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Subject: ***Crew Carwash – Sound Study***
47th Avenue, Columbia Heights, MN 55421

Executive Summary

This sound study is for the proposed Crew Carwash facility to be constructed on approximately 1.23 acres in Columbia Heights, Minnesota (the project). The project will be located northeast of the Central Avenue and 47th Avenue Northeast intersection. The original project layout included 16 blower units within the carwash building and 10 outdoor vacuum generators which represent the primary noise sources evaluated. The existing noise environment is characterized by traffic, commercial activity, and other typical community noise sources. A total of 17 noise-sensitive receptors were identified as close as 40 feet from the project site, including residential buildings, a hotel, a playground, and restaurant patios. SoundPLAN was used to model normal project operations. Based on the modeling results, 13 of the 17 receptors would exceed the Minnesota Pollution Control Agency (MPCA) daytime L_{50} noise thresholds without noise mitigation. To comply with MPCA thresholds, Kimley-Horn recommends Crew Carwash reconfigure and reduce vacuum units, add a noise wall between the vacuum units and sensitive receptors to the south, and install a sound deadening room at the outlet of the carwash tunnel.

Project Description

The carwash project will be constructed on approximately 1.23 acres of undeveloped land in the city of Columbia Heights, Minnesota (the project site), see Figure 1. The project site is directly northeast of the Central Avenue intersection with 47th Avenue Northeast. Central Avenue borders the project to the west, 47th Avenue borders the project to the south, and Grand Avenue Northeast borders the project site to the east. The original site plan included 10 vacuum generators and 16 blowers, which would be the main sources of noise.

Figure 1: Project Site and Receptors

Existing Noise Environment

The project site is located in an urban area where ambient sound levels are influenced by a variety of ongoing human activities. Existing noise sources in the vicinity generally include vehicular traffic on adjacent and nearby roadways (including Central Avenue Northeast/Trunk Highway 65), local transit operations, commercial activities, and occasional emergency vehicle sirens. Additional intermittent noise sources typical of urban environments, such as nearby construction activity, mechanical equipment, and general community activity, also contribute to the existing noise environment. As a result, background noise levels in the project area are characteristic of an urban setting where periods of elevated sound levels occur regularly and fluctuate throughout the day and night depending on traffic volumes and surrounding land uses

Adjacent Noise Receptors

Kimley-Horn identified 17 sensitive noise receptors near the project site. Receptors to the west are as close as 200 feet from the project site and include 3 apartment buildings, 1 hotel, and 1 restaurant patio. Receptors to the south are as close as 65 feet from the project site and include 3 apartment buildings and one single-family residence. Receptors to the east are as close as 40 feet from the project site and include 1 apartment building, 1 playground, and 1 multi-family residence. There is 1 receptor 100 feet north of the project site which is a restaurant patio.

At receptor locations 12 – 15, there are 3 stories of apartment balconies facing the project at approximately 10, 20, and 30 feet above ground level.

Characteristics of Noise

Noise is generally defined as unwanted sound. It is emitted from many natural and man-made sources. Sound pressure levels are usually measured and expressed in decibels (dB). The decibel scale is logarithmic and expresses the ratio of the sound pressure unit being measured to a standard reference level. Most sounds occurring in the environment do not consist of a single frequency, but rather a broad band of differing frequencies. The intensities of each frequency add together to generate sound. Because the human ear does not respond to all frequencies equally, the method commonly used to quantify environmental noise consists of evaluating all of the frequencies of a sound according to a weighting system. It has been found that the A-weighted decibel (dBA) filter on a sound level meter, which includes circuits to differentially measure selected audible frequencies, best approximates the frequency response of the human ear. L_{10} is also a sound pressure metric that represents the sound pressure level, in dBA, exceeded ten percent of the time during a one-hour survey. Similarly, L_{50} represents the sound pressure level, in dBA, exceeded 50 percent of the time during a one-hour survey.

The degree of disturbance from exposure to unwanted sound – noise – depends upon three factors:

1. The amount, nature, and duration of the intruding noise
2. The relationship between the intruding noise and the existing sound environment; and
3. The situation in which the disturbing noise is heard

In considering the first of these factors, it is important to note that individuals have varying sensitivity to noise. Loud noises bother some people more than other people, and some individuals become increasingly upset if an unwanted noise persists. The time patterns and durations of noise(s) also affect perception as to whether or not it is offensive. For example, noises that occur during nighttime (sleeping) hours are typically considered to be more offensive than the same noises in the daytime.

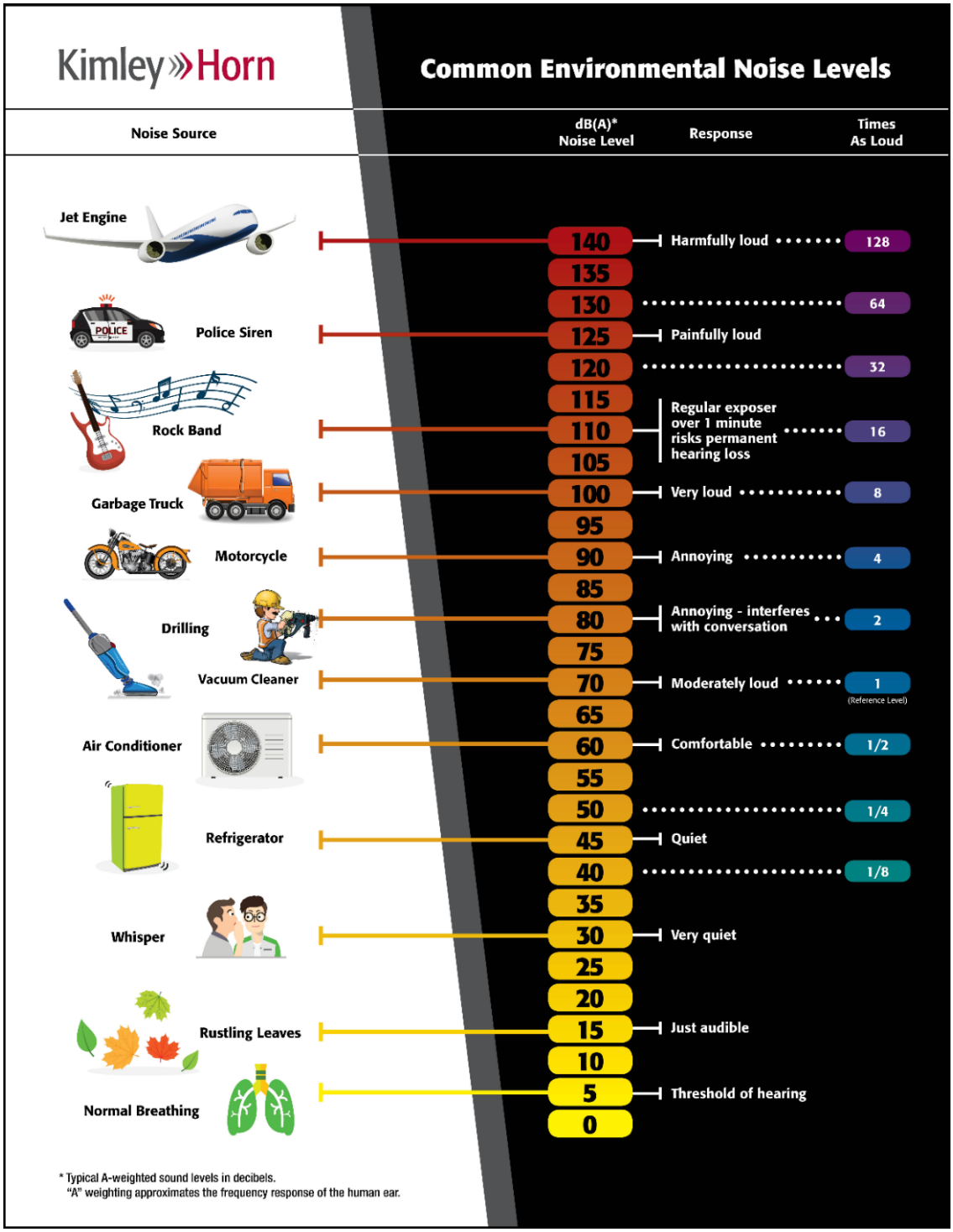
With regard to the second factor, individuals tend to judge the annoyance of an unwanted noise in terms of its relationship to noise from other sources (background noise). A car horn blowing at night when background noise levels are low would generally be more objectionable than one blowing in the afternoon when background noise levels are typically higher. The response to noise stimulus is analogous to the response to turning on an interior light. During the daytime an illuminated bulb simply adds to the ambient light, but when eyes are conditioned to the dark of night, a suddenly illuminated bulb can be temporarily blinding.

The third factor – situational noise – is related to the interference of noise with activities of individuals. In a 60 dBA environment such as is commonly found in a large business office, normal conversation would be possible, while sleep might be difficult. Loud noises may easily interrupt activities that require a quiet setting for greater mental concentration or rest; however, the same loud noises may not interrupt activities requiring less mental focus or tranquility.

As shown in Figure 2, most individuals are exposed to fairly high noise levels from many sources on a regular basis. To perceive sounds of greatly varying pressure levels, human hearing has a non-linear sensitivity to sound pressure exposure. Doubling the sound pressure results in a three decibel change in the noise level; however, variations of three dBA or less are commonly considered “barely perceptible” to normal human hearing. A five decibel dBA change is more readily noticeable. A ten-fold increase in the sound pressure level correlates to a ten decibel [dBA] noise level increase; however, it is judged by most people as only sounding “twice as loud”.

Over time, individuals tend to accept the noises that intrude into their lives on a regular basis. However, exposure to prolonged and/or extremely loud noise(s) can prevent use of exterior and interior spaces and has been theorized to pose health risks.

Figure 2: Common Noise Levels



Minnesota State Noise Standards

The State of Minnesota regulates noise in Minnesota Rules, part 7030.0040. This rule establishes the noise standards in Table 1 based on Noise Area Classification (NAC). A NAC is based on the land use of the location where a person may hear noise. Noise from the project will be regulated according to the NAC of surrounding receptors.

Table 1: Minnesota State Noise Standards

Noise Area Classification	Daytime		Nighttime	
	L_{10}	L_{50}	L_{10}	L_{50}
1: Residential housing, religious activities, camping and picnicking areas, health services, hotels, educational services	65	60	55	50
2: Retail, restaurants and bars, parks and playgrounds, business and government services, recreational activities, transit passenger terminals	70	65	70	65
3: Manufacturing, fairgrounds and amusement parks, agricultural and forestry activities	80	75	80	75
4: Undeveloped and unused land	N/A	N/A	N/A	N/A

Local Regulations

According to Section 4 (10)(d) of Ordinance 1711, for proposed car washes in the city of Columbia Heights, “A sound study is required to determine the overall impact upon the surrounding properties and ensure compliance with performance standards and [Minnesota Pollution Control Agency] MPCA sound requirements.” The MPCA requirements are consistent with the Minnesota State noise Standards listed above. This sound study is being prepared in accordance with this requirement.

According to Chapter 30, Article II, Section 30-21 (a) of the Anoka County Code of Ordinances, “…between the hours of 10:00 p.m. and 7:00 a.m…No person shall engage in or permit heavy machinery activity involving the use of any kind of electric, diesel or gas-powered machine or other power.” The project will not operate outside of 7:00 a.m. to 10:00 p.m..

Noise Measurements

Kimley-Horn used a Larson Davis SoundExpert Lxt Sound Level Meter (Serial No. 0005586) during a field visit to the West Saint Paul Crew Carwash on April 29, 2026. During this field visit, the noise analyst measured sound levels of typical equipment operations. The equipment at the West Saint Paul location is anticipated to have similar sound levels to equipment proposed for the project site. Three 1-minute measurements were conducted for a pair of operating vacuum generators in the parking lot at distances of 5, 10, and 20 feet from the nearest generator. Similarly, three 1-minute measurements were conducted for the blowers in the carwash building at distances of 5, 10, and 20

feet from the open garage door. These measurements were conducted while all blower units within the car wash building were operating. See Table 2 for the field measurement data.

Table 2. Measured Operational Noise Levels (dB)

Noise Source	Distance (ft)	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHZ	2 kHZ	4 kHz	8 kHz	Overall Noise Level (dBA)
Blowers	5	48.1	64.2	74.4	83.5	91.3	93.1	93.8	88.1	77.6	98.4
	10	46.0	63.9	71.6	80.5	89.2	91.3	91.8	85.8	75.0	96.4
	20	41.3	60.3	68.6	75.8	85.0	86.9	87.6	81.5	70.5	92.0
Vacuum Generators	5	25.4	42.2	56.1	67.1	74.6	71.7	73.7	70.5	67.6	79.6
	10	26.4	40.8	54.3	61.7	71.5	68.1	68.4	68.4	63.5	75.9
	20	24.4	45.1	53.3	61.0	67.5	65.1	64.8	64.1	59.8	72.3

Noise Analysis

Operational sound levels from the project were evaluated using SoundPLAN. This program computes predicted sound levels at noise-sensitive areas through a series of adjustments to reference sound levels. SoundPLAN also accounts for topography, groundcover type, and intervening structures. Sound levels generated from the on-site vacuum generators and the car wash blowers are anticipated to be the main sources of sound from the project.

It should be noted that noise from surrounding roadways was not modeled in this analysis, although Central Avenue and other nearby roadways are anticipated to contribute to the ambient noise environment throughout the entire day.

Vacuum Generators

Vacuum generator equipment can generate steady, unvarying sound during daytime operation that may create issues when located near noise-sensitive areas. According to the original site layout, 10 vacuum generators were going to be located along the western boundary of the project site.

Based on the field measurements discussed above, the modeled vacuum generators were calibrated to have an overall noise level one dBA louder than measurement data at 10 feet from the source. The modeled sound power of each vacuum generator is included in Table 3.

Table 3. Modeled Sound Power of Vacuum Generator (dB)

31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHZ	2 kHZ	4 kHz	8 kHz	Overall Sound Power (dBA)
79.0	85.7	89.6	92.1	95.7	90.0	90.0	87.2	86.0	97.2

Blower

The blower system inside of the car wash can generate steady, unvarying sound during daytime operation that may create issues when located near noise-sensitive areas. In the current site layout, the tunnel exit near the blowers will be located on the southern façade of the building and the tunnel entrance, opposite the blowers, will be located on the northern façade. There are 16 blower units modeled in the standard configuration for Crew Carwash locations. Based on the field measurements discussed above, the modeled blowers were calibrated to have an overall noise level one dBA louder than measurement data at 20 feet from the tunnel exit. The modeled sound power of each blower is included in Table 4.

Table 4. Modeled Sound Power of Individual Blower Unit

31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHZ	2 kHZ	4 kHz	8 kHz	Overall Sound Power (dBA)
92.0	98.3	98.5	100.6	102.9	102.3	101.5	95.8	87.0	107.2

Carwash Tunnel Layout

The original carwash tunnel layout was modeled as three rooms with polyvinyl chloride-lined walls and concrete floors and ceilings. The tunnel entrance was modeled as 14 feet wide and 10 feet tall, a partition wall with a 14-foot-wide and 10-foot-tall opening was modeled 26 feet into the tunnel, a second partition wall with a 10-foot-wide and 8-foot-tall opening was modeled approximately 108 feet into the tunnel, the tunnel exit was also modeled as 10 feet wide and 8 feet tall.

Results

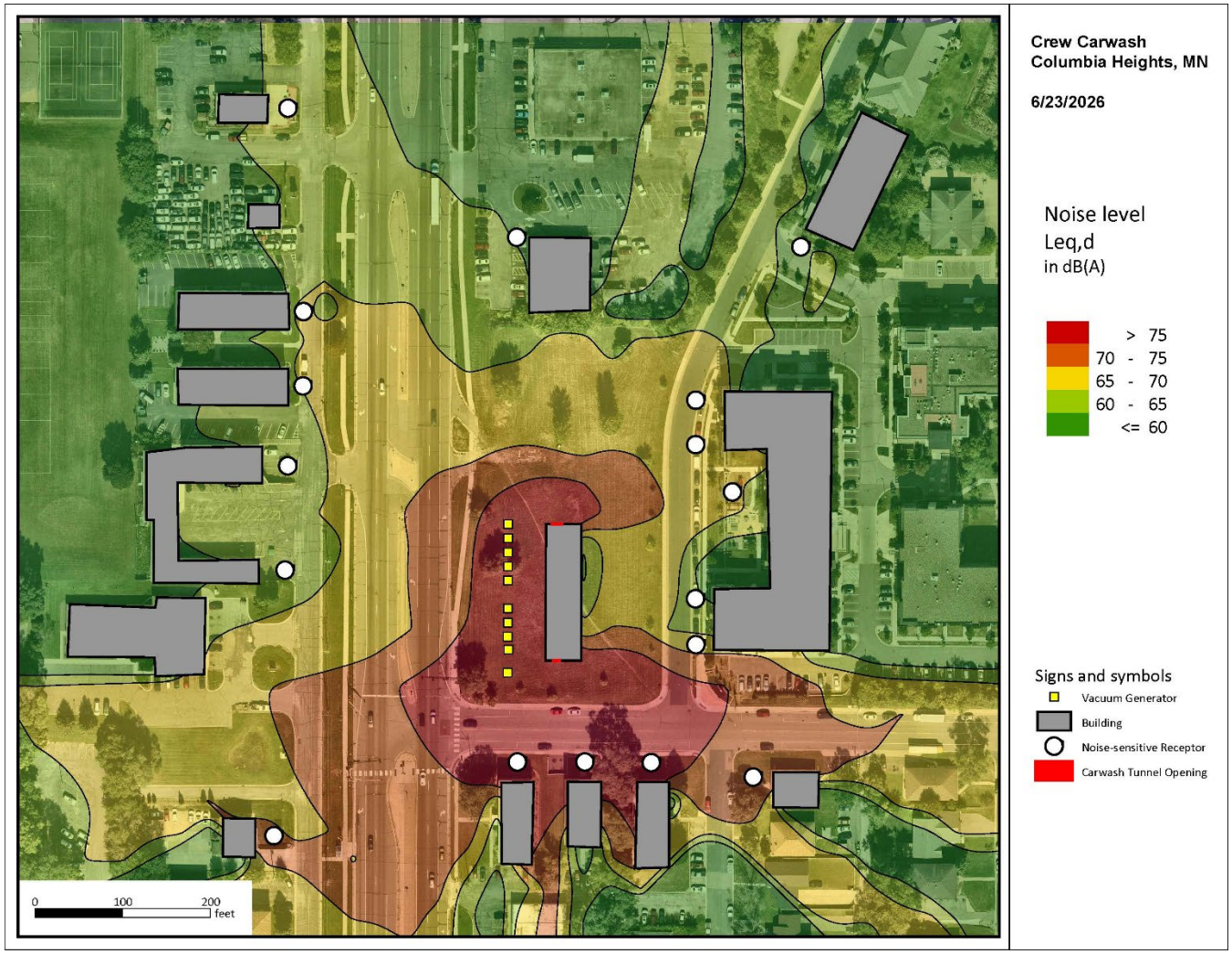
The project would only operate during daytime hours (7 a.mm to 10 p.m.) so results were compared to the MPCA daytime L_{50} thresholds. The model predicts that 13 of the 17 receptors would not comply with MPCA noise standards without mitigation. See Table 2 for anticipated unmitigated noise levels at noise sensitive receptors. See for a map of unmitigated noise levels surrounding the project site under normal operations.

Table 5. Modeled Receptor Noise Levels with no Mitigation

Receptor					Modeled Noise Level (dBA)	In compliance?
ID	Land Use	NAC	Height Above Ground (ft)	Daytime L_{50} Threshold (dBA)		
1	Restaurant	2	5	65	61.0	Yes
2	Restaurant	2	5	65	61.7	Yes
3	Multi-family residence	1	5	60	65.3	No

Receptor					Modeled Noise Level (dBA)	In compliance?
ID	Land Use	NAC	Height Above Ground (ft)	Daytime L_{50} Threshold (dBA)		
4	Multi-family residence	1	5	60	65.5	No
5	Hotel	1	5	60	64.5	No
6	Hotel	1	5	60	64.3	No
7	Multi-family residence	1	5	60	71.0	No
8	Multi-family residence	1	5	60	79.8	No
9	Multi-family residence	1	5	60	80.0	No
10	Multi-family residence	1	5	60	77.7	No
11	Single-family residence	1	5	60	71.5	No
12	Multi-family residence	1	10	60	67.8	No
12	Multi-family residence	1	20	60	68.0	No
12	Multi-family residence	1	30	60	68.0	No
13	Multi-family residence	1	10	60	60.4	No
13	Multi-family residence	1	20	60	61.8	No
13	Multi-family residence	1	30	60	61.8	No
14	Multi-family residence	1	10	60	67.9	No
14	Multi-family residence	1	20	60	67.7	No
14	Multi-family residence	1	30	60	67.7	No
15	Multi-family residence	1	10	60	67.4	No
15	Multi-family residence	1	20	60	67.2	No
15	Multi-family residence	1	30	60	67.2	No
16	Playground	2	5	65	64.9	Yes
17	Multi-family residence	1	5	60	58.3	Yes

Figure 3: Modeled Operational Noise Contours without Mitigation



Recommended Mitigation

To bring noise levels into compliance with MPCA noise standards, Kimley-Horn proposes the following noise mitigation measures:

Vacuums

To reduce noise levels, it is recommended that the vacuum units are reconfigured so that suction is generated at a single location within the carwash tunnel rather than outside, at the vacuum unit. Further, a vacuum nozzle with lower operational noise levels is recommended for this location. Based on coordination with Crew Carwash and the vacuum manufacturer, Kimley-Horn assumed a noise level of 68.1 dBA at 30 feet from the quieter vacuum unit. The modeled sound power at each vacuum unit was calibrated to reflect this quieter noise level but maintain the same spectral spread across frequencies as the field measurements, see Table 6.

Table 6. Modeled Sound Power of Quieter Vacuum Nozzle

31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHZ	2 kHZ	4 kHz	8 kHz	Overall Sound Power (dBA)
77.6	84.2	88.1	90.6	94.2	88.1	88.5	85.7	84.5	95.7

Kimley-Horn also recommends that the number of vacuum units be reduced from 10 to 8 to further reduce noise levels at nearby receptors. Additionally, it is recommended the remaining 8 units are moved to the northern extent of the proposed parking lot and that a 20-foot-long, 8-foot-high brick noise wall be installed adjacent to the southernmost vacuum unit.

Carwash Tunnel Layout

It is recommended that the 16 blower units and other applicable carwash equipment are moved within the tunnel to allow for a 30-foot-long sound deadening room adjacent to the tunnel exit. Kimley-Horn recommends installing two (2) 8-foot tall, 10-foot-wide aluminum roller doors at each end of the carwash tunnel. For noise from the blower units to be adequately shielded, it is recommended that one of these aluminum roller doors always remain closed while the blower units are operational.

In addition to adding a sound-deadening room, Kimley-Horn recommends lining all walls of the carwash tunnel, including the ceiling, with AcoustiBlok 5-inch Quietfiber, see Appendix A for product absorption data. To ensure this sound absorbing treatment does not deteriorate and lose efficacy, Acoustiblok recommends installing their waterproofing treatment to the Quietfiber if it will be frequently exposed to wet conditions.

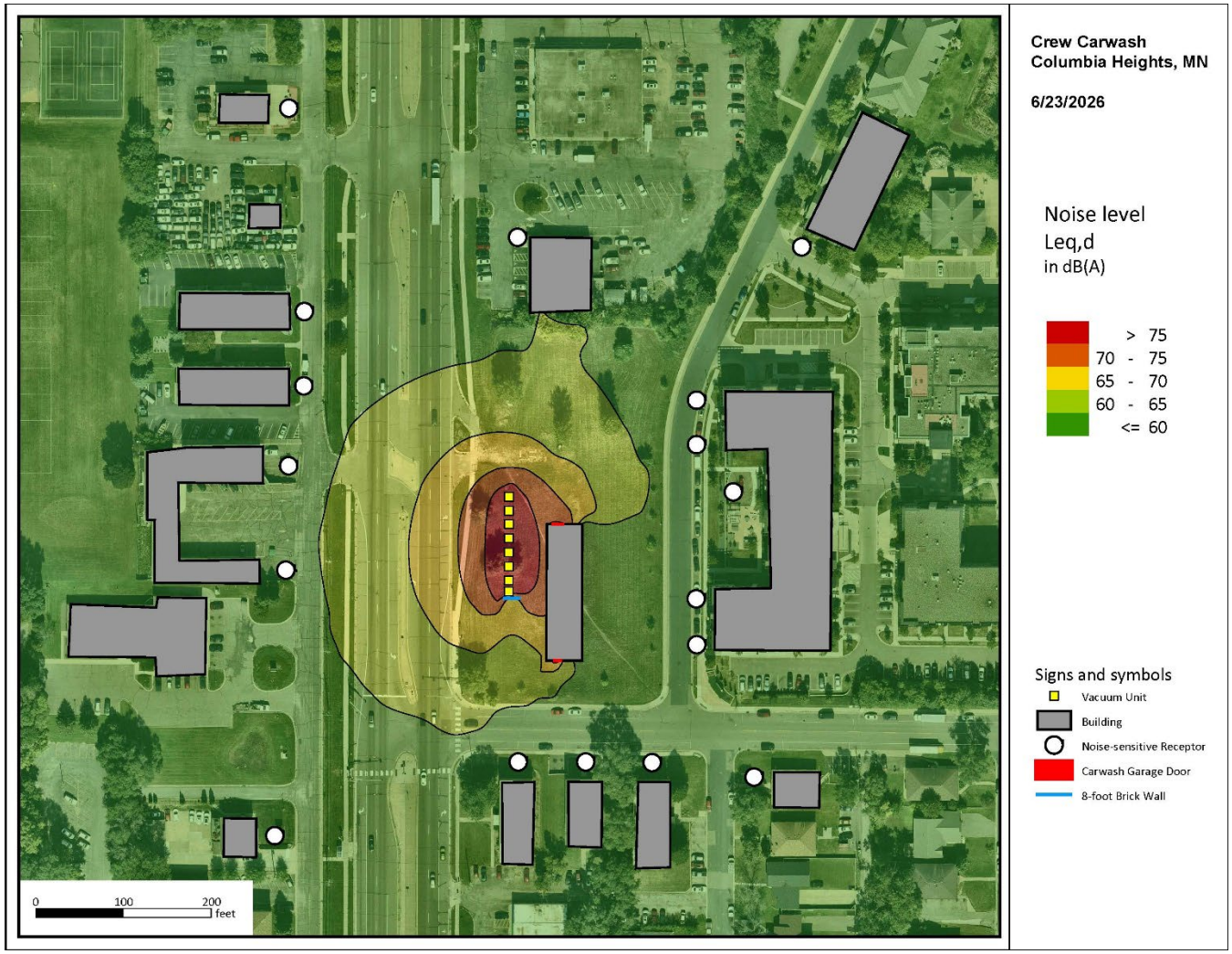
The original model was updated to reflect the recommended changes to the vacuum equipment, site layout, and interior of the carwash tunnel. The updated model predicts that all receptors would comply

with MPCA noise standards. See Table 7 for anticipated mitigated noise levels at noise sensitive receptors. See Figure 4 for a map of mitigated noise levels surrounding the project site under normal operations.

Table 7. Modeled Receptor Noise Levels with Mitigation

Receptor					Modeled Noise Level (dBA)	In compliance?
ID	Land Use	NAC	Height Above Ground (ft)	Daytime L_{50} Threshold (dBA)		
1	Restaurant	2	5	65	56.3	Yes
2	Restaurant	2	5	65	51.9	Yes
3	Multi-family residence	1	5	60	57.5	Yes
4	Multi-family residence	1	5	60	58.9	Yes
5	Hotel	1	5	60	59.3	Yes
6	Hotel	1	5	60	59.9	Yes
7	Multi-family residence	1	5	60	55.1	Yes
8	Multi-family residence	1	5	60	56.0	Yes
9	Multi-family residence	1	5	60	55.3	Yes
10	Multi-family residence	1	5	60	47.8	Yes
11	Single-family residence	1	5	60	42.9	Yes
12	Multi-family residence	1	10	60	43.9	Yes
12	Multi-family residence	1	20	60	47.4	Yes
12	Multi-family residence	1	30	60	48.3	Yes
13	Multi-family residence	1	10	60	44.7	Yes
13	Multi-family residence	1	20	60	48.1	Yes
13	Multi-family residence	1	30	60	49.2	Yes
14	Multi-family residence	1	10	60	57.7	Yes
14	Multi-family residence	1	20	60	57.7	Yes
14	Multi-family residence	1	30	60	57.7	Yes
15	Multi-family residence	1	10	60	57.8	Yes
15	Multi-family residence	1	20	60	57.8	Yes
15	Multi-family residence	1	30	60	57.8	Yes
16	Playground	2	5	65	56.0	Yes
17	Multi-family residence	1	5	60	51.6	Yes

Figure 4. Modeled Operational Noise Levels with Mitigation



Conclusions

The project site is located on undeveloped land adjacent to noise-sensitive land uses including residences, a hotel, restaurant patios, and a playground. The city of Columbia Heights enforces MPCA noise standards; therefore, project noise levels must comply with the daytime L_{50} noise thresholds. 13 of the 17 modeled noise-sensitive receptors adjacent to the project site would exceed the daytime L_{50} noise thresholds without noise abatement. Kimley-Horn has recommended alterations to vacuum equipment, installation of a noise wall, and addition of a sound deadening room to the carwash tunnel. Following coordination with Crew Carwash, Kimley-Horn has implemented these mitigation measures into the current site plans. These recommendations resulted in modeled noise levels that comply with MPCA noise standards. Kimley-Horn encourages Crew Carwash to continue consultation with noise control engineers to ensure the final project design remains compliant with MPCA noise standards.

Appendix A. Acoustiblok Quietfiber Datasheet

Acoustiblok Quietfiber 2”, 3” & 5” – NRC Data

2 Inch Thick Quietfiber
NRC 1.0

Frequency	Absorption Coefficient
40 Hz	0.00
50 Hz	0.00
63 Hz	0.00
80 Hz	0.09
100 Hz	0.29
125 Hz	0.51
160 Hz	0.60
200 Hz	0.82
250 Hz	0.85
315 Hz	0.96
500 Hz	1.02
1000 Hz	1.04
2000 Hz	1.00
4000 Hz	1.05
6300 Hz	1.18
8000 Hz	1.24
10000 Hz	1.37
12500 Hz	1.62

3 Inch Thick Quietfiber
NRC 1.10

Frequency	Absorption Coefficient
40 Hz	0.02
50 Hz	0.07
63 Hz	0.13
80 Hz	0.08
100 Hz	0.61
125 Hz	0.91
160 Hz	1.03
200 Hz	1.17
250 Hz	1.09
315 Hz	1.19
500 Hz	1.20
1000 Hz	1.09
2000 Hz	1.07
4000 Hz	1.05
6300 Hz	1.10
8000 Hz	1.14
10000 Hz	1.21
12500 Hz	1.42

5 Inch Thick Quietfiber
NRC 1.10

Frequency	Absorption Coefficient
40 Hz	0.00
50 Hz	0.04
63 Hz	0.25
80 Hz	0.60
100 Hz	0.97
125 Hz	1.23
160 Hz	1.14
200 Hz	1.24
250 Hz	1.09
315 Hz	1.12
500 Hz	1.15
1000 Hz	1.10
2000 Hz	1.09
4000 Hz	1.07
6300 Hz	1.11
8000 Hz	1.13
10000 Hz	1.25
12500 Hz	1.41