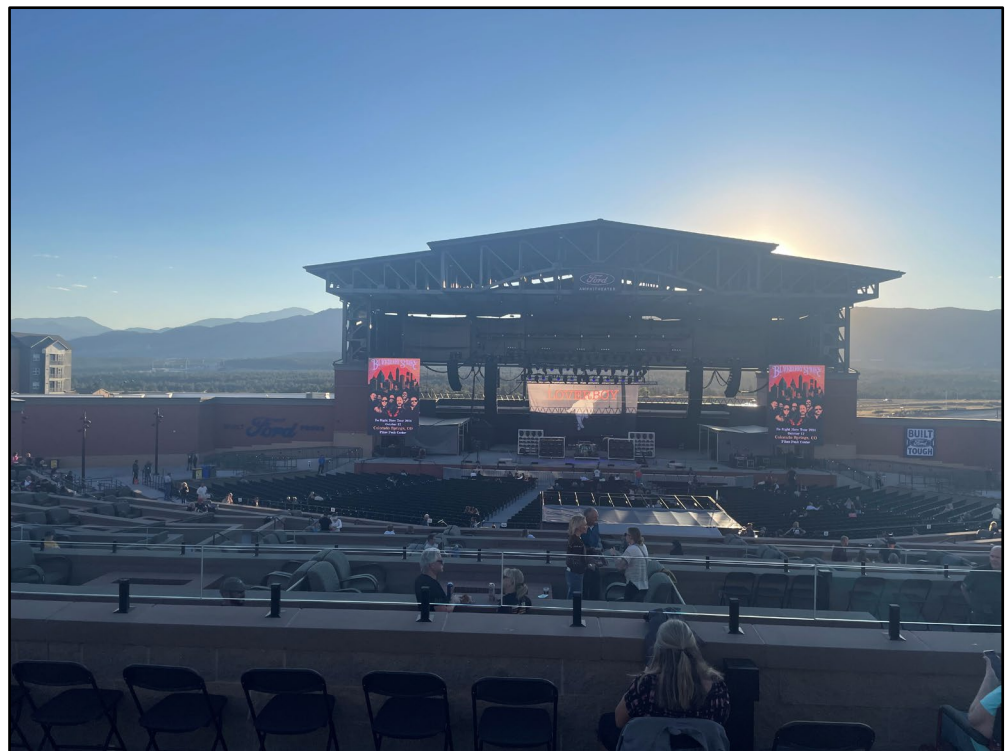


2024 Concert Sound Level Measurements

Ford Amphitheater – Colorado Springs

October 31, 2024



Prepared for:

City of Colorado Springs, Colorado

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Executive Summary

This report describes the results of sound level measurements conducted by Hankard Environmental, Inc. staff during three concerts at the Ford Amphitheater (Facility) in Colorado Springs, Colorado in October 2024. The measurements were conducted at the request of the City of Colorado Springs in response to noise complaints received from nearby community members during previous concerts. The following summarizes the methods and results of the measurement campaign.

- Concert sound levels were measured continuously at the Front of House (FOH) “mix tent” per the requirements of the Development Plan. Sound levels were also measured at anywhere from 10 to 21 locations throughout the surrounding community during each concert.
- Regarding FOH measurements:
 - All 5-minute average sound levels were below the 105 dBA limit for all three concerts.
 - Maximum overall sound levels were compliant with the limit of not exceeding 110 dBA more than once during any 5-minute period.
 - Maximum levels did not exceed 110 dBA at all during the Foreigner concert.
 - During the Ivan Cornejo and Godsmack concerts, maximum levels exceeded the 110 dBA limit, but not more than once during any 5-minute period and were thus compliant.
 - 5-minute average sound levels in the 20 to 80 Hertz one-third octave bands were below the 115 dB limit at all times during all concerts.
 - The maximum sound levels in the 20 to 80 Hertz one-third octave bands were below the 125 dB limit during both the Foreigner and Ivan Cornejo concerts at all times. During the Godsmack concert, maximum levels in the 40 Hertz one-third octave band exceeded 125 dB on five occasions, including two instances during a single 5-minute period. This is the only exceedance of any limit and is not considered material to the complaints (it is an imperceptible increase) or systemic.
- Regarding the community measurements:
 - Over the course of all three concerts, measured sound levels in the community that were mostly or completely attributable to the concert ranged from 43 to 60 dBA, with levels during the Godsmack concert being the highest.
 - This does not include the Polaris Junction apartments, which are located directly adjacent to the Facility and were developed with knowledge of the Facility. At these apartments, measured concert sound levels were as high as 70 dBA.
 - During each concert there were locations in the community where the music was clearly audible, locations where traffic noise mostly or entirely drowned out by sound from the concert, and locations where there was a mix of concert sound and

traffic noise. In some cases, these differences were experienced within individual neighborhoods, in that one house might be located on a busy road where traffic noise was dominant, but a few houses away traffic noise was much diminished and the concert clearly audible.

- Measured concert sound levels in the surrounding community during Foreigner ranged from approximately 43 to 58 dBA. The concert was clearly audible in the neighborhoods to the northeast, east, and southeast.
- Measured concert sound levels in the surrounding community during Ivan Cornejo ranged from approximately 46 to 53 dBA. The concert was clearly audible in the neighborhoods to the northeast and audible in neighborhoods to the east and southeast with some interference from traffic drowning out the concert.
- Measured concert sound levels in the surrounding community during the Godsmack concert ranged from approximately 49 to 60 dBA. The concert was clearly audible in neighborhoods to the northeast and east, with some interference from traffic.
- Atmospheric conditions play a significant role in the long-distance propagation of sound. The two most important phenomena are the presence of temperature inversions and wind direction. In general conditions for acoustic measurements for all three concerts were good with light winds and clear skies.
 - Temperature inversions, where warmer air sits atop cooler air, are common in Colorado. Temperature inversions cause sound from a source, in this case the Facility, to bend back down toward the ground, which increases the sound level received at a residence over what would occur without the inversion. Inversions cannot be measured directly by our staff, so we are unsure if they existed during the measurements.
 - Wind direction is also important, with greater sound levels being received downwind (wind blowing from the Facility toward residences).
 - Foreigner: Generally from the west at 1 to 2 miles per hour.
 - Ivan Cornejo: Generally from the north at 1 to 2 miles per hour.
 - Godsmack: Steady wind from the south at 3 to 5 miles per hour.
- Sound level measurements were conducted using Larson Davis model 831 meters that meet Type 1 provisions meters per the American National Standards Institute (ANSI) Standard S1.4, *Specification for Sound Level Meters*. All sound level meters were calibrated on location prior to the measurements using a handheld calibrator that was calibrated by an accredited laboratory within 18 months of use.
- Measurements were taken by Hankard Environmental staff experienced in concert sound level measurements and measurements of a source in the presence of background sound.

1. Introduction

This report describes the results of sound level measurements conducted by Hankard Environmental during three concerts at the Ford Amphitheater (Facility) in Colorado Springs, Colorado in October 2024. The measurements were conducted at the request of the City of Colorado Springs in response to noise complaints received during previous concerts. The Facility is located on the north side of Colorado Springs, as shown in Figure 1-1.

The following report sections describe the sound level requirements for the Facility, and the procedures and results of sound level measurements during each of the three concerts studied.

Figure 1-2 shows a photograph looking out from the stage. Figure 1-3 shows a typical community sound level measurement setup.

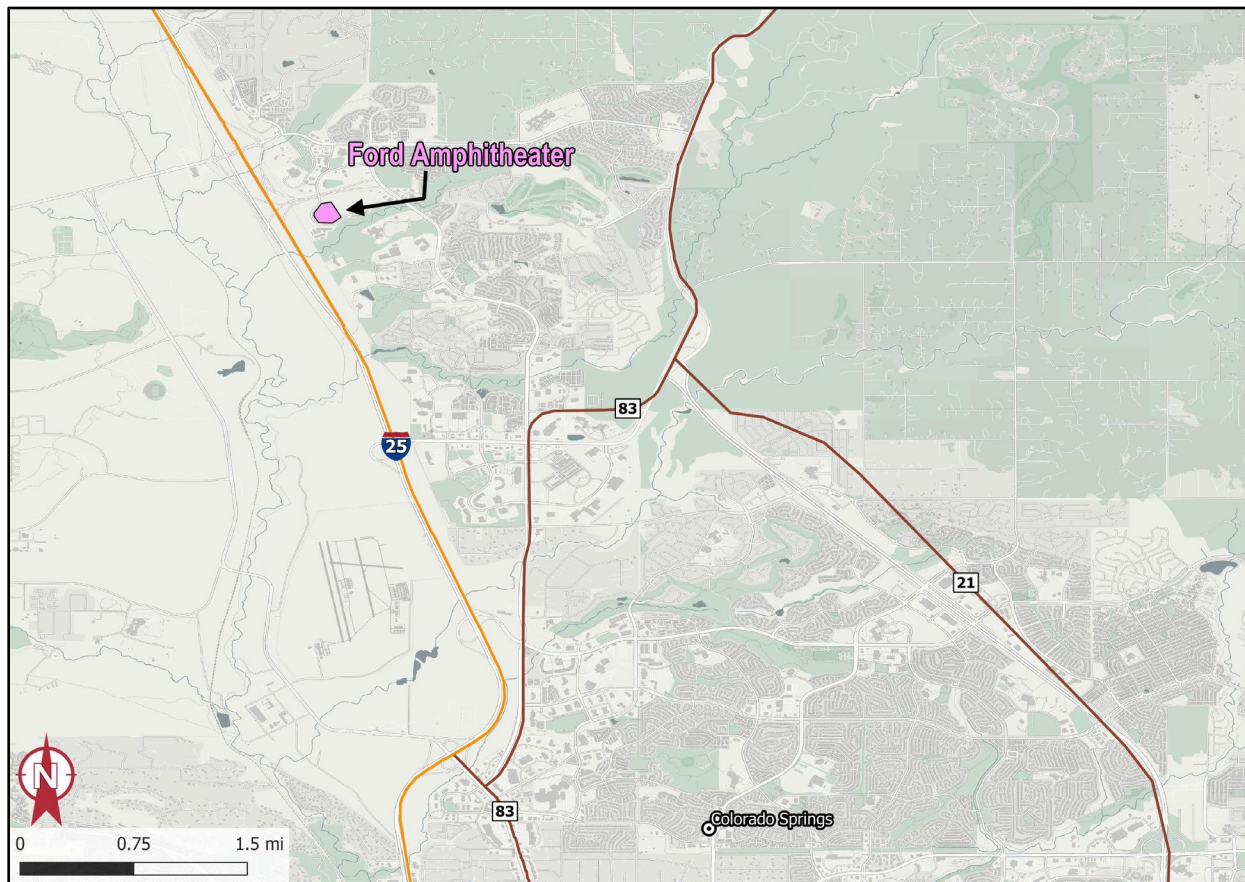


Figure 1-1. General Location of the Ford Amphitheater

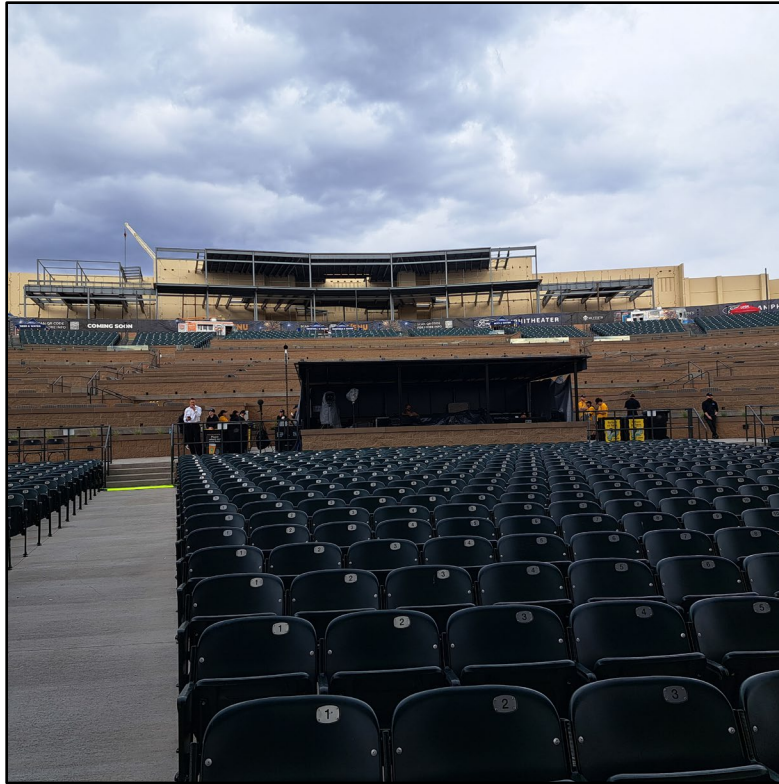


Figure 1-2. Photograph Looking Out from Stage



Figure 1-3. Typical Community Sound Level Measurement Setup

2. Development Plan Sound Level Limits

Sound levels generated during concerts are subject to the limits described in the Facility's Development Plan, which are listed in Table 2-1, below. All levels are as measured at the Front of House (FOH) "mix tent".

Table 2-1. Development Plan Sound Level Limits

Sound Level Metric	Details	Limit
Average overall sound level	5-minute equivalent level (L_{eq})	105 dBA
Maximum overall sound level	Instantaneous maximum (no more than one instance per 5-minute period)	110 dBA
Average one-third octave band sound level (20 to 80 Hertz)	5-minute equivalent level (L_{eq})	115 dB
Maximum one-third octave band sound level (20 to 80 Hertz)	Instantaneous maximum (no more than one instance per 5-minute period)	125 dB

3. Sound Level Measurement Results – Foreigner Concert

Sound levels were monitored during the October 2, 2024 Foreigner concert at FOH and at various locations within the community. Table 3-1 lists the results of the FOH measurements, and Figure 3-1 shows the FOH average and maximum sound levels throughout the night. None of the measured levels exceed their respective limits. Table 3-2 lists the results of the community sound level measurements and Figure 3-2 shows where the measurements were taken.

Table 3-1. Measured FOH Sound Levels (Foreigner)

Sound Level Metric	Measured Level	Limit
Average overall sound level	97 dBA (loudest 5-minute average)	105 dBA
Maximum overall sound level	110 dBA	110 dBA
Average 20 Hz one-third octave band	61 dB	115 dB
Average 25 Hz one-third octave band	74 dB	115 dB
Average 31 Hz one-third octave band	94 dB	115 dB
Average 40 Hz one-third octave band	105 dB	115 dB
Average 50 Hz one-third octave band	102 dB	115 dB
Average 63 Hz one-third octave band	101 dB	115 dB
Average 80 Hz one-third octave band	97 dB	115 dB
Maximum 20 Hz one-third octave band	73 dB	125 dB
Maximum 25 Hz one-third octave band	82 dB	125 dB
Maximum 31 Hz one-third octave band	102 dB	125 dB
Maximum 40 Hz one-third octave band	112 dB	125 dB
Maximum 50 Hz one-third octave band	113 dB	125 dB
Maximum 63 Hz one-third octave band	113 dB	125 dB
Maximum 80 Hz one-third octave band	110 dB	125 dB

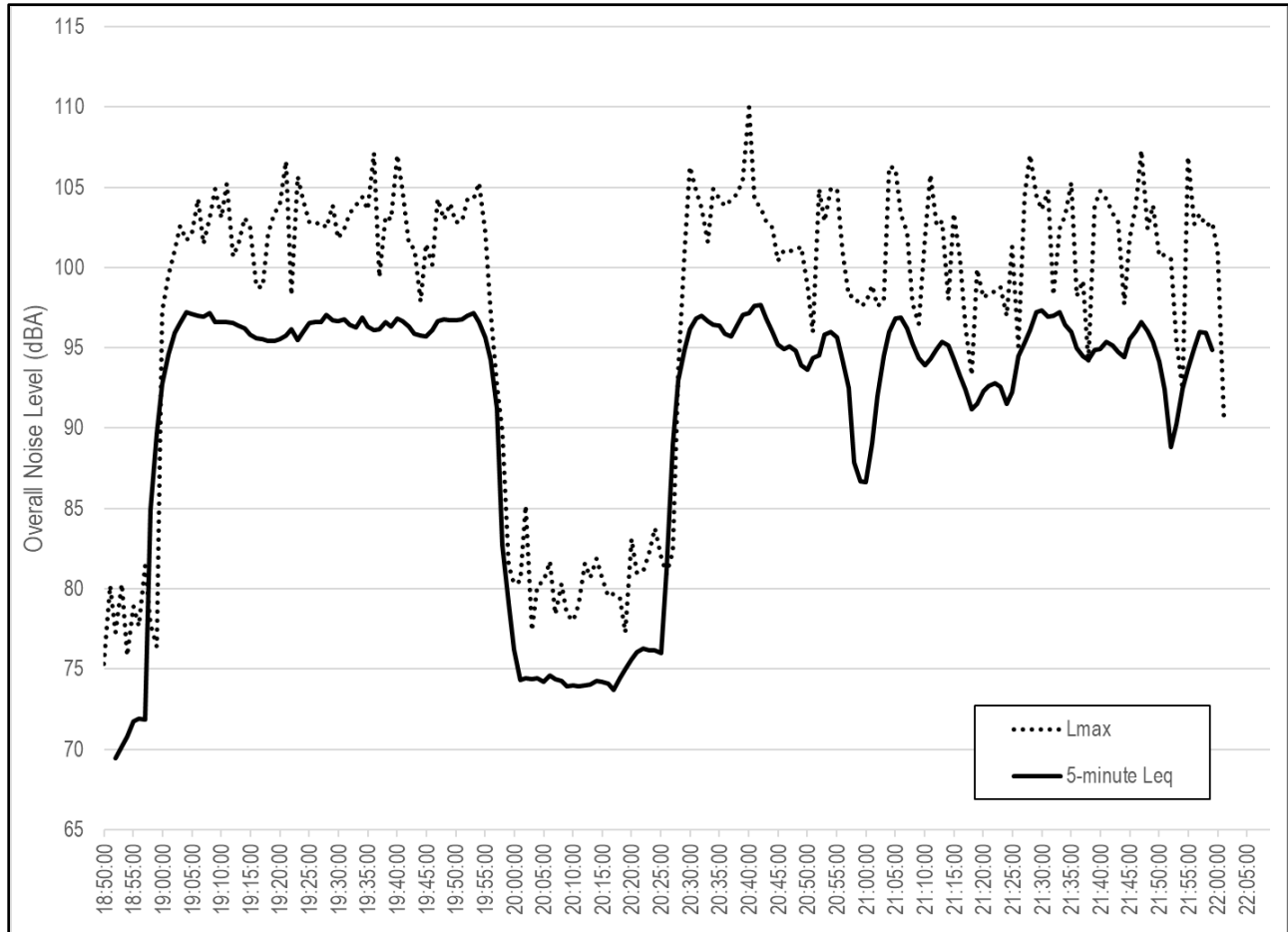


Figure 3-1. Front of House Overall 5-minute L_{eq} and L_{max} (Foreigner)

Table 3-2. Measured Community Sound Levels (Foreigner)

Measurement Location	Location Description	Measurement Start Time	Overall level (dBA)	Audibility
M1	Spectrum Loop and Kaycee Case Place	19:27:00	53	No traffic, concert barely audible
M2	Voyager Parkway and Fox Run Circle	19:32:00	56	All traffic noise, concert not audible
M3	825 Diamond Rim Drive	19:46:00	46	No traffic, concert/vocals clearly audible
M4	1115 Diamond Rim Drive	19:49:00	43	No traffic, concert audible, vocals indistinct
M5	Spectrum Loop and Kaycee Case Place	20:40:00	58	No traffic, concert clearly audible
M6	13250 Northgate Estates Drive	20:47:00	51	Constant traffic noise, concert barely audible
M7	1115 Diamond Rim Drive	20:53:00	42	Concert barely audible, vocals indistinct
M8	825 Diamond Rim Drive	20:56:00	47	Traffic noise from I-25, concert not performing (background noise only)
M8	825 Diamond Rim Drive	20:59:00	50	Traffic noise, concert audible (bass, vocals clearly audible)
M9	7 Spectrum Lane	21:12:00	53	Heavy traffic noise, concert barely audible
M10	12596 Rock Bridge Circle	21:19:00	53	Concert clearly audible over traffic noise (I-25?), bass, vocals, drum very clear
M11	12695 Rock Bridge Circle	21:42:00	60	Heavy traffic noise (I-25?), concert loud and clearly audible, drum solo loud
M12	Stout Road and Voyager Parkway	19:26:40	64	Concert barely audible, fair amount of traffic
M13	Gray Hawk Drive and Spectrum Loop	19:36:00	47	Concert barely audible
M14	Corner of Diamond Rim Drive and Canyon's Edge Drive	19:43:09	46	Concert barely audible, considerable distant traffic noise
M15	Corner of Voyager Parkway and North Gate Boulevard	19:52:01	55	Concert inaudible, lots of traffic noise
M16	Empty lot off of Canyon's Edge Drive	19:58:54	46	Music inaudible (but maybe start of intermission)
M17	Entrance to Progressive Parking Lot (off of roundabout)	20:41:11	51	Concert clearly audible, very little traffic
M18	Thimbleberry Point and Oracle Boulevard	20:45:55	54	Concert clearly audible, but more direct line of sight to I-25 (background traffic noise)
M19	Brookhill Drive Cul-de-sac (near Serenity Drive)	21:03:38	50	Concert moderately audible, some Voyager traffic noise audible
M20	Bella Springs Apartment Office	21:09:54	52	Concert distinctly audible, traffic on Voyager
M21	Polaris Junction Apartments	21:16:33	65	Piano solo - concert fully audible
M21	Polaris Junction Apartments	21:19:25	69	Full band(ish) - concert fully audible

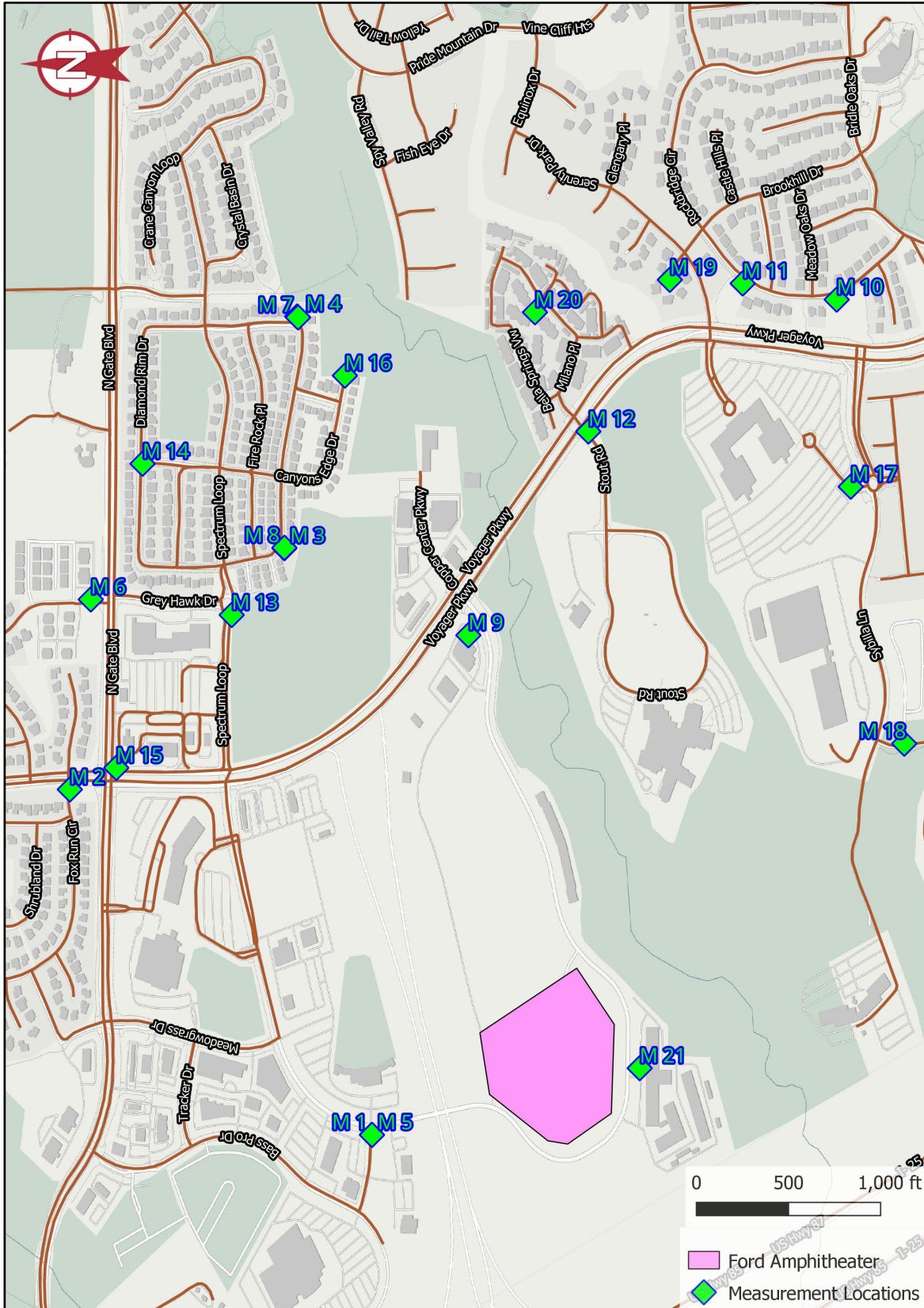


Figure 3-2. Community Sound Level Measurement Locations (Foreigner)

4. Sound Level Measurement Results - Ivan Cornejo Concert

Sound levels were monitored during the October 4, 2024 Ivan Cornejo concert at FOH and at various locations within the community. Table 4-1 lists the results of the FOH measurements, and Figure 4-1 shows the FOH average and maximum sound levels throughout the night. None of the measured levels exceed their respective limits. Table 4-2 lists the results of the community sound level measurements and Figure 4-2 shows where the measurements were taken.

Table 4-1. Measured FOH Sound Levels (Ivan Cornejo)

Sound Level Metric	Measured Level	Limit
Average overall sound level	97 dBA (loudest 5-minute average)	105 dBA
Maximum overall sound level	115 dBA (exceeded 110 dBA three times but not more than once per 5-minute period)	110 dBA
Average 20 Hz one-third octave band	63 dB	115 dB
Average 25 Hz one-third octave band	74 dB	115 dB
Average 31 Hz one-third octave band	99 dB	115 dB
Average 40 Hz one-third octave band	108 dB	115 dB
Average 50 Hz one-third octave band	105 dB	115 dB
Average 63 Hz one-third octave band	106 dB	115 dB
Average 80 Hz one-third octave band	100 dB	115 dB
Maximum 20 Hz one-third octave band	75 dB	125 dB
Maximum 25 Hz one-third octave band	91 dB	125 dB
Maximum 31 Hz one-third octave band	112 dB	125 dB
Maximum 40 Hz one-third octave band	120 dB	125 dB
Maximum 50 Hz one-third octave band	119 dB	125 dB
Maximum 63 Hz one-third octave band	122 dB	125 dB
Maximum 80 Hz one-third octave band	113 dB	125 dB

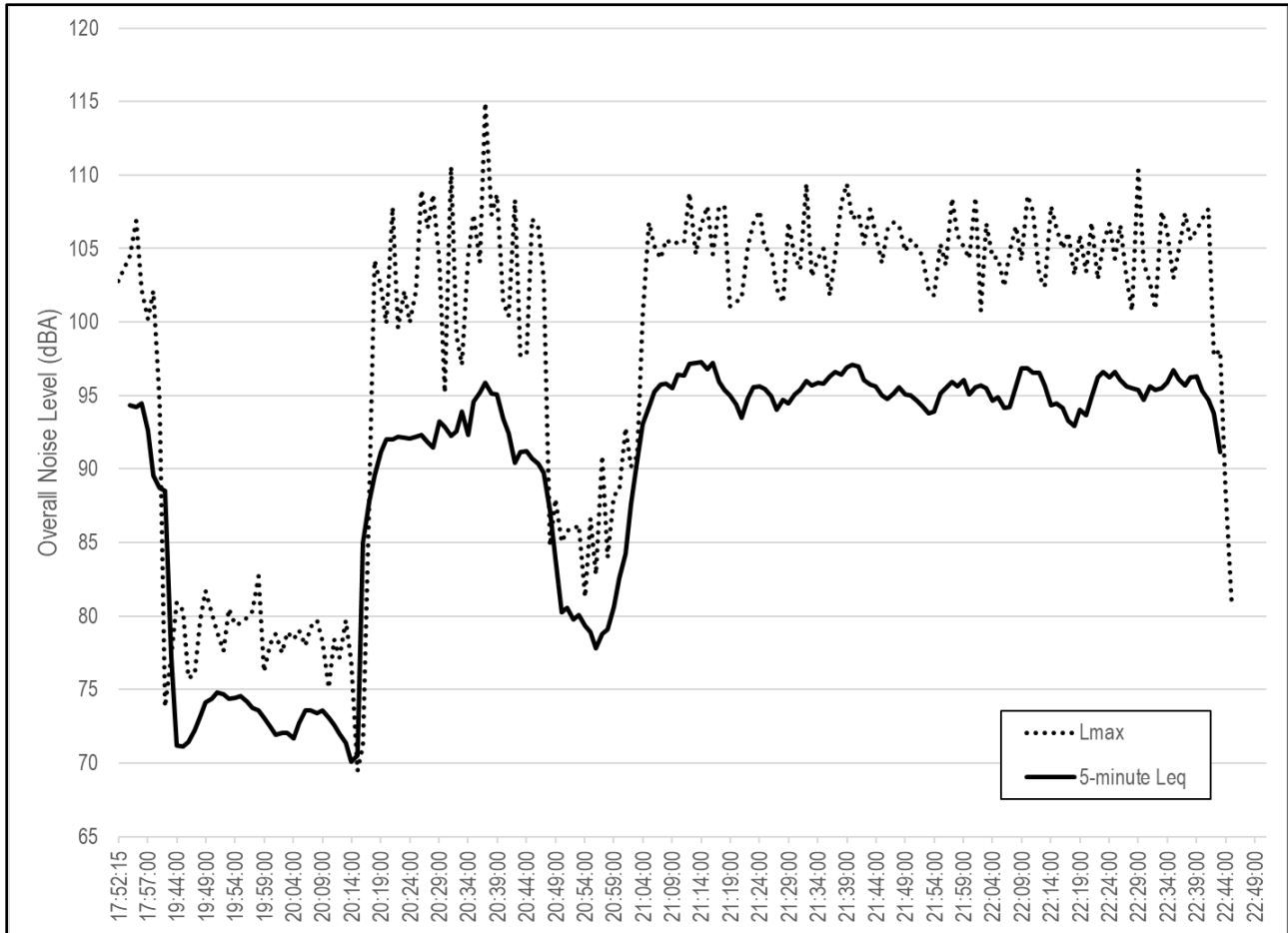


Figure 4-1. Front of House Overall 5-minute L_{eq} and L_{max} (Ivan Conejo)

Table 4-2. Measured Community Sound Levels (Ivan Cornejo)

Measurement Location	Location Description	Measurement Start Time	Overall level (dBA)	Audibility
M1	Wicked Think Marketing - 13520 Northgate Estates Drive	20:33:00	58	Opening act: Traffic on Northgate Boulevard, Concert - vocals clearly audible when no traffic present
M2	825 Diamond Rim Drive	-	-	Traffic noise present, concert inaudible (no sound recorded due to 2 barking dogs)
M3	1115 Diamond Rim Drive	20:57:00	46	Distant traffic, concert inaudible. 13-minute recording - ~8 minutes into recording concert became audible (bass, vocals)
M4	12569 Rockbridge Circle	21:25:57	51	Constant traffic on Voyager Parkway, concert audible but drowned out by traffic
M5	12695 Rockbridge Circle	21:35:56	53	Constant traffic on Voyager Parkway, concert clearly audible (vocals, bass, drums)
M6	Intersection of Voyager Parkway and Serenity Park	20:35:00	mid 50's	Concert barely audible
M7	Sybilla Lane	20:49:43	50	Concert barely audible over traffic
M8	Diamond Rim Drive	21:13:14	53	Concert audible
M9	Canyon's Edge Drive	21:28:07	51	Concert audible (music, bass, vocals, high frequencies audible)
M10	Spy Valley Road and Pride Mountain Drive	21:45:39	50	Concert audible, cheering audible

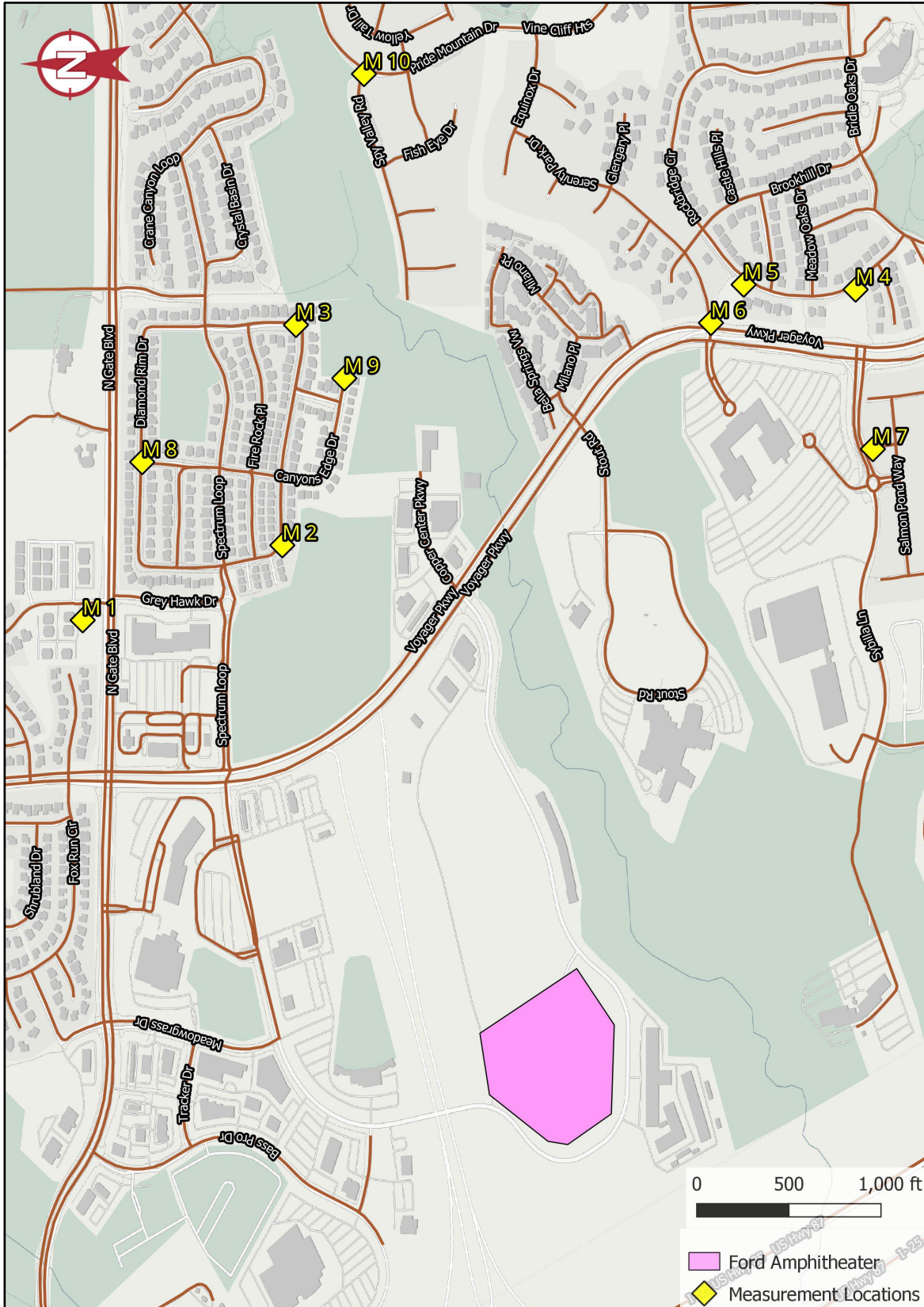


Figure 4-2. Community Sound Level Measurement Locations (Ivan Cornejo)

5. Sound Level Measurement Results - Godsmack Concert

Sound levels were monitored during the October 17, 2024 Godsmack concert at FOH and at various locations within the community. Table 5-1 lists the results of the FOH measurements, and Figure 5-1 shows the FOH average and maximum sound levels throughout the night. In general, all levels were in compliance with the limits. One minor exception is in the 40 Hertz one-third octave band, maximum levels exceeded 125 dB more than once during a 5-minute period on two occasions. This is an imperceptible exceedance. Table 5-2 lists the results of the community sound level measurements and Figure 5-2 shows where the measurements were taken.

Table 5-1. Measured FOH Sound Levels (Godsmack)

Sound Level Metric	Measured Level	Limit
Average overall sound level	100 dBA (loudest 5-minute average)	105 dBA
Maximum overall sound level	111 dBA (exceeded 110 dBA limit twice but not more than once within a 5-minute period)	110 dBA
Average 20 Hz one-third octave band	66 dB	115 dB
Average 25 Hz one-third octave band	90 dB	115 dB
Average 31 Hz one-third octave band	111 dB	115 dB
Average 40 Hz one-third octave band	114 dB	115 dB
Average 50 Hz one-third octave band	112 dB	115 dB
Average 63 Hz one-third octave band	108 dB	115 dB
Average 80 Hz one-third octave band	105 dB	115 dB
Maximum 20 Hz one-third octave band	83 dB	125 dB
Maximum 25 Hz one-third octave band	107 dB	125 dB
Maximum 31 Hz one-third octave band	128 dB (exceeded 125 dB only once)	125 dB
Maximum 40 Hz one-third octave band	128 dB (exceeded 125 dB limit 5 times, and at two points twice within one 5-minute period)	125 dB
Maximum 50 Hz one-third octave band	123 dB	125 dB
Maximum 63 Hz one-third octave band	118 dB	125 dB
Maximum 80 Hz one-third octave band	117 dB	125 dB

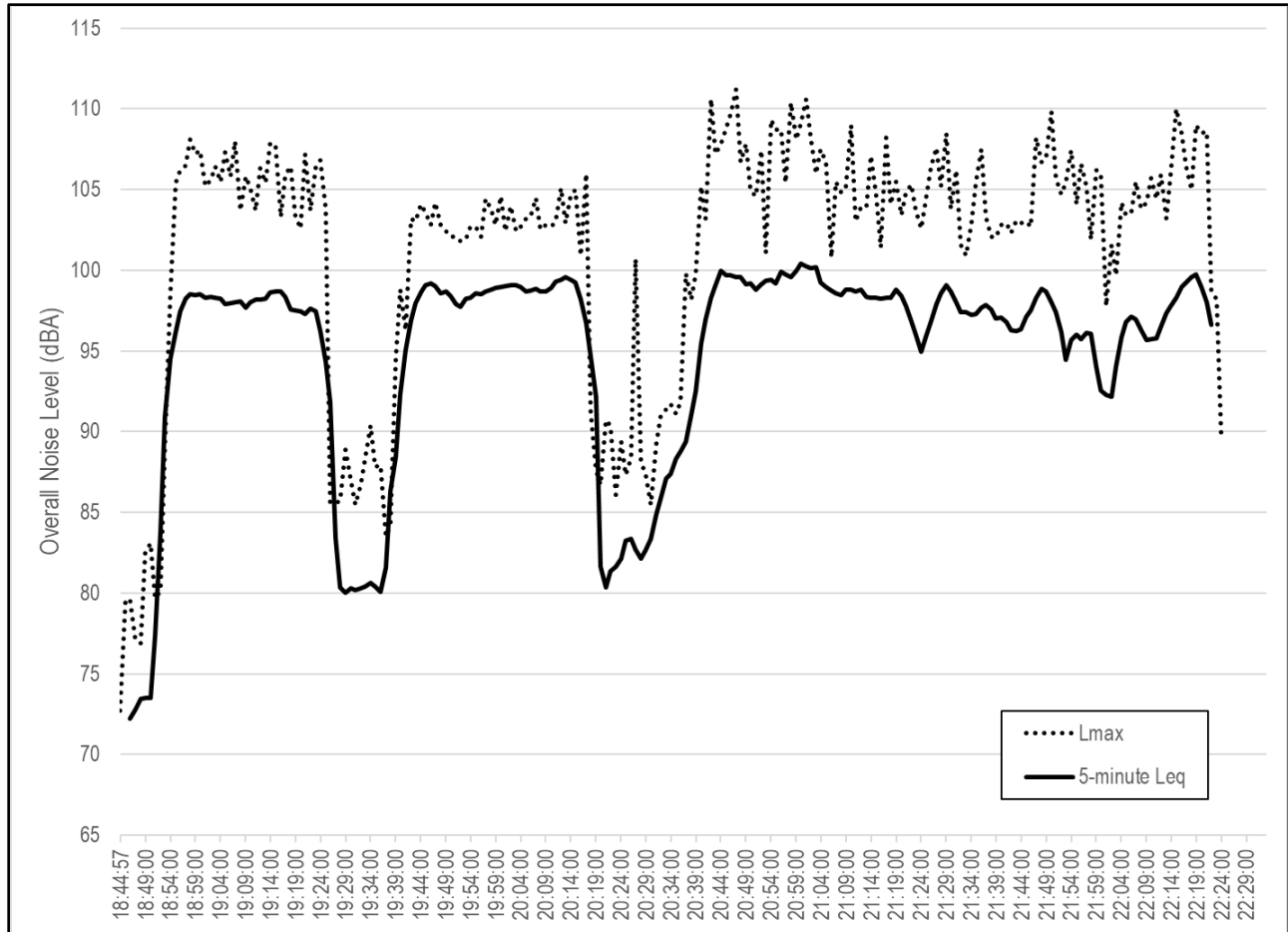


Figure 5-1. Front of House Overall 5-minute Leq and L_{max} (Godsmack)

Table 5-2. Measured Community Sound Levels (Godsmack)

Measurement Location	Location Description	Measurement Start Time	Overall level (dBA)	Audibility
M1	Wicked Think Marketing	19:15:34	60	Concert audible, traffic present on Northgate
M2	125 Coyote Willow Drive	23:43:47	56	Concert very audible, some traffic noise present, 2nd band starts at 7:42
M3	411 Fox Run Circle, at driveway	20:05:43	57	Concert very audible, clear, bass, drums
M4	411 Fox Run Circle, by house	20:12:27	59	Noticeably louder due to concert
M5	Wicked Think Marketing	20:42:46	58	Concert audible, traffic present
M6	125 Coyote Willow Drive	20:52:17	49	Concert audible, some traffic
M7	411 Fox Run Circle	21:07:29	59	Concert audible, seems louder at this location
M8	Voyager Parkway and Serenity Park Drive	19:19:13	62	Concert less audible but present
M9	1102 Crystal Basin Drive	19:39:54	53	Concert clearly audible
M10	785 Diamond Rim Drive	19:53:02	57	Concert clearly audible
M11	13046 Canyons Edge Drive	20:30:32	50	Concert clearly audible
M12	725 Diamond Rim Drive	20:45:05	52	Concert clearly audible

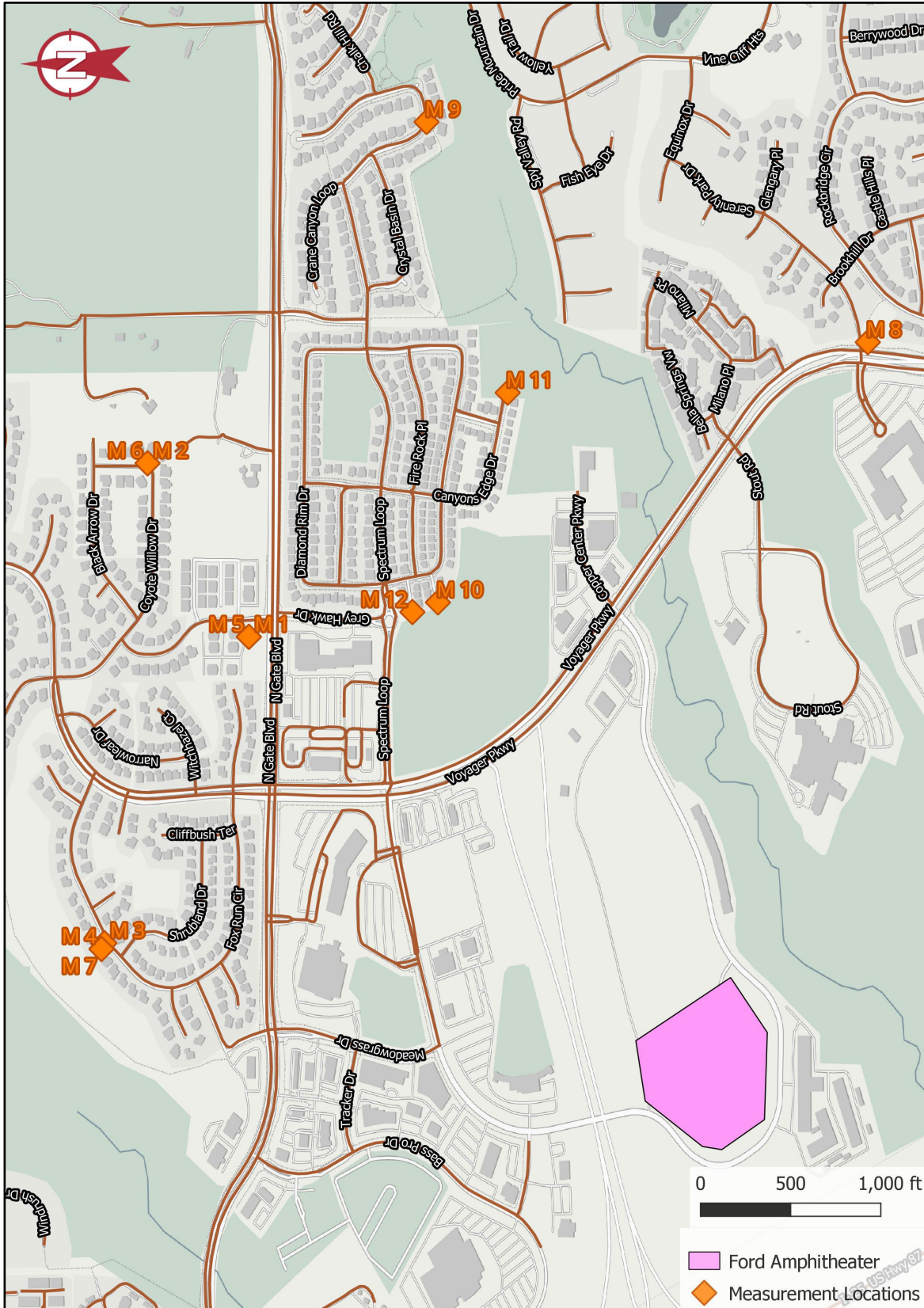


Figure 5-2. Community Sound Level Measurement Locations (Godsmack)