Community Development Department / Planning Division
12725 SW Millikan Way / PO Box 4755
Beaverton, OR 97076
General Information: 503-526-2222 V/TDD
www.BeavertonOregon.gov

MEMORANDUM

TO: Planning Commission
FROM: Steve Regner, Senior Planner
DATE: October 23, 2024
SUBJECT: LU2023-00557 Ashcreek Playschool Supplemental Memorandum

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This memo is to provide the Planning Commission with additional materials from the applicant.

Exhibit 3.9

The applicant provides a summary of DEQ and Beaverton Municipal Code Noise Ordinance applicability and outlines existing and proposed mitigation measures.

Exhibit 3.10

The applicant provides a noise study, conducted in 2022, commissioned by Murray Hills Christian Church, focused on playground noise impacts.

Conclusion

Based on the additional information provided by the applicant, staff maintains the recommendation of approval, with the conditions of approval identified in the October 2, 2024 staff report.

Staff also reminds the Planning Commission that the scope of review for the requested Conditional Use Permit is limited to the application, which is the activities related to the preschool, and not general use of the church, which operates under a separate conditional use permit.

Exhibits

Exhibit 3.9 Applicant Responses to Sound Concerns

Exhibit 3.10 2022 Sound Study

Supplemental statement regarding noise at the Murray Hills Christian Church playground

The proposed modification to the Conditional Use Permit and design review letter for a playground at the Murray Hills Christian Church (15050 SW Weir Rd) should both be approved with the existing noise mitigation factors proposed. No further conditions or requirements should be placed on the property because the project is exempt from DEQ noise regulations, and the existing factors are adequate to address neighborhood concerns.

Exempt: The Beaverton Development Code requires industrial and commercial uses to meet the Oregon DEQ limits. However, a school playground at a church used by a non-profit preschool is not an industrial or commercial use and we are exempt from the Oregon DEQ limits. Beaverton City Code 5.15.035(f) explicitly notes private school playgrounds are exempt. There has been no evidence presented to suggest that the project exceeds the Oregon DEQ limits, however since the use is exempt, suggestions that the applicant take on further costs and delays to pursue this information are not appropriate.

Existing mitigation in the proposal: The proposal already contains noise mitigation:

- **Operational limits**: Currently, there can be 20 children outside at any one time. Under the new permit, there would only be 30 children (the max) outside during transition periods when classes are coming and going from the playground. Currently, there is no limit on the amount of time we can have 20 children on the playground. We've voluntarily agreed to limit outdoor time to 3 hours per day.
- **Facilities improvements**: There was previously no fence separating the playground from the broader community and parking lot. With a fence and gate newly installed, it is more clear to playground users and Ashcreek students that this is a separate place for play. We've also agreed to develop appropriate signage to help address this issue.
- **Vegetative corridor**: Working with Clean Water Services, we will be planting additional native plants in the space between the playground and the wetlands as required by their Service Provider Letter. Additional vegetation could help to break up the flow of noise between the playground and neighbors.

Given the exemption and our additional efforts to be good neighbors, please approve the modification to the Conditional Use Permit and the Design Review Letter for the existing playground.

Submitted by Daniel Hauser, Ashcreek Playschool Board Treasurer

ABD Engineering & Design

Architectural Acoustics ▪ AV Design ▪ Noise & Vibration

November 23, 2022

Jim Cure
Murray Hills Christian Church
15050 SW Weir Rd.
Beaverton, OR 97007
503-475-3467 | jim.cure47@gmail.com

Re: Murray Hills Christian Church – Playground Noise Study

Introduction

This report summarizes the results of a noise study conducted by ABD Engineering & Design, Inc. (ABD) to determine the noise levels at nearby residences from the playground at Murray Hills Christian Church, located at 15050 SW Weir Road in Beaverton, OR. Measurements were conducted at the site to determine sound levels at the residences. This report includes the measurement results, analysis, and mitigation options to reduce noise levels experienced by the residences.

Nothing in these documents should be construed as modifying the requirements of any applicable building code. Where conflicts exist, the most restrictive condition should be satisfied.

Background

A playground is located on the west side of Murray Hills Christian Church (MHCC), as shown in Figure 1. Based on a survey of aerial photography, the playground has been in place since 2011. The playground is used by the preschool associated with the church, and is also open to the public during posted hours of 10am to dusk. Recently, nearby neighbors have been complaining about noise from the playground. The MHCC board of trustees requested that ABD perform a noise study to determine the existing noise levels from the playground and provide recommendations for potential mitigation measures to reduce noise levels at surrounding residences. ABD visited the site on September 26, 2022, to measure noise levels during a typical day, both with and without activity on the playground.

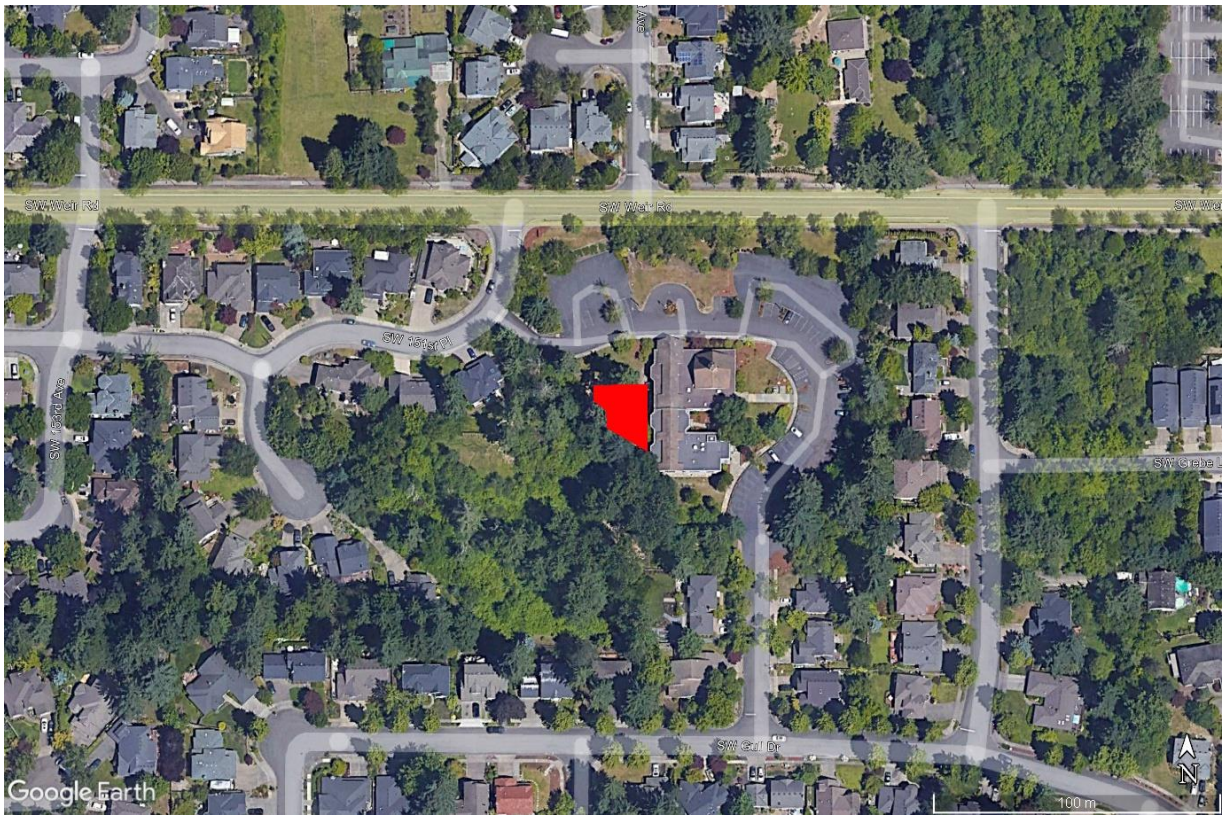

Figure 1. Playground location

Terminology

Sound is the term given to variations in air pressure capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property that is measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over a wide range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB)[1].

When the sound energy doubles, the decibel value increases by 3 dB. However, a doubling of energy does not correspond to a subjective doubling of loudness. Table 1 gives an idea of the qualitative experience of different changes in sound level. The table can be used as a guide when evaluating the impact of changes in the sound level.

Table 1. Subjective effects of changes in sound levels

Change in Sound Level	Change in Apparent Loudness
3 dB	Just perceptible
5 dB	Clearly perceptible
10 dB	Twice or half as loud
20 dB	Much louder or quieter

Table 12.2, *Engineering Principles of Acoustics* by Douglas D. Reynolds (1981)

[1] Decibels are a logarithmic unit, so when decibel levels are combined, logarithmic addition is used instead of typical arithmetic addition. For instance, 40 dB + 40 dB = 43.0 dB, 50 dB + 50 dB = 53.0 dB, and 40 dB + 50 dB = 50.4 dB, which rounds to 50 dB.

The human auditory response to sound is a function of the magnitude of the sound, the frequency spectrum of the sound (the specific pitch components of the sound), the duration of the sound, and the existence of other sounds. It is difficult to describe the perceived level of a sound with a single number because of the many parameters that influence the human auditory response. However, there have been a significant number of acoustic studies that have helped provide noise descriptors that correlate well with human responses.

Studies have conclusively shown that at equal sound pressure levels, people are generally more sensitive to higher-frequency sounds (such as those made by speech, horns, and whistles) than lower-frequency sounds (such as those made by motors and engines)[2]. To address this preferential response to frequency, the A-weighting scale was developed. The A-weighted scale adjusts the sound level in each frequency band in a similar manner to how the human auditory system perceives sound levels. Thus, the A-weighted sound level (referred to as "dBA") provides a single number rating that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound.

Since noise tends to fluctuate over time, especially for environmental measurements, statistical levels (also called percentile levels or L_n) are used to describe the time-varying characteristics of the sound. The relevant statistical metrics for this project are the hourly L_1, L_{10}, and L_{50} levels, which represent the sound level exceeded for 1% (36 seconds), 10% (6 minutes), and 50% (30 minutes) of an hour. For instance, if the hourly L_{10} of a measurement is 55 dBA, this means that the sound level was 55 dBA or louder for a total of 6 minutes (usually spread out over the hour), and quieter than 55 dBA for 54 minutes. L_1 generally corresponds to short-term noise events such as a loud vehicles, yells, and aircraft, L_{10} gives an idea of the more common louder noises, and L_{50} is the more continuous noise.

Noise Ordinances

There are several ordinances related to noise at the State, County, and City level. These ordinances are discussed in the following sections.

Oregon Administrative Rules

OAR 340-035 – DEQ: Noise Control Regulations is the statewide noise code. It is noted that these regulations apply only to industrial and commercial noise sources, wind energy facilities, vehicles, and aircraft. Therefore, the DEQ regulations are not applicable to this project. However, they do provide a useful framework and point of comparison. New or existing noise sources for a site are regulated by what is commonly known as the DEQ "maximum allowable noise rule." These limits apply at "noise sensitive properties," which are defined as "property normally used for sleeping, or normally used as schools, churches, hospitals, or public libraries." The noise level criteria for this rule are shown in Table 2 for reference.

[2] D.W. Robinson and R.S. Dadson, "A Re-Determination of the Equal-Loudness Relations for Pure Tones," British Journal of Applied Physics, vol. 7, pp. 166-181, 1956. (Adopted by the International Standards Organization as Recommendation R-226.)

Table 2. DEQ Noise Limits for New or Existing Industrial and Commercial Noise Sources

OAR 340-035-0035 – Table 7, 8 *Allowable Statistical Noise Levels in Any One Hour*	
7 a.m. – 10 p.m.	**10 p.m. – 7 a.m.**
L_{50} – 55 dBA	L_{50} – 50 dBA
L_{10} – 60 dBA	L_{10} – 55 dBA
L_1 – 75 dBA	L_1 – 60 dBA

OAR 340-035-0035(1)(b)(B)(i) provides a limit for the change in the ambient or background noise caused by a new source, which is referred to as the DEQ "ambient degradation rule," which states that a new source cannot raise the L_{10} and L_{50} levels by more than 10 dBA. Again, this is only applicable to industrial or commercial sources, and also only applies to new sources on previously unused sites, so the noise from the playground is not regulated by this limit. However, it is a useful point of comparison.

Washington County Municipal Code

WCC 8.24 – Noise Control presents the noise standards for Washington County. *WCC 8.24.020.C* indicates that "Sounds caused by organized athletic or other group activities, when those activities are conducted on property generally used for those purposes, including stadiums, parks, schools, churches, airports and athletic fields…" are exempt from the regulation. Because the use of the playground for the church preschool is an organized group activity, this use would likely be deemed exempt. However, usage by the community would not be exempt from the WCC regulations.

WCC 8.24.030 indicates that "It is unlawful for any person to make, continue or cause to be made or continued, any noise which unreasonably annoys, disturbs, injures or endangers the comfort, repose, health, peace or safety of any person of normal sensitivity in a noise sensitive unit." There are no set limits that would be considered a violation; rather, violations would be determined subjectively based on the nature and timing of the noise.

As a point of reference, the Washington County Noise Control Task Force issued a report in July 2005 which enumerates multiple issues with the noise control regulations. In particular, it notes that a nuisance ordinance (a subjective ordinance with no objective limits, such as the *WCC 8.24* ordinance) poses an issue. They state that "Qualitative or subjective judgements based on people's reaction to noise do not constitute sufficient basis for court judgement of offense. A noise regulation must be quantitative in order to be enforceable."

Beaverton City Code

BC 5.05.130 – Unnecessary Noise is the noise code for the City. *BC 5.05.130.A* states that "No person shall make, assist in making, continue or cause to be made any loud, disturbing or unnecessary noise which either annoys, disturbs, injures or endangers the comfort, repose, health, safety or peace of others." This is a nuisance code, and as noted above, there is no objective basis for enforcement of such a code. *BC 5.05.130.B* lists several examples of noises which would be in violation, but none are applicable to this situation.

Beaverton Development Code

BDC 60.50 presents regulations for special use conditions. *BDC 60.50.25.7* notes that child care or day care facilities must provide an outdoor play area. It also notes that a fence is needed to separate the play area from abutting lots, although no restrictions are placed on the fence materials. *BDC 60.50.25.11* notes that noise levels from special use conditions (which includes many different types of special uses, including aircraft and various industrial and commercial uses) must meet the Oregon DEQ noise limits – however, as noted above, the DEQ noise limits are not applicable to playgrounds.

Sound Level Measurements

ABD measured sound levels around the site on September 26, 2022, between 9 a.m. and 1 p.m. During this time, there were several periods when the playground was in use, and periods when the playground was empty or quiet.

Measurement Locations

Measurements were taken at 5 locations around the church, as well as an additional measurement near to the playground for reference purposes. As shown in Figure 2, these measurements are indicated by the cardinal direction relative to the playground, and the reference measurement location is labeled with *Ref*. Continuous measurements were made at most locations with Soft dB Piccolo II sound level meters, which conform to ANSI S1.4 Type 2 specifications. At location NW, continuous measurements were made with a Larson Davis model 831C sound level meter, which conforms to ANSI S1.4 Type 1 specifications. Attended measurements were made at all meters at multiple times throughout the measurement period, and continuous audio recordings were made at the NW location.

Figure 2. Measurement locations

Measured Sound Levels

Four conditions were observed during the measurement period.

- *Background 1* – 9:30 a.m. to 10:30 a.m. – playground was empty
- *Active 2* – 10:30 a.m. to 11:20 a.m. – approximately 10 children on playground
- *Background 3* – 11:20 a.m. to 12:10 p.m. – 2 adults with very young children on playground, very quiet (normal talking only)
- *Active 4* – 12:10 p.m. to 1:10 p.m. – approximately 7 children on playground

It is noted that the playground noise was not the primary source at all locations. Table 3 presents the primary noise sources during active periods, based on the measured levels and notes from the attended measurements.

Table 3. Primary noise sources noted at measurement locations during active periods

Location	Primary Sources
Ref	Playground noise is dominant, shouts are main source. Traffic on Weir is audible.
SE	Playground is almost entirely inaudible. Traffic noise from Weir and Murray is dominant. Very occasional yells can just barely be heard.
S	Playground is audible but quiet, the same sound level or quieter than traffic noise.
W	Playground is barely audible. Wildlife and traffic are primary sources. Noise from nearby power tools influenced the L_1 levels.
NW	Playground is clearly audible, but generally the same level as traffic on Weir and Murray, though occasional shouts are louder.
NE	Playground inaudible. Traffic noise from Weir is the dominant source, and noise from Murray is audible.

Table 4 through Table 6 below present the statistical sound levels measured during each of the four periods. Although the playground is not required to meet the Oregon DEQ noise limits, the limits are included for reference. Additionally, the maximum change in noise level between the Background and Active periods is included.

Table 4. Measured L_{50} noise levels

Location	L_{50} Sound Level (dBA)				DEQ Limit	Max. Level Change (dBA)	
	Bkgd 1	Active 2	Bkgd 3	Active 4		Measured	DEQ Limit
Ref	*41*	*47*	*38*	*45*	--	*8.5*	*N/A*
SE	40	40	38	40	*55*	2.0	*+10*
S	40	40	38	40		2.5	
W	40	41	38	41		3.2	
NW	42	44	39	44		5.1	
NE	46	45	45	47		1.6	

Table 5. Measured L_{10} noise levels

Location	L_{10} Sound Level (dBA)				DEQ Limit	Max. Level Change (dBA)	
	Bkgd 1	Active 2	Bkgd 3	Active 4		Measured	DEQ Limit
Ref	*50*	*55*	*50*	*53*	--	*10.0*	*N/A*
SE	45	45	45	45	*60*	0.4	*+10*
S	44	44	44	47		3.5	
W	45	46	45	48		3.2	
NW	49	50	49	50		4.9	
NE	53	52	53	53		1.2	

Table 6. Measured L_1 noise levels

Location	L_1 Sound Level (dBA)				DEQ Limit	Max. Level Change (dBA)	
	Bkgd 1	Active 2	Bkgd 3	Active 4		Measured	DEQ Limit
Ref	*57*	*63*	*56*	*61*	--	*7.7*	*N/A*
SE	53	52	54	57	*75*	4.2	
S	50	53	55	56		5.5	
W	51	58	55	59		7.1	
NW	54	58	54	59		5.2	
NE	57	57	56	59		3.9	

As can be seen in the tables, all of the measured levels are significantly quieter than the limits set by the State. Additionally, the change in levels between background and active conditions is well below 10 dB in all cases. Even if the number of children on the playground doubled, the levels would not increase by more than 3 dB, which is still well below the limits.

For reference, the following graphs present the sound levels over the full measurement period for selected locations. The red shaded areas indicate the active time periods when children were playing on the playground. Callouts of examples of types of noise are included for reference – these are illustrative, not an exhaustive list.

Figure 3 shows the sound levels at the SE measurement position, which is on the opposite side of the church from the playground. As can be seen in the graph, the levels when the playground is in use are essentially identical to the levels when it is quiet. The short spikes in sound level are from traffic on Weir Road, and the bigger spikes are typically airplane flyovers.

Figure 4 shows levels at the S measurement point. When the playground is active, particularly during the second active period, a slight rise in the sound level is noted and the number of events also increases.

Figure 5 presents the levels measured at the NW point, which is the closest residence to the playground. The level does increase, and the shouts can be seen as a general increase in the maximum levels. However, while audible, it only represents a change of about 5 dB, as noted in Table 6 above.

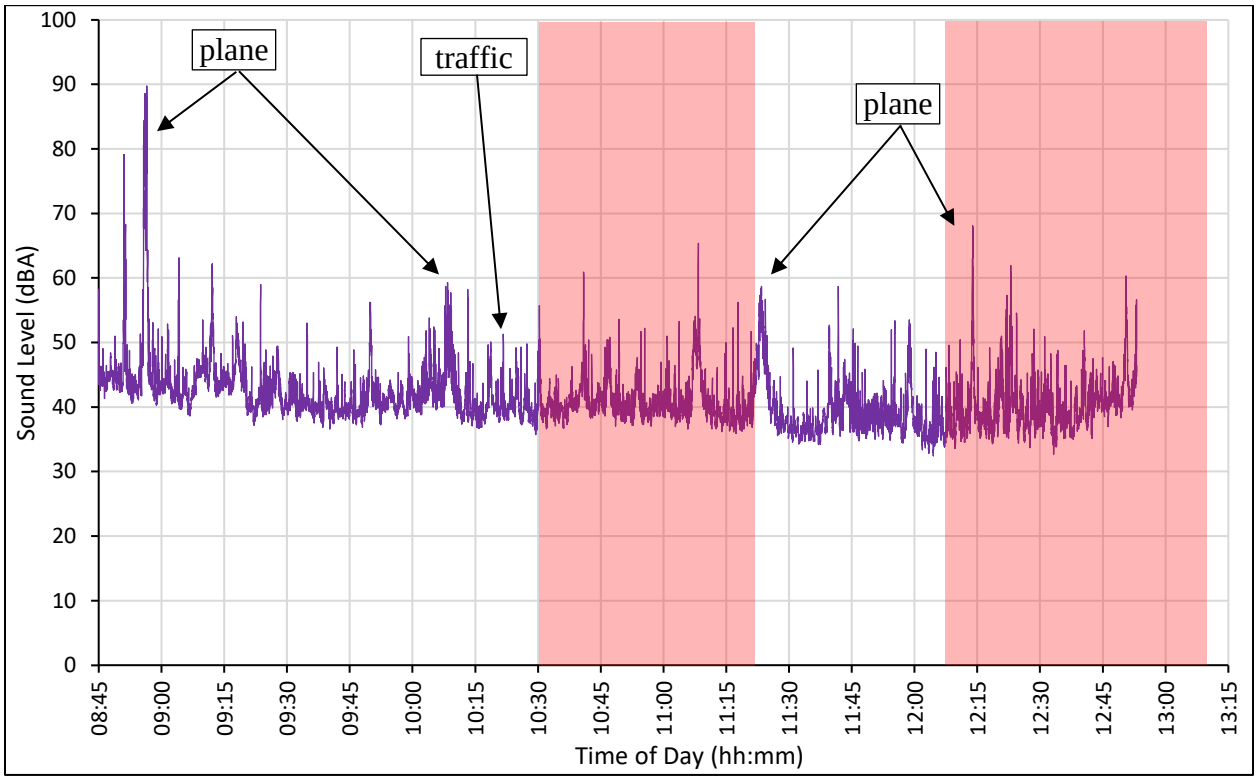

Figure 3. Measured levels at SE point

Figure 4. Measured levels at S point

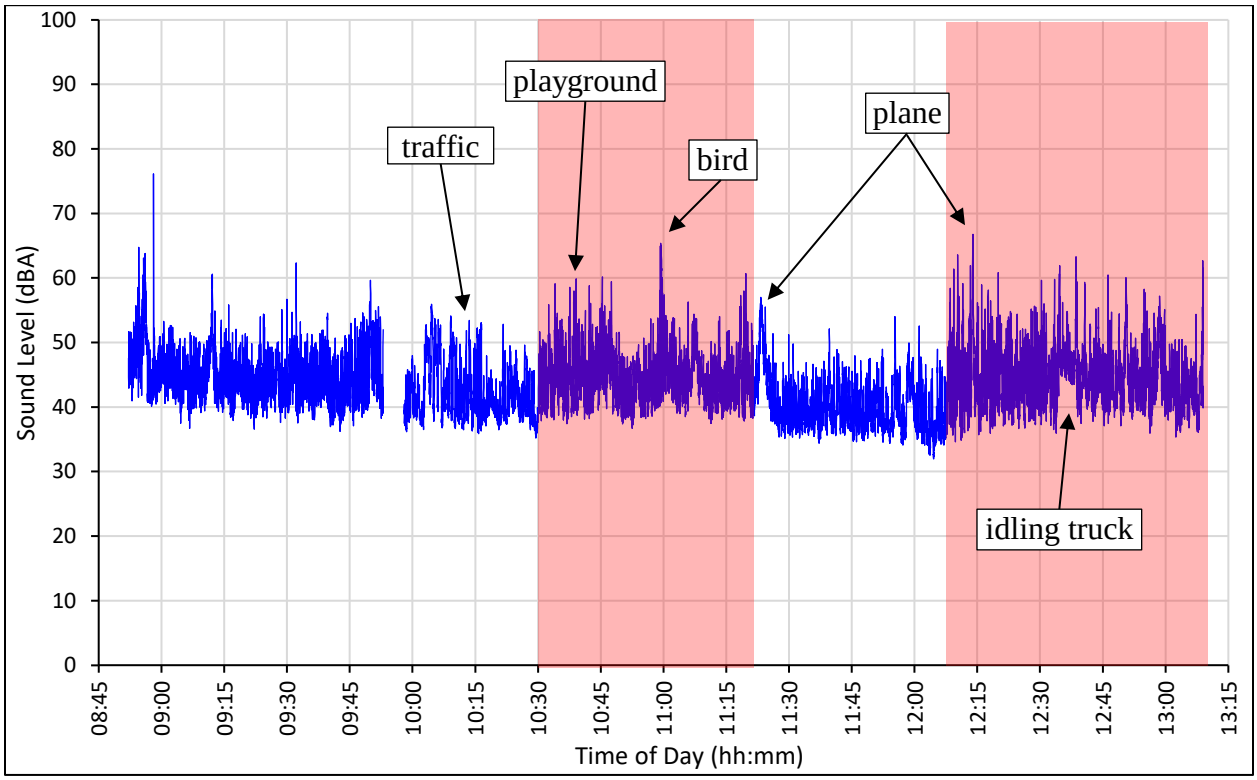

Figure 5. Measured levels at NW point

Mitigation Options

As noted in the *Noise Ordinances* section above, all of the regulations either do not apply, or do not provide objective and enforceable limits. As discussed in the *Sound Level Measurements* section, the sound levels generated by the playground are well below the limits that would be applicable to other noise sources, and the change in noise levels would not be considered to be significant. Therefore, no mitigation is required by code. However, because the shouts are audible at residences, the MHCC board of trustees requested that ABD provide options to reduce sound levels under a "good neighbor" policy.

To determine the effect of different mitigation options at nearby residences, ABD used a computer program called SoundPLAN, which accounts for source sound level and spectrum, distance, ground type, elevation, vegetation, reflections, and barrier effects from fences and buildings. It follows the ISO 9613 calculation standard, which is an industry standard for environmental noise modeling. As a baseline comparison, calculations were first made with the existing conditions to validate the model. Then, a noise barrier was added to the model. Finally, an option of moving the playground to a different location was analyzed. These mitigated levels were compared against the unmitigated condition to determine how effective each option would be.

Installing Noise Barrier

A noise barrier wall was discussed as a potential mitigation option. This wall would be built along the west and south sides of the playground. The wall would be tall enough to break line of sight between any child's location on the playground and the upper floor of the

residences to the west and south. An elevated jungle gym is located at the south end of the playground, so additional wall height would be needed to block this path. Figure 6 indicates the required minimum heights of the various wall sections, relative to grade. Additionally, it was noted that once the wall is in place, a reflection off the wall of the church would cause an increase in noise levels at residences to the west, so absorption is recommended on the wall of the church between the bays, at a height from 8 to 14 feet above grade.

Figure 6. Minimum noise barrier heights

Noise barrier walls should be constructed without gaps, and the material should have a surface density of at least 1 lb/ft^2. Be aware that for walls this tall, a structural review may be needed to calculate wind loading. Potential wall materials include:

- Masonry, such as concrete panel or CMU block
- Mass-loaded vinyl sheet, such as SoundSeal BBC-EXT-R, Acoustiblok Acoustifence
- Post-and-panel barrier, such as IAC Noishield, AIL Tuf-Barrier, Kinetics NoiseBlock

Absorption on the exterior wall of the church could include:

- Metal-faced panel, such as Kinetics KNP, Eckel EFP
- Weather-resistant panel, such as MBI Weather Resistant, SoundSeal SR-100

With these mitigation measures installed, the levels to the west and south are reduced. Levels to the north are increased slightly, but noise from Weir Road is the primary source at these locations, so the resultant increase would not be noticeable.

Table 7 presents the predicted noise levels from the playground for the existing condition, levels with wall mitigation (but no absorption), and the change in sound level. The locations of the houses are shown in Figure 7. Adding absorption on the wall would reduce levels at the closest residences (NW and S) by a further 3 dB, but would have minimal effect at other residences.

Figure 7 shows a graph of the change in level with the installation of the wall, but no absorption on the wall – this can be thought of as a detailed view of the "Change in Level" column in the table. Areas shown in green would experience lower sound levels than current, and areas in blue would experience louder playground noise. The heavy black line indicates no change in level.

Table 7. Predicted change in playground noise levels at residences with wall mitigation

Address	Location	Predicted Playground Noise (dBA)		
		Existing	With Wall	Change in Level
10050 SW 151st	NW	57	51	-6
10600 SW 151st	--	52	47	-5
10150 SW 151st	--	52	49	-3
10175 SW 149th	S	53	50	-3
10170 SW 149th	SE	37	35	-2
10025 SW 148th	NE	34	36	+2

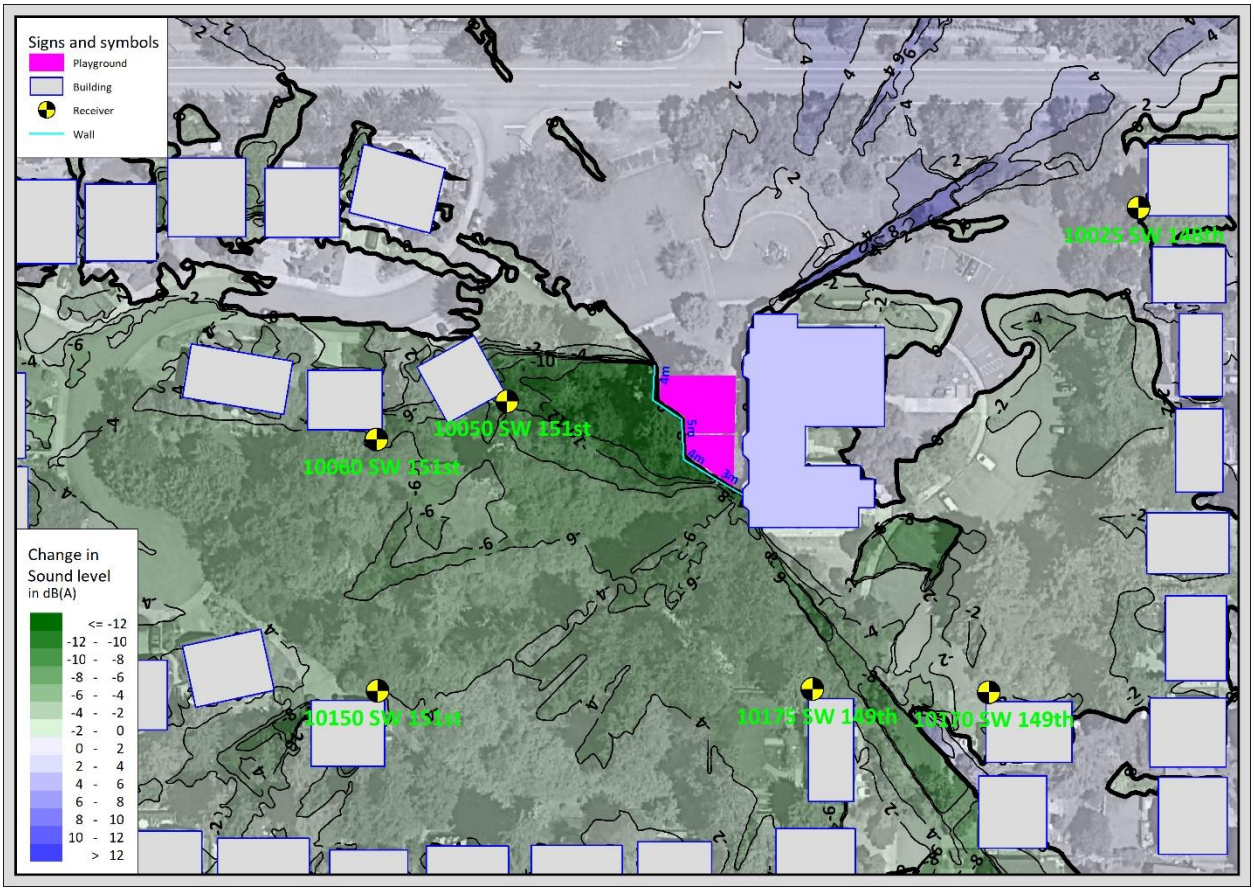

Figure 7. Predicted change in playground noise level with wall mitigation

As shown, the wall mitigation option would reduce noise levels at the nearby west residences by around 6 dB, which is a noticeable decrease. Adding absorption on the wall as well would reduce the levels by 9 dB compared to the existing condition, which would be perceived as half as loud. The levels to the south would decrease slightly, and the levels to the north would increase slightly.

Relocating Playground

Another potential option is to relocate the playground to the north side of the church, near the flagpole. The intent with this option would be to minimize cost, so no noise barriers were included. Table 8 present the predicted levels and change in levels. Figure 8 presents a map of the change in levels (note that the color scale is different between Figure 7 and Figure 8).

Table 8. Predicted change in playground noise levels at residences with relocated playground

Address	Location	Predicted Playground Noise (dBA)		
		Existing	Relocated	Change in Level
10050 SW 151st	NW	57	52	-5
10600 SW 151st	--	52	40	-12
10150 SW 151st	--	52	45	-7
10175 SW 149th	S	53	40	-13
10170 SW 149th	SE	37	48	+11
10025 SW 148th	NE	34	53	+19

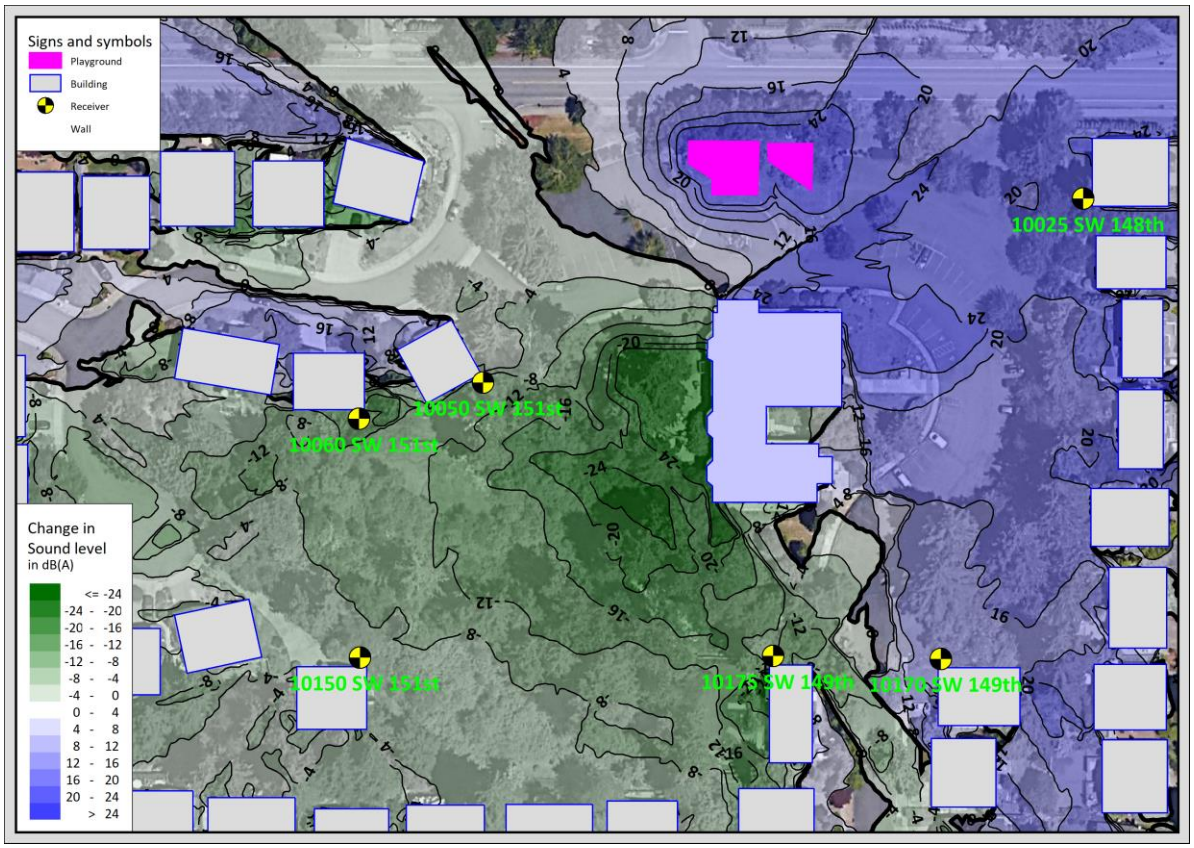

Figure 8. Predicted change in level from relocating playground

As shown, relocating the playground would result in a similar reduction as the wall at the former closest residence (10050 SW 151st / NW). However, it would significantly increase playground noise levels to the east and southeast, doubling or quadrupling the playground noise levels at these residences. Additional noise barriers would be required to mitigate this noise, which would defeat the purpose of relocating to save money. Therefore, the relocation option is not recommended.

Conclusions

ABD measured noise levels of the existing playground noise from Murray Hills Christian Church. Noise levels from the playground were audible at some locations to the west and south, but would not be considered significant per the noise regulations. Additionally, the noise regulations are either not applicable or do not provide an objective and enforceable limit.

Mitigation options were explored. A noise barrier wall is the recommend mitigation option, and adding absorption to the wall of the church could increase the effectiveness of this solution. Relocating the playground to the north is not recommended.

If you have any questions, please contact us.

Sincerely,

ABD Engineering & Design, Inc.
Per:

Benjamin Wolf, INCE Bd. Cert.
Senior Acoustical Consultant

cc: Melinda Miller, Marci Boks – ABD