MD ACOUSTICS
Sound Solutions for Planning and Design

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October 20, 2021

Ms. Peggy Ferrin, CPPB
Town of Paradise Valley
6401 E Lincoln Drive
Paradise Valley, AZ 85253

Subject: The Andaz Resort– Noise Study and Recommendations – Town of Paradise Valley, AZ

Dear Ms. Ferrin:

MD Acoustics, LLC (MD) is pleased to provide this noise study and recommendations report as it relates to proposed operations and events at the Andaz Resort located at 6114 N Scottsdale Rd, Scottsdale, AZ. This study has been prepared based on the comments from the Town and the owner regarding operations on two (2) event lawns at the resort. The project was assessed with regard to potential operations and event noise, such as weddings, and other gatherings. For your reference, Appendix A contains a glossary of acoustical terms.

1.0 Assessment Overview

This assessment evaluates the Project Noise Levels from the two (2) resort lawns and compares the projected noise levels to the Town's noise ordinance. Figure 1 below shows the site location, with a red box around the area under evaluation. MD measured the baseline noise condition, simulated an event with amplified speech, and modeled 12 scenarios.

Figure 1: Site Location

Recommendations are provided to ensure that the project operations meet the Town's noise ordinance. MD traveled to the project site and performed several baseline measurements to gather the existing condition at or near the site. Measurements were performed at the property boundaries which were used to define the existing noise condition at the site. MD utilized Type 1 and 2 sound level meters that meet ANSI S1.4 engineering standards to record minute-by-minute baseline data

2.0 Local Acoustical Requirements

MD compared the results of the noise assessment to Section 10-7-3 of the Town of Paradise Valley, Town Code. The Town Code states: "Table 1 sets forth the noise level limits for stationary sources, and it is unlawful to project a sound or noise, except those caused by motor vehicles, from one property into another in excess of the stated limits".

Table 1: Limiting Noise Levels for Stationary Sources

TIME	MAXIMUM ALLOWABLE NOISE LEVEL dB (A)
7:00 a.m. to 10:00 p.m.	56
10:00 p.m. to 7:00 a.m. and on all Sundays and specified legal holidays	45

Therefore, project operations must comply with the Town's noise limit of 56 dBA during daytime (7AM to 10PM) hours and 45 dBA during nighttime (10PM to 7AM) hours

3.0 Study Method and Procedure

Existing Noise Condition/Baseline

On September 15, 2021, two (2) 15-minute baseline noise measurements were conducted at the project site between 3:00 PM and 3:30 PM. The project site is adjacent to resort property to the north, existing commercial uses to the east, existing residential uses to the south, and Quail Run Road and adjacent residences to the west. Noise data indicate that the ambient noise level ranges from 51.5 dBA Leq at Albers Lawn to 45.8 dBA at the dirt field to the west of the event lawns considered in this report. Additional field notes and photographs are provided in Appendix B.

Simulated Event Measurements

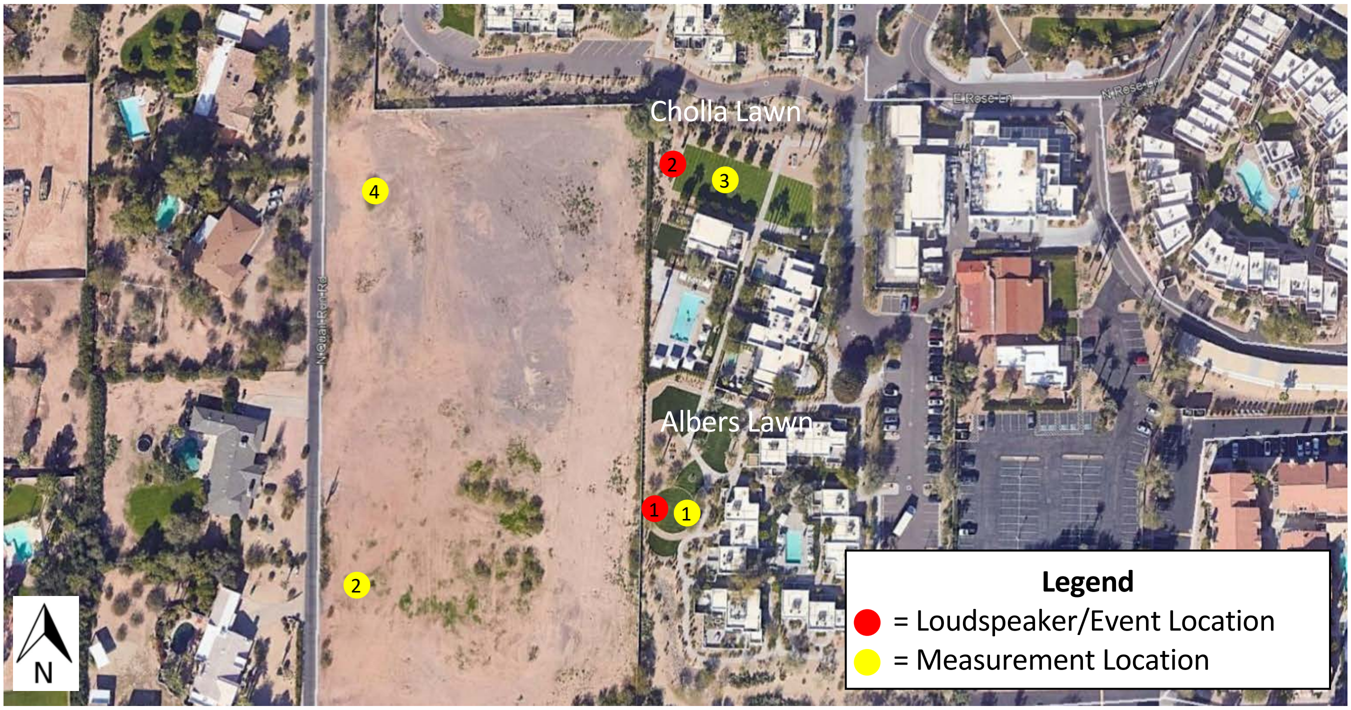
At the Andaz resort, complaints sometimes arise during an amplified speech event when a person speaks too loudly into the microphone. This is difficult to control because people can change the loudness with which they speak or the distance between their mouth and the microphone very quickly.

To understand this issue, MD traveled to the site and measured noise levels during a simulated event using the audio equipment and settings typical of events held on Albers Lawn and on Cholla Lawn. The noise was measured at the event lawns under study and near the western property line of the Andaz resort.

Figure 2 indicates the location of the audio equipment and measurement locations for the experiment performed on Albers Lawn.

<Figure 2, next page>

Figure 2: Event Lawn Simulated Events



The noise measured approximately 85-92 dBA at Measurement Location 1 and approximately 52-58 dBA at Measurement Location 2 on Albers Lawn. Noise levels measured approximately 80-85 dBA at Measurement Location 3 and approximately 50-52 dBA at Measurement Location 4.

Although fluctuations in exterior noise levels due to air traffic, car traffic, and other noise events during the measurement period may have impacted measurement results, the measurement data provide an approximation of the noise levels possible during operations at these event lawns.

Stationary Noise Level Prediction Modeling

SoundPlan Acoustic Modeling Software (SP) was utilized to model the operational noise levels from the project site. SP acoustical modeling software is capable of evaluating stationary noise sources (e.g., loudspeakers for live events, DJs, parking lots, crowds, loading/unloading, patios, etc.) and much more. SP's software utilizes algorithms (based on inverse square law) to calculate noise level projections. The software allows the user to input specific noise sources, spectral content, sound barriers, building placement, topography, and sensitive receptor locations. In addition, SP can model the noise sources as point sources, line sources, and area sources.

The future worst-case noise level projections were modeled using referenced sound level data for the various stationary on-site sources (amplified speech on an event lawn). The model assumes noise projections at 5-feet above the ground level. Table 2 below outlines the referenced noise levels used to calibrate the models. Potential solutions to reduce the noise impact to adjacent residences were compared using these reference sound levels as a baseline condition and evaluated based on the noise level projections.

Table 2: Reference Sound Level Measurements for SoundPlan Model

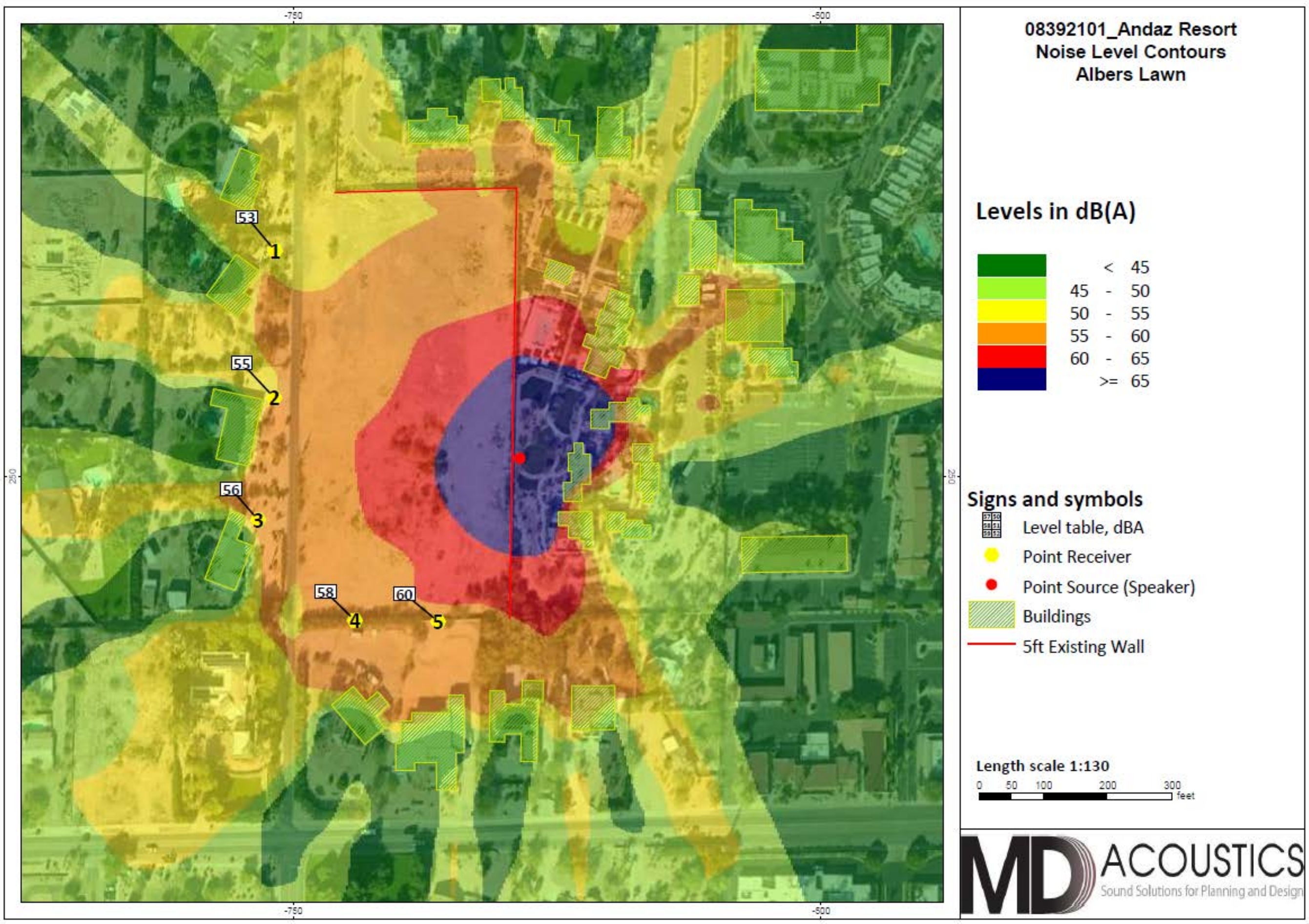
Source	Source Type	Reference Level (dBA)	Distance (ft)
Amplified Speech[1]	Point Source	100	3
1. Based on sound measurements conducted 9/15/2021 at Andaz Resort			

4.0 Findings and Recommendations

4.1 Albers Lawn

Figure 3 illustrates the Existing Condition/Baseline SP model. This represents the noise level at an instant in which a person shouts into a microphone during a speech. Although this level would only exist for a second or two, it has the potential to exceed the noise ordinance and generate noise complaints.

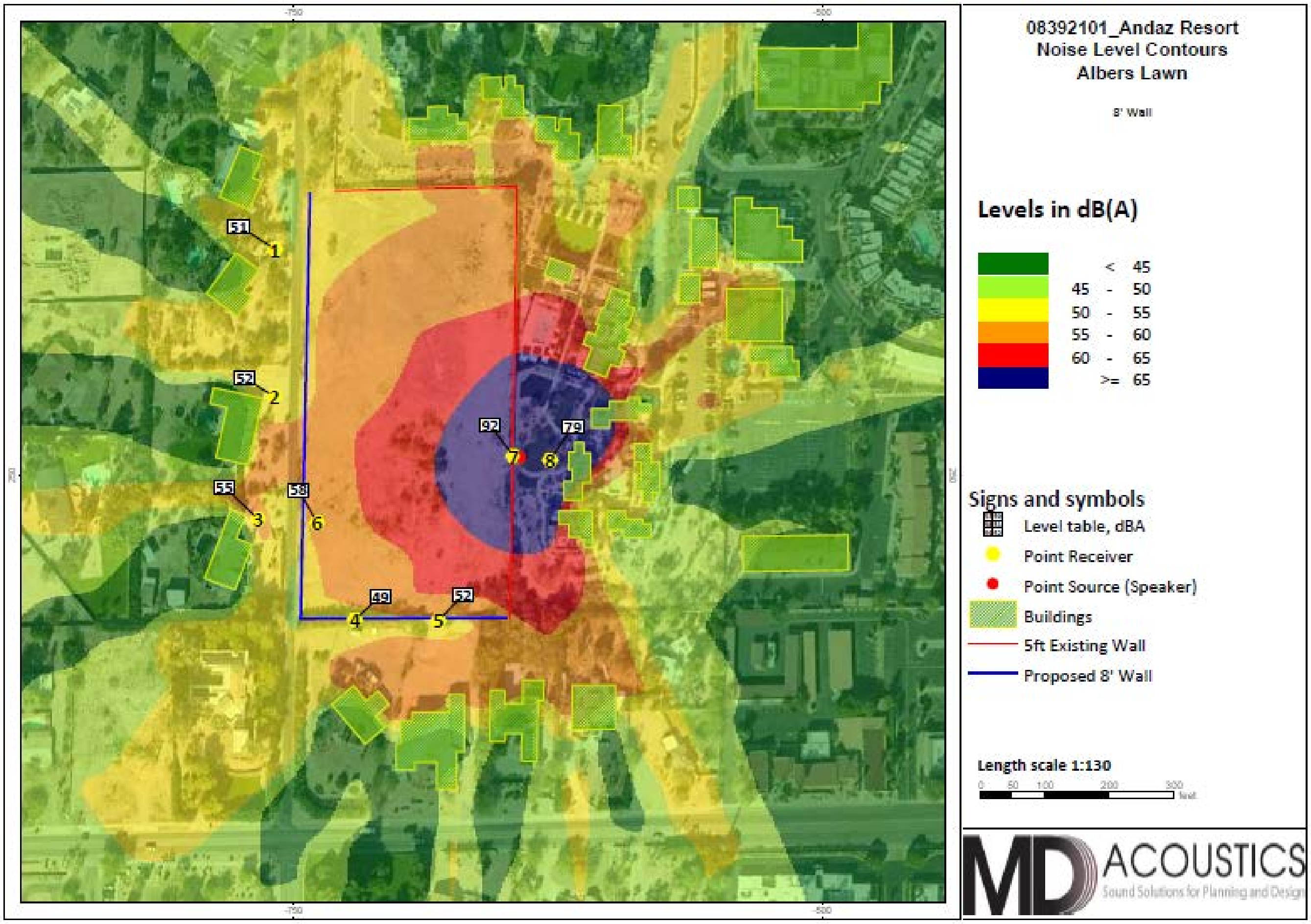
Figure 3: Albers Lawn Existing Condition/Baseline



MD evaluated six (6) potential noise abatement options for Albers Lawn and compared them to the existing condition shown in Figure 3.

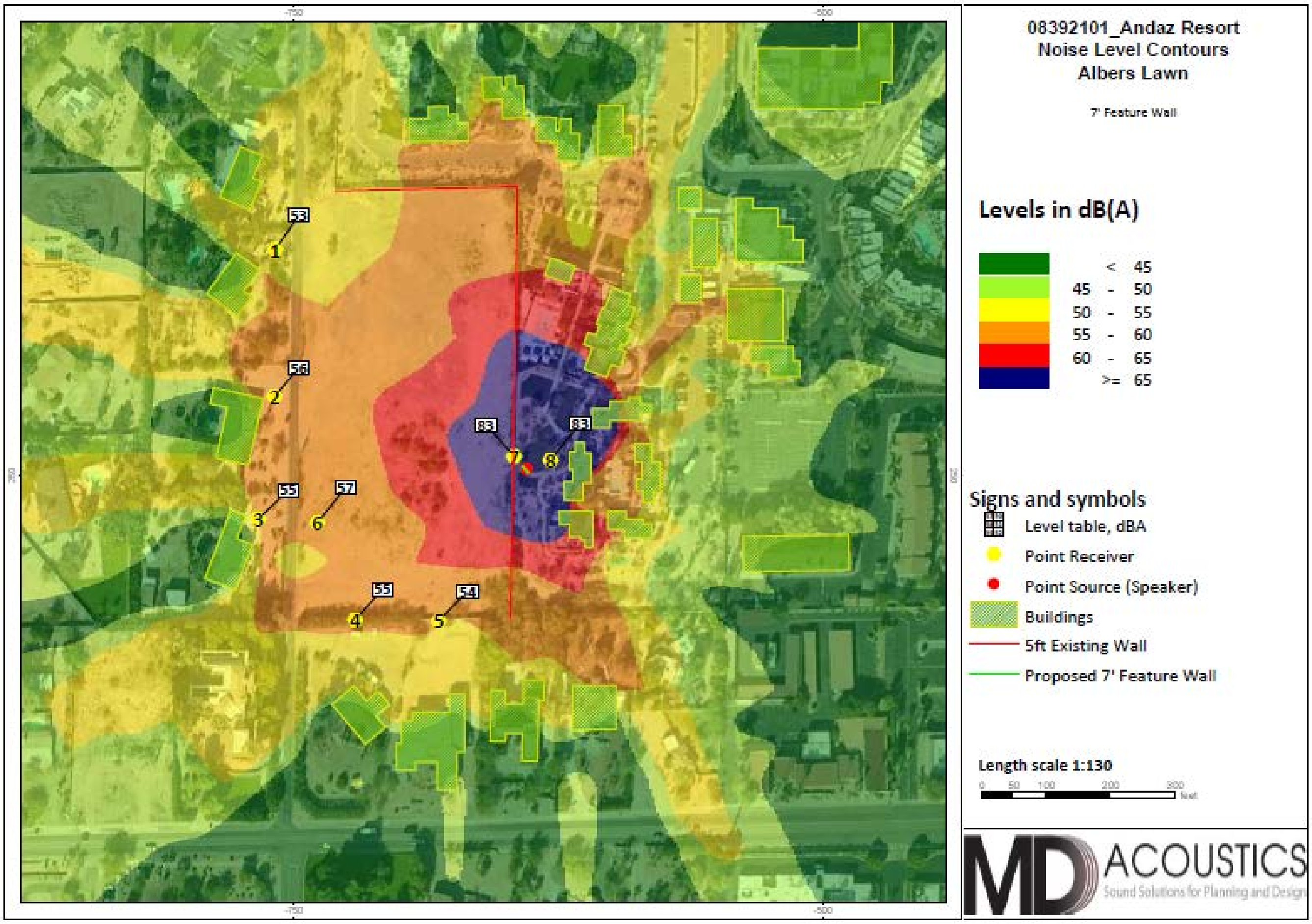
8'Wall: Figure 4 shows the situation that was modeled with an 8' CMU wall around the dirt field to the west of Albers Lawn.

Figure 4: Albers Lawn 8' Wall Scenario



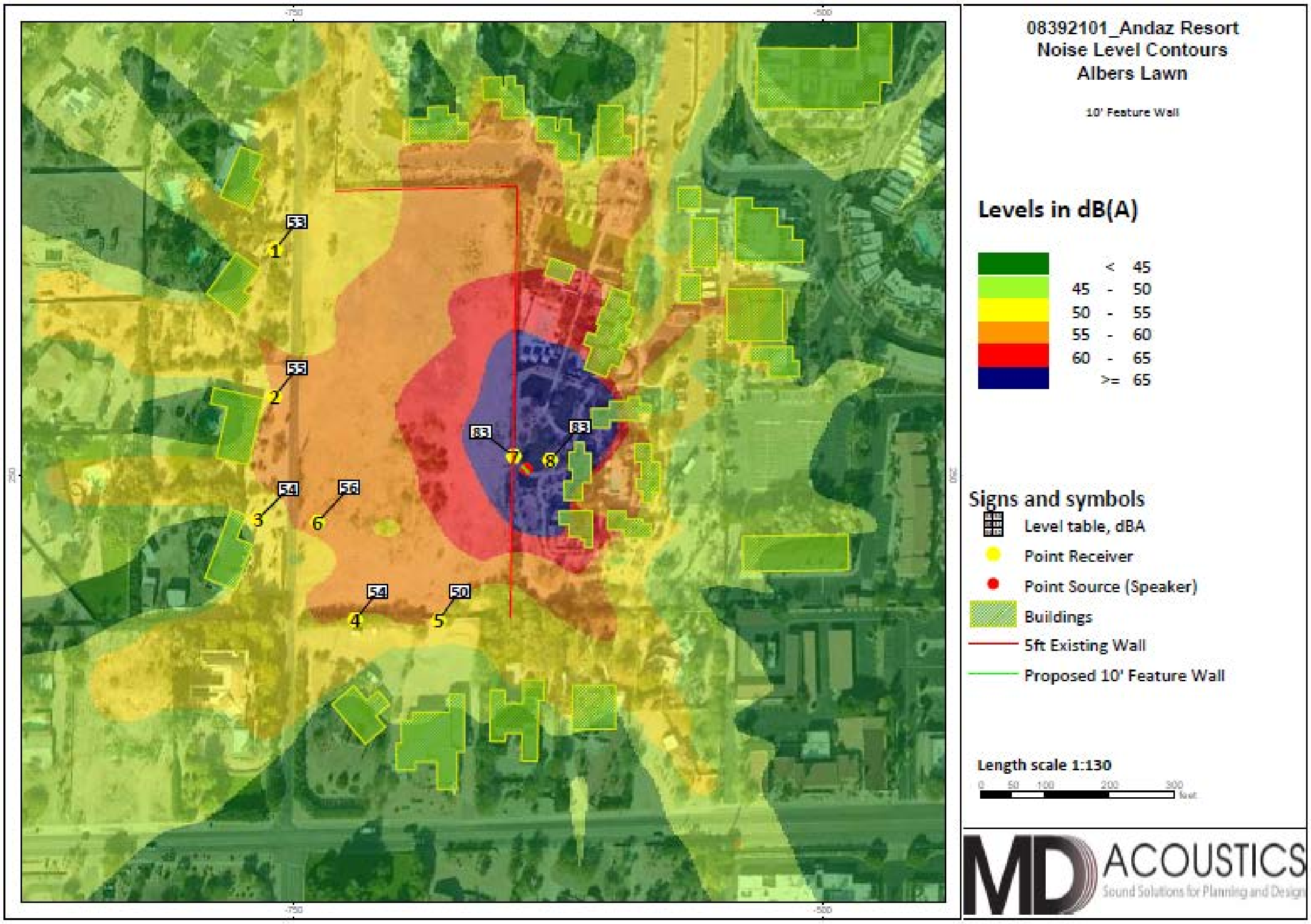
7' Tall Feature Wall: Figure 5 shows the situation that was modeled with a 15' wide by 7' tall feature wall built to contain the speakers such that the sound would be redirected to the northeast.

Figure 5: Albers Lawn 7' Tall Feature Wall



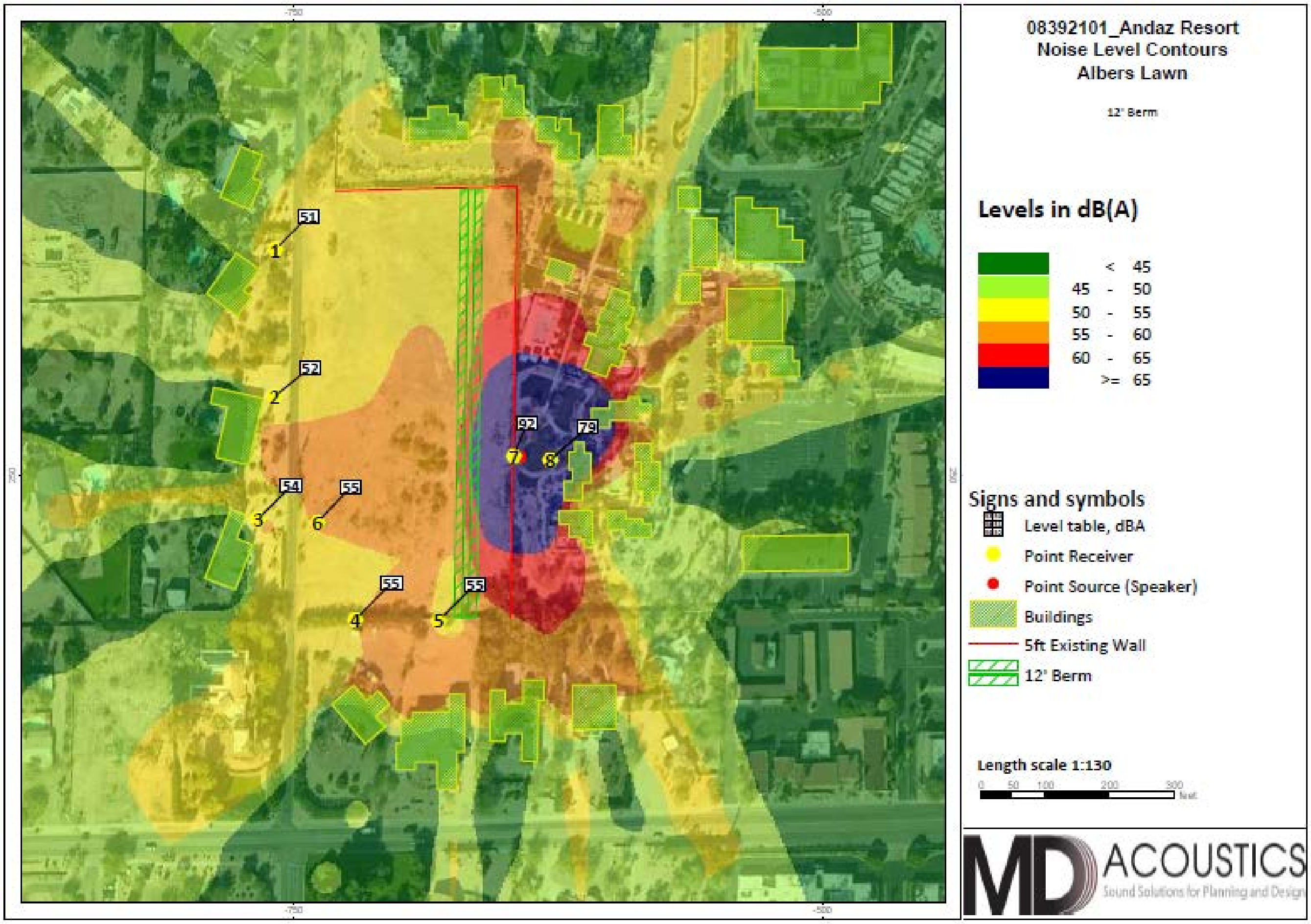
10' Tall Feature Wall Figure 6 shows the situation that was modeled with a 15' wide by 10' tall feature wall built to contain the speakers such that the sound would be redirected to the northeast.

Figure 6: Albers Lawn 10' Feature Wall



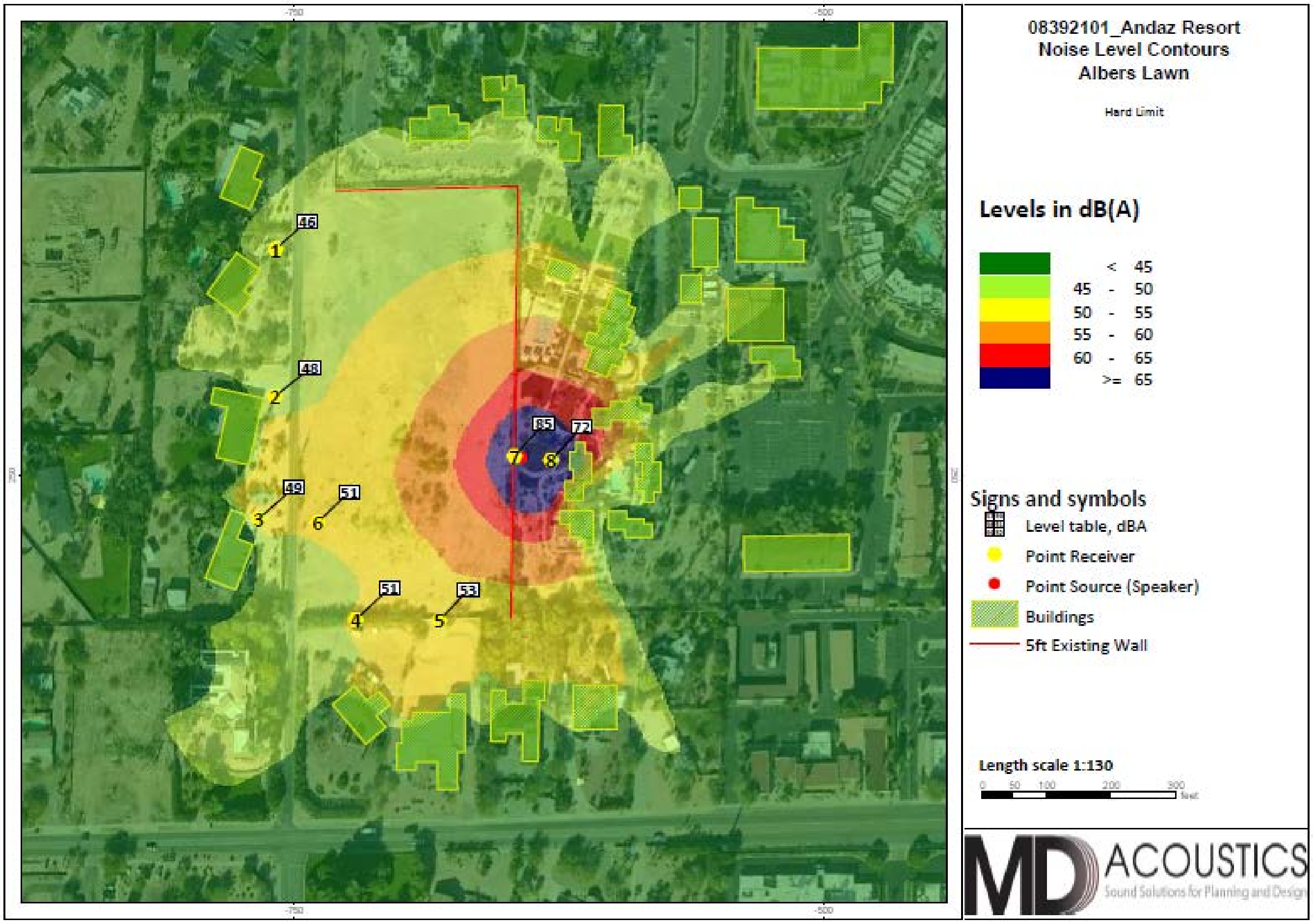
12' Berm: This situation was modeled with a 12' tall berm to the west of the Albers Lawn. See Figure 7 below.

Figure 7: Albers Lawn 12' Berm



Hard Limit: This situation was modeled as if a limiter were installed on the audio system such that the maximum source level is constrained not to exceed 93 dBA at 3 ft. See Figure 8 below.

Figure 8: Albers Lawn Hard Limit



Distributed Audio System: This situation was modeled to show the effect of having four(4) times as many loudspeakers distributed around the space with a lower output volume. See Figure 9 below.

Figure 9: Albers Lawn Distributed Audio System

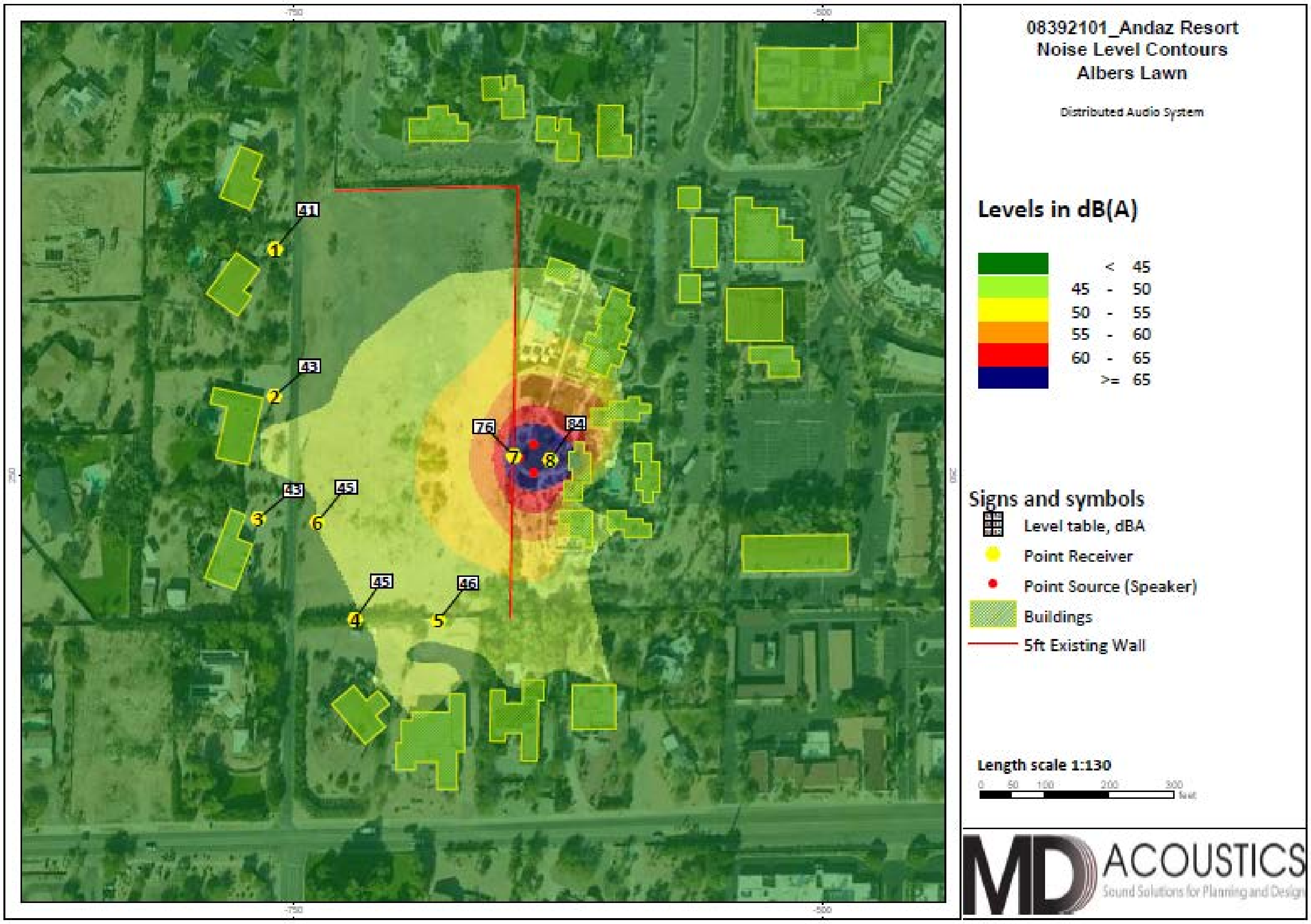


Table 3 provides the characteristics associated with changes in noise levels. When evaluating different scenarios, a 1-2 dB improvement is nominal (i.e., not noticeable), a 3-5 dB improvement is good, and a 10-12 dB improvement is very good.

Table 3: Change in Noise Level Characteristics[1]

Changes in Intensity Level, dBA	Changes in Apparent Loudness
1	Not perceptible
3	Just perceptible
5	Clearly noticeable
10	Twice (or half) as loud

1. https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm

Table 4 summarizes the results of the Albers Lawn scenarios. The results have been color coded to align with Table 3: red means less than 3 dB improvement from the Baseline Condition (see Figure 3) at that receptor, green corresponds to a 3-9 dB improvement at that receptor, and blue represents a 10 dB or greater improvement.

Table 4: Albers Lawn Modeling Results

Scenario	Source Level (dBA @ 3 ft)	Sound Level at Nearby Residences[1] (dBA)				
		1	2	3	4	5
Existing Condition/Baseline	100	53	55	56	58	60
8' Wall	100	51	52	55	49	52
7' Feature Wall	100	53	56	55	55	54
10' Feature Wall	100	53	55	54	54	50
12' Berm	100	51	52	54	55	55
Hard Limit	93	46	48	49	51	53
Distributed Audio System	81	41	43	43	45	46

1. See Figure 3 for receptor locations.

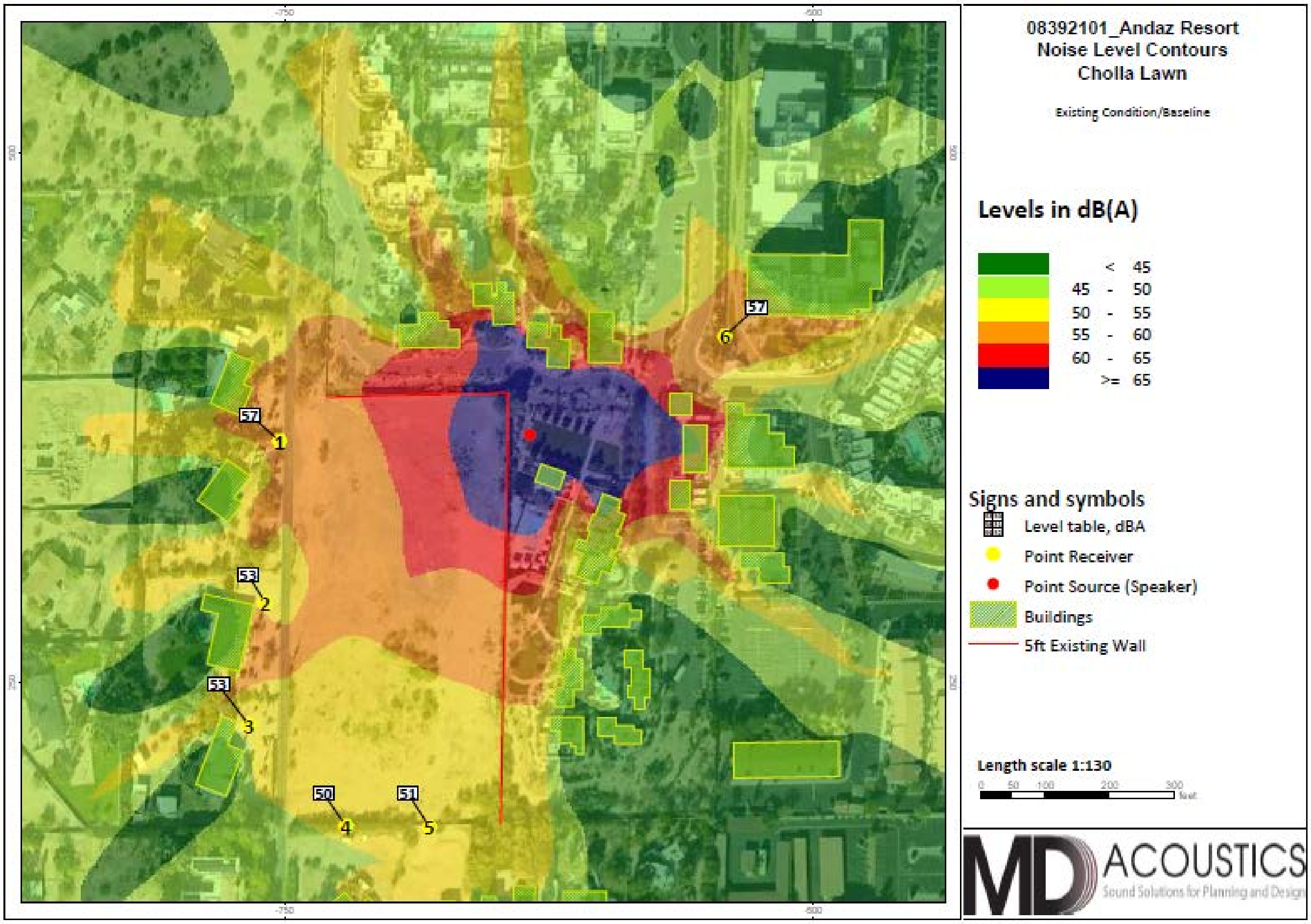
As shown in Table 4, the 8’ Wall option provides a negligible difference at almost all receptors. The 7’ feature wall provides a 3 dB decrease at Receptor 4 and a 6 dB decrease at Receptor 5. The 10’ feature wall provides a 4 dB decrease at Receptor 4 and a 10 dB decrease at Receptor 5. The 12’ berm provides a 3 dB decrease at Receptors 2 and 4 and a 5 dB decrease at Receptor 5. The Hard Limit provides a 7 dB improvement across all receptors, and the Distributed Audio System provides a 12-15 dB difference at all locations.

4.2 Cholla Lawn

Figure 4 illustrates the Existing Condition/Baseline SP model for Cholla Lawn. This represents the noise level at an instant in which a person shouts into a microphone during a speech. Although this level would only exist for a second or two, it has the potential to exceed the noise ordinance and generate noise complaints.

<Figure 10, next page>

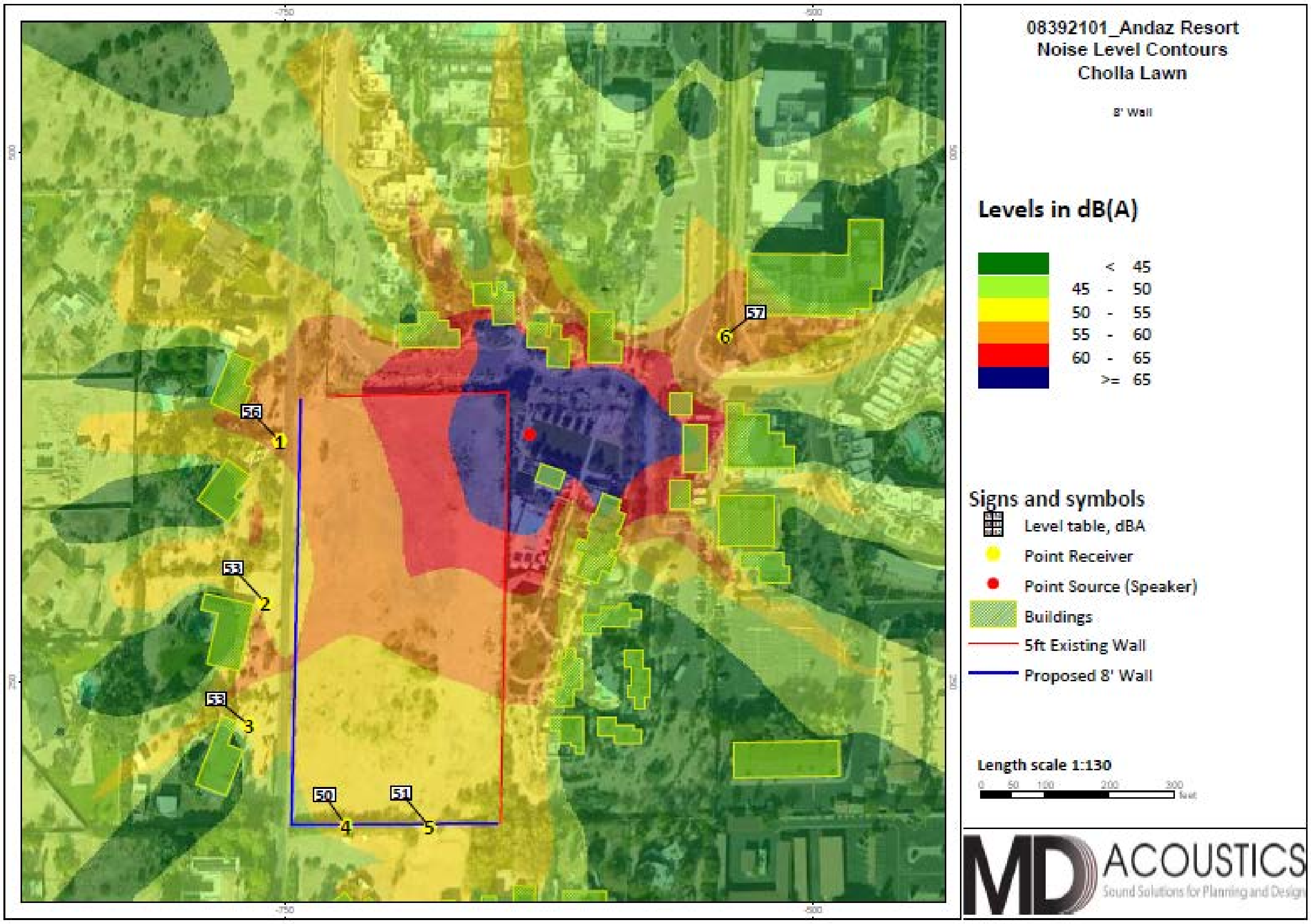
Figure 10: Cholla Lawn Existing Condition/Baseline



MD evaluated four (4) potential noise abatement measures for Cholla Lawn and compared them to the existing condition shown in Figure 10. The following options were evaluated:

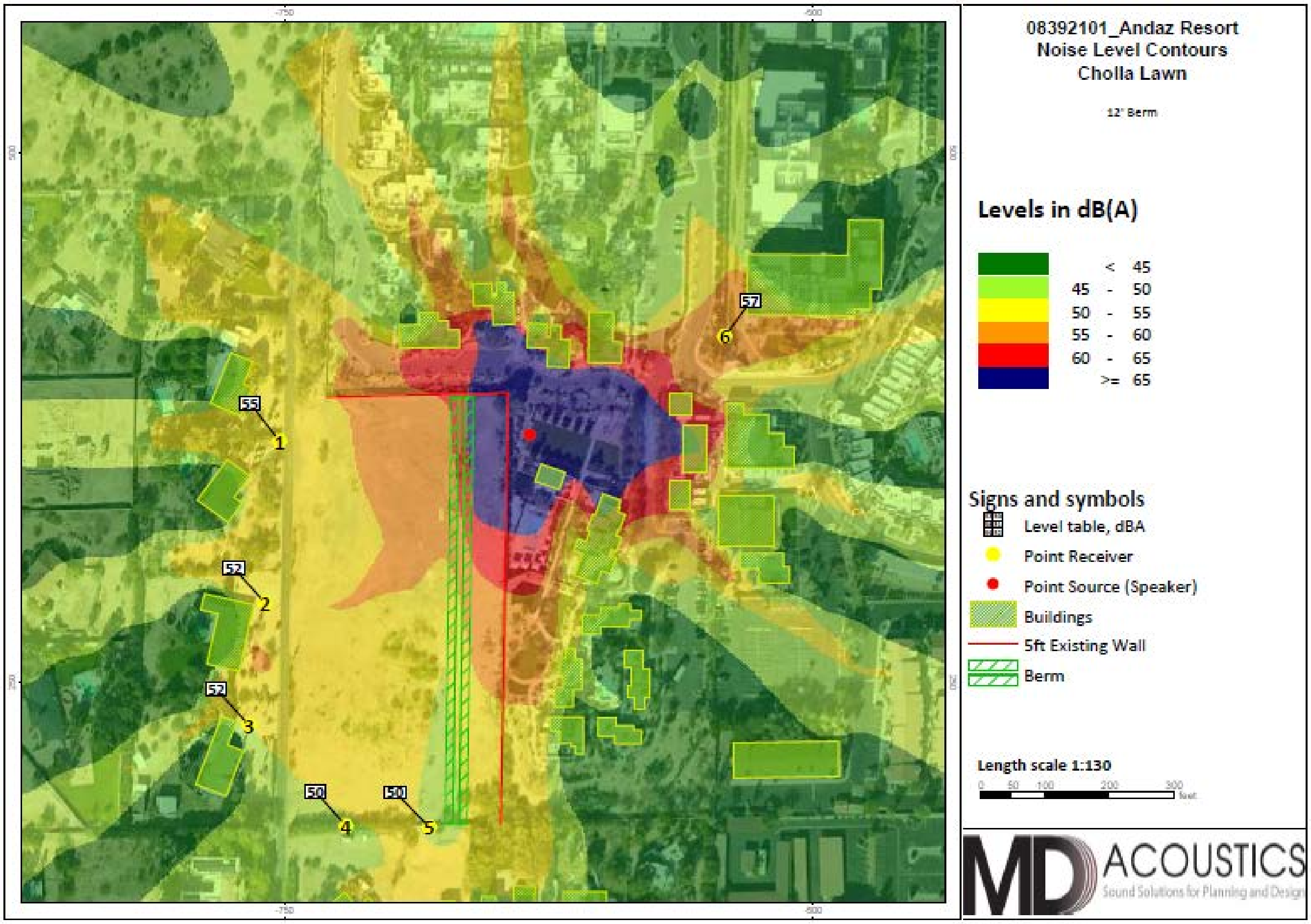
8' Wall: This situation was modeled with an 8' CMU wall around the dirt field to the west of Albers Lawn.

Figure 11: Cholla Lawn 8' Wall



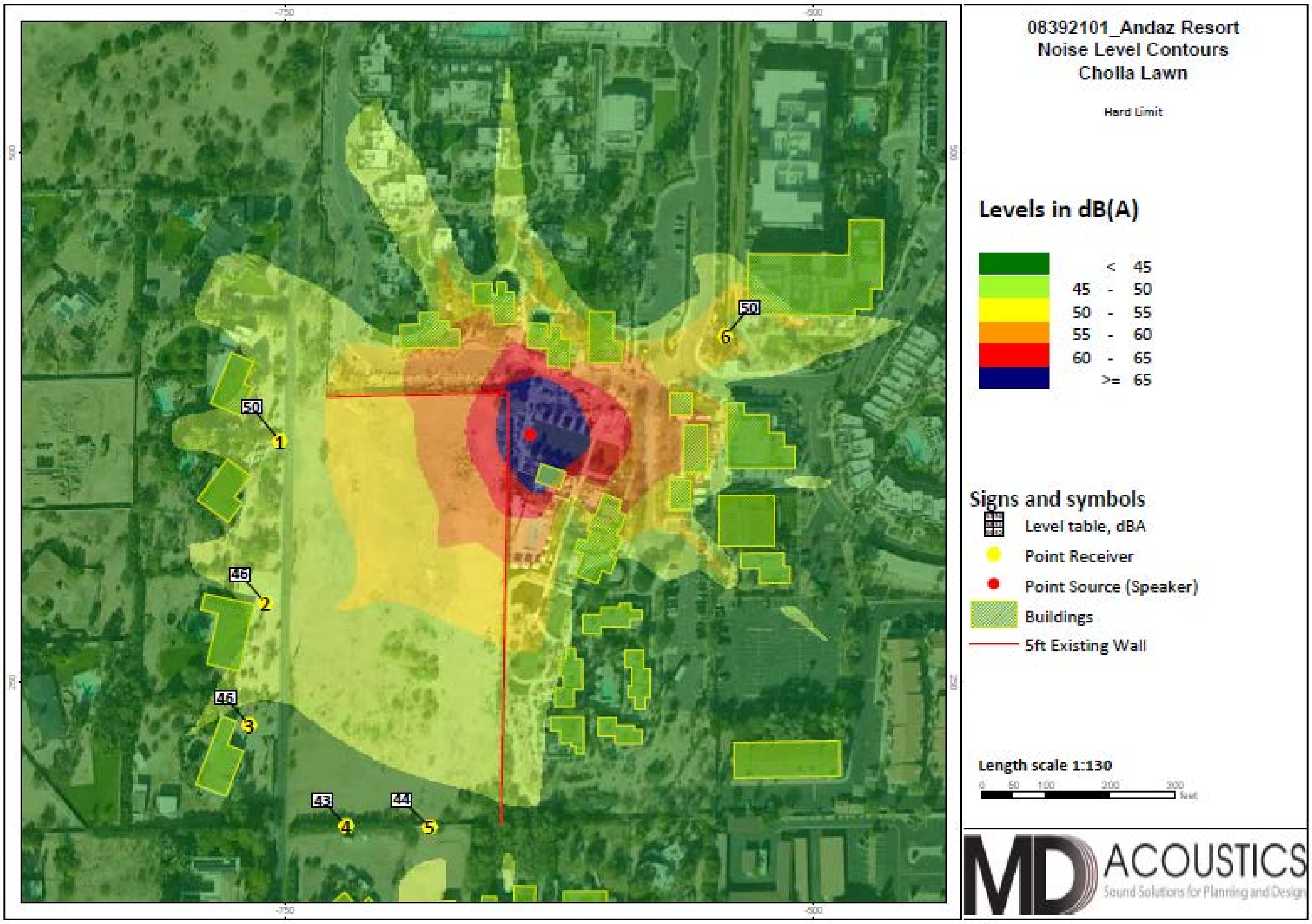
12' Berm: This situation was modeled with a 12' tall berm to the west of the Cholla Lawn. See Figure 12 below.

Figure 12: Cholla Lawn 12' Berm



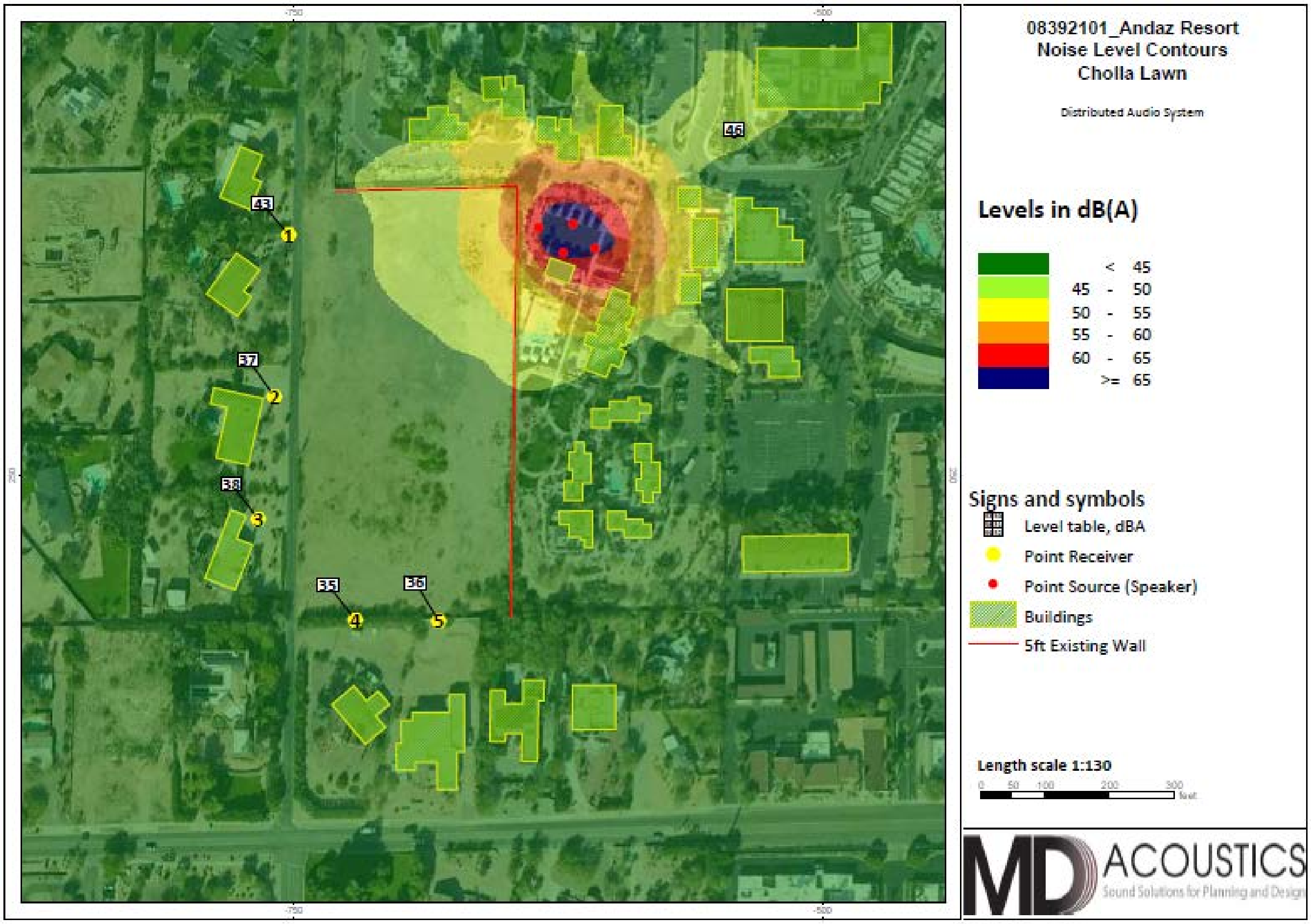
Hard Limit: This situation was modeled as if a limiter were installed on the audio system such that the maximum source level is constrained not to exceed 93 dBA at 3 ft.

Figure 13: Cholla Lawn Hard Limit



Distributed Audio System: This situation was modeled to show the effect of having more loudspeakers distributed around the space at a lower output volume. See Figure 14 below.

Figure 14: Cholla Lawn Distributed Audio System



Appendix C contains the SP modeling contours for each scenario and Table 5 summarizes the results. The results have been color coded to align with Table 3: red means less than 3 dB improvement at that receptor, green corresponds with a 3-9 dB improvement at that receptor, and blue represents a 10 dB or greater improvement.

Table 5: Cholla Lawn Modeling Results

Scenario	Source Level (dBA @ 3 ft)	Sound Level at Nearby Residences[2] (dBA)					
		1	2	3	4	5	6
Existing Condition/Baseline	100	57	53	53	50	51	57
8' Wall	100	56	53	53	50	51	57
12' Berm	100	55	52	52	50	50	57
Hard Limit	93	50	46	46	43	44	50
Distributed Audio System	81	43	37	38	35	36	46

1. See Figure 4 for receptor locations.

5.0 Conclusions

MD is pleased to provide this noise study and recommendations for the Andaz Resort. Two (2) scenarios were measured onsite at both the Albers and Cholla event lawns to provide real-world reference sound levels. The measured noise levels were used to evaluate potential noise control solutions using SoundPlan Acoustic Modeling Software.

MD explored ten (10) noise abatement options, six (6) for Albers Lawn and four (4) for Cholla Lawn. However, only two (2) solutions provided a reduction that would make an audible difference for both event spaces. The only solutions explored during this study that provided an audible difference at both event lawns was to implement a hardware noise limit on the audio system or to increase the number and distribution of loudspeakers with a decreased volume level during outdoor events.

If you have any questions regarding this analysis, please call our office at (602) 774-1950.

Sincerely,
MD Acoustics, LLC

Samuel Hord, INCE
Acoustical Consultant

Appendix A

Glossary of Acoustical Terms

Glossary of Terms

A-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear. A numerical method of rating human judgment of loudness.

Ambient Noise Level: The composite of noise from all sources, near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

C-Weighted Sound Level: The sound pressure level in decibels as measured on a sound level meter using the C-weighted filter network. The C-weighting filter greatly de-emphasizes very high frequency components of the sound and slightly de-emphasizes the very low frequency components. A numerical method of rating human judgment of loudness.

Community Noise Equivalent Level (CNEL): The average equivalent A-weighted sound level during a 24-hour day, obtained after addition of five (5) decibels to sound levels in the evening from 7:00 to 10:00 PM and after addition of ten (10) decibels to sound levels in the night before 7:00 AM and after 10:00 PM.

Decibel (dB): A unit for measuring the amplitude of a sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micro-pascals.

dB(A): A-weighted sound level (see definition above).

dB(C): C-weighted sound level (see definition above).

dB(Z): Z-weighted sound level (see definition of dB above).

Equivalent Sound Level (LEQ): The sound level corresponding to a steady noise level over a given sample period with the same amount of acoustic energy as the actual time varying noise level. The energy average noise level during the sample period.

Habitable Room: Any room meeting the requirements of the Uniform Building Code or other applicable regulations which is intended to be used for sleeping, living, cooking or dining purposes, excluding such enclosed spaces as closets, pantries, bath or toilet rooms, service rooms, connecting corridors, laundries, unfinished attics, foyers, storage spaces, cellars, utility rooms and similar spaces.

Human Sensitivity to Sound: In general, the healthy human ear can hear between 20 Hz to 20,000 Hz. Frequencies below 125 Hz are typically associated with low frequencies or bass. Frequencies between 125 Hz and 5,000 Hz are typically associated with mid-range tones. Finally, frequencies between 5,000 and 20,000Hz are typically associated with higher range tones.

The human ear is sensitive to changes in noise levels, depending on the frequency. Generally speaking, the healthy human ear is most sensitive to sounds between 1,000 Hz and 5,000 Hz (A-weighted scale) and perceives a sound within that range as being more intense than a sound with a higher or lower frequency with the same magnitude. At lower and higher frequencies, the ear can become less sensitive depending on a number of factors. Table 1 provides a brief summary of how humans perceive changes in noise levels.

Table 1: Change in Noise Level Characteristics[1]

Changes in Intensity Level, dBA	Changes in Apparent Loudness
1	Not perceptible
3	Just perceptible
5	Clearly noticeable
10	Twice (or half) as loud

https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/polguide02.cfm

L(n): The A-weighted sound level exceeded during a certain percentage of the sample time. For example, L10 in the sound level exceeded 10 percent of the sample time. Similarly, L50, L90 and L99, etc.

Noise: *A*ny unwanted sound or sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying. The State Noise Control Act defines noise as "...excessive undesirable sound...".

Percent Noise Levels: See L(n).

Sound Level (Noise Level): The weighted sound pressure level obtained by use of a sound level meter having a standard frequency-filter for attenuating part of the sound spectrum.

Sound Level Meter: An instrument, including a microphone, an amplifier, an output meter, and frequency weighting networks for the measurement and determination of noise and sound levels.

Single Event Noise Exposure Level (SENEL): The dB(A) level which, if it lasted for one second, would produce the same A-weighted sound energy as the actual event.

Appendix B

Short Term Noise Measurement

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Simi Valley, CA 93065

15-Minute Continuous Noise Measurement Datasheet

Project: Andaz Resort
Site Address/Location: 6114 N Scottsdale Rd, Scottsdale, AZ
Date: 9/15/2021
Field Tech/Engineer: Francisco Irrarazabal

Site Observations: Clear sky, measurement was performed within 5-feet of existing property line walls and/or in locations away from reflective surfaces, where feasible. Ambient noise consisted of traffic. Amplified noise from a nearby school could be heard occasionally.

General Location:
Sound Meter: Piccolo II **SN:** P0220030907
Settings: A-weighted, slow, 1-sec, 15-minute interval
Meteorological Con.: 105 degrees F, 2 to 5 mph wind, eastern direction
Site ID: ST-1 and ST-2

Site Topo: Flat
Ground Type: Hard site conditions, reflective

Noise Source(s) w/ Distance:
1 - Albers Lawn

Figure 1: Monitoring Locations

Figure 2: ST-1 Photo

Figure 3: ST-2 Photo

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15-Minute Continuous Noise Measurement Datasheet - Cont.

Project: Andaz Resort
Site Address/Location: 6114 N Scottsdale Rd, Scottsdale, AZ
Site ID: ST-1 and ST-2

Table 1: Baseline Noise Measurement Summary

Location	Start	Stop	Leq	Lmax	Lmin	L2	L8	L25	L50	L90
1	3:09 PM	3:24 PM	51.5	65.1	40.6	58.6	55.7	52.1	48.0	42.9
2	3:05 PM	3:20 PM	45.8	65.8	37	53.2	47.4	44.2	42.4	39.2

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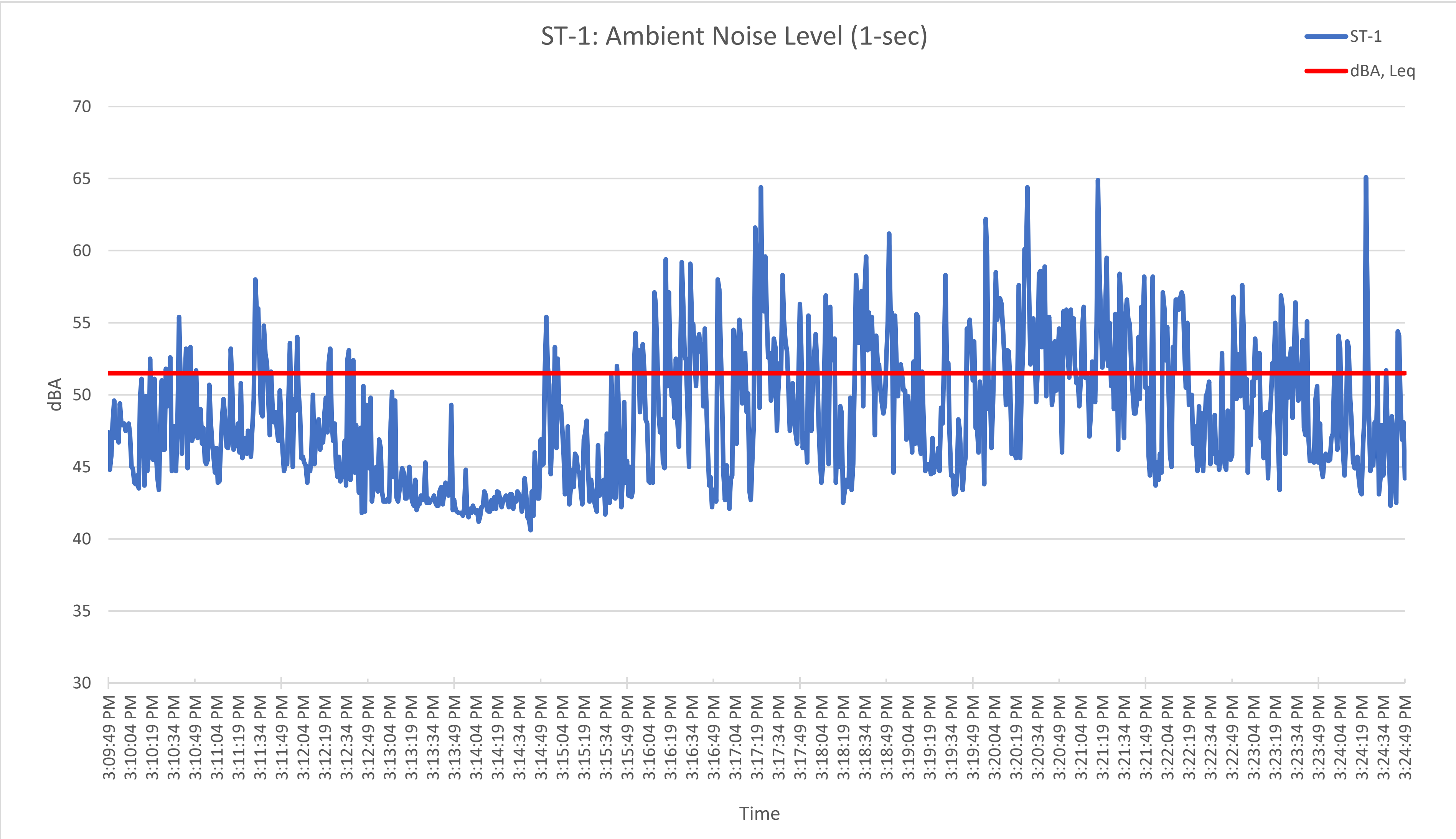
15-Minute Continuous Noise Measurement Datasheet - Cont.

Project: Andaz Resort
Site Address/Location: 6114 N Scottsdale Rd, Scottsdale, AZ
Site ID: ST-1



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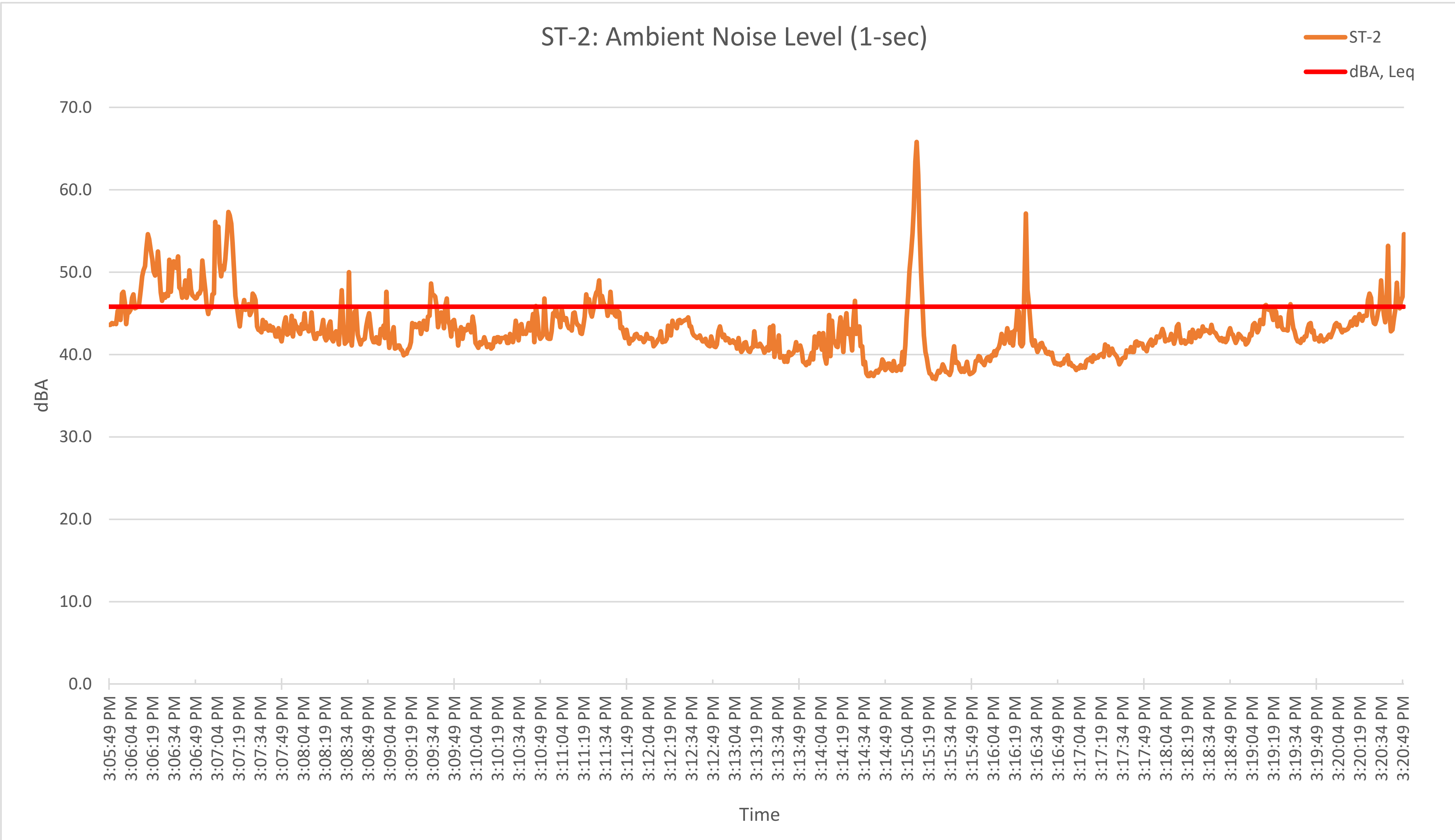
15-Minute Continuous Noise Measurement Datasheet - Cont.

Project: Andaz Resort
Site Address/Location: 6114 N Scottsdale Rd, Scottsdale, AZ
Site ID: ST-2



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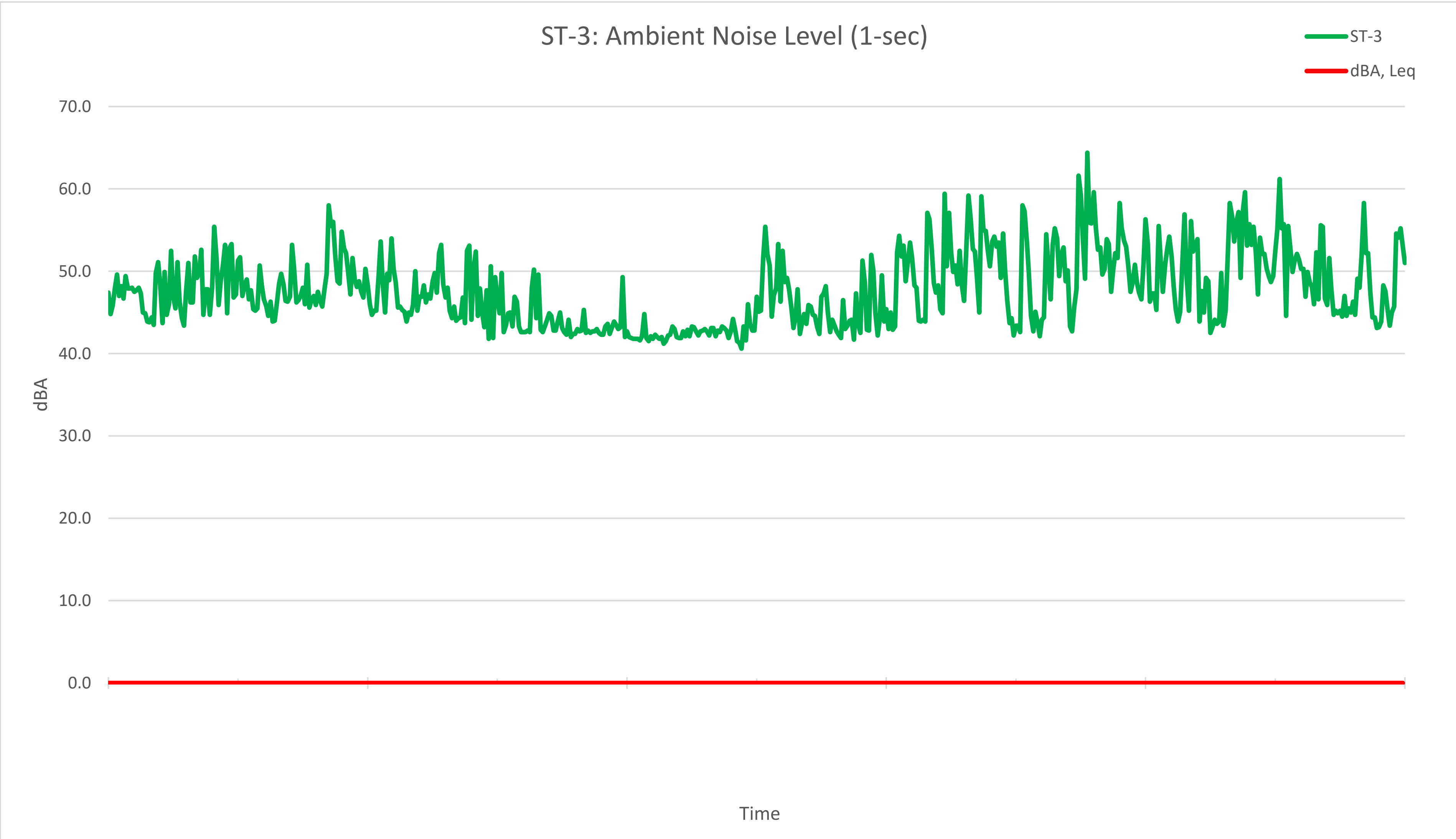
10-Minute Continuous Noise Measurement Datasheet - Cont.

Project: Andaz Resort
Site Address/Location: 6114 N Scottsdale Rd, Scottsdale, AZ
Site ID: ST-3



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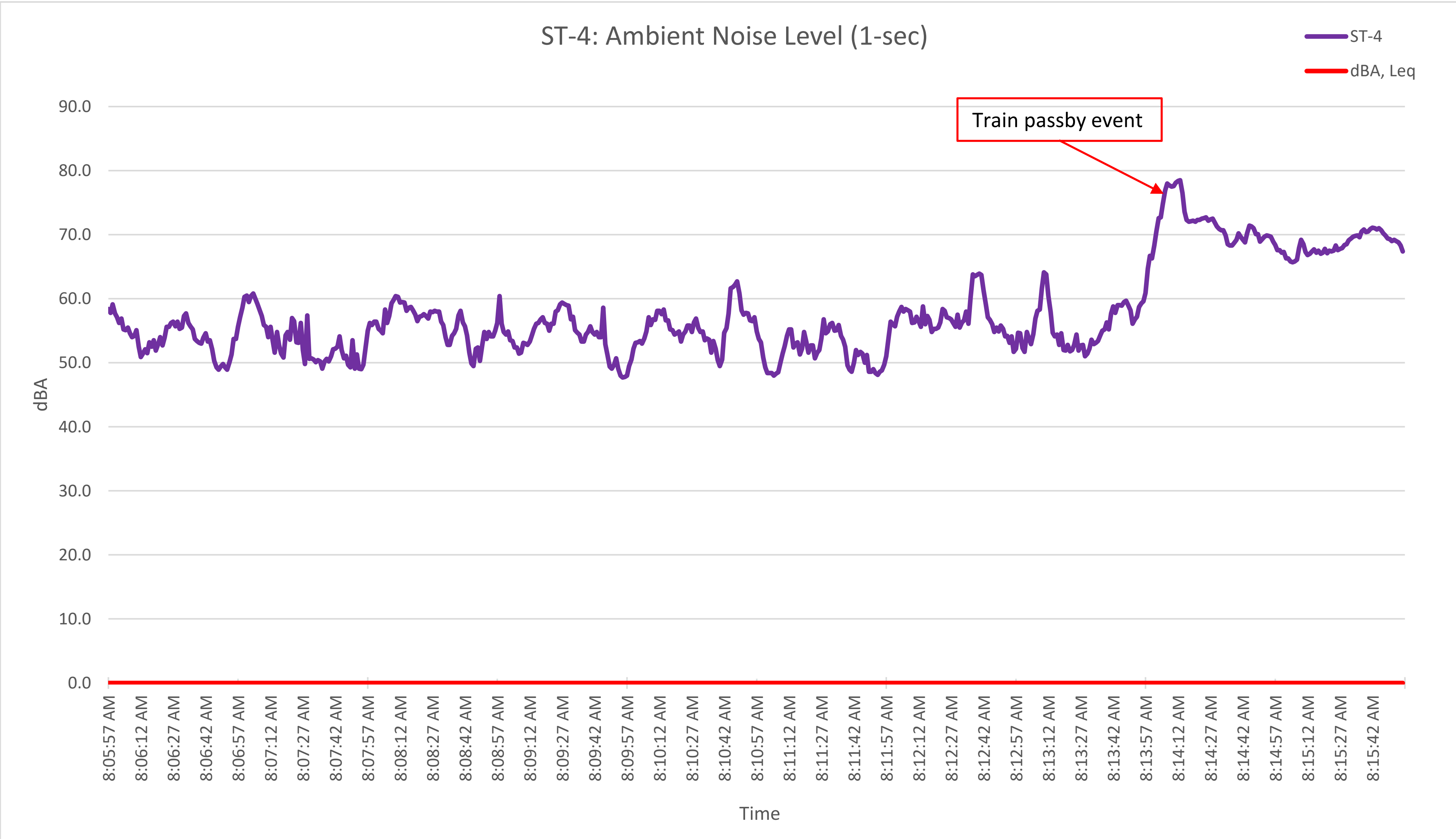
10-Minute Continuous Noise Measurement Datasheet - Cont.

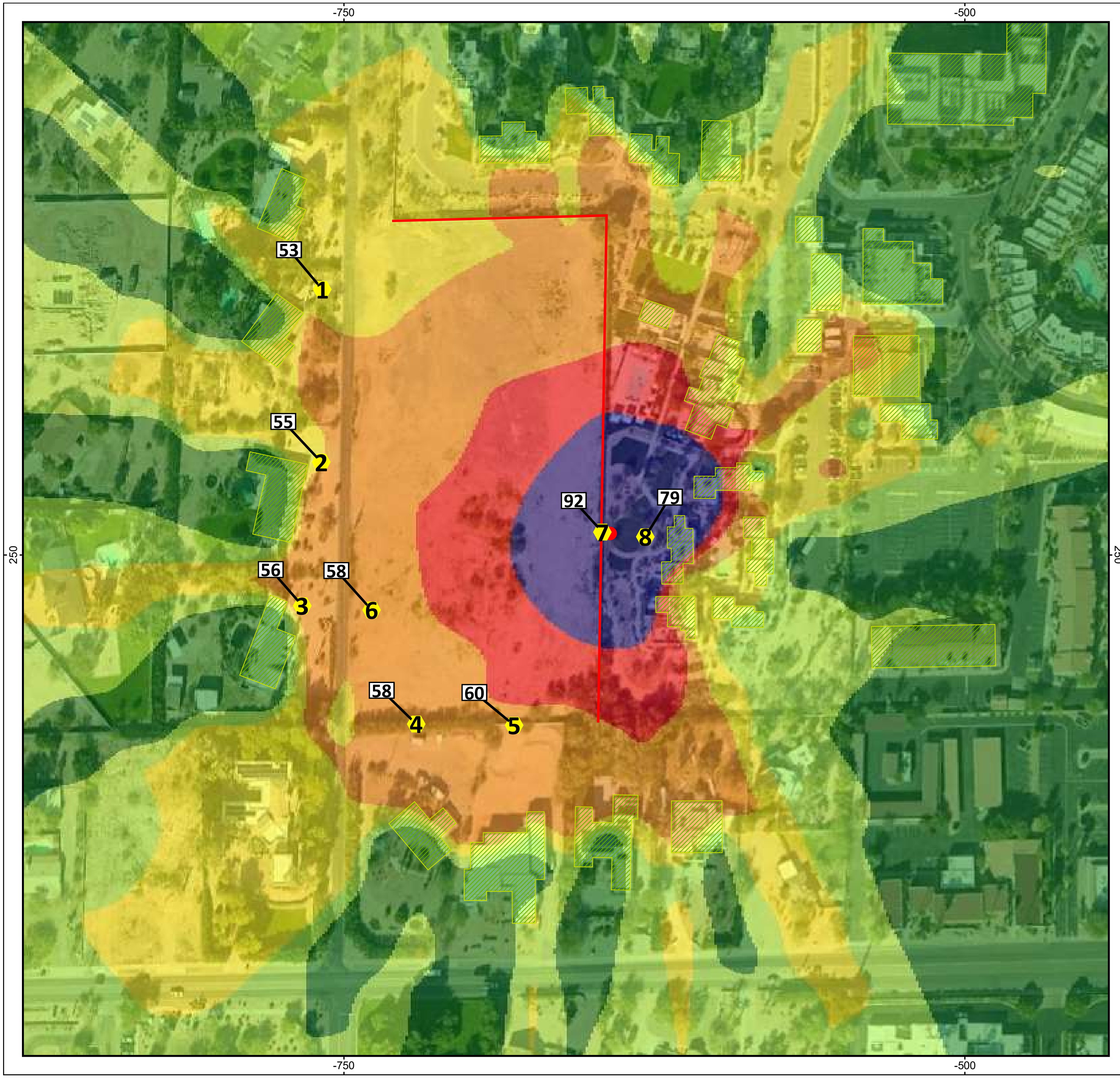
Project: Andaz Resort
Site Address/Location: 6114 N Scottsdale Rd, Scottsdale, AZ
Site ID: ST-4



Appendix C

Operational Worst Case

Noise Level and Contours



08392101_Andaz Resort
Noise Level Contours
Albers Lawn

Existing Condition/Baseline

Levels in dB(A)

Dark green	< 45
Light green	45 - 50
Yellow	50 - 55
Orange	55 - 60
Red	60 - 65
Blue	>= 65

Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall

Length scale 1:130

0 50 100 200 300 feet

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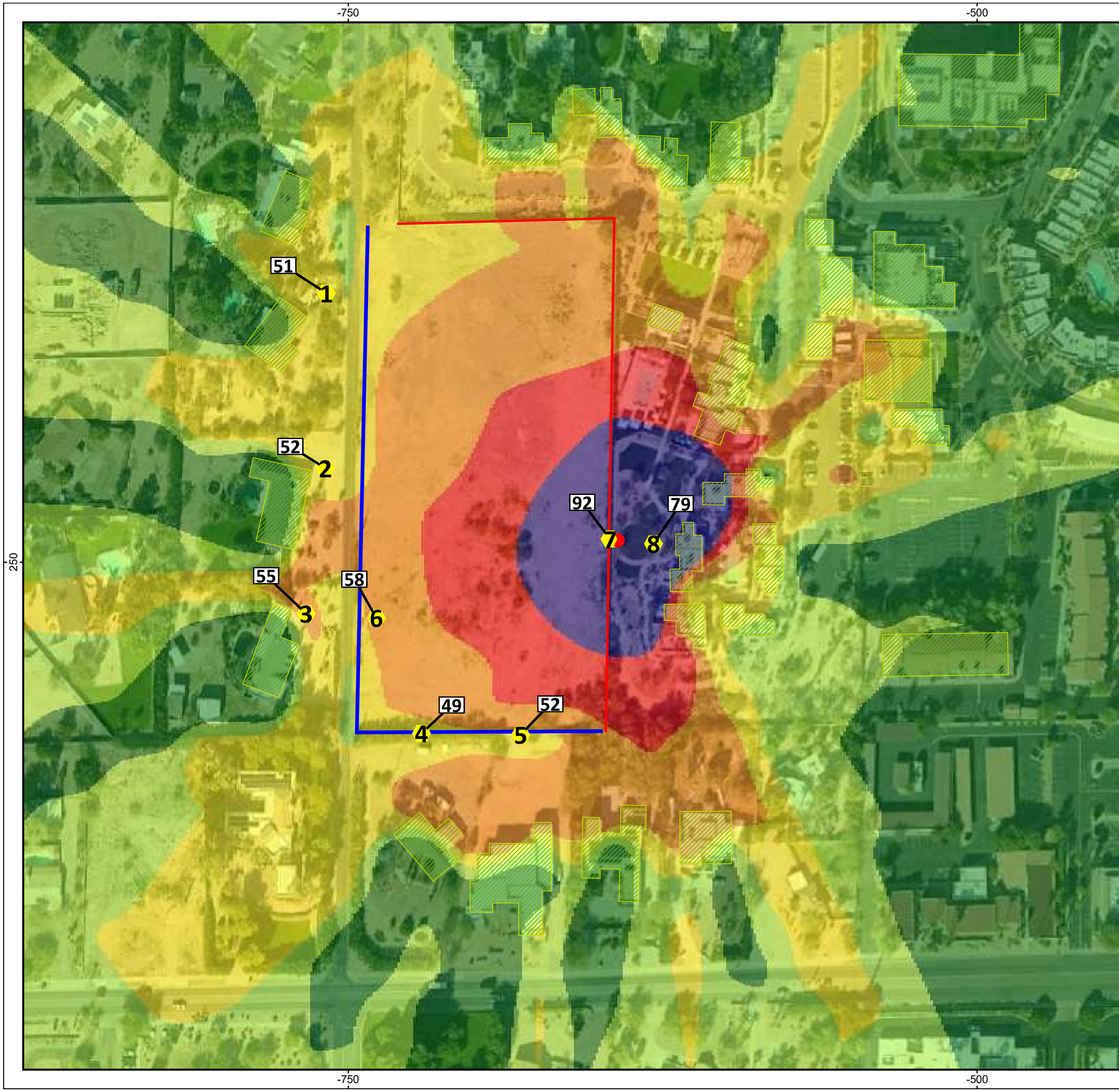

08392101_Andaz Resort
Noise Level Contours
Albers Lawn

8' Wall

Levels in dB(A)

	<	45
45	-	50
50	-	55
55	-	60
60	-	65
	>=	65

Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall
- Proposed 8' Wall

Length scale 1:130

0 50 100 200 300 feet

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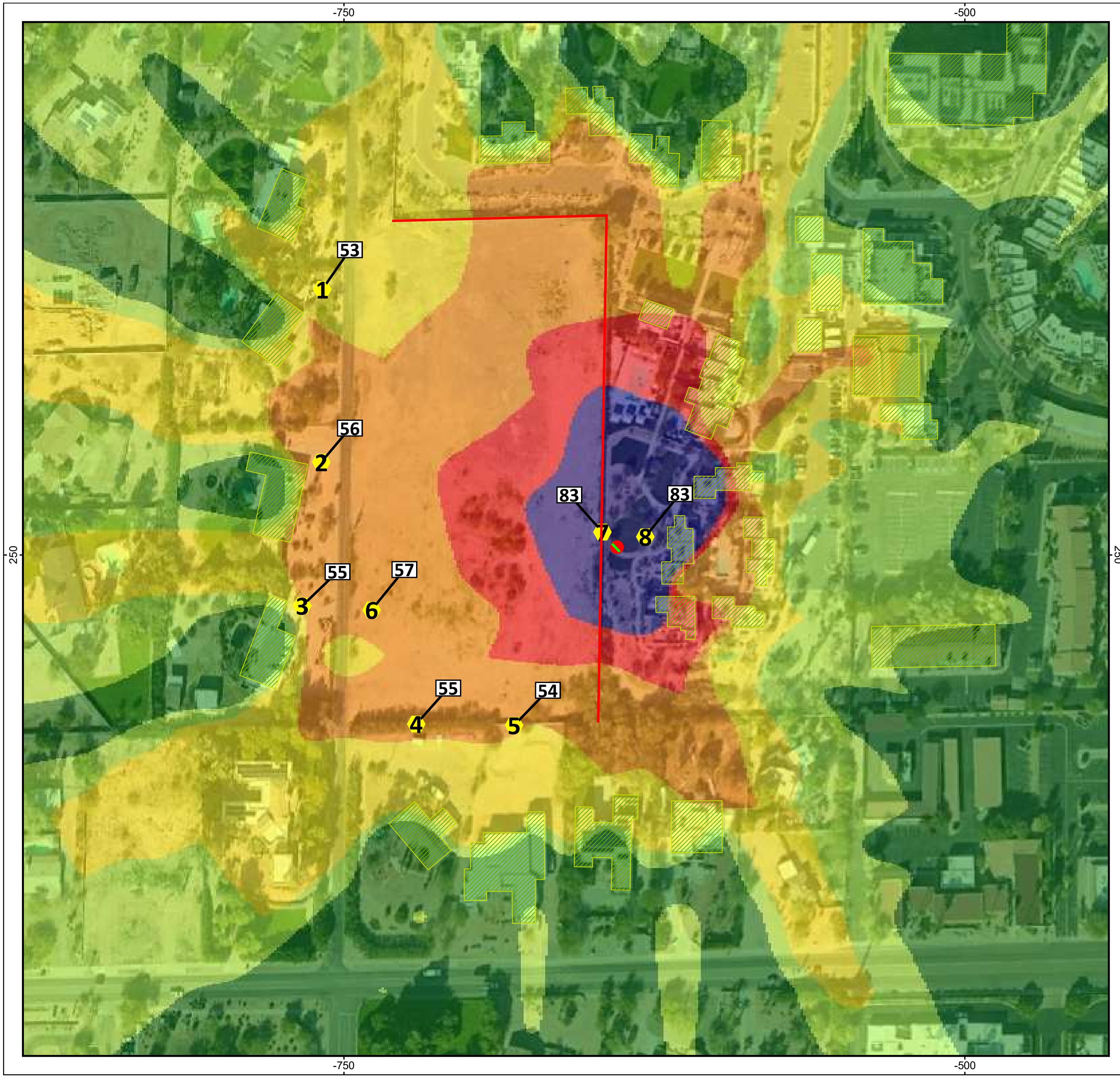
08392101_Andaz Resort
Noise Level Contours
Albers Lawn

7' Feature Wall



Levels in dB(A)

	< 45
	45 - 50
	50 - 55
	55 - 60
	60 - 65
	>= 65

Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall
- Proposed 7' Feature Wall

Length scale 1:130

0 50 100 200 300 feet

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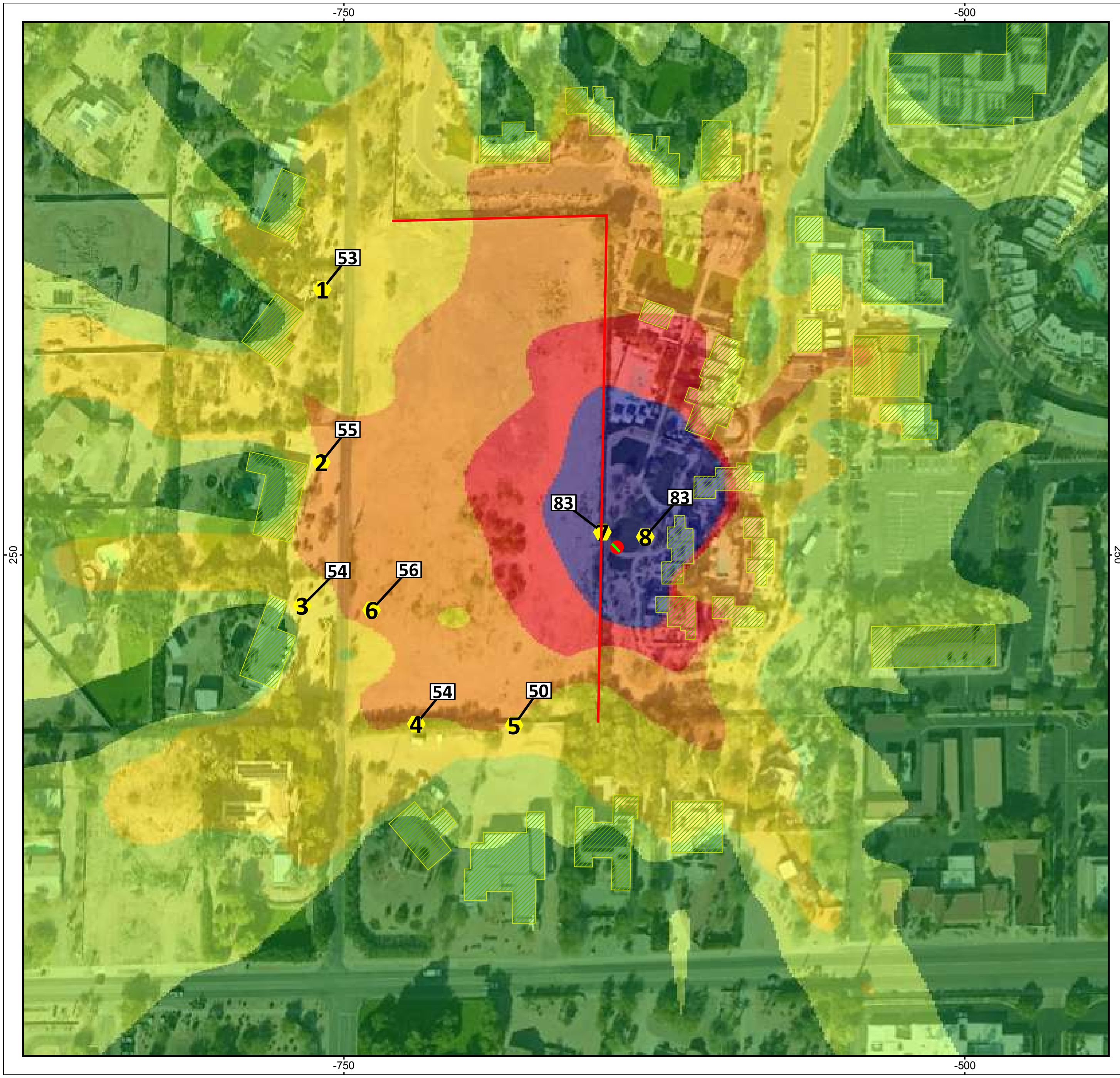


08392101_Andaz Resort
Noise Level Contours
Albers Lawn

10' Feature Wall

Levels in dB(A)

	< 45
	45 - 50
	50 - 55
	55 - 60
	60 - 65
	>= 65

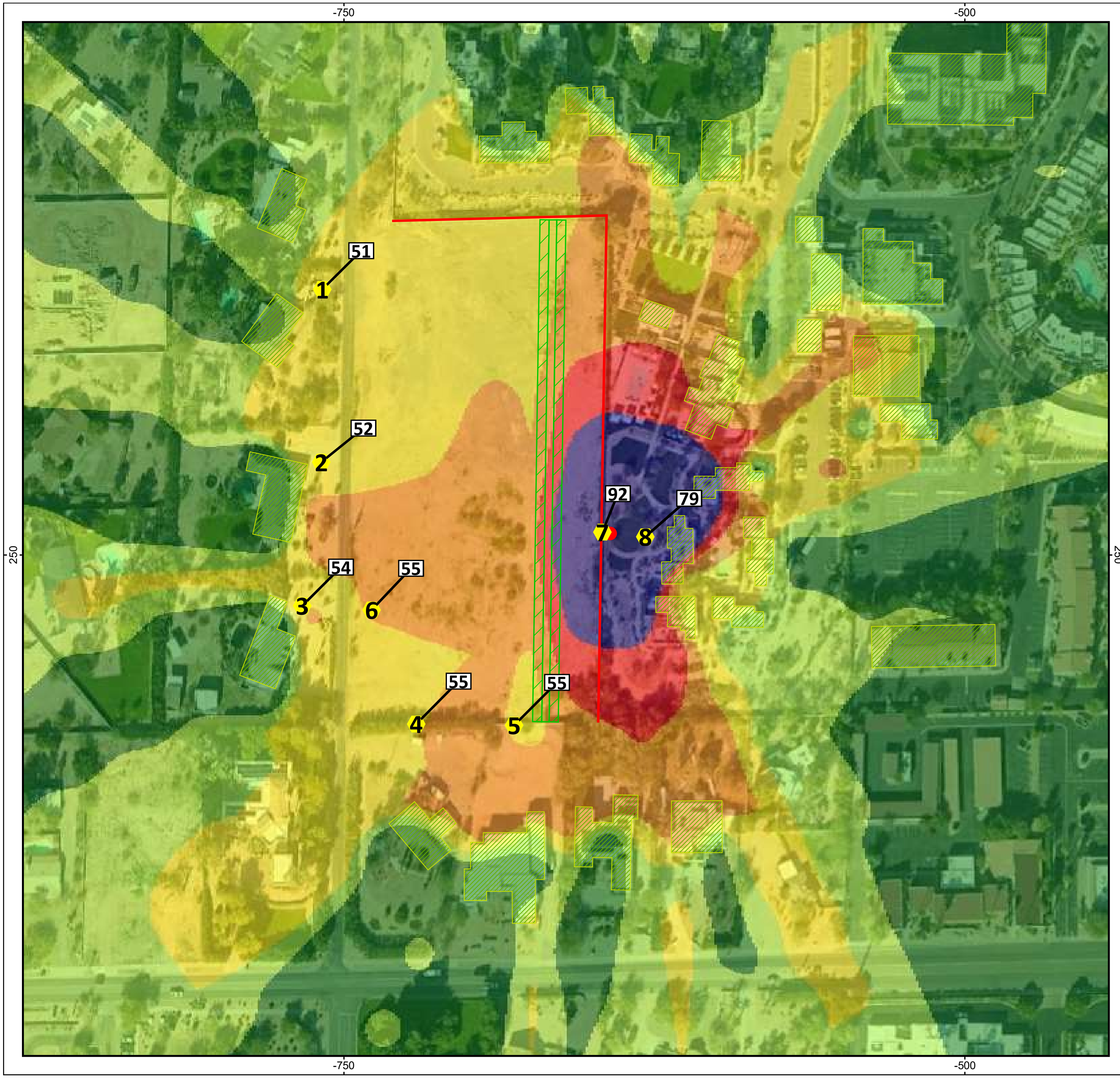
Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall
- Proposed 10' Feature Wall

Length scale 1:130

0 50 100 200 300 feet

MD ACOUSTICS
Sound Solutions for Planning and Design



08392101_Andaz Resort
Noise Level Contours
Albers Lawn

12' Berm

Levels in dB(A)

	< 45
	45 - 50
	50 - 55
	55 - 60
	60 - 65
	>= 65

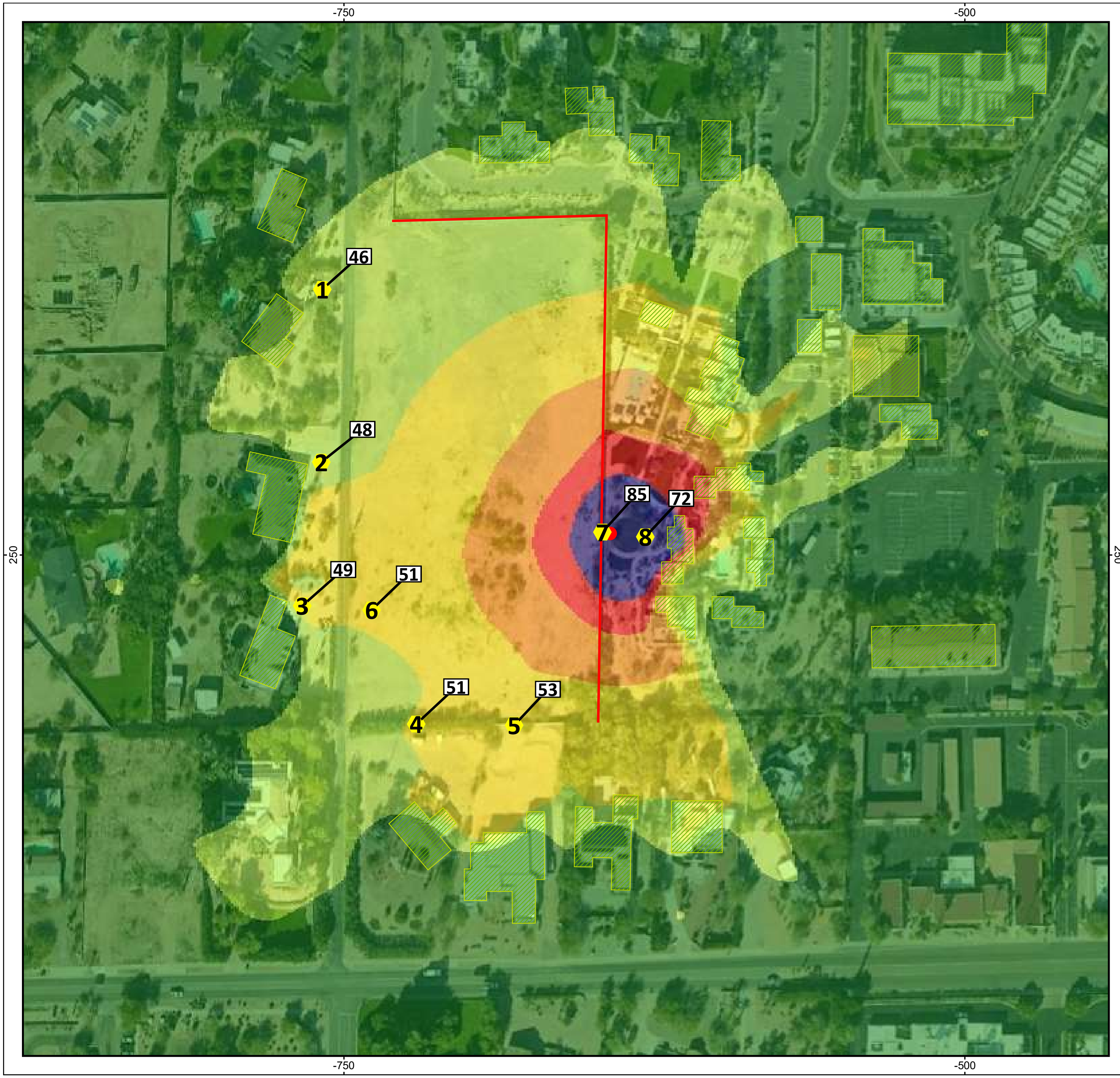
Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall
- 12' Berm

Length scale 1:130

0 50 100 200 300 feet

MD ACOUSTICS
Sound Solutions for Planning and Design



08392101_Andaz Resort
Noise Level Contours
Albers Lawn

Hard Limit

Levels in dB(A)

	< 45
45	- 50
50	- 55
55	- 60
60	- 65
	>= 65

Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall

Length scale 1:130

0 50 100 200 300 feet

MD ACOUSTICS
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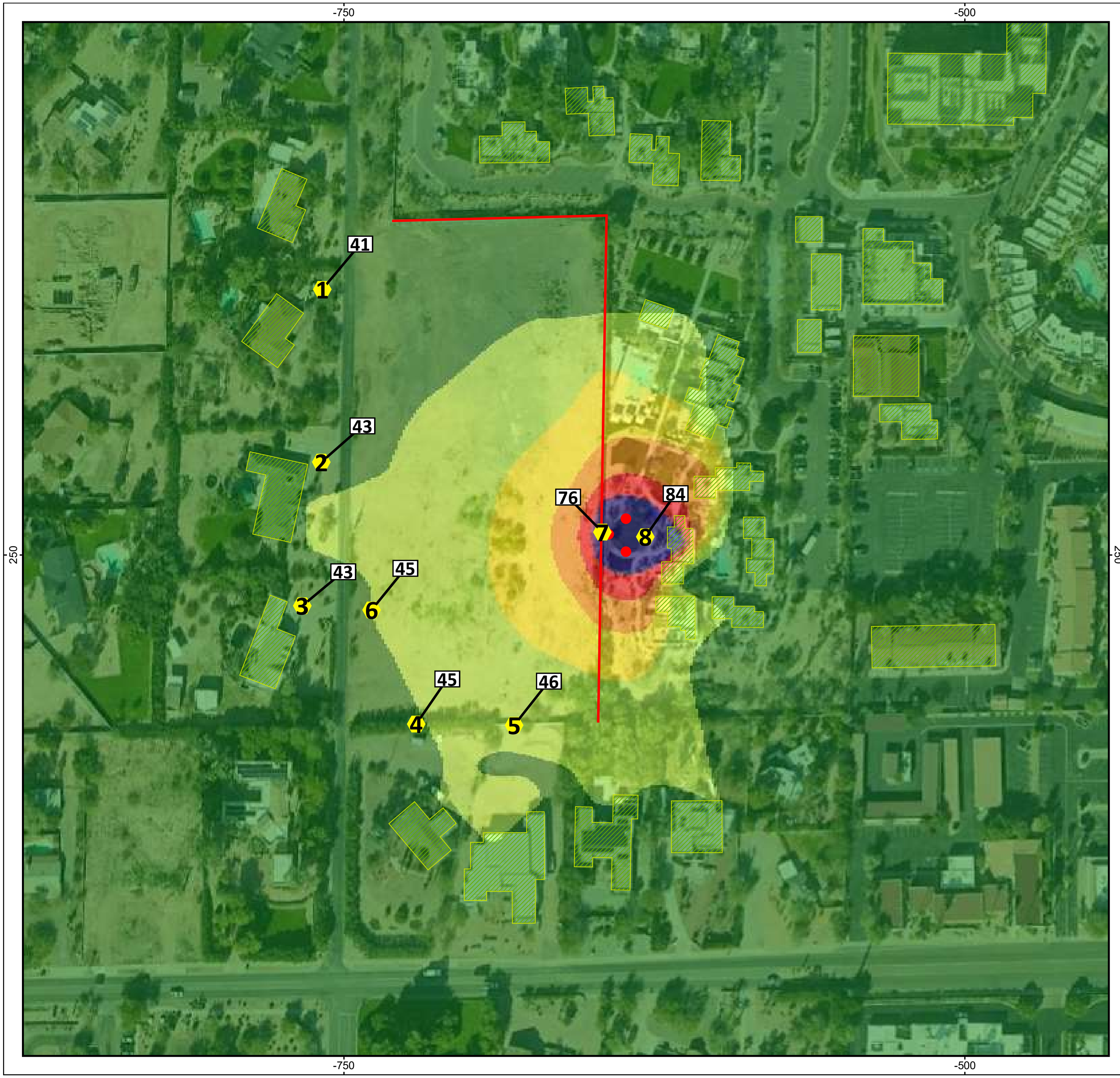
08392101_Andaz Resort
Noise Level Contours
Albers Lawn

Distributed Audio System



Levels in dB(A)

	< 45
	45 - 50
	50 - 55
	55 - 60
	60 - 65
	>= 65

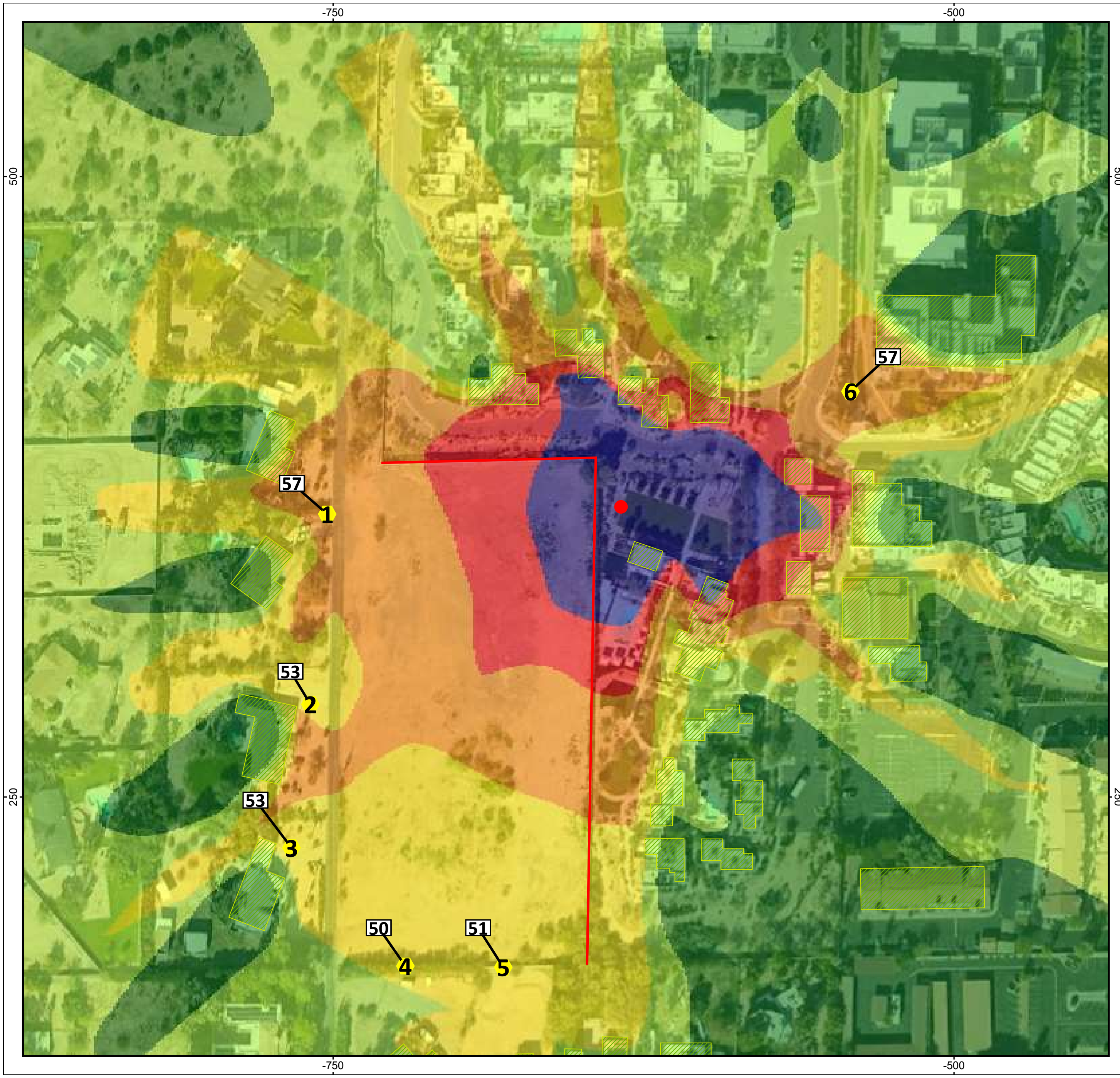
Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall

Length scale 1:130

0 50 100 200 300 feet

MD ACOUSTICS
Sound Solutions for Planning and Design



08392101_Andaz Resort
Noise Level Contours
Cholla Lawn

Existing Condition/Baseline

Levels in dB(A)

	< 45
	45 - 50
	50 - 55
	55 - 60
	60 - 65
	>= 65

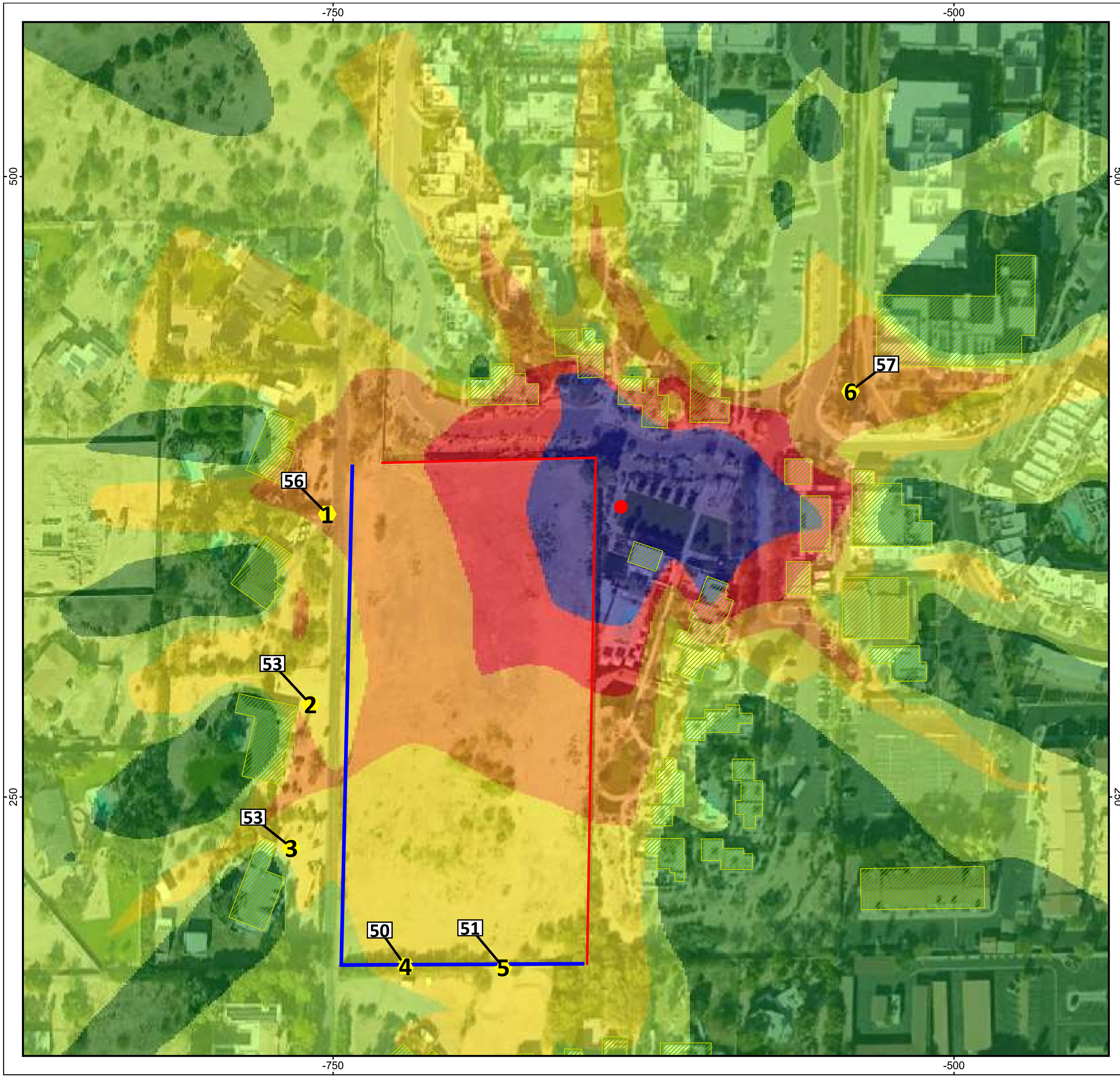
Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall

Length scale 1:130

0 50 100 200 300 feet

MD ACOUSTICS
Sound Solutions for Planning and Design



08392101_Andaz Resort
Noise Level Contours
Cholla Lawn

8' Wall

Levels in dB(A)

	<	45
45	-	50
50	-	55
55	-	60
60	-	65
	>=	65

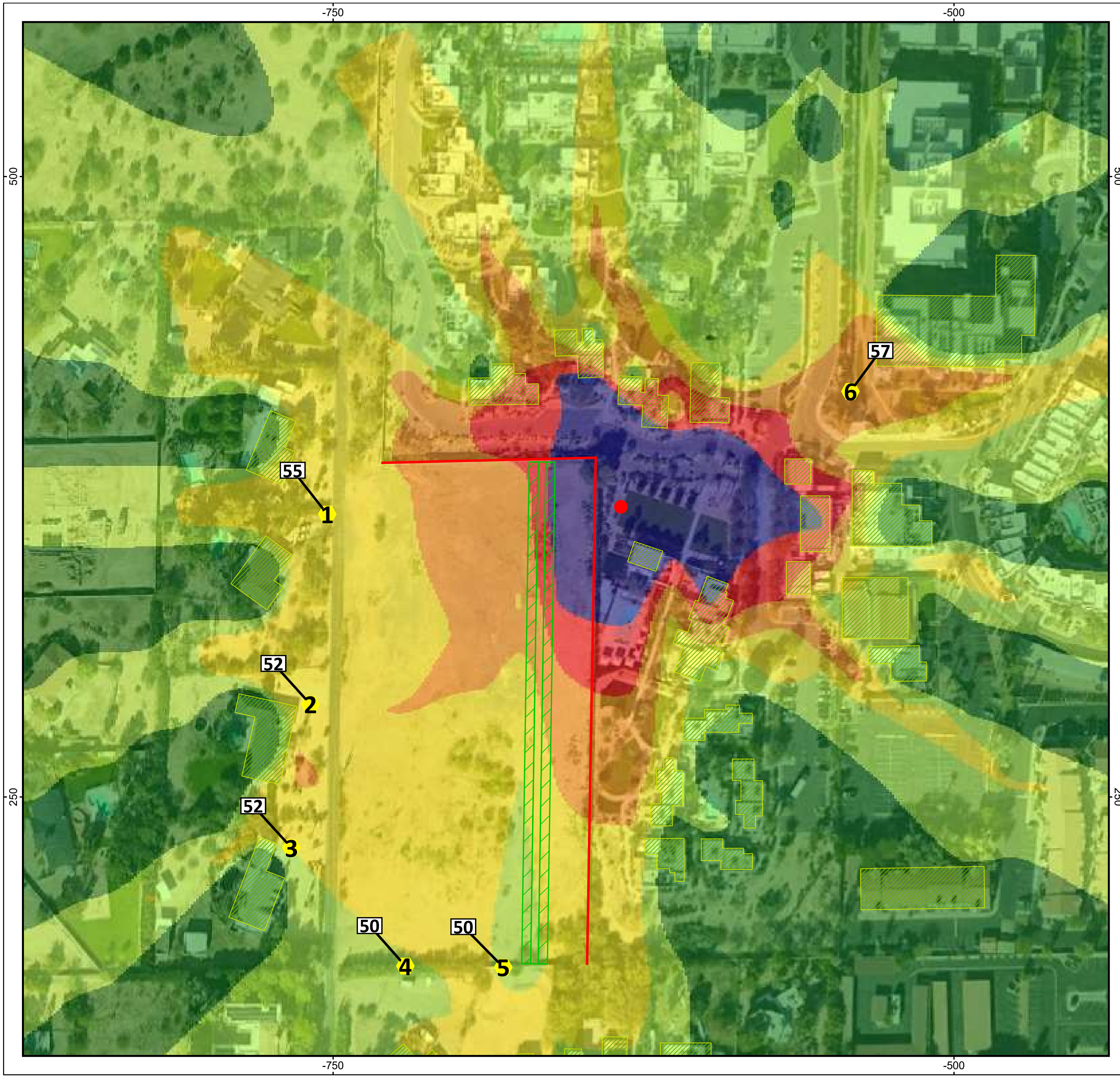
Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall
- Proposed 8' Wall

Length scale 1:130

0 50 100 200 300 feet

MD ACOUSTICS
Sound Solutions for Planning and Design



08392101_Andaz Resort
Noise Level Contours
Cholla Lawn

12' Berm

Levels in dB(A)

	< 45
45	- 50
50	- 55
55	- 60
60	- 65
	>= 65

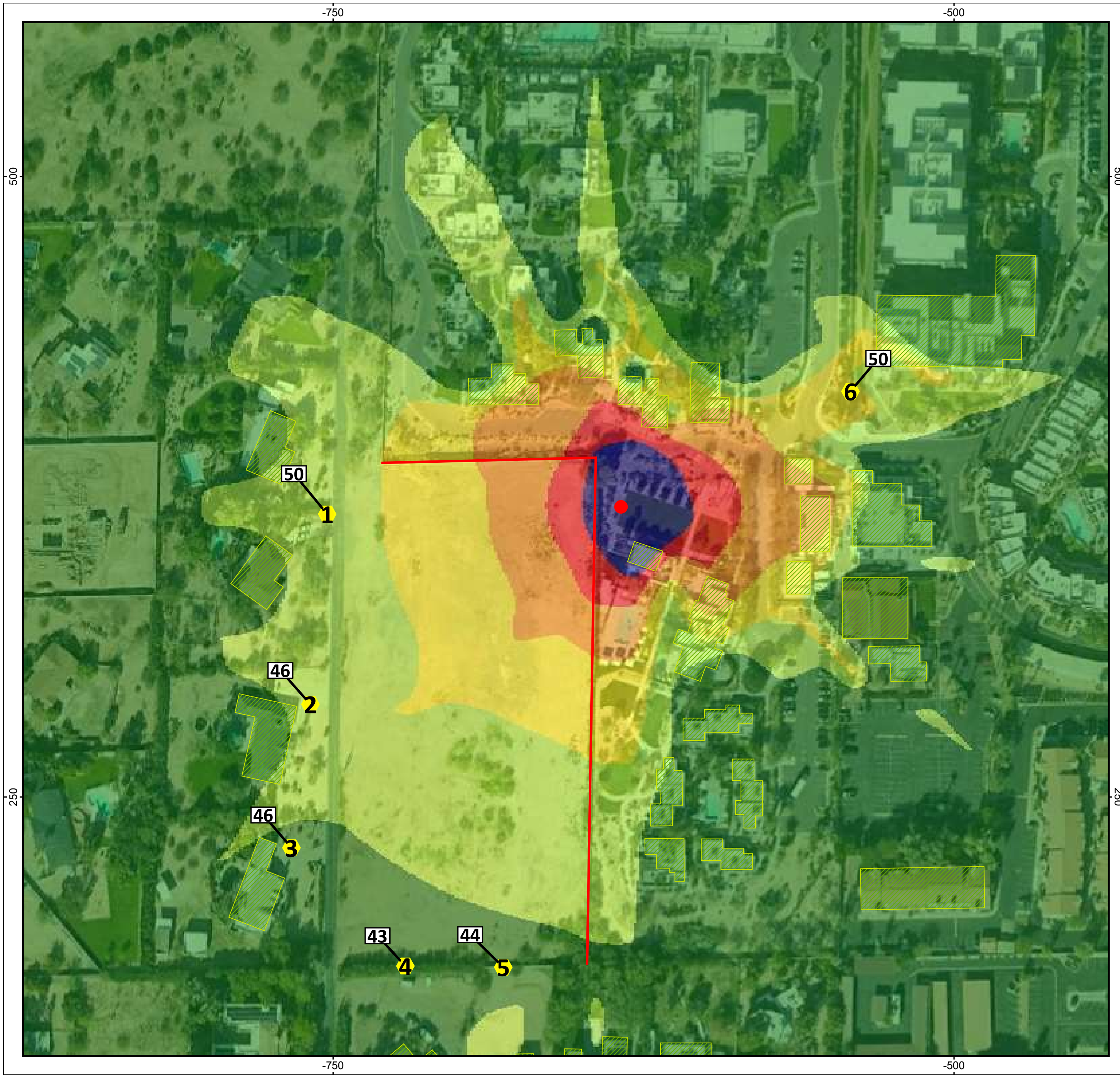
Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall
- Berm

Length scale 1:130

0 50 100 200 300 feet

MD ACOUSTICS
Sound Solutions for Planning and Design



08392101_Andaz Resort
Noise Level Contours
Cholla Lawn

Hard Limit

Levels in dB(A)

dark green	< 45
light green	45 - 50
yellow	50 - 55
orange	55 - 60
red	60 - 65
dark blue	>= 65

Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall

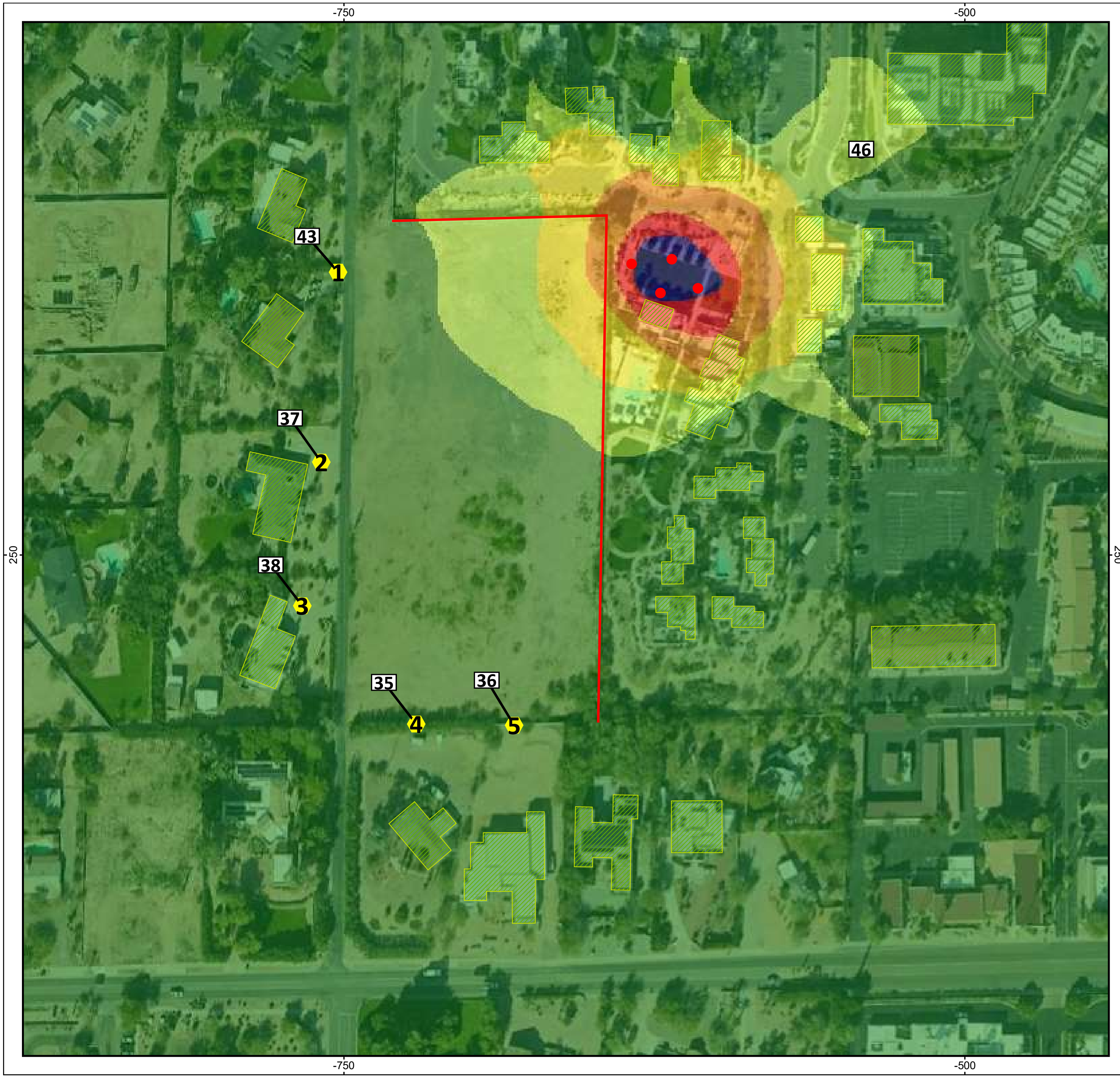
Length scale 1:130

0 50 100 200 300 feet

MD ACOUSTICS
Sound Solutions for Planning and Design

08392101_Andaz Resort
Noise Level Contours
Cholla Lawn

Distributed Audio System



Levels in dB(A)

	< 45
45	- 50
50	- 55
55	- 60
60	- 65
	>= 65

Signs and symbols

- Level table, dBA
- Point Receiver
- Point Source (Speaker)
- Buildings
- 5ft Existing Wall

Length scale 1:130

0 50 100 200 300 feet

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