	50.6	60.1	82.4	44.0
2017/09/13	00:00:00	50.5	45.0	46.5	48.4	79.4	41.9
2017/09/13	01:00:00	53.0	44.0	46.9	55.0	80.8	40.5
2017/09/13	02:00:00	44.7	42.9	44.6	46.7	69.9	40.2
2017/09/13	03:00:00	47.3	45.8	48.2	50.9	75.5	41.1
2017/09/13	04:00:00	48.3	47.4	49.8	52.6	69.3	44.0
2017/09/13	05:00:00	49.9	50.7	52.0	53.5	66.0	46.9
2017/09/13	06:00:00	54.8	55.7	56.9	57.7	69.4	51.1
2017/09/13	07:00:00	52.5	54.0	55.5	57.2	70.4	46.2
2017/09/13	08:00:00	50.1	48.4	52.8	57.4	74.6	43.1
2017/09/13	09:00:00	45.6	45.6	48.5	51.3	65.7	41.8
2017/09/13	10:00:00	65.4	46.7	51.4	57.1	106.1	42.2
2017/09/13	11:00:00	62.9	47.2	51.2	56.3	100.7	42.4