TECHNICAL MEMORANDUM

To:	Ms. Sharonda R. Williams, Special Counsel FishmanHaygood LLP 201 St. Charles Avenue, 46th Floor New Orleans, LA 70170
From:	Justin Cook, Principal Consultant Chris Nottoli, Senior Consultant Julia Nagy, Senior Consultant Eric Cox, Senior Consultant Mike Hamilton, Senior GIS Specialist Vincent Ma, Staff Consultant Mariano Sarrate, Staff Consultant Dominic Scarano, Staff Consultant
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Subject:	Children's Hospital New Orleans - Community Noise and Vibration Analysis
Reference:	HMMH Project Number 311780.000

Harris Miller Miller & Hanson Inc. (HMMH) is an industry leader in environmental and transportation planning including noise and vibration control, air quality analysis, airport and airspace planning, and sustainable energy solutions. Appendix A provides a comprehensive overview of the firm's qualifications and Appendix B provides personnel resumes.

HMMH performed noise and vibration monitoring and noise modeling to document and analyze the noise environment in the vicinity of the Children's Hospital New Orleans (the Hospital) in New Orleans, Louisiana. The Hospital and its community stakeholders are interested in gaining a better understanding of the noise and vibration effects attributable to the helicopter operating at the Hospital's helistop.

This technical memorandum provides a foundation intended to facilitate conversations between the Hospital and its surrounding communities related to the contributions of the Hospital helicopter operations to the local noise environment. It provides an overview of noise metrics, noise and vibration monitoring sites, noise monitoring protocols, helicopter test flights, long-term and short-term monitoring results, and the noise modeling methodology, inputs, and results.

Executive Summary

HMMH conducted noise and vibration monitoring to assess the effects of the Hospital's helicopter operations on the adjacent noise environment. HMMH completed three noise monitoring efforts in the period between July 21-24, 2020: 1) helicopter test flight noise and vibration monitoring, 2) long-term noise and vibration monitoring, and 3) short-term noise monitoring.

The helicopter test flight monitoring results provide noise and vibration data on the noise events that occur from helicopter operations at the Hospital. Long-term monitoring data provides an understanding of the ambient noise conditions that the community experiences. When compared to test flight monitoring results, long-term monitoring data suggest that the overall continuous noise events in the community exceed the single event noise from Hospital helicopter operations. Short-term monitoring allows for identification of noise sources at specific sites in the community during a condensed period. Short-term monitoring data shows that multiple sources of community noise exist beyond helicopter noise, including noise attributable to aircraft, construction, roadways, and trains.

While noise levels in the community due to Hospital helicopter operations may sometimes briefly exceed those caused by other community noise sources, the operations are relatively short in duration and infrequent when

compared to noise from more prevailing sources like roadway traffic. The data suggests that the noise and vibration contributions for the Hospital's helicopter operations are not significant when compared to the overall ambient community noise environment. Such that, if the Hospital's helicopter operations were eliminated, the ambient community noise environment would remain unchanged.

Noise modeling was also completed to create noise contours that provide a graphical visualization of the approximate noise during a single helicopter event and how it compares to the range of the ambient community noise measured during short- and long-term monitoring. Modeled results show the change in noise levels between historical to existing helistop conditions and corresponding flight tracks.

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1. Brief Introduction to Noise Terminology

Sound is a physical phenomenon consisting of minute vibrations (waveforms) that travel through a medium such as air or water.

Noise is sound that is unwelcome because of its undesirable effects on persons (e.g., speech interference, sleep disturbance) or on entire communities (annoyance).

This section presents the metrics or descriptors most commonly used to quantify noise. Noise metrics may be thought of as measures of "noise dose." There are two main types, describing (1) single noise events (single-event noise metrics) and (2) total noise experienced over longer time periods (cumulative noise metrics). Single-event metrics are indicators of the intrusiveness, loudness, or noisiness of individual aircraft or helicopter noises. Cumulative metrics used to measure long-term noise are indicators of community annoyance. Unless otherwise noted, all noise metrics presented in this document are reported in terms of the A-weighted decibel (dBA). Figure 1 displays common environmental sound levels in dBA.

Decibel (dB): All sounds come from a source – a musical instrument, a voice speaking, an airplane. The energy that produces these sounds is transmitted through the air in waves, or sound pressures, which impinge on the ear, creating the sound we hear.

The decibel is a ratio that compares the sound pressure of the sound source of interest (e.g., the aircraft over flight) to a reference pressure (the quietest sound we can hear). Because the range of sound pressures is very large, we use logarithms to simplify the expression to a smaller range and express the resulting value in decibels (dB). Two useful rules of thumb to remember when comparing individual noise sources are: (1) most of us perceive a six to ten dB increase to be about a doubling of loudness, and (2) changes of less than about three dB are not easily detected outside of a laboratory.

A-Weighting Decibel (dBA): Frequency, or "pitch", is an important characteristic of sound. When analyzing noise, we are interested in how much is low-, middle-, and high-frequency noise. This breakdown is important for two reasons. First, our ears are better equipped to hear mid- and high-frequencies; thus, one finds mid- and high-frequency noise more annoying. Second, engineering solutions to noise problems are different for different frequency ranges. The "A" filter approximates the sensitivity of our ear and helps us to assess the relative loudness of various sounds.

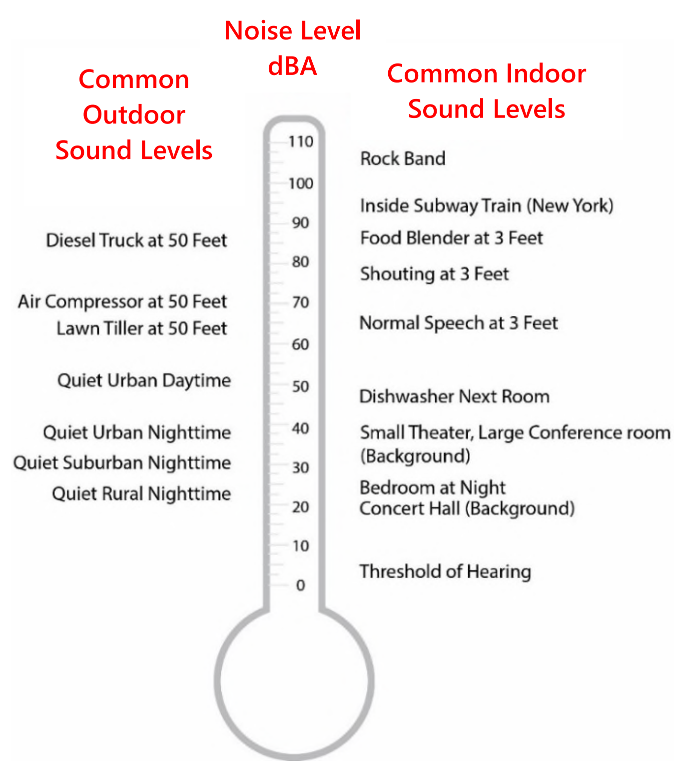

Figure 1 Common Indoor and Outdoor Sound Levels
Source: HMMH, 2018

Equivalent Sound Level (Leq): Leq is a measure of the exposure resulting from the accumulation of sound levels over a particular period of interest, e.g., one hour, an eight-hour school day, nighttime, or a full 24-hour day. Leq plots for consecutive hours can help illustrate how the noise dose rises and falls over a day or how a few loud aircraft significantly affect some hours. Leq may be thought of as the constant sound level over the period of interest that would contain as much sound energy as the actual varying level. It is a way of assigning a single number to a time-varying sound level.

Day-Night Average Sound Level (DNL): Annoyance is greater when an intrusive sound occurs at night. In simple terms, DNL is the 24-hour Leq with one adjustment; all noises occurring at night (defined as 10 p.m. through 7 a.m.) are increased by 10 dB, to reflect the added intrusiveness of nighttime noise events when background noise levels decrease. In calculating aircraft exposure, this 10 dB increase is mathematically identical to counting each nighttime aircraft noise event ten times.

Maximum A-weighted Sound Level (LAmax): A-weighted sound levels vary with time. For example, the sound increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance. We often describe a particular noise “event” by its maximum sound level (LAmax); two events with identical LAmax may produce different total exposures. One may be of very short duration, while the other may be much longer. A LAmax presents the loudest instantaneous noise during a given event. Leq differs from LAmax because it is the average noise level over the entire duration of an event.

Sound Exposure Level (SEL): The most common measure of cumulative noise exposure for a single aircraft flyover is the Sound Exposure Level (SEL). Mathematically, it is the sum of the sound energy over the duration of a noise event – one can think of it as an equivalent noise event with a one-second duration. Because the SEL is normalized to one second, it will almost always be larger in magnitude than the Lmax for the event. In fact, for most aircraft events, the SEL is about 7 to 12 dB higher than the Lmax. Also, the fact that it is cumulative measure means that a higher SEL can result from either a louder or longer event, or some combination.

Maximum Vibration Levels: Maximum vibration levels are similar to Lmax in that it captures the highest instantaneous vibration during a given measurement interval but does not have any weightings applied during the calculations.

Linear Vibration Levels: Linear vibration levels are similar to Leq as it presents the exposure resulting from the accumulation of vibrations over a particular period of interest. It is a way of assigning a single number to a varying vibration level. Like the maximum vibration levels, linear vibration calculations do not have any weightings applied in the calculation.

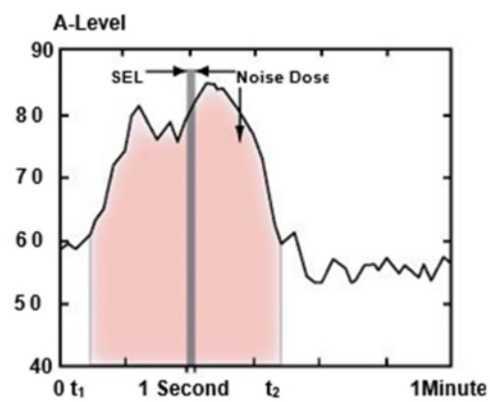

Figure 2 Sound Exposure Level
Source: HMMH, 2018

2. Noise and Vibration Monitoring

2.1 Methodology and Protocol

HMMH staff conducted noise and vibration monitoring in accordance with industry best practices, in general compliance with appropriate professional standards and city code. The August 19, 2020 code of the City of New Orleans Article IV. Noise Sec 66-201 – Noise measurement, outlines the necessary equipment required to measure noise. Requirements include using a calibrated sound level meter Type 2 or better, conducting measurements using A-weighting, and conforming to standards promulgated by American National Standards Institute and Testing Procedures (ANSI).[1]

Noise monitoring was conducted using Bruel & Kjaer Model 2270 and 2245 analyzers. All of the instrumentation conforms to ANSI Standard S1.4 for Type 1 precision, representing the highest level of precision, with current calibrations traceable to the U.S. National Institute of Standards and Technology (NIST). Type 1 precision instrumentation requires constant calibration to meet ANSI standards; calibrations were carried out in the field before and after each measurement using NIST-certified calibration devices.

The results presented in this report should not be compared to noise measurements made using less precise instrumentation, such as cell phone applications. Cellphone microphones are not certified for noise measurements and do not conform to ANSI or NIST standard for several reasons. The built-in microphones found in cellphones have limitations due to their miniature size and circuit board placement, which affect their dynamic range and signal-to-noise ratio. Another constraint of built-in microphones is the lack of access and inability to perform periodic or pre-measurements.[2] Additionally, the placement of the microphone can affect measured sound levels. It is imperative that microphones be placed away from trees, walls, and structures as sound reflecting off surfaces will increase the sound levels measured.

Vibration monitoring was conducted using a PCB Model 393A03 seismic accelerometer connected to the Bruel & Kjaer Model 2270 analyzer with current calibration traceable to the U.S. NIST. Additional calibration checks were carried out when deploying and collecting the equipment using a NIST-certified PCB Model 699B02 hand-held shaker.

HMMH completed three monitoring efforts in the period between July 21-24, 2020: 1) helicopter test flight noise and vibration monitoring, 2) long-term noise and vibration monitoring, and 3) short-term noise monitoring. Monitoring efforts provided data to assess the effects of the Hospital's helicopter operations on the adjacent noise environment. Figure 3 depicts the measurement sites and community points in relation to the Hospital.

HMMH conducted noise and vibration measurements at three predetermined sites during a single day of helicopter test flights. The helicopter test flights consisted of a single helicopter arriving and departing the rooftop (existing) helistop and the decommissioned (historical) helistop for each of the Hospital's most frequently used flight paths: westerly flight path, easterly flight path, and northernly flight path. HMMH positioned the monitoring equipment at the nearest residential land uses directly north of the Hospital (Tchoupitoulas Street). One long-term measurement site was located directly underneath the northern flight path. This site utilized both noise and vibration equipment. The other two measurement sites utilized only noise equipment and were located to the west and east of that site. Helicopter test flights monitoring details and results are summarized in Section 2.2.

[1] https://library.municode.com/la/new_orleans/codes/code_of_ordinances?nodeId=PTIICO_CH66EN_ARTIVNO_DIV1GE

[2] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5102154/

Long-term noise measurements were conducted at five predetermined sites during a period of two days; vibration measurements were conducted at one long-term noise site. The sites were chosen based on proximity to residential land uses directly north of the Hospital (Tchoupitoulas Street). The monitors recorded continuous one-second noise and vibration levels over two 24-hour periods. HMMH staff deployed the monitoring equipment and ensured that it was safely secured at each of the monitoring sites. Section 2.3 summarizes long-term monitoring details and results.

Short-term noise measurements were conducted at ten sites for a period of one-hour at each of these sites. HMMH staff were present throughout the duration of each measurement. Short-term monitoring details and results are summarized in Section 2.4.

Figure 3 Measurement Sites and Community Points

2.2 Helicopter Test Flight Monitoring Results

The helicopter test flight monitoring results are intended to provide noise and vibration data on the events that occur as a result of helicopter operations at the Hospital. Monitors recorded helicopter test flight data at one-second intervals for both noise and vibration levels for the duration of the measurements. Noise data was collected at three test flight measurement sites (TF-01 through TF-03) for current flight paths, historic flight paths, and no-fly conditions. Vibration data was collected at TF-01. HMMH staff processed and analyzed noise data, as summarized in Table 1 for TF-01, Table 2 for TF-02, and Table 3 for TF-03.[3] Vibration data is summarized in Section 2.3.2 and contained within Table 5 and Table 6.

Table 1 - Helicopter Flight Paths and Sound Levels at TF-01

Site	Address	Condition	Flight Path	Operation	Sound Level (dB)	
					Lmax	SEL
TF-01	301 Calhoun Street	Current	North	Approach	93	100
				Departure	80	94
			South-East	Approach	83	95
				Departure	86	96
			South-West	Approach	83	92
				Departure	93	101
		Historic	North	Approach	77	89
			North-East	Approach	77	88
				Departure	74	81
		No-Fly	North	Approach	92	103
				Departure	83	94

[3] Flight paths shown in Figure 19 and Figure 20 do not represent the flight tracks flown during the test flights conducted on July 21st, 2020.

Table 2 - Helicopter Flight Paths and Sound Levels at TF-02

Site	Address	Condition	Flight Path	Operation	Sound Level (dB)	
					Lmax	SEL
TF-02	Henry Clay Avenue / Tchoupitoulas Street	Current	North	Approach	90	102
				Departure	82	93
			South-East	Approach	86	97
				Departure	91	97
			South-West	Approach	80	89
				Departure	87	96
		Historic	North	Approach	88	99
			North-East	Approach	85	97
				Departure	88[1]	94[1]
		No-Fly	North	Approach	88	97
				Departure	83	94

Notes: 1) Simultaneous traffic noise during helicopter test flight

Table 3 - Helicopter Flight Paths and Sound Levels at TF-03

Site	Address	Condition	Flight Path	Operation	Sound Level (dB)	
					Lmax	SEL
TF-03	300 Webster Street	Current	North	Approach	86	98
				Departure	78	89
			South-East	Approach	82	96
				Departure	84	93
			South-West	Approach	80	89
				Departure	82	92
		Historic	North	Approach	88	97
			North-East	Approach	87	97
				Departure	76	84
		No-Fly	North	Approach	84	95
				Departure	79	92

2.3 Long-Term Monitoring Results

HMMH conducted long-term monitoring at five sites to determine ambient conditions of the local noise and vibration environment. This data provides an understanding of the ambient noise conditions that the community experiences when no helicopter activity is occurring at the Hospital's existing helistop. HMMH processed, analyzed, and calculated the minimum, maximum, and average sound levels at each location. The five long-term measurement sites (LT-01 through LT-05) are listed in Table 4.[4]

2.3.1 Noise Results

The long-term monitoring equipment measured noise and vibration levels continuously over two 24-hour time periods (48 hours total). The instruments were programmed to record slow-response broadband A-weighted sound levels in one-second and one-hour intervals. Long-term measurement results are summarized in Table 4. Hourly sound levels at each measurement site are depicted in Figure 4 through Figure 8. Data from LT-05 was contaminated with prolonged HVAC noise requiring several hours to be removed from the dataset, as shown in Figure 8.

The long-term measurement data shows the ambient noise and vibration levels in the community surrounding the Hospital. The data in Table 4 provides a breakout of noise metrics by daytime and nighttime periods: day time (defined as 7 a.m. through 10 p.m.) and night (defined as 10 p.m. through 7 a.m.). Common community noise sources include vehicle traffic, train horns, and aircraft overflights not associated with the Hospital. Generally, the nighttime results are lower than daytime due to decreased roadway traffic and other community noise contributors. In comparison to the measured flight test measurements, the noise levels fall within the maximum and minimum range of the ambient community Lmax levels, which suggests the overall continuous noise events in the community exceed the single event noise from helicopter operations at the Hospital.

The DNL values shown in Table 4 are provided as a point of reference to compare to Federal Aviation Administration (FAA) guidance on assessing noise impacts on communities surrounding airports that have a DNL level of 65 or greater from just aircraft operations. As Table 4 shows, the community DNL ranges between 57 dB and 66 dB.

In 2020, the Hospital has averaged 0.77 patient flights per day for emergency purposes. Hospital helicopter operations are infrequent in comparison to other sources of noise in the community. According to Hospital helicopter operations logs, in the period between July 22-24, 2020, which largely corresponds to the noise monitoring period, only one helicopter operation occurred. In 2019, the Hospital's average flights per year were at 0.94 patients per day. In 2020, the Hospital's average flights per year decreased to 0.77 patients per day.

Based on the number of Hospital helicopter operation that occur on a daily and yearly basis, there are not enough of these operations that would generate DNL values from only Hospital helicopter operations to exceed DNL 65.

Figure 4 through Figure 8 show peak levels throughout different hours of the day. For example, LT-01 shows peak levels at 2 a.m. and 7 a.m. during the 48-hour measurement period. The peak levels at 7 a.m. can be attributed to rush hour traffic while peak levels at 2 a.m. are due to insect noise in the community. One helicopter flight, operated by the Hospital, occurred at 10:22 p.m. on July 22nd. The operation is tagged in each figure so one can more easily compare the overall level of the fight to the ambient noise levels in the community. While the noise level of the flight varies at each site, it is below highest measured levels over the entire measurement period at LT-01, LT-03 and LT-04.

[4] Vibration measurements were collected at LT-02.

Table 4 - Long-Term Measurement Sites and Sound Levels

Site	Address	Start	End	Hourly Sound Level (dB)		
				Time Period	Lmax	Leq
LT-01	325 Exposition Boulevard	7/22/2020 9:00 AM	7/24/2020 9:00 AM	Day 1	61 to 79	50 to 56
				Night 1	59 to 77	45 to 58
				Day-Night Average Sound Level 1 = 59		
				Day 2	64 to 78	50 to 56
				Night 2	60 to 82	48 to 58
				Day-Night Average Sound Level 2 = 60		
				Overall DNL for 48-Hour Monitoring = 60		
LT-02	303 Calhoun Street	7/21/2020 4:00 PM	7/23/2020 4:00 PM	Day 1	67 to 82	52 to 61
				Night 1	59 to 72	49 to 51
				Day-Night Average Sound Level 1 = 58		
				Day 2	67 to 79	52 to 57
				Night 2	62 to 84	50 to 61
				Day-Night Average Sound Level 2 = 62		
				Overall DNL for 48-Hour Monitoring = 61		
LT-03	301 Henry Clay Avenue	7/22/2020 9:00 AM	7/24/2020 9:00 AM	Day 1	74 to 91	58 to 68
				Night 1	74 to 90	50 to 63
				Day-Night Average Sound Level 1 = 67		
				Day 2	74 to 93	56 to 67
				Night 2	70 to 87	50 to 63
				Day-Night Average Sound Level 2 = 65		
				Overall DNL for 48-Hour Monitoring = 66		
LT-04	6037 Annunciation Boulevard	7/22/2020 12:00 PM	7/24/2020 12:00 PM	Day 1	67 to 88	48 to 58
				Night 1	54 to 77	44 to 53
				Day-Night Average Sound Level 1 = 56		
				Day 2	70 to 86	51 to 60
				Night 2	56 to 71	45 to 51
				Day-Night Average Sound Level 2 = 57		
				Overall DNL for 48-Hour Monitoring = 57		
LT-05*	6065 Tchoupitoulas Street	7/22/2020 10:00 AM	7/24/2020 10:00 AM	Day 1	52 to 77	50 to 53
				Night 1	53 to 62	50 to 51
				Day-Night Average Sound Level 1 = 57		
				Day 2	53 to 68	50 to 54
				Night 2	53 to 67	51 to 53
				Day-Night Average Sound Level 2 = 59		
				Overall DNL for 48-Hour Monitoring = 58		

Notes: * Data from LT-05 was contaminated with prolonged HVAC noise requiring several hours to be removed from the dataset.

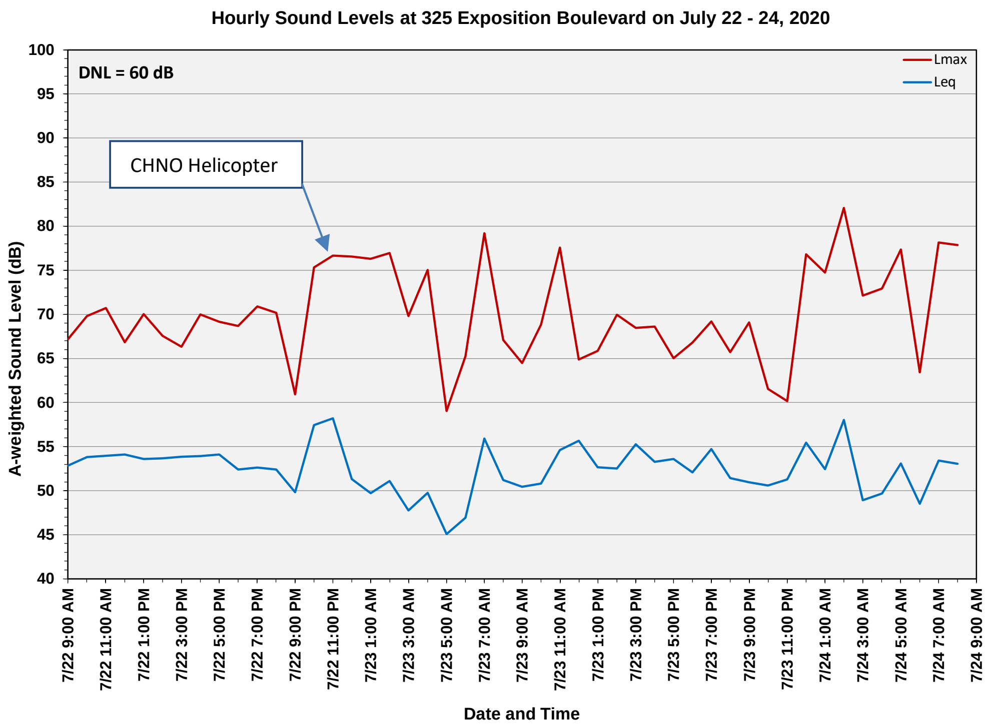

Figure 4 – LT-01 Sound Levels

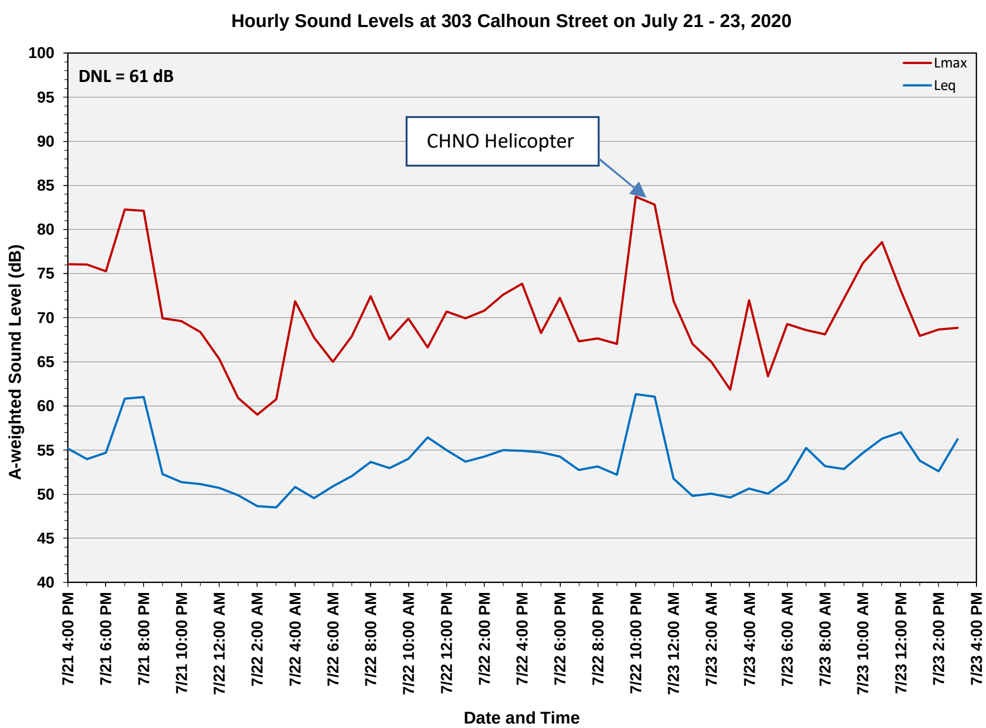

Figure 5 – LT-02 Sound Levels

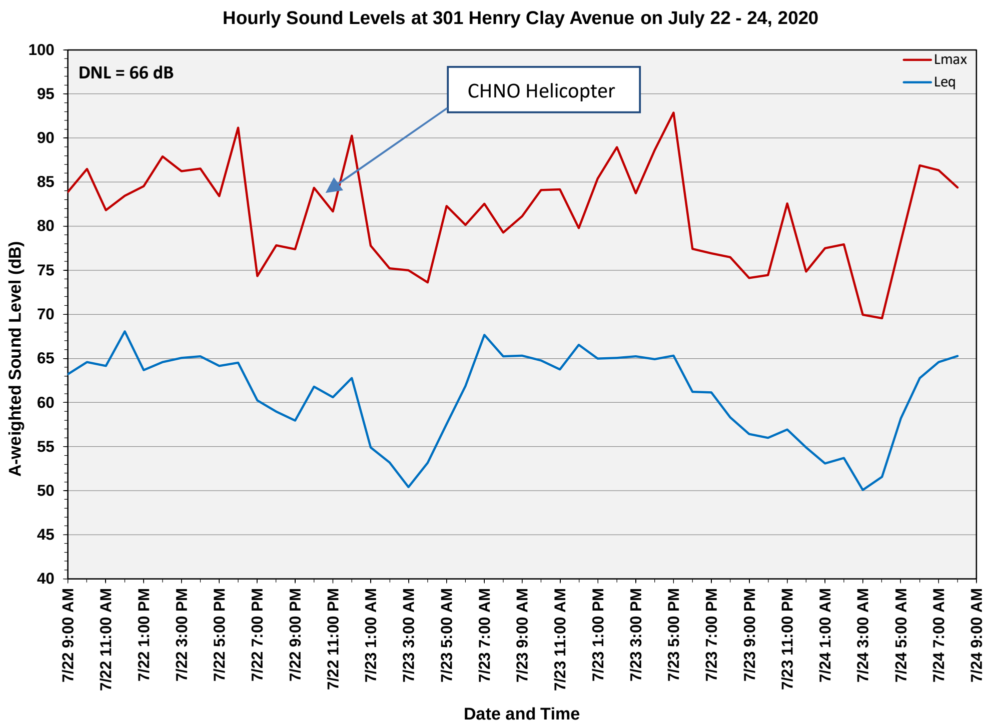

Figure 6 – LT-03 Sound Levels

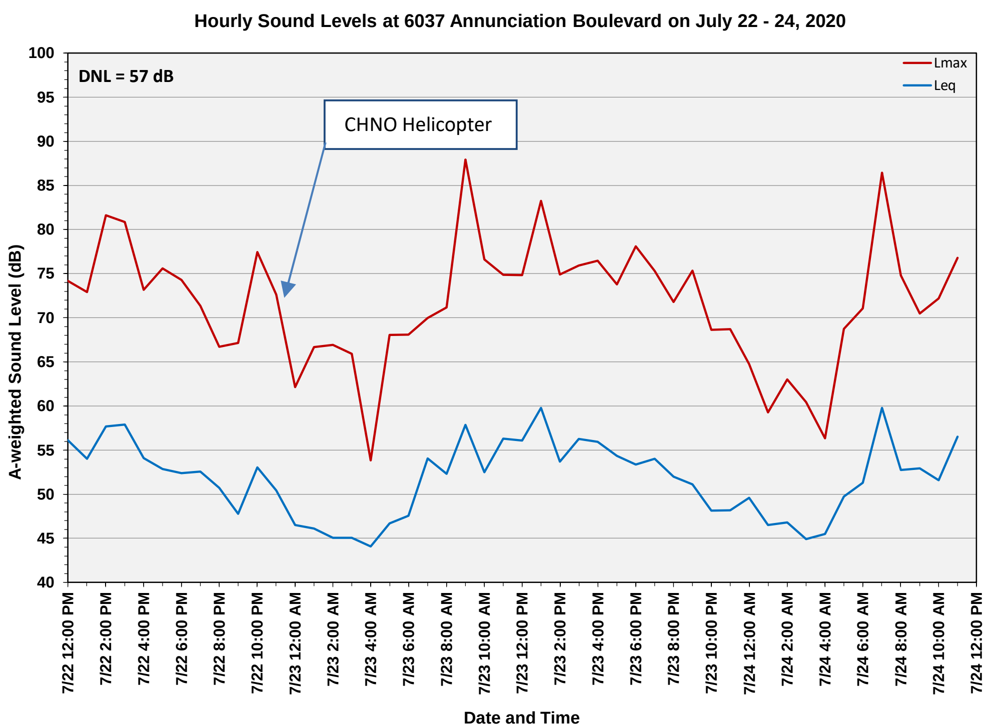

Figure 7 – LT-04 Sound Levels

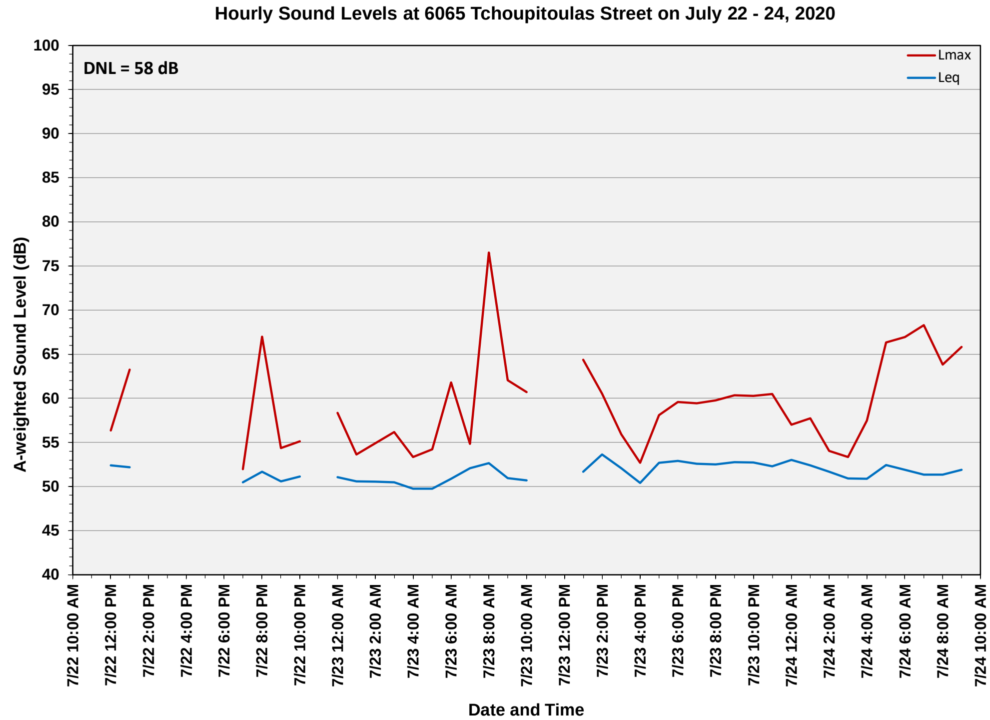

Figure 8 – LT-05 Sound Levels[5]

[5] Data from LT-05 was contaminated with prolonged HVAC noise requiring several hours to be removed from the dataset.

2.3.2 Vibration Results

The two-day vibration measurements occurred simultaneously with the noise monitoring at LT-02. Vibration analyses typically establish baseline readings even when not directly used for an assessment as presented in Table 5. The long-term and test flight data is compared for the same period each day with and without test flights. Table 6 shows that there is no difference in vibration levels between with and without test flights for the same measurement hour, indicating that test flights did not produce distinct vibration events.

Most perceptible indoor vibration is caused by sources within buildings such as operation of mechanical equipment, movement of people, or slamming of doors. Typical outdoor sources of vibration waves that propagate through the ground and create perceptible ground-borne vibration in nearby buildings include construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is fairly smooth, the vibration from rubber-tired traffic is rarely perceptible.

Based on the results in Tables 5 and 6 below and observations in the field, sources other than the Hospital's helicopter generated just as much if not greater vibration levels and at a much higher frequency of occurrence.

Table 5 – Long-Term Vibration Levels

Site	Address	Start	End	Hourly Vibration Level (VdB)		
				Time Period	Max	Linear
LT-02	303 Calhoun Street	7/21/2020 4:00 PM	7/23/2020 4:00 PM	Day 1	77 to 83	59 to 65
				Night 1	68 to 81	52 to 61
				Overall 24-Hour Vibration Level 1 = 62		
				Day 2	78 to 87	61 to 66
				Night 2	72 to 83	54 to 60
				Overall 24-Hour Vibration Level 2 = 62		
				Overall 48-Hour Vibration Level = 62		

Table 6 – Long-Term and Test Flight Vibration Levels

Site	Address	Start	End	Hourly Vibration Level (VdB)		
				Test Flights	Max	Linear
LT-02	303 Calhoun Street	7/21/2020 10:55 AM	7/21/2020 11:35 AM	Yes	78	64
		7/22/2020 10:55 AM	7/22/2020 11:35 AM	No	79	64
		7/23/2020 10:55 AM	7/23/2020 11:35 AM	No	86	65

2.4 Short-Term Monitoring Results

Short-term monitoring allows for identification of noise sources at specific sites in the community during a condensed time period. The short-term monitoring equipment logged noise levels continuously over 1-hour daytime measurement periods, concurrent with the long-term monitoring. The instruments were programmed to record slow-response broadband A-weighted sound levels in 1-second intervals. Sites were chosen to represent the typical noise environment around the Hospital. The addresses of the ten short-term sites (ST-01 through ST-10) are listed in Table 7, along with a summary of measurement periods, and the Lmax and Leq one-hour sound levels. Each site is broken down further in the subsequent subsections. One-hour sound levels at each measurement site are depicted in Figure 9 through Figure 18. Short-term monitoring efforts and associated data show that multiple sources of community noise exist beyond helicopter noise, including noise attributable to aircraft, construction, roadways, and trains. Figure 9 through Figure 18 include markings that identify noise events; textboxes identifying the noise sources are included in the figures.

Roadway noise was the continuous and dominating noise source at all of the short-term sites. However, the data illustrates that the most significant roadway noise occurred at ST-03 and ST-05 through ST-10. The daytime Lmax levels at the short-term sites are higher than the long-term sites since the noise levels are averaged over a shorter period of time, in which louder community noise events (e.g. roadway noise, construction, landscaping equipment, etc.) have a greater effect on the overall levels. Across the five long-term sites, the range of daytime Lmax was between 52-91 dB whereas, short-term daytime Lmax ranged from 67-90 dB, falling within the range of ambient noise levels in the community. The long-term daytime Leq ranged from 50-68 dB while the short-term levels ranged from 50-67 dB. The agreeance between these levels show that the community levels are generally similar regardless of the various daytime hours.

Table 7 - Short-Term Measurement Sites and Sound Levels

Site	Address	Start	End	One - Hour Sound Level (dB)	
				Lmax	Leq
ST-01	Avenger Baseball Field	1:39:57 PM	2:39:56 PM	83	58
ST-02	Henry Clay Ave/Tchoupitoulas St	2:51:03 PM	3:51:02 PM	90	67
ST-03	6340 Annunciation St	9:55:06 AM	10:55:05 AM	67	50
ST-04	Annunciation St/Calhoun St	1:35:00 PM	2:37:08 PM	79	54
ST-05	Henry Clay Ave/Annunciation St	2:52:04 PM	3:52:03 PM	81	56
ST-06	430 Webster St	10:30:52 AM	11:30:51 AM	84	61
ST-07	Annunciation St/State St	2:49:30 PM	3:49:29 PM	90	62
ST-08	5900 Annunciation St	9:12:33 AM	10:12:32 AM	72	56
ST-09	6220 Patton St	10:27:02 AM	11:27:01 AM	75	55
ST10	Gilmore Park	8:21:00 AM	9:20:59 AM	75	57

2.4.1 Short-Term Site 1

Short-Term Site 1 (ST-01) was along the western edge of Avengers field, west of the Hospital. The predominate noise sources at ST-01 were an aircraft overflight, roadway traffic, construction, and landscaping equipment. Table 8 outlines the ambient noise compared to the same time period of any available long-term monitors. The Lmax and Leq at ST-01 is approximately 12 dB and 9 dB higher, respectively, than LT-02 due to a military aircraft flyover that occurred during the duration of the measurement. The single event noise metrics associated with the aircraft flyover are an Lmax of 64 to 87 and an SEL of 69 to 90, as presented in Table 9. The time-history graph is presented in Figure 9.

Table 8 – ST-01 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-01	East Drive (Avenger Field)	7/21/2020 1:40 PM	7/21/2020 2:40 PM	83	58
LT-01	325 Exposition Boulevard	7/21/2020 1:40 PM	7/21/2020 2:40 PM	-	-
LT-02	303 Calhoun Street			61	49
LT-03	301 Henry Clay Avenue			-	-
LT-04	6037 Annunciation Boulevard			-	-
LT-05	6065 Tchoupitoulas Street			-	-

Table 9 – ST-01 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-01	Military Aircraft	64 to 87	69 to 90

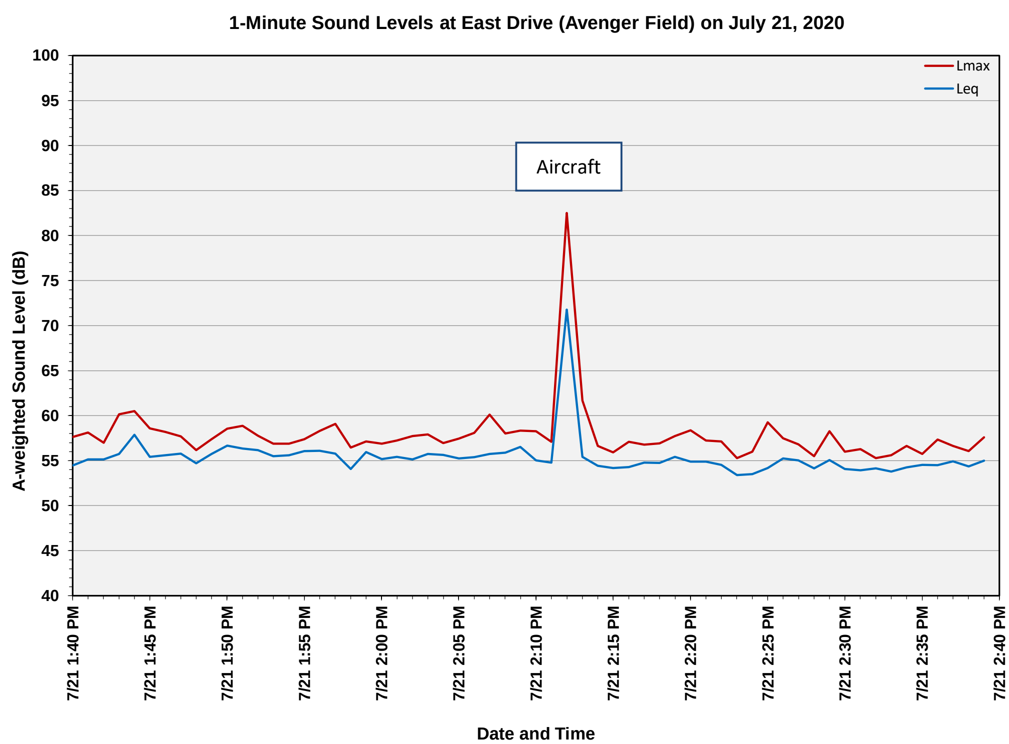

Figure 9 – ST-01 Time History Sound Levels

2.4.2 Short-Term Site 2

Short-Term Site 2 (ST-02) was located at the intersection of Henry Clay Avenue and Tchoupitoulas Street, on the northeast corner of the Hospital. The predominate noise sources at ST-02 were buses, a helicopter overflight, trucks, and vehicles. As presented in Table 10, the Lmax and Leq is approximately 29 dB and 18 dB higher, respectively, than LT-02 due to the multiple noise events that occurred. Noise metrics are presented for each significant single event in Table 11 and the time-history graph is presented in Figure 10.

Table 10 – ST-02 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-02	Henry Clay Avenue / Tchoupitoulas Street	7/21/2020 2:51 PM	7/21/2020 3:51 PM	90	67
LT-01	325 Exposition Boulevard	7/21/2020 2:51 PM	7/21/2020 3:51 PM	-	-
LT-02	303 Calhoun Street			61	49
LT-03	301 Henry Clay Avenue			-	-
LT-04	6037 Annunciation Boulevard			-	-
LT-05	6065 Tchoupitoulas Street			-	-

Table 11 – ST-02 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-02	Buses	82 to 92	88 to 95
	Helicopters	92	97
	Heavy Trucks	70 to 92	77 to 95
	Vehicles Driving Off	70 to 90	74 to 82

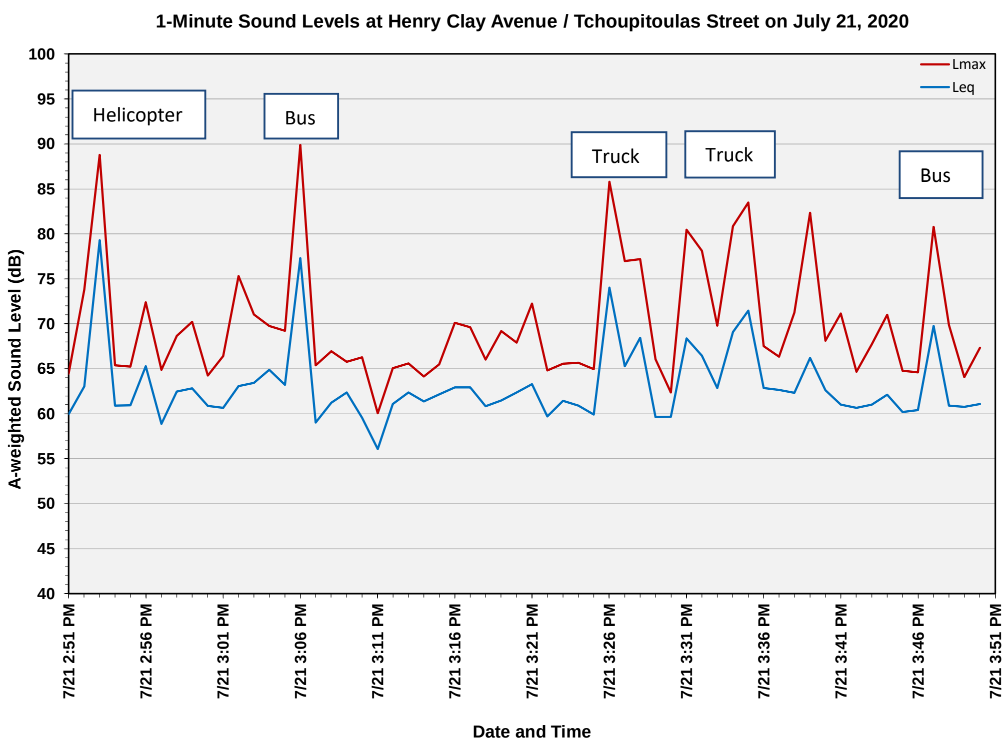

Figure 10 – ST-02 Time History Sound Levels

2.4.3 Short-Term Site 3

Short-Term Site 3 (ST-03) was located one block northwest of the Hospital on Annunciation Street. The predominate noise sources at ST-03 were birds, train horns, and trucks**.** Table 12 show the ambient noise at this site is comparable to the levels at two of the three available long-term sites. The single event in Table 13 and the time-history graph presented in Figure 11 illustrate the various noise events over the ambient conditions. The data also suggest that truck traffic around this site have higher noise levels than the train horn.

Table 12 – ST-03 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-03	6340 Annunciation Street	7/22/2020 9:55 AM	7/22/2020 10:55 AM	67	50
LT-01	325 Exposition Boulevard	7/22/2020 9:55 AM	7/22/2020 10:55 AM	70	54
LT-02	303 Calhoun Street			70	54
LT-03	301 Henry Clay Avenue			87	65
LT-04	6037 Annunciation Boulevard			-	-
LT-05	6065 Tchoupitoulas Street			-	-

Table 13 - ST-03 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-03	Bird Chirp	70	77
	Train Horns	60 to 64	68
	Heavy Trucks	72	75

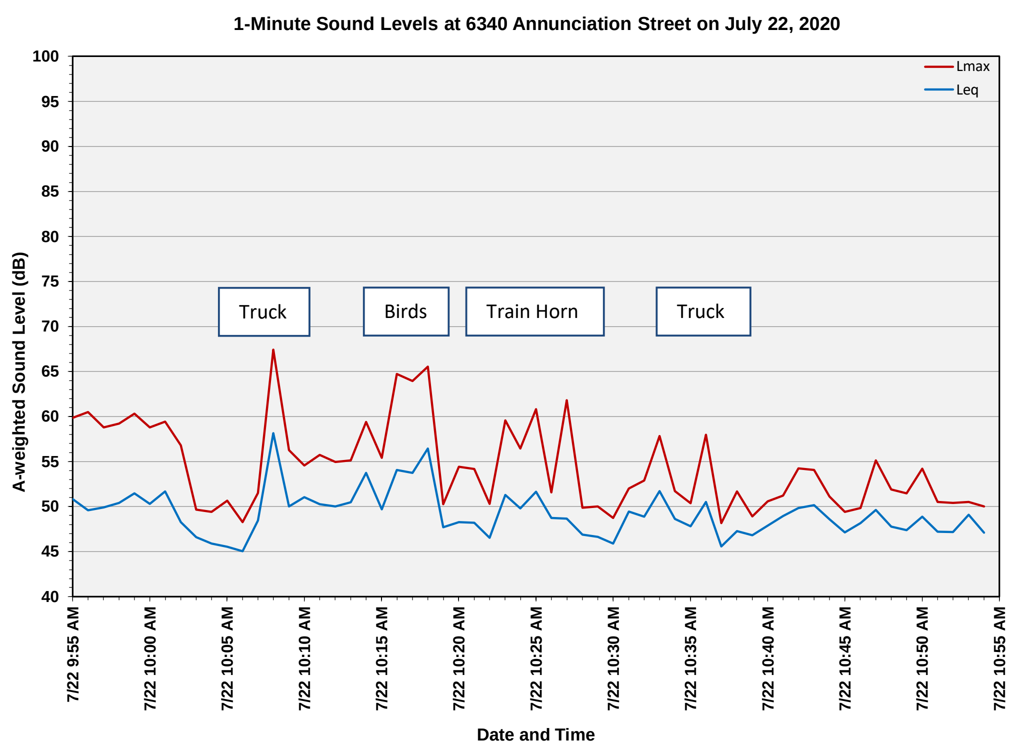

Figure 11 – ST-03 Time History Sound Levels

2.4.4 *Short-Term Site 4*

Short-Term Site 4 (ST-04) was located at the intersection of Annunciation Street and Calhoun Street, one block north of the Hospital. Table 14 shows that ST-04 averaged an Lmax 8 dB above the long-term sites and 1 dB below the average Leq. The large disparity in Lmax is due to significant roadway traffic with maximum sound levels between 64 and 85 dB. However, the Leq shows the ambient noise at this site is comparable to the long-term sites. The roadway single events are presented in Table 15 and Figure 12.

Table 14 – ST-04 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-04	Annunciation Street / Calhoun Street	7/22/2020 1:35 PM	7/22/2020 2:37 PM	79	54
LT-01	325 Exposition Boulevard	7/22/2020 1:35 PM	7/22/2020 2:37 PM	70	54
LT-02	303 Calhoun Street			70	53
LT-03	301 Henry Clay Avenue			84	63
LT-04	6037 Annunciation Boulevard			78	55
LT-05	6065 Tchoupitoulas Street			55	52

Table 15 – ST-04 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-04	Vehicles	64 to 85	66 to 83

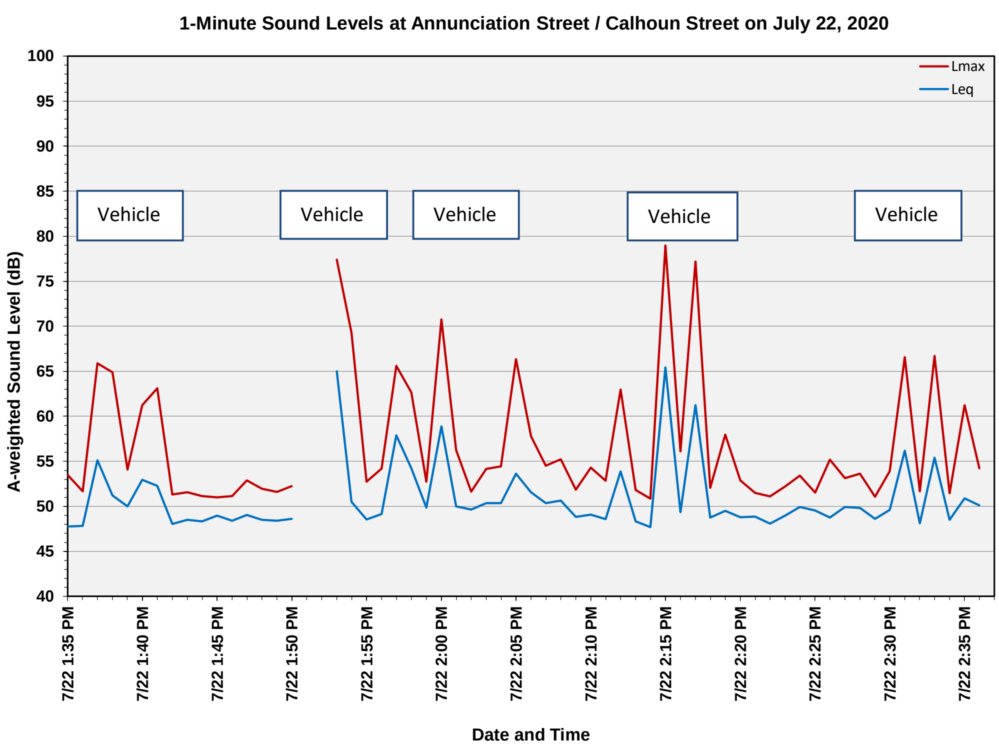

Figure 12 – ST-04 Time History Sound Levels

2.4.5 Short-Term Site 5

Short-Term Site 5 (ST-05) was located at the intersection of Henry Clay Avenue and Annunciation Street, one block north of the Hospital. Table 16 shows that ST-05 averaged an Lmax 4 dB above the long-term sites and as much as much as 14 dB above LT-01 and LT-02. The Leq was approximately 2 dB below the average Leq. The predominate noise sources at ST-05 were train horns, trucks, and roadway traffic as presented in Table 17 and Figure 13.

Table 16 – ST-05 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-05	Henry Clay Avenue / Annunciation Street	7/22/2020 2:52 PM	7/22/2020 3:52 PM	81	56
LT-01	325 Exposition Boulevard	7/22/2020 2:52 PM	7/22/2020 3:52 PM	67	54
LT-02	303 Calhoun Street			73	55
LT-03	301 Henry Clay Avenue			88	66
LT-04	6037 Annunciation Boulevard			81	58
LT-05	6065 Tchoupitoulas Street			-	-

Table 17 – ST-05 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-05	Train Horns	58 to 86	68 to 92
	Heavy Trucks	67 to 72	73 to 81
	Vehicles	62 to 86	68 to 87

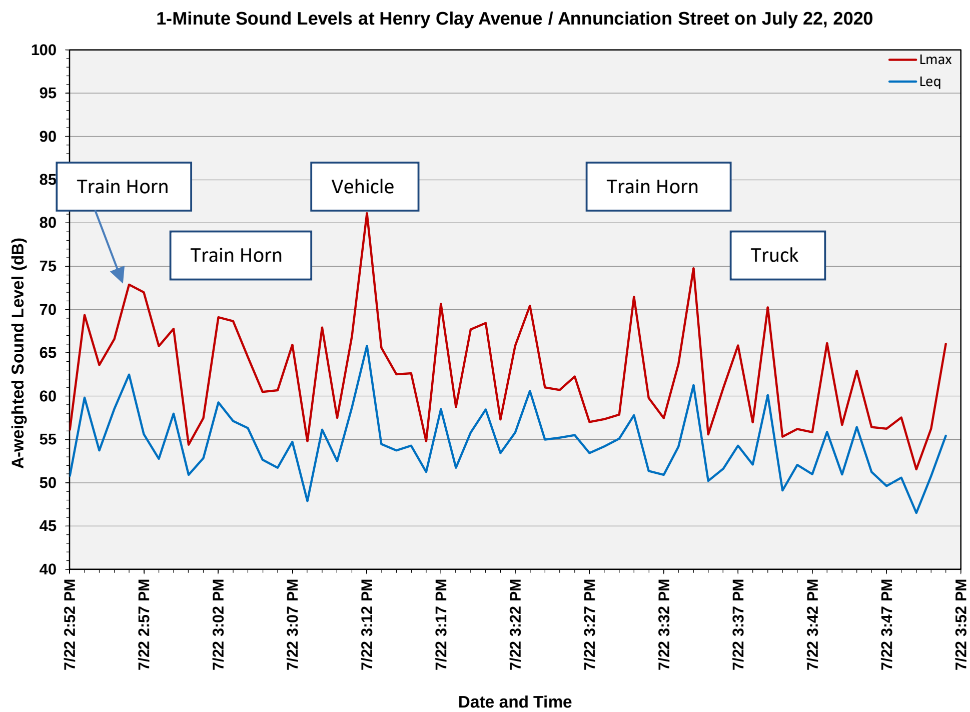

Figure 13 – ST-05 Time History Sound Levels

2.4.6 Short-Term Site 6

Short-Term Site 6 (ST-06) was located at 430 Webster Street, two blocks northeast of the Hospital. Table 18 shows that ST-06 averaged an Lmax 5 dB above the long-term sites and the Leq was approximately 4 dB above the average Leq. The predominate noise sources at ST-06 were roadway traffic, aircraft overflights, and landscaping as presented in Table 19 and Figure 14.

Table 18 - ST-06 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-06	430 Webster Street	7/23/2020 10:31 AM	7/23/2020 11:31 AM	84	61
LT-01	325 Exposition Boulevard	7/23/2020 10:31 AM	7/23/2020 11:31 AM	78	54
LT-02	303 Calhoun Street			79	56
LT-03	301 Henry Clay Avenue			84	65
LT-04	6037 Annunciation Boulevard			75	54
LT-05	6065 Tchoupitoulas Street			-	-

Table 19 - ST-06 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-05	Garbage Truck	84 to 85	92 to 99
	Helicopters	77	85
	Landscaping	81	79
	Vehicles	65 to 78	72 to 82

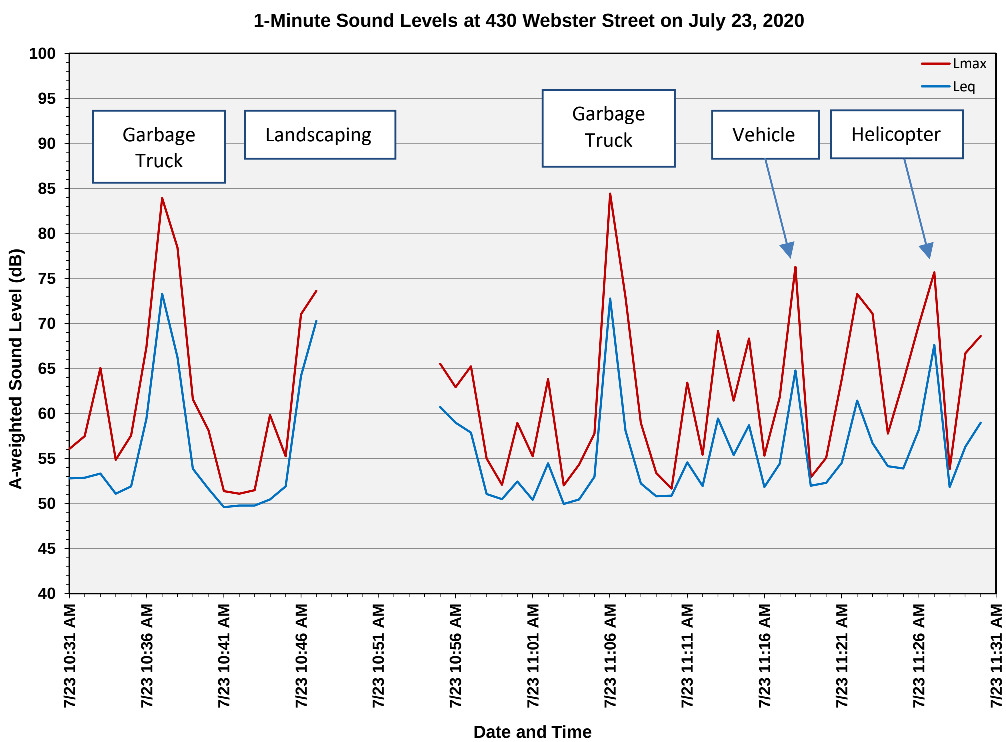

Figure 14 - ST-06 Time History Sound Levels

2.4.7 Short-Term Site 7

Short-Term Site 7 (ST-07) was located at the intersection of Annunciation Street and State Street, three blocks east of the Hospital. Table 20 shows that ST-07 averaged an Lmax 13 dB above the long-term sites and the Leq was approximately 3 dB above the average Leq. The predominate noise sources at ST-07 were roadway traffic, aircraft overflights, construction, and train horns as presented in Table 21 and Figure 15.

Table 20 – ST-07 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-07	Annunciation Street / State Street	7/22/2020 2:49 PM	7/22/2020 3:50 PM	90	62
LT-01	325 Exposition Boulevard	7/22/2020 2:49 PM	7/22/2020 3:50 PM	67	54
LT-02	303 Calhoun Street			73	55
LT-03	301 Henry Clay Avenue			88	66
LT-04	6037 Annunciation Boulevard			81	59
LT-05	6065 Tchoupitoulas Street			-	-

Table 21 – ST-07 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-07	Airplane	62	73
	Train Horns	64 to 82	69 to 82
	Heavy Trucks	69 to 87	74 to 81
	Vehicles	67 to 91	71 to 93

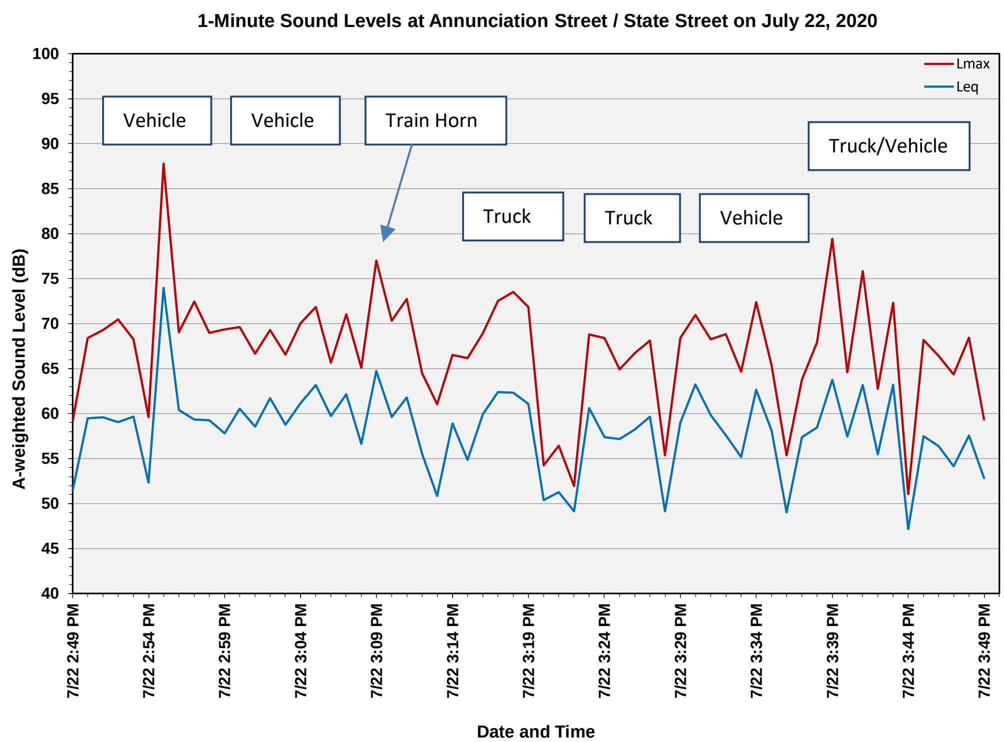

Figure 15 – ST-07 Time History Sound Levels

2.4.8 Short-Term Site 8

Short-Term Site 8 (ST-08) was located at 5900 Annunciation Street, five blocks east of the Hospital. Table 22 shows that ST-07 averaged an Lmax 1 dB below the long-term sites and the Leq was approximately 1 dB above the average Leq. The predominate noise sources at ST-08 were roadway traffic, aircraft overflights, and landscaping equipment as presented in Table 23 and Figure 16.

Table 22 – ST-08 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-08	5900 Annunciation Street	7/23/2020 9:12 AM	7/23/2020 10:13 AM	72	56
LT-01	325 Exposition Boulevard	7/23/2020 9:12 AM	7/23/2020 10:13 AM	66	50
LT-02	303 Calhoun Street			68	52
LT-03	301 Henry Clay Avenue			81	65
LT-04	6037 Annunciation Boulevard			88	58
LT-05	6065 Tchoupitoulas Street			62	51

Table 23 – ST-08 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-08	Landscaping	61 to 72	71 to 79
	Airplane	66	72
	Train Horns	60 to 62	61 to 69
	Heavy Trucks	65 to 66	70 to 71

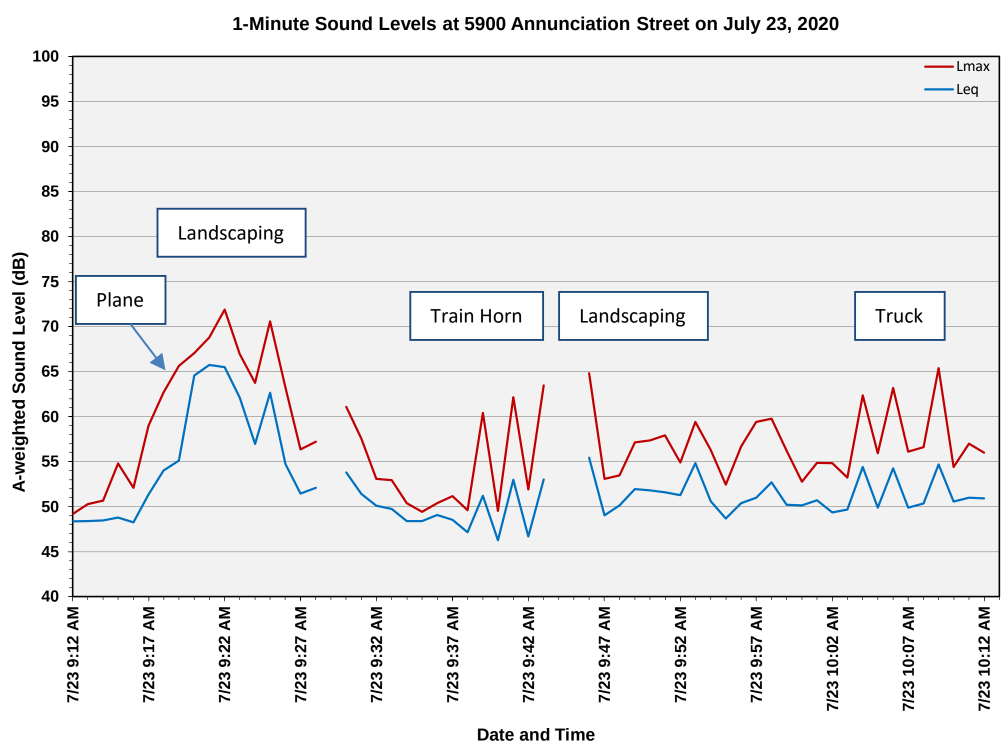

Figure 16 – ST-08 Time History Sound Levels

2.4.9 Short-Term Site 9

Short-Term Site 9 (ST-09) was located at 6220 Patton Street, three blocks north of the Hospital. Table 24 shows that ST-09 averaged an Lmax 1 dB below the long-term sites and the Leq was approximately 1 dB above the average Leq. The predominate noise sources at ST-09 were roadway traffic and barking dogs as presented in Table 25 and Figure 17.

Table 24 – ST-09 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-09	6220 Patton Street	7/23/2020 10:27 AM	7/23/2020 11:27 AM	75	55
LT-01	325 Exposition Boulevard	7/23/2020 10:27 AM	7/23/2020 11:27 AM	69	51
LT-02	303 Calhoun Street			76	55
LT-03	301 Henry Clay Avenue			84	65
LT-04	6037 Annunciation Boulevard			74	53
LT-05	6065 Tchoupitoulas Street			-	-

Table 25 – ST-09 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-09	Dog Bark	80	79
	Heavy Trucks	66 to 74	67 to 76
	Vehicles	64 to 71	70 to 76

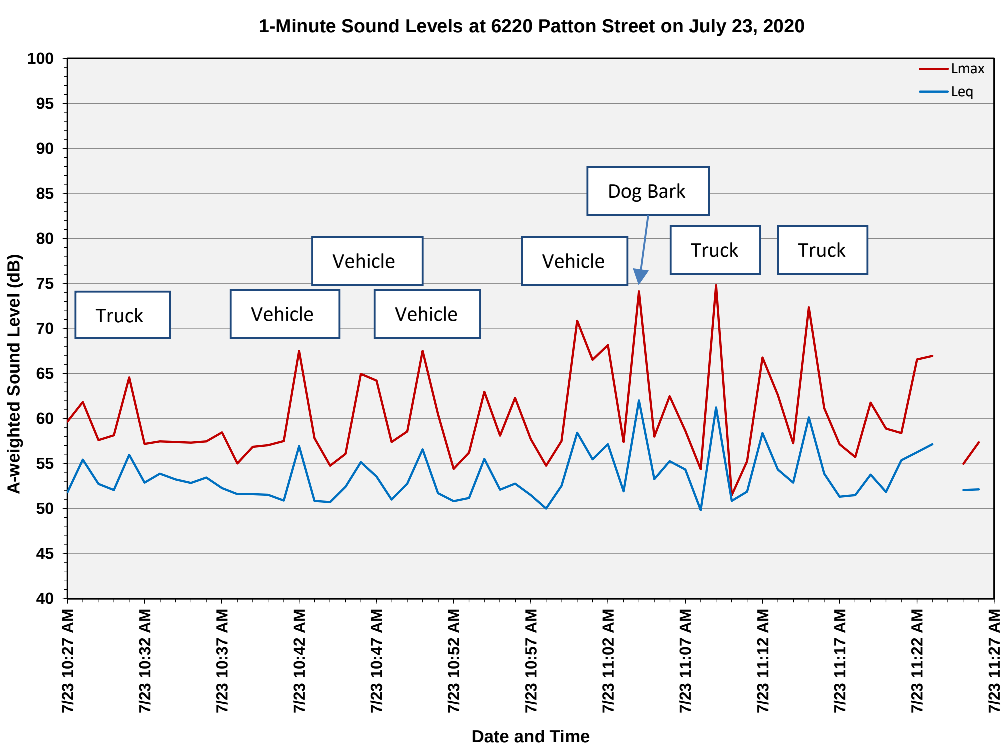

Figure 17 – ST-09 Time History Sound Levels

2.4.10 Short-Term Site 10

Short-Term Site 10 (ST-10) was located at the intersection of Laurel Street and State Street, three blocks northeast of the Hospital. Table 26 shows that ST-10 averaged an Lmax 5 dB above the long-term sites and the Leq was approximately 2 dB above the average Leq. The predominate noise sources at ST-10 were roadway traffic and train horns as presented in Table 27 and Figure 18.

Table 26 – ST-10 Sound Level Comparison

Site	Address	Start	End	Hourly Sound Level (dB)	
				Lmax	Leq
ST-10	Laurel Street / State Street	7/24/2020 8:21 AM	7/24/2020 9:21 AM	75	57
LT-01	325 Exposition Boulevard	7/24/2020 8:21 AM	7/24/2020 9:21 AM	65	52
LT-02	303 Calhoun Street			-	-
LT-03	301 Henry Clay Avenue			81	63
LT-04	6037 Annunciation Boulevard			69	53
LT-05	6065 Tchoupitoulas Street			66	52

Table 27 – ST-10 Single Event Levels

Site	Noise Source	Sound Level (dB)	
		Lmax	SEL
ST-10	Train Horns	65 to 66	70 to 72
	Heavy Trucks	70 to 77	74 to 83
	Vehicles	59 to 71	67 to 80

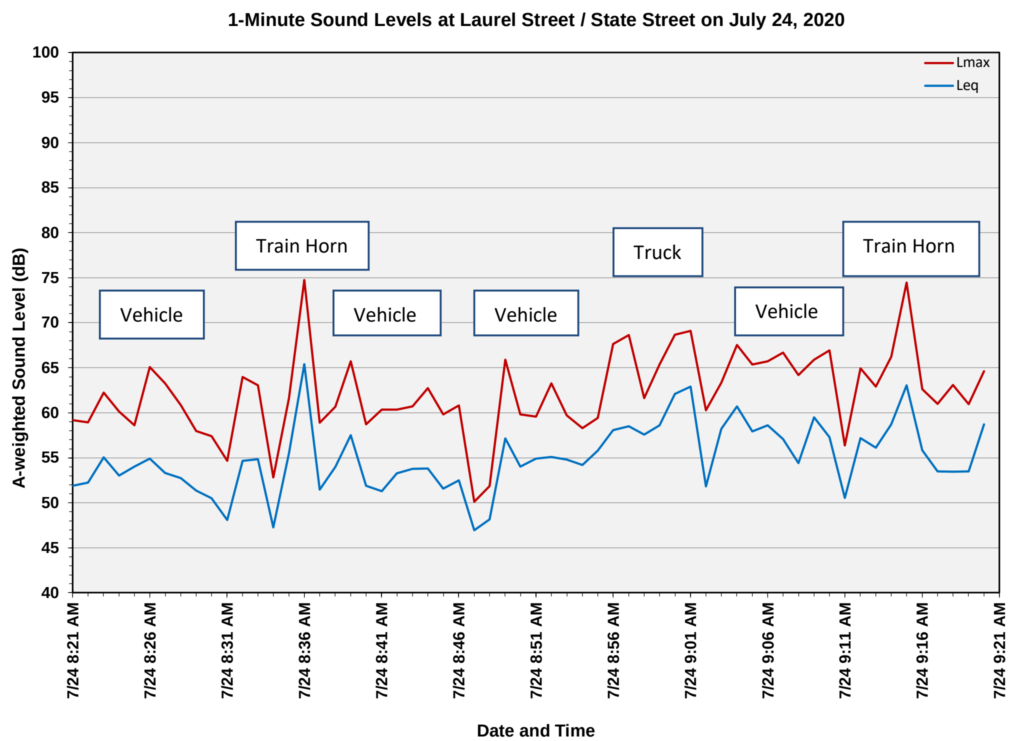

Figure 18 – ST-10 Time History Sound Levels

3. Noise Modeling

HMMH utilized the Federal Aviation Administration (FAA) Aviation Environmental Design Tool (AEDT), Version 3c, for all noise modeling efforts. This section summarizes the modeling assumptions used in AEDT along with the corresponding modeling results.

It is important to note that actual flights will vary in duration and will not fly the modeled paths exactly. The purpose of modeling to facilitate a comparison of expected noise conditions between helicopter flight paths from the existing helistop and historical flight paths from the decommissioned helistop.

3.1 Helicopter Selection and Procedures

The Bell 429 helicopter was selected as the appropriate AEDT substitute for the Eurocopter EC-145 which is flown by the Hospital. HMMH adjusted the AEDT standard helicopter flight procedures to include increased altitudes and ground speeds[6]. It should also be noted that AEDT does not explicitly state the descent and ascent angles for each operation; however, it has been calculated from the procedural data.

In AEDT, all arriving helicopter descend at a 5.9-degree slope from an initial altitude of 1,000 feet Above Ground Level (AGL) to 500 feet AGL over a track distance approximately 1 mile from the helistop. At one-half mile from the helistop, the aircraft descend at a 9.7-degree slope until they reach an altitude of 15 feet AGL above the helistop where they begin a vertical decent.

Departing helicopters begin with a vertical ascent to 15 feet above the helistop. They proceed to climb out at a 4.2-degree slope over a 500-foot track distance to an altitude of 30 feet AGL. The helicopters then climb at a 15.5-degree angle for 3,500 feet until they reach cruising altitude of 1000 feet.

3.2 Flight Track Geometry

HMMH used the historical flight track data provided by the Hospital to derive representative arrival and departures model flight tracks for the existing and historical helistops and presented in Figure 19 and Figure 20, respectively, with a comparison of all tracks in Figure 21.[7] The northern flight tracks have the most geometric difference between existing and historical conditions. The northern historical departure tracks fly directly north while the northbound existing tracks fly north-northeast. Existing arrivals from the north fly directly southwest to the helistop while the historical paths fly south-southwest and turn west to the historical helistop.

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[6] Flight procedures provided by Mr. Evan Bertucci of LCMC Health on July 28th, 2020.
[7] Flight tracks reviewed and approved by Mr. Evan Bertucci of LCMC Health on August 11th, 2020.

Figure 19 - Existing Helistop Tracks

Figure 20 - Historical Helistop Tracks

Figure 21 – Historical and Existing Helicopter Model Tracks Comparison

3.3 Meteorological Conditions

AEDT has several settings that affect aircraft performance profiles and sound propagation based on meteorological data. Meteorological settings include average annual temperature, barometric pressure, and relative humidity at the airport. The AEDT default values for annual average weather conditions at the Hospital:

- Temperature: 68.72° F
- Sea-level Pressure: 1015.85 millibars
- Relative Humidity 77.58%
- Dew Point: 61.14° F
- Wind Speed: 5.07 Knots

3.4 Terrain Data

Terrain data describes the elevation of the ground surrounding the helistop and on Hospital property. The AEDT uses terrain data to adjust the ground level under the flight paths. The terrain data does not change the aircraft's performance or noise levels but does alter the vertical distance between the aircraft and a "receiver" on the ground. Terrain data were obtained from the United States Geological Survey National Elevation Dataset with one-third arc second (approximately 33 feet) resolution. The data were utilized in conjunction with the terrain feature of the AEDT to generate the noise contours at the Hospital.

3.5 Modeling Results

The modeling results are presented in Figure 22 through Figure 35. Receptor points are presented in Table 28 through Table 31. The contours are an extensive set of points that connect points of identical values to form a visual contour. The tabulated data shows the noise level at that exact point within the contour. The noise contours and receptor points provide a graphical and tabular form to visualize the approximate noise during a helicopter event and how it compares to the range of the ambient community noise measured the short- and long-term sites.

Departure operations often experience a higher measured and modeled noise levels because they require approximately seven minutes to power allowing avionics systems to boot-up and perform safety checks on the engine. Upon departure, higher power settings are required to generate enough lift and speed to begin flying. Arrivals require less thrust as a reduction of lift allows the helicopter to descend and land safely on the helistop.

Generally, the modeled noise level results in terms of Lmax correlate with the long-term and short-term measurement data within the 70-85 dB range. As anticipated, the modeled noise level results in terms of Leq do not correlate as well to measurement data since the model does not include all community noise that takes place during actual measurements.

The importance of the modeled Leq results is in the delta or change in noise levels between historical to existing helistop and corresponding flight tracks. Since the existing helistop is at an elevation of approximately 90 feet and does not have any buildings breaking line of sight to the nearest residences to the north of the Hospital, the noise level differences between the historical and existing helistop modeled operations show an overall increase in noise levels. The height of the helistop also effects the general exposure to the surrounding community. Because the existing helistop is 66 feet above the 24-foot historical helistop, actual noise exposure will propagate over a larger surface area. This is evident as the departure Leq in Table 29 are as much as 14 dB higher than the historical conditions and 7 dB higher during an arrival flight as shown in Table 31.

The modeled Test Flight (TF) points do not correlate as well with the measured test flight data because actual and representative tracks are not identical.

Figure 22 - Existing Arrival North

Figure 23 - Existing Arrival South East

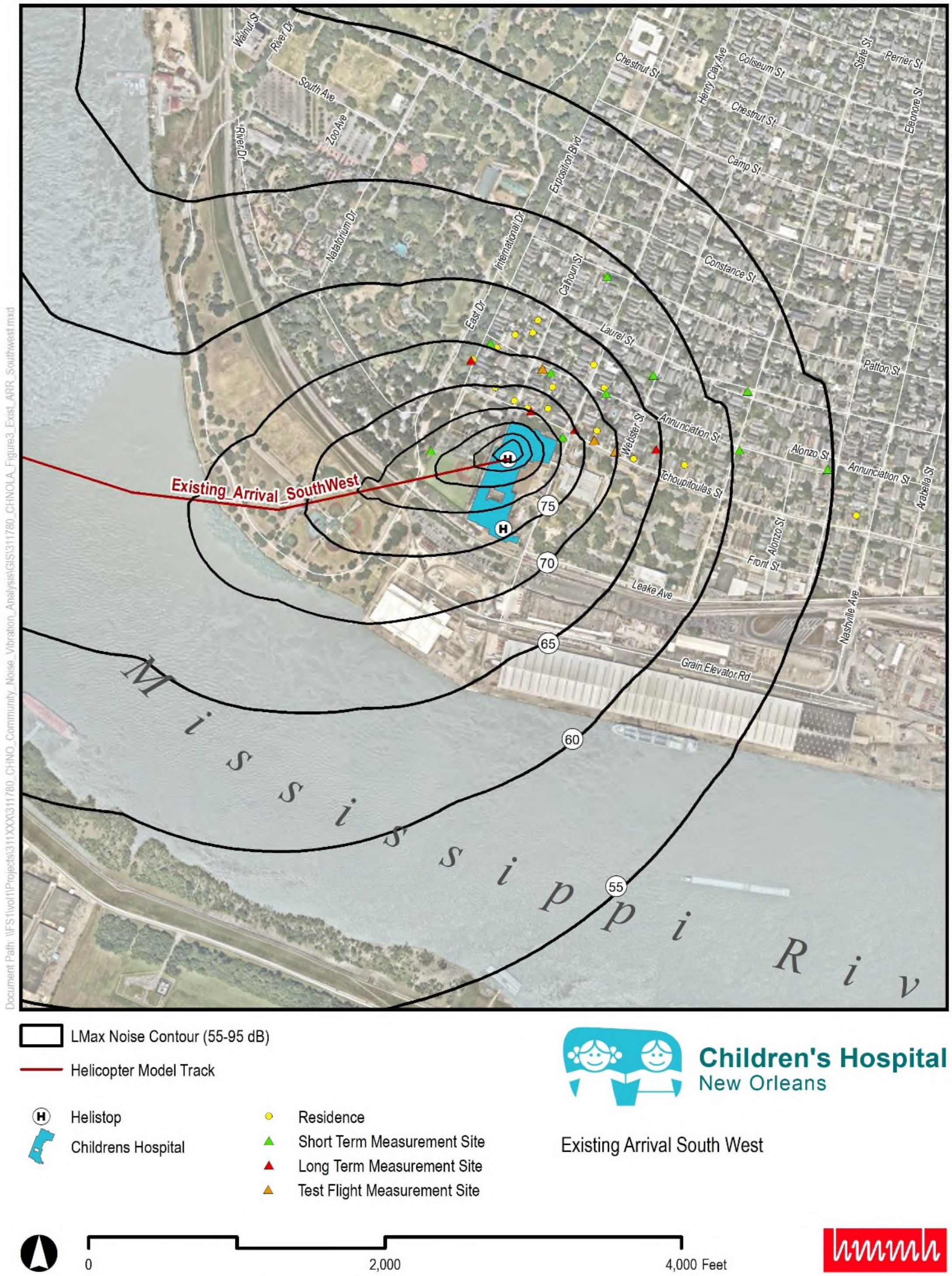


Figure 24 - Existing Arrival South West

Figure 25 - Existing Departure North

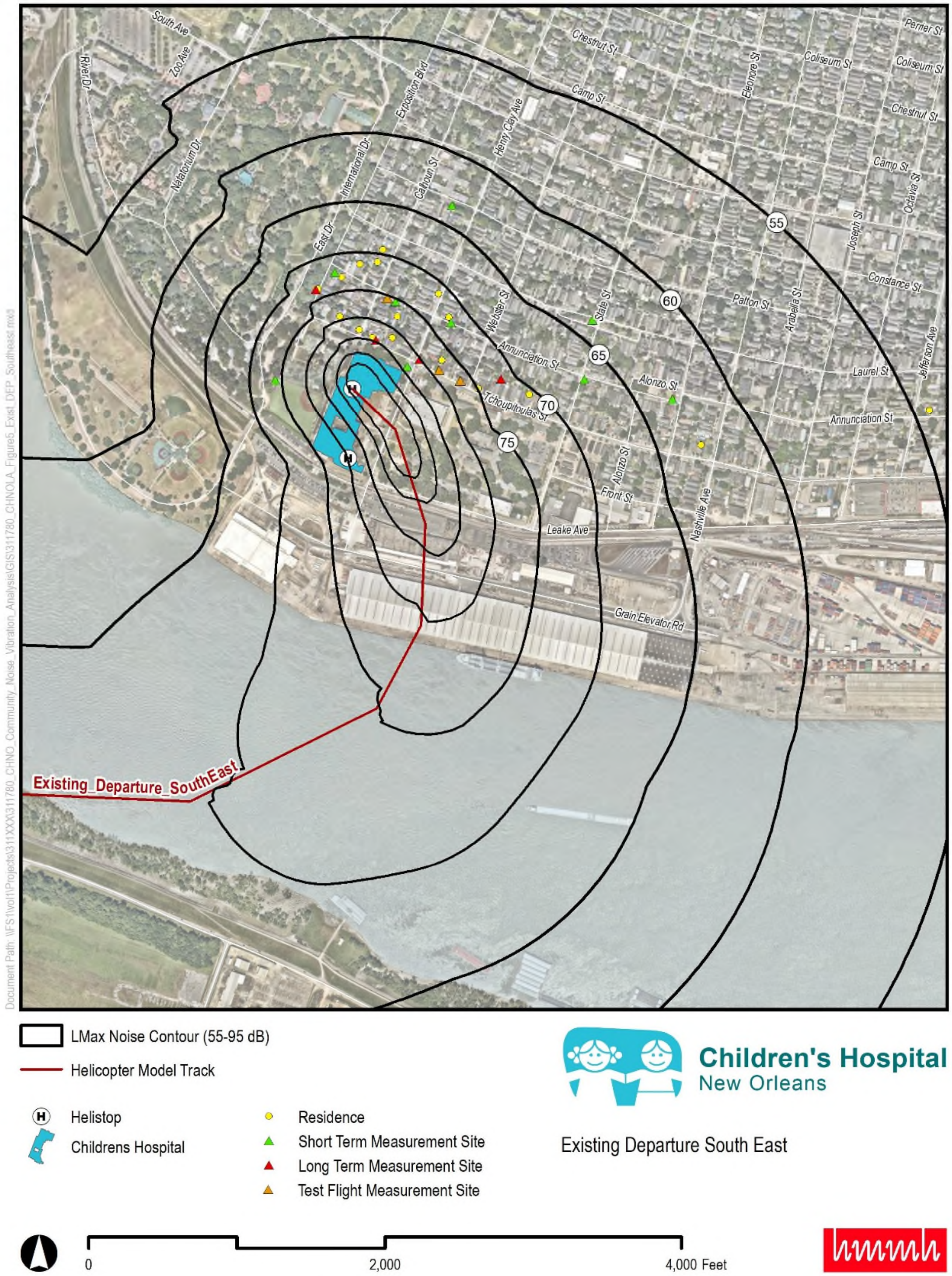


Figure 26 - Existing Departure South East

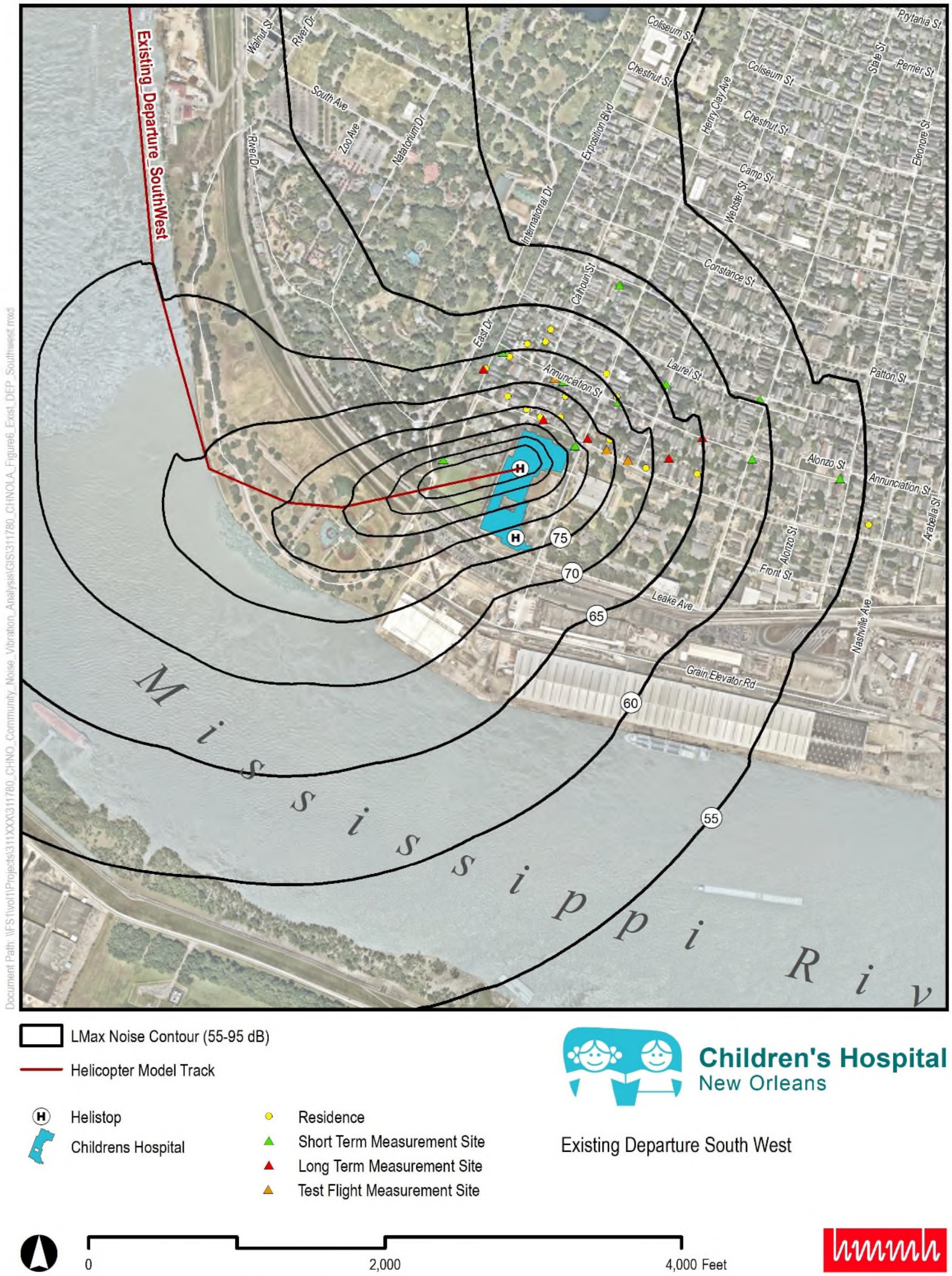


Figure 27 - Existing Departure South West

Figure 28 - Historical Arrival North

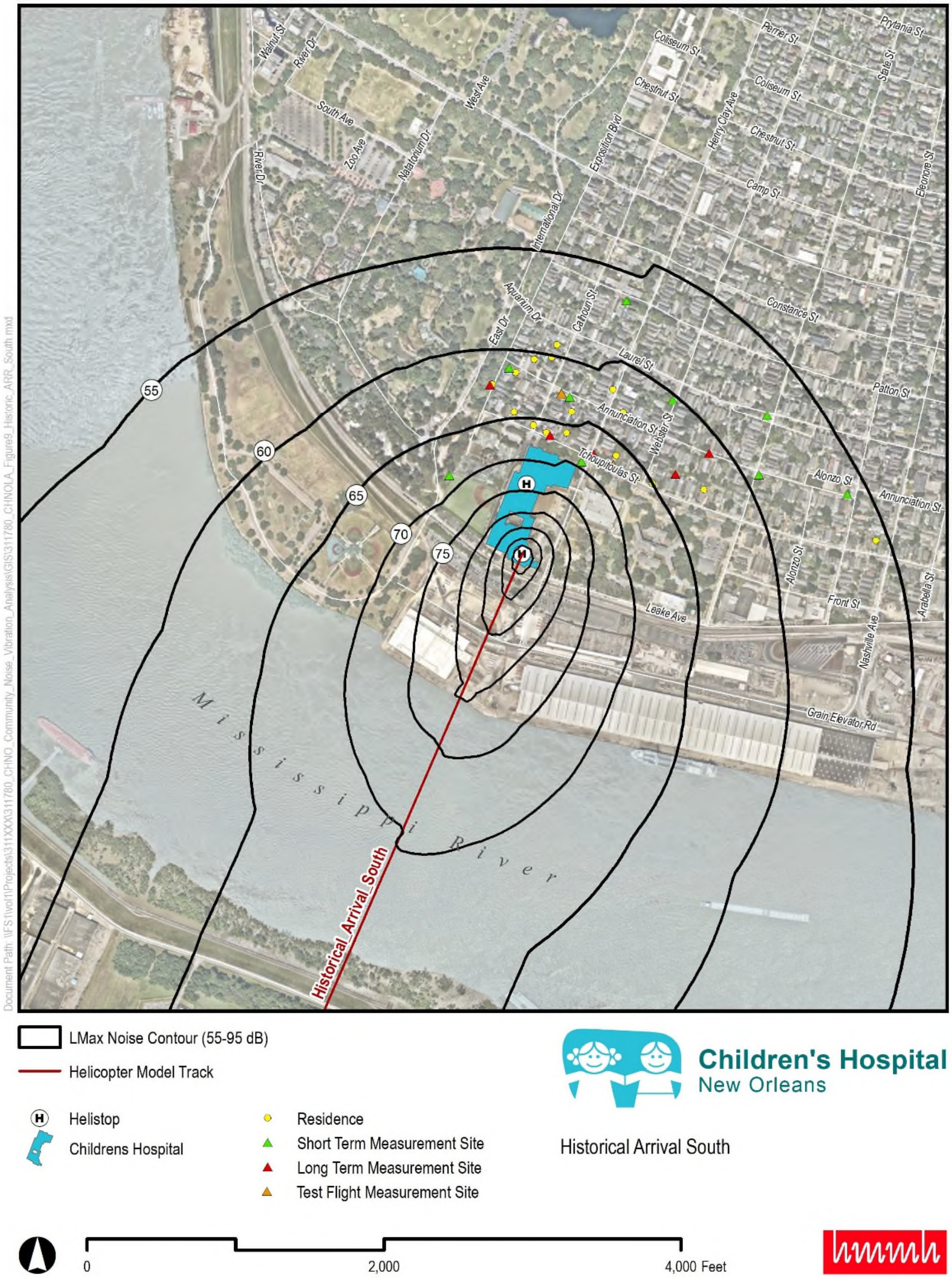


Figure 29 - Historical Arrival South

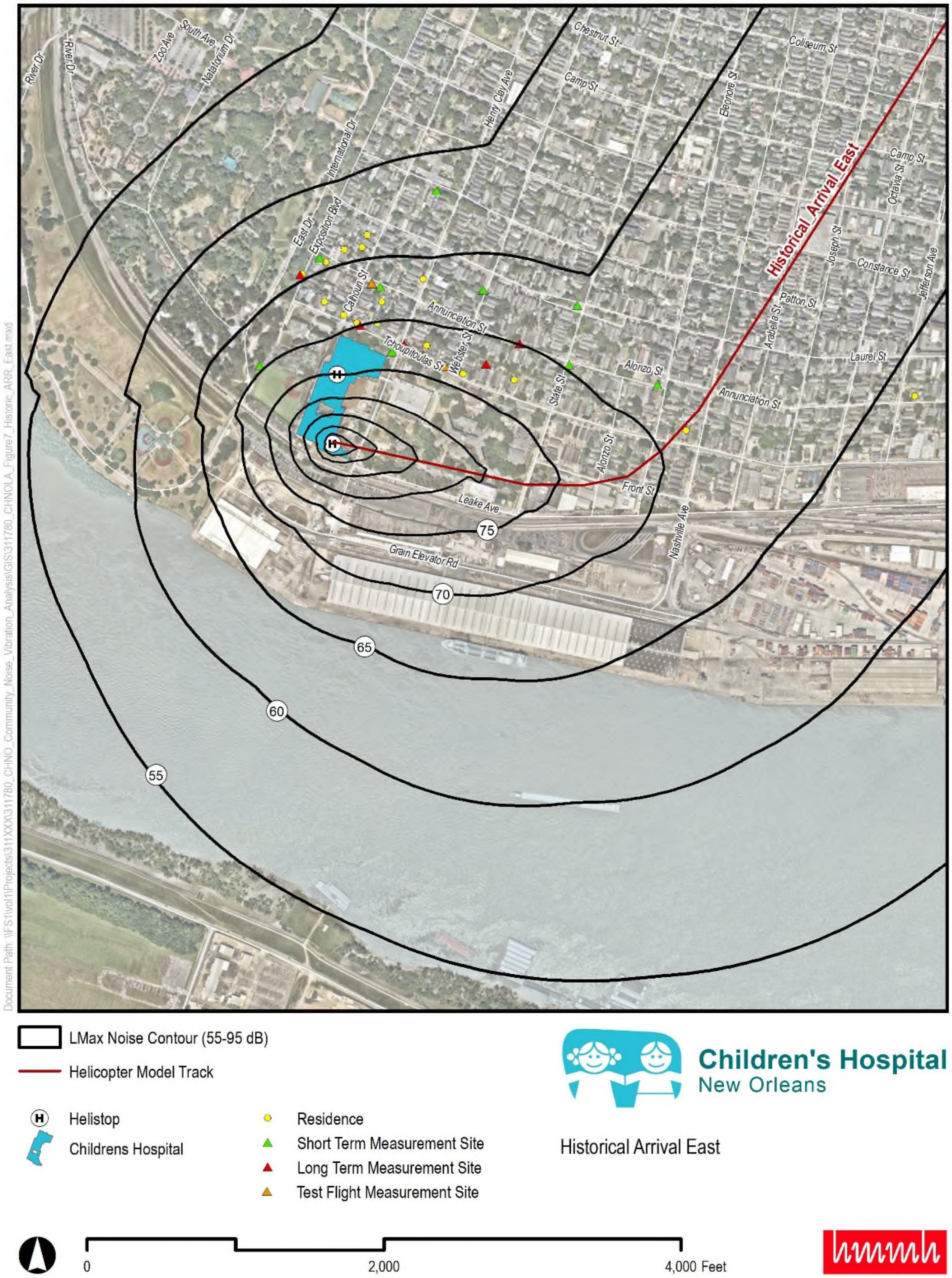


Figure 30 - Historical Arrival East

Figure 31 - Historical Arrival West

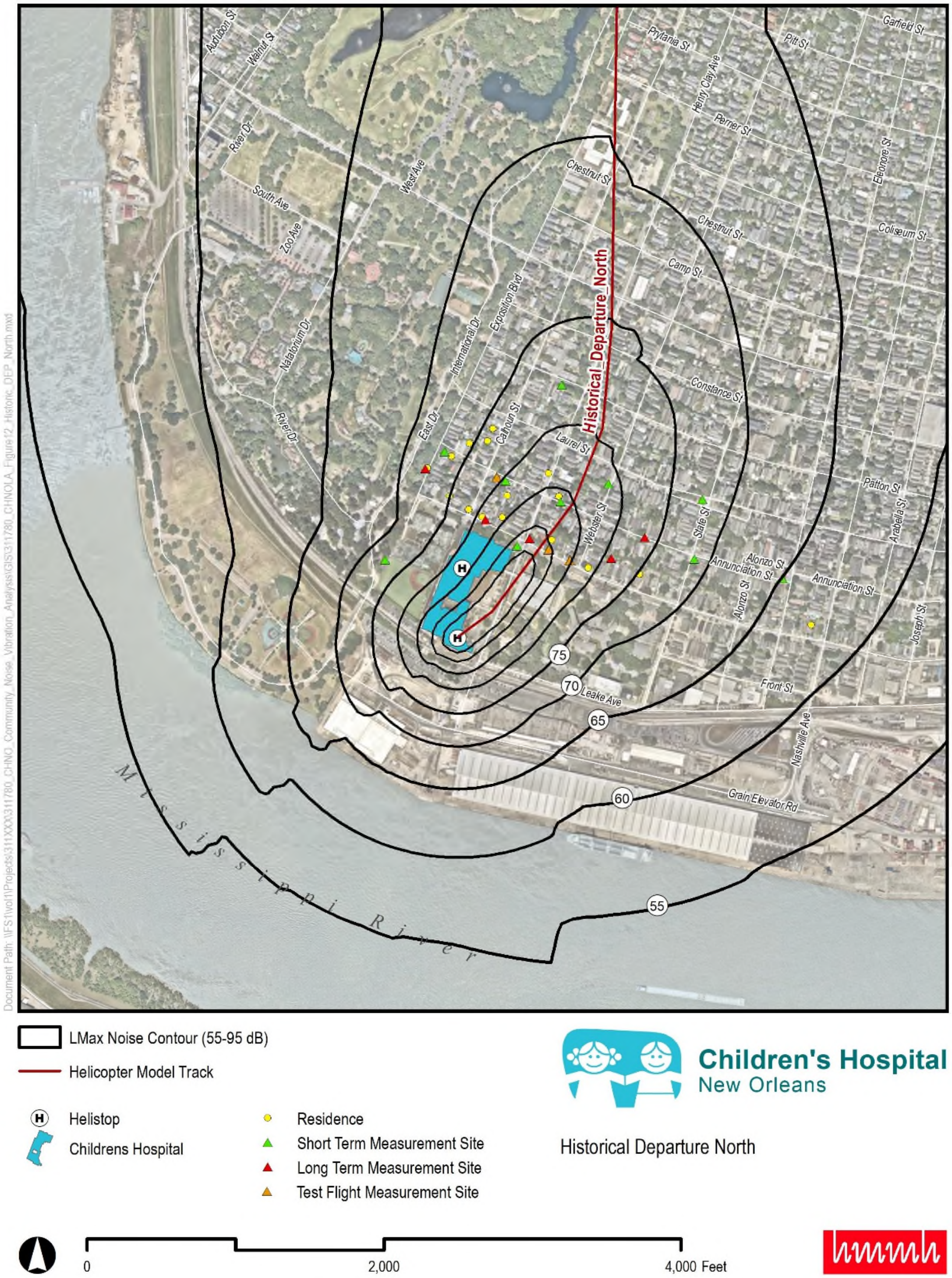


Figure 32 - Historical Departure North

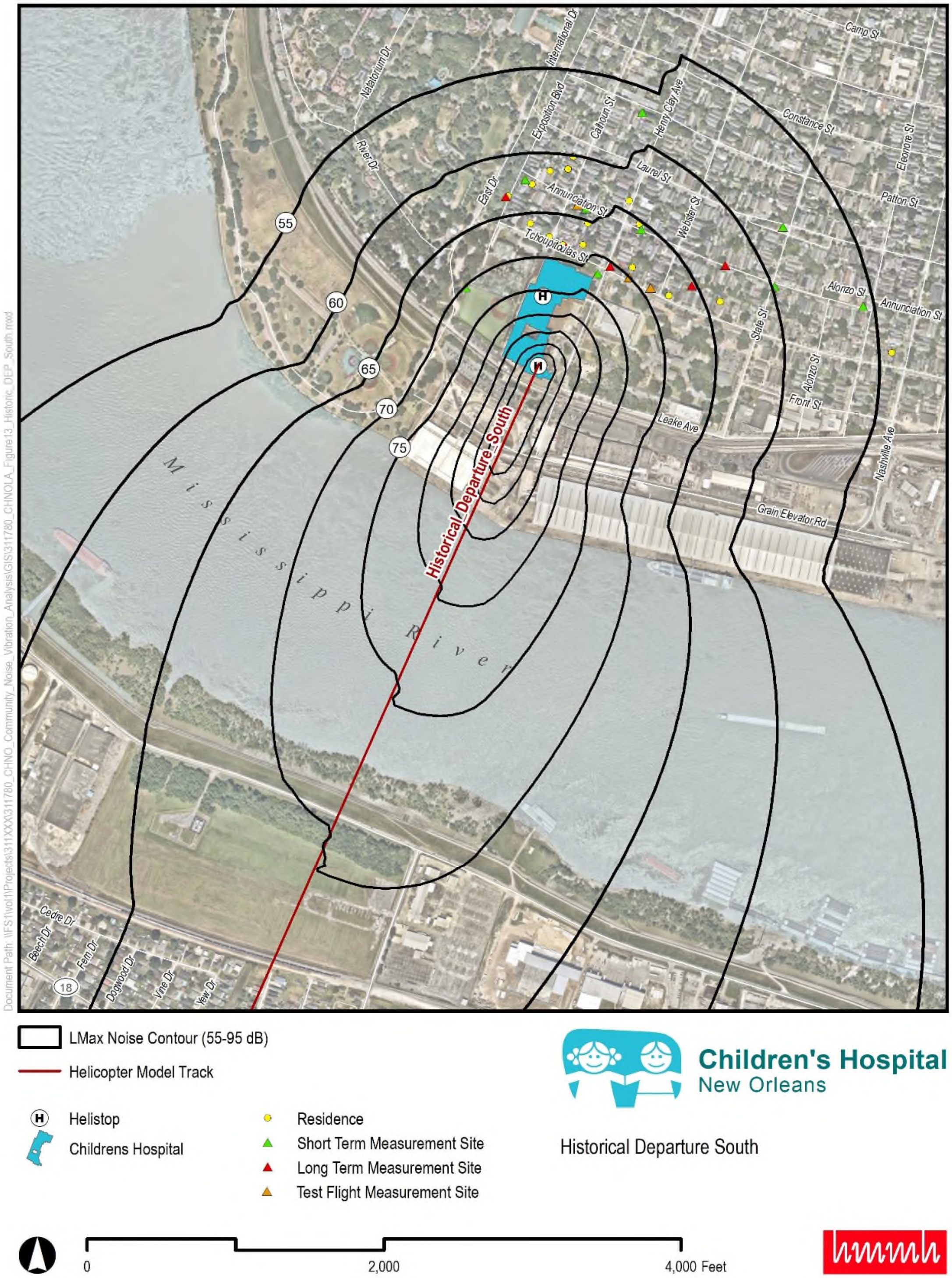


Figure 33 - Historical Departure South

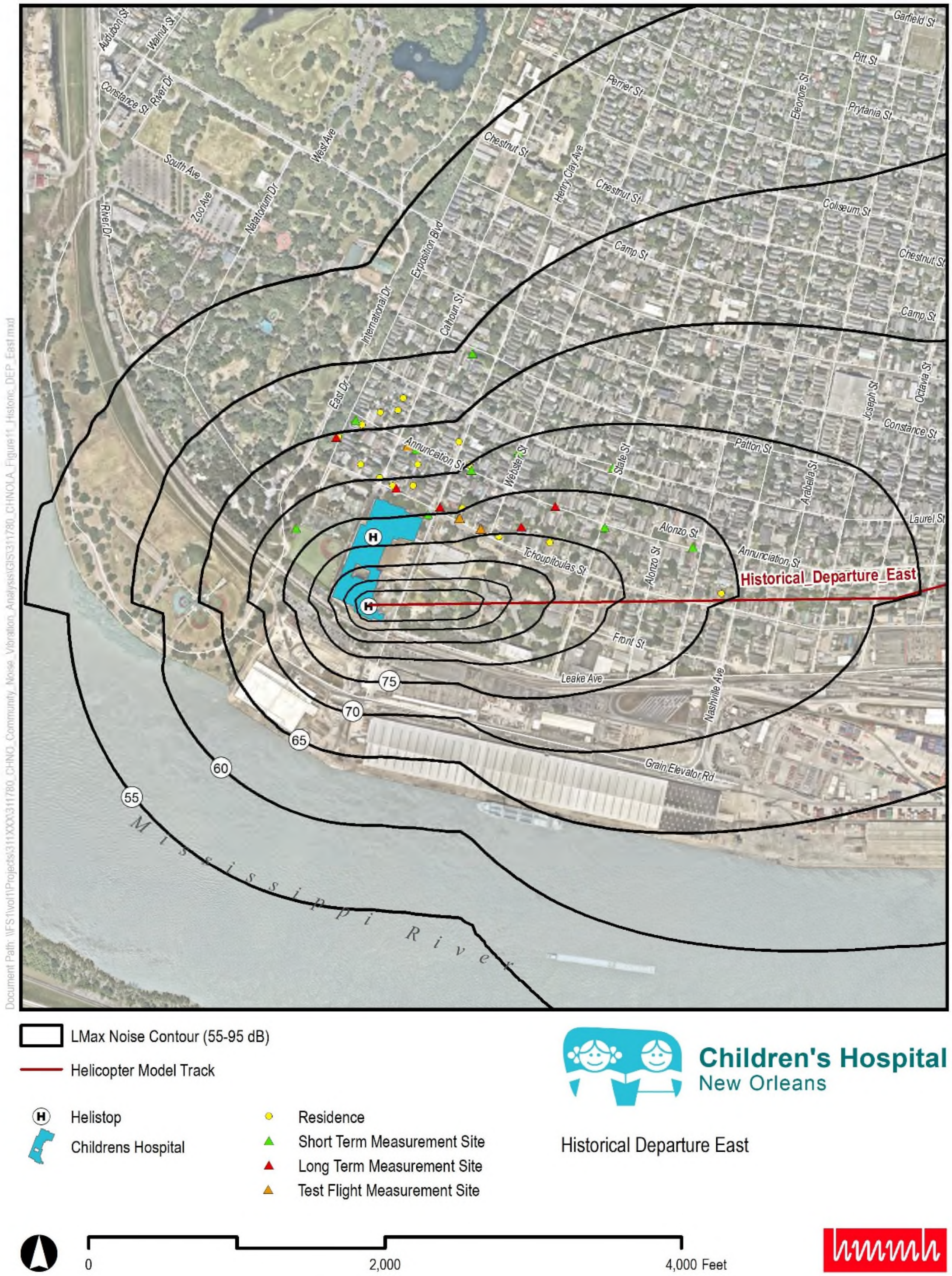


Figure 34 - Historical Departure East

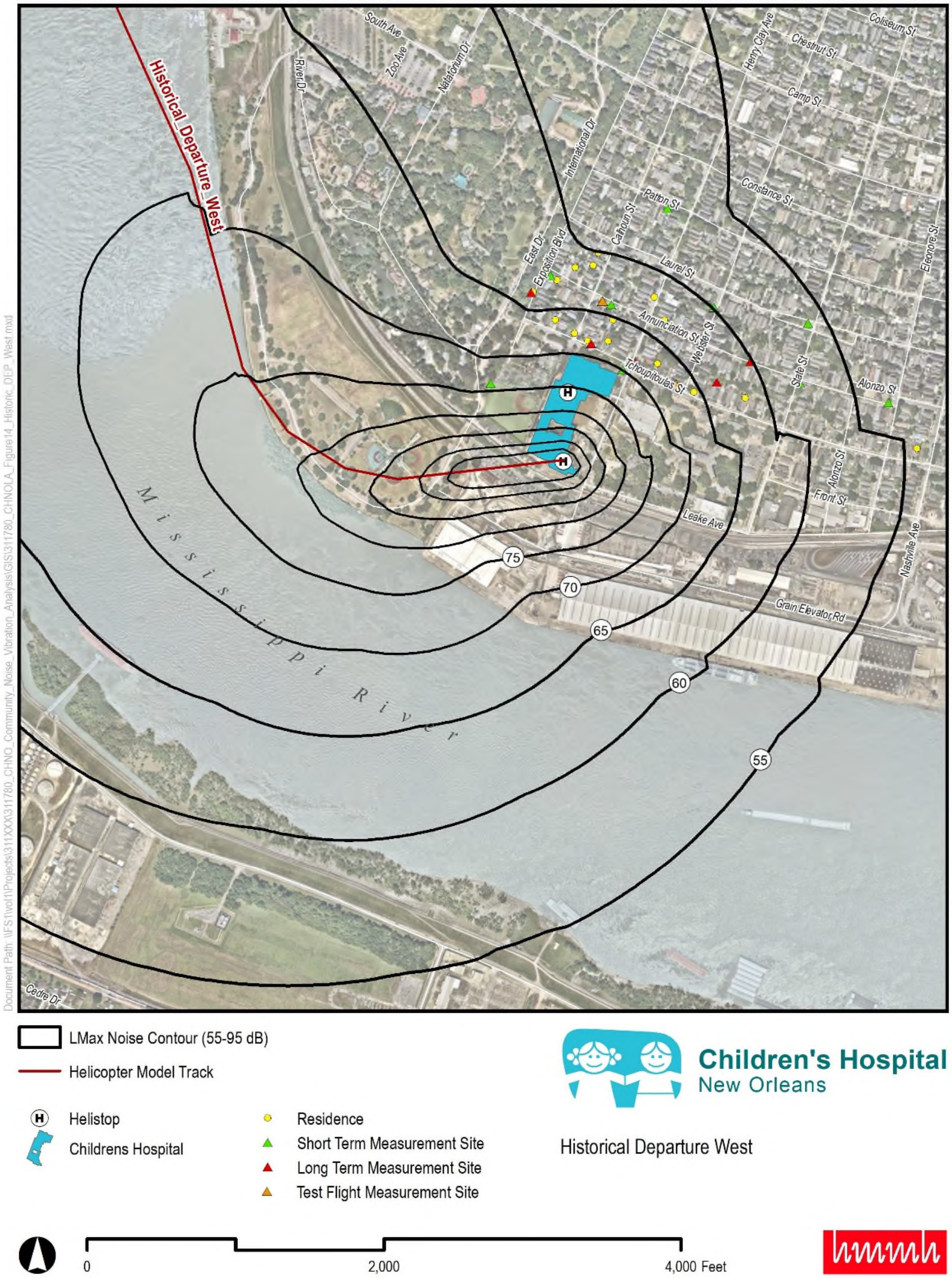


Figure 35 - Historical Departure West

Table 28 - Departures - LMAX (dB)

	Existing				Historical					Difference
Location	North	South East	South West	Average (a)	North	South	East	West	Average (b)	(a)-(b)
R1	79.2	79.2	77.1	78.5	75.0	66.1	68.3	66.1	68.9	9.7
R2	73.5	73.5	71.6	72.9	72.1	63.2	65.4	63.8	66.1	6.8
R3	83.2	82.9	80.8	82.3	78.4	67.6	69.8	67.6	70.8	11.5
R4	86.0	84.2	82.2	84.1	81.0	68.2	70.7	68.2	72.0	12.1
R5	87.4	81.7	79.6	82.9	84.1	67.6	71.0	67.6	72.6	10.4
R6	82.8	77.6	75.5	78.6	82.2	65.3	68.7	65.3	70.4	8.2
R7	75.2	69.5	67.3	70.7	75.8	60.1	62.7	60.1	64.7	6.0
R8	97.1	76.9	75.5	83.2	89.5	69.0	74.7	66.8	75.0	8.1
R9	74.5	70.5	65.5	70.1	74.8	63.8	80.6	61.6	70.2	0.0
R10	80.2	74.8	70.7	75.3	81.3	67.8	80.4	65.6	73.8	1.5
R11	92.4	72.1	69.9	78.1	85.8	65.3	70.1	63.1	71.1	7.0
R12	73.8	71.4	69.3	71.5	74.6	61.3	63.6	61.3	65.2	6.3
R13	73.0	73.0	70.8	72.3	73.7	62.4	64.6	62.4	65.8	6.5
R14	56.3	54.6	47.8	52.9	55.2	47.8	69.3	47.6	55.0	-2.1
R15	75.4	71.0	68.8	71.7	76.0	61.1	63.6	61.1	65.4	6.3
R16	85.9	71.2	69.1	75.4	83.5	64.1	67.1	62.0	69.2	6.3
R17	60.9	62.5	54.6	59.3	62.4	54.4	75.6	54.4	61.7	-2.4
LT1	73.5	73.5	71.7	72.9	71.9	63.2	65.4	63.9	66.1	6.8
LT2	87.0	84.6	82.5	84.7	81.8	68.4	71.1	68.4	72.4	12.3
LT3	104.7	80.1	77.3	87.4	92.2	70.5	74.0	68.3	76.3	11.1
LT4	77.0	68.0	65.0	70.0	76.4	62.3	76.5	60.1	68.8	1.2
LT5	78.8	71.5	68.3	72.9	78.9	65.4	79.0	63.2	71.6	1.2
ST1	76.0	73.9	90.8	80.2	72.3	70.2	72.3	73.8	72.1	8.1
ST2	105.5	83.4	80.4	89.8	92.1	72.1	75.0	69.9	77.3	12.5
ST3	72.2	72.2	70.1	71.5	73.0	62.0	64.2	62.4	65.4	6.1
ST4	80.0	75.5	73.4	76.3	80.4	64.0	67.2	64.0	68.9	7.4
ST5	93.9	72.3	70.1	78.7	86.2	65.6	70.8	63.4	71.5	7.2
ST6	85.7	67.0	64.6	72.4	81.1	62.1	71.2	59.9	68.6	3.9
ST7	70.8	66.9	61.3	66.3	71.3	59.8	77.8	57.7	66.6	-0.3
ST8	64.7	63.0	56.2	61.3	64.9	55.5	76.2	53.4	62.5	-1.2
ST9	78.2	63.4	61.2	67.6	77.7	56.3	61.4	56.6	63.0	4.6
ST10	73.7	63.8	60.3	65.9	72.2	58.0	73.0	55.9	64.8	1.1
TF1	73.5	73.5	71.7	72.9	71.9	63.2	65.4	63.9	66.1	6.8
TF2	94.4	79.3	77.2	83.6	91.6	70.5	75.8	68.3	76.6	7.1
TF3	86.5	77.4	74.0	79.3	87.0	69.4	78.4	67.2	75.5	3.8
									Average Difference	**5.8 dB**

Table 29 - Departures LEQ (dB)

Existing					Historical					Difference
Location	North	South East	South West	Average (a)	North	South	East	West	Average (b)	(a)-(b)
R1	55.2	55.2	55.2	55.2	43.6	43.2	43.2	43.1	43.3	11.9
R2	49.5	49.5	49.3	49.4	40.7	40.0	40.1	40.1	40.2	9.2
R3	58.4	58.4	58.4	58.4	45.3	44.8	44.8	44.7	44.9	13.5
R4	60.2	60.1	60.1	60.1	46.3	45.6	45.6	45.5	45.7	14.4
R5	58.8	58.7	58.6	58.7	46.5	45.0	45.2	45.0	45.4	13.3
R6	54.2	54.0	53.9	54.0	44.4	42.5	42.7	42.5	43.0	11.0
R7	45.0	44.7	44.6	44.7	39.1	36.8	36.8	36.7	37.4	7.4
R8	56.1	55.0	55.0	55.4	48.4	45.3	45.5	45.0	46.0	9.3
R9	44.5	44.4	44.2	44.4	41.9	40.9	43.0	40.8	41.6	2.7
R10	50.6	50.5	50.4	50.5	45.9	44.8	45.7	44.7	45.3	5.3
R11	51.3	49.3	49.2	49.9	44.8	40.7	41.0	40.5	41.7	8.2
R12	46.6	46.5	46.5	46.6	39.5	38.0	38.0	38.0	38.4	8.2
R13	48.5	48.5	48.4	48.4	40.1	39.2	39.2	39.2	39.4	9.0
R14	25.6	25.3	24.6	25.2	25.0	24.1	31.9	24.1	26.3	-1.1
R15	46.5	46.3	46.2	46.3	39.8	37.8	37.8	37.7	38.3	8.0
R16	48.9	47.7	47.6	48.1	43.3	39.1	39.4	38.9	40.2	7.9
R17	32.2	32.5	31.7	32.1	32.4	31.7	37.3	31.7	33.3	-1.2
LT1	49.5	49.5	49.3	49.4	40.7	40.1	40.2	40.1	40.3	9.1
LT2	60.7	60.6	60.6	60.6	46.7	45.9	45.9	45.8	46.1	14.6
LT3	60.0	58.7	58.5	59.1	49.8	46.5	46.6	46.3	47.3	11.8
LT4	44.0	43.4	43.3	43.6	40.7	38.7	40.4	38.5	39.5	4.0
LT5	48.0	47.8	47.7	47.8	43.7	42.2	43.4	42.0	42.8	5.0
ST1	56.7	56.4	56.8	56.6	48.8	48.7	48.8	48.7	48.8	7.8
ST2	62.9	62.1	62.0	62.3	50.6	48.1	48.2	47.9	48.7	13.6
ST3	47.7	47.7	47.6	47.6	39.7	38.7	38.8	38.8	39.0	8.7
ST4	51.8	51.6	51.5	51.6	43.0	41.1	41.2	41.0	41.6	10.0
ST5	51.9	49.7	49.6	50.4	45.1	41.1	41.4	40.9	42.1	8.3
ST6	46.5	43.8	43.6	44.6	42.0	37.6	38.4	37.4	38.8	5.8
ST7	40.0	39.7	39.5	39.8	37.9	36.5	39.8	36.4	37.7	2.1
ST8	34.3	34.1	33.7	34.0	33.4	32.3	37.7	32.2	33.9	0.1
ST9	40.7	38.4	38.1	39.1	38.5	32.6	33.1	32.7	34.2	4.9
ST10	39.0	37.6	37.4	38.0	36.6	33.9	36.6	33.7	35.2	2.8
TF1	49.4	49.5	49.3	49.4	40.7	40.1	40.2	40.1	40.3	9.1
TF2	57.8	57.4	57.4	57.5	49.9	46.9	47.1	46.7	47.6	9.9
TF3	54.6	54.5	54.5	54.5	48.2	46.2	46.6	46.0	46.7	7.8
									Average Difference	7.8 dB

Table 30 - Arrivals LMAX (dB)

Existing					Historical					Difference
Location	North	South East	South West	Average (a)	North	South	East	West	Average (b)	(a)-(b)
R1	76.0	76.0	75.0	75.7	73.0	64.3	67.1	64.6	67.3	8.4
R2	70.6	70.6	71.5	70.9	70.2	62.0	64.6	64.1	65.3	5.6
R3	79.5	79.5	78.3	79.1	75.1	65.7	68.8	65.7	68.8	10.3
R4	81.9	80.8	79.6	80.8	76.6	66.3	69.7	66.3	69.7	11.1
R5	81.8	78.4	77.2	79.1	77.6	65.7	70.1	65.7	69.8	9.3
R6	77.8	74.4	73.2	75.2	76.2	63.6	68.4	63.6	67.9	7.2
R7	69.9	66.6	66.2	67.6	71.4	59.4	63.4	60.8	63.8	3.8
R8	82.7	75.7	72.5	77.0	79.9	66.1	72.0	65.0	70.8	6.2
R9	74.3	74.2	62.8	70.4	71.5	62.3	72.4	60.0	66.5	3.9
R10	79.6	76.3	67.9	74.6	75.6	65.0	73.6	63.9	69.5	5.1
R11	77.5	71.4	68.0	72.3	78.4	62.5	68.2	61.5	67.6	4.6
R12	69.7	68.5	68.2	68.8	71.2	60.4	64.1	62.0	64.4	4.4
R13	70.0	70.0	69.8	70.0	71.0	61.3	64.5	63.0	64.9	5.0
R14	59.0	66.5	48.0	57.8	56.5	49.2	63.8	47.4	54.2	3.5
R15	70.4	68.1	67.3	68.6	71.9	60.1	64.2	61.4	64.4	4.2
R16	75.2	69.6	67.2	70.7	76.2	61.6	66.6	60.4	66.2	4.5
R17	63.8	68.7	53.9	62.1	61.6	55.4	69.8	53.4	60.1	2.1
LT1	70.6	70.6	71.6	70.9	70.1	62.1	64.6	64.2	65.3	5.7
LT2	82.7	81.2	79.9	81.3	77.0	66.5	70.0	66.5	70.0	11.2
LT3	84.2	78.1	75.0	79.1	81.1	67.6	72.2	66.5	71.8	7.3
LT4	76.0	72.0	62.3	70.1	71.9	60.9	69.9	58.6	65.3	4.8
LT5	77.7	74.6	65.4	72.5	74.0	63.2	72.1	61.6	67.7	4.8
ST1	71.8	71.8	82.7	75.4	71.4	68.2	69.4	73.7	70.7	4.8
ST2	87.0	81.0	78.0	82.0	81.5	69.2	72.9	68.0	72.9	9.1
ST3	69.3	69.3	69.6	69.4	70.4	61.1	64.1	63.0	64.6	4.8
ST4	75.5	72.5	71.3	73.1	75.0	62.3	67.2	62.3	66.7	6.4
ST5	78.1	71.8	68.2	72.7	78.8	62.8	68.6	61.7	68.0	4.7
ST6	77.6	69.5	62.9	70.0	73.8	60.3	67.0	58.5	64.9	5.1
ST7	71.3	70.9	59.6	67.3	68.4	59.2	69.6	56.4	63.4	3.8
ST8	66.2	68.0	55.2	63.1	63.8	55.7	68.8	53.6	60.5	2.7
ST9	69.7	63.8	61.1	64.9	70.4	56.2	61.8	57.4	61.5	3.4
ST10	71.4	68.0	57.8	65.7	68.5	57.2	66.4	55.4	61.9	3.8
TF1	70.6	70.6	71.6	70.9	70.1	62.1	64.6	64.2	65.3	5.6
TF2	84.9	77.6	74.2	78.9	80.7	67.6	73.1	66.4	72.0	6.9
TF3	83.7	76.8	71.1	77.2	78.7	66.6	73.4	65.4	71.0	6.2
									Average Difference	**5.7 dB**

Table 31 - Arrivals LEQ (dB)

Existing					Historical					Difference
Location	North	South East	South West	Average (a)	North	South	East	West	Average (b)	(a)-(b)
R1	33.8	35.5	34.0	34.4	33.3	27.6	27.9	26.8	28.9	5.6
R2	30.5	31.7	31.4	31.2	31.0	25.6	26.0	25.9	27.1	4.1
R3	36.3	37.2	35.9	36.5	35.0	28.9	29.0	27.3	30.0	6.4
R4	38.4	37.3	37.0	37.6	36.3	29.5	29.6	27.4	30.7	6.9
R5	38.9	35.6	36.1	36.8	37.4	29.2	30.0	27.0	30.9	5.9
R6	36.3	33.1	33.0	34.1	36.2	27.7	28.6	25.7	29.5	4.6
R7	30.6	28.2	27.6	28.8	32.0	24.1	24.9	23.1	26.0	2.7
R8	41.4	35.5	34.3	37.1	39.5	29.3	32.0	26.7	31.9	5.2
R9	34.9	34.2	26.9	32.0	32.1	25.3	32.8	24.1	28.6	3.4
R10	38.9	36.2	30.4	35.2	35.9	28.0	33.6	26.4	31.0	4.2
R11	37.5	31.6	30.3	33.1	37.6	27.1	29.1	24.4	29.5	3.6
R12	30.4	29.4	28.9	29.5	31.8	24.8	25.3	24.0	26.5	3.1
R13	30.6	30.7	30.0	30.4	31.6	25.4	25.7	24.8	26.9	3.6
R14	22.1	27.7	14.4	21.4	19.9	13.8	25.8	13.7	18.3	3.1
R15	31.1	29.1	28.5	29.5	32.4	24.8	25.4	23.6	26.5	3.0
R16	35.4	30.3	29.2	31.6	35.9	26.4	27.8	23.7	28.5	3.2
R17	26.3	30.4	19.6	25.4	24.1	19.2	31.0	18.8	23.3	2.1
LT1	30.4	31.8	31.5	31.2	30.9	25.6	26.0	26.0	27.1	4.1
LT2	39.0	37.4	37.4	37.9	36.6	29.7	29.8	27.6	30.9	7.0
LT3	41.7	36.4	35.8	38.0	40.1	30.6	32.0	27.5	32.5	5.4
LT4	35.9	32.3	26.8	31.7	32.4	24.5	30.9	22.9	27.7	4.0
LT5	38.0	34.6	28.9	33.8	34.3	26.5	32.5	24.9	29.5	4.3
ST1	33.1	33.7	40.6	35.8	31.2	29.5	30.8	33.4	31.2	4.6
ST2	43.3	38.1	37.4	39.6	40.3	31.8	32.5	28.5	33.3	6.3
ST3	30.0	30.3	29.7	30.0	31.1	25.1	25.4	24.7	26.6	3.4
ST4	34.8	31.8	31.4	32.7	35.1	26.8	27.7	25.0	28.6	4.0
ST5	38.0	32.1	30.5	33.5	37.9	27.3	29.4	24.5	29.8	3.7
ST6	36.8	30.2	26.9	31.3	34.0	24.7	28.5	22.5	27.4	3.9
ST7	32.4	31.6	24.2	29.4	29.6	22.7	31.1	21.6	26.3	3.2
ST8	28.2	29.9	20.7	26.3	25.9	19.9	30.8	19.0	23.9	2.4
ST9	30.4	25.3	23.9	26.5	31.6	21.7	24.3	20.7	24.6	1.9
ST10	32.4	29.2	22.9	28.1	30.0	21.7	28.9	20.3	25.2	2.9
TF1	30.4	31.8	31.5	31.2	30.9	25.6	26.0	26.0	27.1	4.1
TF2	42.6	36.8	35.5	38.3	39.9	30.3	32.8	27.6	32.7	5.6
TF3	41.6	36.5	32.9	37.0	38.3	29.3	33.3	27.2	32.0	5.0
									Average Difference	**4.2 dB**

4. Results Summary

The data herein suggests that the noise and vibration contributions for the Hospital's helicopter operations are not significant when compared to the overall ambient community noise environment. Such that, if the Hospital's helicopter operations were eliminated, the ambient community noise environment would remain unchanged. Short- and long-term noise monitoring in the community surrounding the Hospital identified many community noise sources in addition to the Hospital's helicopter operations, including roadway traffic, train horns, and aircraft overflights that are not associated with the Hospital.

The measurement and modeling data suggest that these community noise sources cause more noise events that are more prevalent than Hospital helicopter overflights. The measured and modeled helicopter noise levels fall within the ambient noise levels of the community during the measurement period. While noise levels in the community due to Hospital helicopter overflights may briefly exceed those caused by other community noise sources, overflights are relatively short in duration and infrequent when compared to noise from more prevailing sources like roadway traffic.

Helicopter test flights were flown to capture noise levels of flight paths flown by the Hospital. As shown in Table 1, the highest noise level, Lmax of 93 dB, during the test flights was captured at TF-01 (301 Calhoun Avenue). TF-01 is located just north of the existing helistop and is the closest of the 3 sites used to measure noise levels during the test flights.

When comparing event noise levels taken at short term measurement site ST-02 against test flight measurement site TF-02, similar SEL noise levels are observed. These two sites were located approximately 170 feet away from each other. The highest SEL noise levels of the Hospital's helicopter at TF-02 was 91 dB for current departure flight paths and 90 dB for current arrival flight paths. SEL noise levels of only community noise sources taken at ST-02 were similar. For instance, SEL noise levels of roadway traffic were measured to be in the range of 77 to 95 dB and occur much more frequently.

The data suggests that, when compared to the decommissioned helistop, the existing helistop and flight tracks produce marginally higher noise levels in the community surrounding the Hospital, mainly due to the higher elevation of the pad allowing for less shielding of noise from surrounding buildings. However, as stated, any increase in noise due to the change in helistops is minor when compared to the frequency and duration of other noise sources within the community.

Appendix A: HMMH Aviation Qualifications

Appendix A Contents

A. Aviation Environmental Services

A.1 Overview

HMMH was founded in 1981 with the express purpose of providing the highest possible caliber of noise consulting to airports. Since then, we have built a diverse practice providing noise, vibration, air quality, and clean energy consulting to a range of transportation, commercial, and industrial clients.

HMMH has an impressive depth of technical expertise. Our Aviation Environmental Services Group includes acousticians, trained air traffic controllers, project managers, noise and vibration monitoring experts, current and experienced commercial pilots, aviation planners, and GIS specialists.

HMMH's understanding of the technical issues associated with aircraft noise and vast experience is unmatched by the competition. To date, we have provided our expertise to more than 200 airports worldwide. ***We are known throughout the country as the noise experts!***

HMMH's noise and vibration capabilities range from basic assessments of noise exposure to detailed, innovative technical analyses of unique airport and other projects. The firm tackles the tough challenges of Environmental Assessments (EAs), Environmental Impact Statements (EISs) and airport noise compatibility plans.

HMMH is a leader in developing noise and land use compatibility plans under Title 14 of the Code of Federal Regulations (CFR) Part 150 and 161, in the design, specification, and installation of airport Noise and Operations Monitoring Systems (NOMS), in acoustical testing for airport sound insulation programs, and in conducting airport ground noise studies.

HMMH's experience with Part 150 Noise Studies is truly unmatched by our competition. To date, HMMH has conducted Part 150 Studies at 87 airports– 19 of which were in the last five years. No other consulting firm can say that!

HMMH has an international reputation for technical excellence in measuring, modeling, and addressing aviation and helicopter noise; assisting airports and other institutions to identify and implement effective solutions; and – most important of all – ***effectively communicating with and establishing the trust of all stakeholders*****.**

A.2 Qualifications

HMMH brings more than 39 years of extensive of aviation noise experience. Our goal is to serve as an extension of our client's staff. We are proud of the longstanding relationships (some spanning several decades) that we have developed with many of our clients. Our qualifications are outlined below.

Helicopter Expertise

HMMH understands that helicopter noise and the complaints associated with operations are a unique and challenging issue facing cities, airports, and other institutions, such as hospitals. HMMH has conducted work for helipads and heliports in various urban areas around the country. HMMH evaluates potential effects on surrounding communities due to helicopter operations. We recently completed a noise study that looked at the possibility of a heliport in Downtown Boston for the Massachusetts Department of Transportation (MassDOT). Additionally, we have completed similar studies in New York, San Francisco, and Los Angeles. These projects have involved measurements, modeling, and recommendation of mitigation measures. HMMH is currently involved in Helicopter Annoyance research for the Federal Aviation Administration (FAA) and has worked on helicopter noise issues at several airports.

On-Call Consulting Services

HMMH's aviation noise credentials offer airports the opportunity for access to consulting assistance on a continuing basis. We have provided comprehensive on-call support to develop, maintain, monitor, and enhance airports' noise compatibility efforts for more than 30 years under these contracts. HMMH provides all-encompassing measurement, analysis, modeling and mitigation services. Continuing assistance allows HMMH to provide an airport with a long-term perspective on the benefits and costs, planning consequences, public response, and other potential implications of proposed actions.

Within the last five years alone, we have served (and in most cases continue to serve) as noise consultant to more than 25 airports across the U.S., including, but not limited to, the following:

- Baltimore/Washington International Thurgood Marshall and Martin State Airports, MD (1985-present)
- Denver International, CO (1995-present)
- Fort Lauderdale Executive, FL (1984-present)
- Fort Lauderdale-Hollywood International, FL (1990-present)
- Hanscom Field, MA (1982-present)
- Logan International, MA (1982-present)
- Naples Municipal, FL (1995-present)
- North Palm Beach County, Lantana, and Palm Beach International, FL (1991-present)
- Raleigh-Durham International Airport, NC (1981-2013)
- Oakland International, CA (2007-present)
- Witham Field / Martin County Airport, FL (2007-2014)

In addition to those listed above, HMMH currently serves as acoustical consultant on an ongoing basis at the following airports:

- Burlington International (VT)
- Dallas Love Field (TX)
- Denver International (CO)
- East Hampton (NY)
- Fresno Yosemite International (CA)
- LA/Ontario International (CA)
- Los Angeles International (CA)
- Martin State (MD)
- Nashville International (TN)
- Oakland International (CA)
- Oakland North Field (CA)
- Raleigh-Durham International (NC)
- Salt Lake City International (UT)
- Seattle-Tacoma International (WA)
- T.F. Green (RI)
- Toronto Pearson International (Ontario, Canada)
- Van Nuys (CA)
- Worcester Regional (MA)

HMMH services provided under aviation noise on-call contracts have included:

- Noise measurements
- Noise modeling
- Part 150 studies and updates
- Noise Compatibility Program implementation
- Part 161 Studies
- Land use compatibility planning
- Assessments of Performance Based Navigation Implementation
- Noise elements of Environmental Impact Statements and other NEPA/SEPA/CEQA documents
- Noise elements of Master Plans and updates Assistance in noise office
- Assistance in noise office establishment, noise office staffing and training
- Assistance in development and implementation of issue-specific or ongoing public involvement programs

- Development of websites, pilot information programs, and other communications collateral
- Litigation support and Expert Testimony
- Sound insulation program design, implementation, and management
- Ground noise, noise barrier, and “hush-house” analysis and design
- Noise model improvement
- Noise expertise on non-aviation transportation modes
- Preparation of quarterly/annual noise contours and reports
- Radar flight data acquisition and analysis
- Design, specification, installation, and support of portable or permanent noise and operations monitoring systems
- Specialized experience in evaluation and use of computer systems and noise monitoring systems in airport noise control activities.

HMMH’s broad experience is augmented by comprehensive measurement equipment, proprietary computer programs, and specialized staff skills to cover all aspects of an airport’s noise analysis needs.

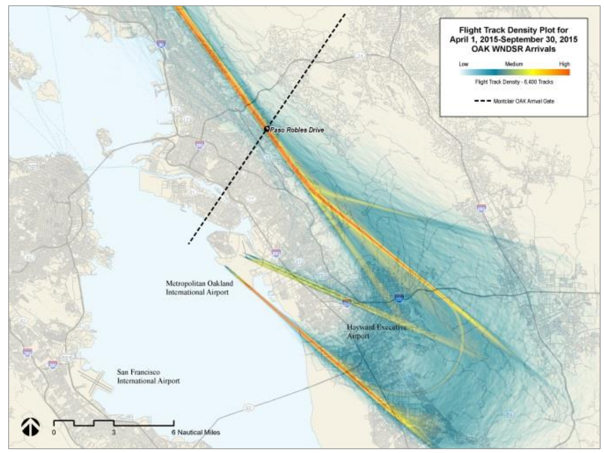
Flight Track Data Collection, Processing, and Analysis

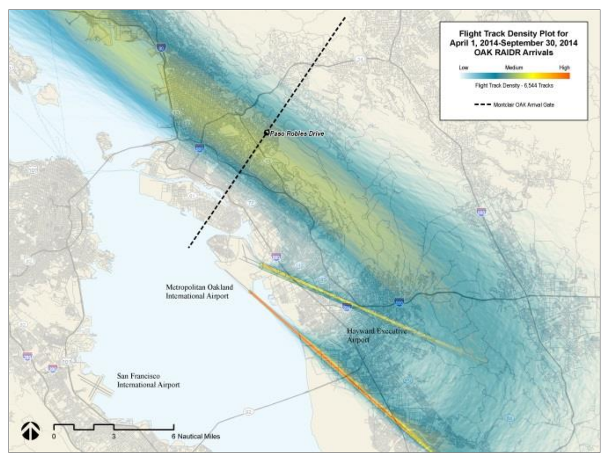
Our clients value the foresight and experience HMMH has placed on developing industry-leading capabilities to obtain and utilize aircraft flight track and identification data from a variety of sources. Since 1989, HMMH has processed radar data from over 50 radar systems associated with airports of various levels of activity. The data sets have varied from several days to several years. HMMH’s processing software, InFLIGHT™, is used to process raw radar data into a usable data format to support airport consulting projects and HMMH’s analysis programs.

Our capabilities and the tools we have developed and improved upon over the years allow us to obtain, sort, filter, and display flight tracks in an essentially unlimited fashion – ***if our clients have envisioned it, we have provided it***. In order to provide the highest level of service to our clients with flight track and aircraft identification data collection, processing and analysis, HMMH has developed **InFLIGHT™**.

InFLIGHT™

InFLIGHT provides an efficient means for HMMH to prepare modeled flight tracks for the FAA’s Integrated Noise Model (INM) and its successor, the Aviation Environmental Design Tool (AEDT), based on a set of flight track and aircraft identification data.





HMMH has provided comprehensive noise consulting services to the Port of Oakland since 2007 – this flight track density plot graphics shows the flight track analysis of an arrival procedure pre- (upper figure) and post-implementation (lower figure) of the Northern California Metroplex.

Noise Modeling

HMMH has prepared numerous noise contours for all sizes of airports in conjunction with FAA Part 150 studies, airport master plans, Federal NEPA studies, and state environmental studies.

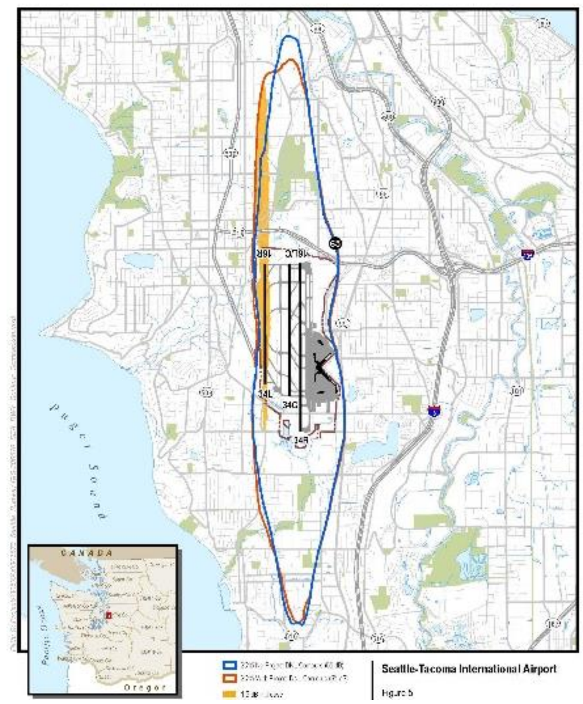
With our recently developed AEDT preprocessor, HMMH has the ability to model every flight track (a full year, even more, is possible), as flown, using the FAA's airport noise model and AEDT.

Our AEDT preprocessor takes advantage of the noise model's capabilities. Our tools automate the process of preparing the noise model inputs directly from recorded flight operations, to model the full range of aircraft activity as precisely as possible. The software improves the precision of modeling by utilizing operations monitoring results in the following areas:

- Directly converts the flight track recorded by the airport for every identified aircraft operation to a noise model track, rather than assigning all operations to a limited number of prototypical tracks;
- Models each operation on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types to an average of runway use; and
- Compares each flight profile to the standard noise model aircraft profiles and selects the best match for each flight.
- Uses actual radar data to develop noise contour for each day of the year and then averages the results to obtain the annual DNL contour.

HMMH is unique in our ability to model a full year of flight tracks through the FAA's noise models. However, only a fraction of our airport noise exposure contour generation is completed by modeling a full year of tracks. The reasons are many, but one limiting factor is the availability of a complete year of accurate data at many airports. However, this is beginning to change with the availability of historical data through the FAA's National Offload Program and the FAA making data available from their System Wide Information Management System (SWIM) to airports and consultants for noise modeling and flight track analyses. HMMH is currently receiving and processing FAA data for the entire Northern California Terminal Radar Approach Control (NorCal TRACON) for the work we are supporting at San Carlos, Oakland International and San Francisco International Airports.

For the majority of our noise modeling projects, we use a sample set of flight tracks to develop traditional model tracks and generate the noise exposure contours. In a few instances, we have been asked to prepare a modeled input file to produce the results of the use of a full year of flight tracks and aircraft identification data. Usually we are asked to develop such a model so that we can take that base model and prepare "what if" scenarios. Several recent examples that come to mind are: (1) the FAA proposed four corner post analysis at Salt Lake City International Airport, (2) proposed noise abatement procedures analysis at Beijing Capital International Airport and (3) the noise analysis for the proposed North-West Runway at Heathrow International Airport.



This figure shows the Sea-Tac International Airport 65 dB DNL contours for the 2015 No Project and 2015 With Project (temporary closure of the center runway for rehabilitation) along with the area within the 65 dB DNL contour for the 2015 With Project displaying the area of 1.5 dB and greater change.

Familiarity with the Aviation Environmental Design Tool (AEDT)

FAA now requires that all newly initiated noise and environmental studies conducted under FAA programs must incorporate noise contours developed using the

Aviation Environmental Design Tool (AEDT), which integrates a number of FAA noise, airspace, and emissions models. HMMH is highly qualified to apply this model in an efficient and technically superior manner, since its staff had major roles on the guidance provided to the FAA and its model developers through exceptionally high level involvement on the AEDT Design Review Group (DRG).

While the AEDT has a different user interface, data input processes, and other application procedures, the current release produces results that are essentially identical to the last release of its noise modeling forerunner, the Integrated Noise Model (INM), because the two models incorporate the same algorithms and aircraft noise and performance data bases.[1] The FAA is applying noise modeling algorithm enhancements and database extensions to the AEDT, so this is an excellent opportunity for the Port to transition to this new model.

HMMH is well prepared to appropriately use AEDT to produce highly accurate and defensible noise exposure contours that meet or exceed federal regulations and guidelines. Given HMMH's in-depth understanding, knowledge and use of AEDT, other firms are coming to us for AEDT training and preparation of contours.

Dispersion Modeling

Dispersion modeling is not required if we use our AEDT pre-processor to model a complete set of flight tracks. If we opt to not use a full set of actual flight tracks in the noise model, HMMH has unsurpassed abilities to develop dispersed model flight tracks to be sure the resulting noise results are highly accurate and defensible. We recently invested in software development to automate flight track development, including backbone and dispersion modeled tracks, based on groupings of the annual data we determine is appropriate at each airport. This process uses statistical analyses to assign aircraft to the backbone and disperse tracks and will be able to disperse them unevenly as is more typical as the backbone track does not always lie in the middle of the dispersion of flight tracks.

Noise Compatibility Planning

The scope of HMMH's Part 150 experience is unmatched: we have managed or had lead roles on Part 150 studies or compatibility program implementation at 87 airports – no other consulting firm can say that! That experience is the best guarantee that our services are consistent with state-of-the-art technical, regulatory, and implementation conditions, and that our clients benefit from initiatives undertaken, challenges addressed, and lessons learned from recent similar assignments.

Noise Management and Mitigation Procedures

HMMH leads and often is responsible for setting aviation industry trends. HMMH is consultant to the Federal Interagency Committee on Aviation Noise (FICAN) and in this capacity is responsible for writing FICAN's findings on a range of technical and policy directions at the federal level. HMMH is also leading the FAA's current research to update aircraft noise annoyance dose-relationship curves; the results of this research will have national policy implications.

HMMH's staff includes former airport noise officers who understand airport noise issues. We also have provided noise office staffing on a contract basis to Chicago Midway and O'Hare, Baltimore-Washington, Sacramento, and San Francisco. Our direct experience working for and with these airports has provided us with a detailed working knowledge of noise office functions and trends; we know the political and time pressures noise office staff work under, as well as the responsiveness the community demands. The policies

[1] The AEDT does include a slightly different contour plotting procedure; however, it permits applying refinements that can address any apparent inconsistencies.

we have helped shape and the training we provide are designed to be responsive to these needs.

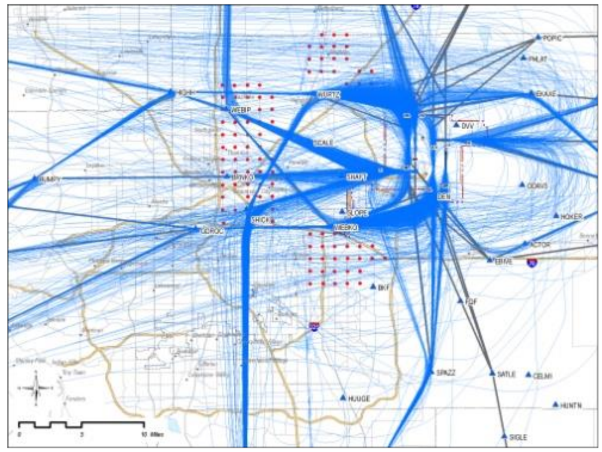
We have a thorough understanding of FAA ATC operations and airspace issues, extensive use of GIS and land use planning applications, and are industry leaders in the development and application of new and emerging noise abatement techniques and issues.

The crux of a successful noise compatibility program is the noise abatement and land use compatibility measures developed to minimize aircraft noise exposure to the population residing in the airport environs and to eliminate land use incompatibilities.

Airport and Airspace Use

Changes in the use of the airport and its airspace involve policy decisions that may have legal implications and that may affect air transportation service levels, as well as air traffic control management. HMMH has the necessary expertise in-house and may utilize a combination of simulation and evaluation tools such as: Total Airspace & Airport Modeler (TAAM), Terminal Area Route Generation,

Evaluation, & Traffic Simulation (TARGETS) &/or Sector Design & Analysis Tool (SDAT) to evaluate operational impacts resulting from changes to air traffic procedures, limitations on times of operation, Preferential Runway Advisory System (PRAS), and/or airspace design. If applied, these tools will provide a quantitative description of operational cost/benefits and input for high fidelity noise modeling and analysis.



Radar data based on FAA's proposed RNAV procedures at Denver International Airport

HMMH's experience in this highly specialized area includes:

- Noise abatement flight track design
- Changes in pattern altitude
- Preferential or rotational runway use
- Modification to approach and departure procedures
- Continuous Decent Approaches
- Feasibility Analysis
- Area Navigation (RNAV) and required navigation performance (RNP) routes
- Restrictions on engine run-ups
- Limitations on the number or types of operations, types of aircraft, or noise levels of aircraft
- Limitations on the times of operation
- Noise related landing fees

Airport GIS

For successful noise compatibility planning, it is essential to utilize a GIS to assess the land uses and planned land uses in the airport environs. Through the use of spatial and statistical information from County, State and Federal data providers, HMMH was one of the first firms to fully integrate GIS data into the noise compatibility process. This integration has been a vital asset to airports across the country as we can quickly determine the existing compatibility within aircraft noise exposure contours and determine tools and methodologies airports can employ to improve noise compatibility.

Diagram depicts area of increased aircraft noise exposure due to start of takeoff roll noise to residents on a hillside facing the Airport – completed with the 2009 NEM Update at SDIA

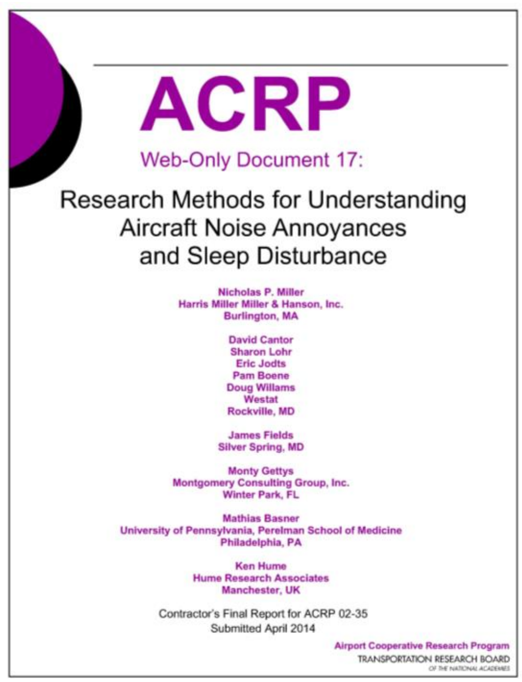
Aircraft Noise Research and Policy Development

HMMH is involved in research and policy setting on all the key noise issues that airports face on a daily basis, including the single largest aircraft noise research project currently being conducted by the FAA. We conduct research directly for the FAA and the National Academy's Airport Cooperative Research Program (ACRP), and we provide expert advice to the FAA's Center of Excellence for Alternative Jet Fuels and Environment, ASCENT.

Annoyance

The National Airports Annoyance Survey, undertaken on behalf of the FAA, is a current project example that illustrates our capability gained over 35 years of experience. The primary goal of this national survey of aircraft noise annoyance in the US is to update previous dose-response relationships and provide a best estimate of the relationship between aircraft noise exposure and the self-reported annoyance of residents for the nation as a whole. The "Schultz Curve," has been a cornerstone of FAA aircraft noise and land use compatibility policy for the past 30 years. Yet, the data providing the basis for that relationship are out-of-date, drawn from multiple transportation modes, and generally from non-US surveys. The objective is to develop a nationally applicable update of the dose-response curve that will quantify citizens' current annoyance reaction to aircraft noise. This curve will be used for evaluating the current DNL 65 dB basis for establishing significant noise impact from aircraft noise.

In addition, HMMH is currently leading an effort for Airports Council International-North America to evaluate the impact of various possible policy proposals on airports.



ACRP

Web-Only Document 17:

Research Methods for Understanding Aircraft Noise Annoyances and Sleep Disturbance

Nicholas P. Miller
Harris Miller Miller & Hanson, Inc.
Burlington, MA

David Cantor
Sharon Lohr
Eric Jodts
Pam Boene
Doug Williams
Westat
Rockville, MD

James Fields
Silver Spring, MD

Monty Gettys
Montgomery Consulting Group, Inc.
Winter Park, FL

Mathias Basner
University of Pennsylvania, Perelman School of Medicine
Philadelphia, PA

Ken Hume
Hume Research Associates
Manchester, UK

Contractor's Final Report for ACRP 02-35
Submitted April 2014

Airport Cooperative Research Program
TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Awakenings from Nighttime Noise

Research has shown that awakenings from nighttime noise do not correlate well with measures of total noise exposure, such DNL or a nighttime Leq. HMMH analyzed comprehensive sleep data collected at a range of airports and developed a methodology that uses standard output from noise models to compute the number of people awakened at least once from a full night of aircraft operations. In 2008, our approach was published by the American National Standards Institute (ANSI) Committee S12 as an approved standard: ANSI S12.9-2008 / Part 6, "Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes." The Federal Interagency Committee on Aviation Noise (FICAN) subsequently recommended use of the standard for analyses of awakenings for airport studies, and it is the current state of practice.

Effects of Noise on Children's Learning

HMMH is currently evaluating the effects of aircraft noise on children's learning for the Airport Cooperative Research Program. Past research suggests that aircraft noise is related to delayed learning; the current project is focused on classroom observations to validate a variety of possible mechanisms. These mechanisms include the possibilities that aircraft noise events may cause students to be distracted from their lessons, may cause speech disruption and interfere with communication between teacher and student, may lead to elevated cognitive fatigue and loss of focus for teachers. We expect that the results will contribute toward future policy making.

Public Outreach

HMMH understands that the success of any airport planning or environmental project often hinges on community understanding and acceptance.

A key to successful outreach is presenting complex technical issues clearly and concisely, an area in which HMMH excels. Examples include project websites use of actual operations data, and presentation of those data using "user-friendly" techniques like flight track density plots. HMMH also utilizes graphic presentation of complex tabular information, such as flight track density plots, as in the graphic shown below for Fort Lauderdale-Hollywood International's (FLL) "Partnership for Quieter Skies" program.

Our clients have praised us for bringing depth of expertise, objectivity in our work, creativity, and a unique ability to communicate openly and effectively with the public.

Educational Reports and Presentation Methods

HMMH excels at conveying complex noise study information and results to the general public and interested stakeholders. HMMH staff have assisted our clients at meetings with every facet of the airport public, including citizens, airport users, FAA and other federal agency staff, local political officials, and airport advisory groups. We believe our track record in those situations speaks for itself.

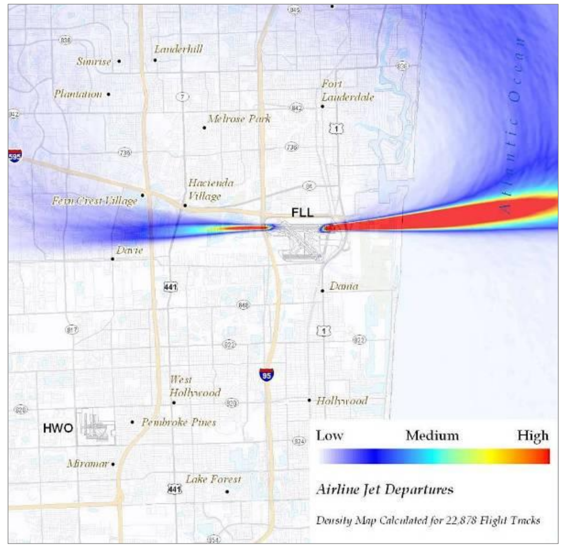
HMMH offers technical capabilities that translate into credibility for our clients' projects. An example of our specialized capabilities for conveying the difficult topic of noise includes Soundscape Design™, a cutting-edge tool designed by HMMH to assist the public in understanding the potential noise impacts from proposed projects. Soundscape Design is the audio equivalent of models that architects, and planners use to illustrate what a project will look like before it is built, e.g., similar to a model of a proposed new airport terminal. Soundscape Design uses recordings from actual neighborhoods of interest and superimposes appropriate aircraft noise, to illustrate the potential sound of proposed changes. Citizens are far more receptive to "hearing" changes than to looking at graphics.

HMMH regularly translates complex technical information into practical, useable guidance. HMMH leads a training course on airport noise which provides an overview of the technical, legal, and practical issues that are important for professionals dealing with airport noise issues and an AEDT training course designed primarily for consultants, engineers and other professionals who conduct noise analyses using AEDT.

Investigative / Expanded Reports

HMMH has extensive experience preparing reports for clients, as already demonstrated by our previous reference to the research conducted and reports developed for the FAA and for TRB under the ACRP program. As part of our ongoing work for Broward County Aviation Department (BCAD) since 1990, HMMH prepares the at Fort Lauderdale-Hollywood Airport (FLL) Partnership for Quieter Skies (PQS) report on a quarterly basis. The PQS report includes fleet noise, high noise events, arrival and departure density plots, runway usage graphic and statistics, and an update of all noise-related projects ongoing at the Airport. The report preparation includes ensuring the report meets Americans with Disabilities Act (ADA) requirements for posting on the BCAD website.

HMMH also prepares Quarterly Noise Reports, per California Title 21 regulations, for Oakland and San Diego International Airports.



Flight Track Density Plot for FLL Partnership for Quieter Skies Program

Appendix B: HMMH Personnel Resumes

Justin W. Cook - INCE, LEED GA

Principal Consultant

Experience

HMMH, 2017-Present

BridgeNet International, 2007-2017

Wyle Laboratories, 2006-2007

BridgeNet International, 2000-2006

Education

B.S., Mathematics, University of California, Irvine, 2002

Institute of Noise Control Engineering (INCE) Certification, INCE-USA, 2010

LEED Green Associate (LEED GA) Certification, U.S. Green Building Council, 2014

Affiliations

Member, Institute of Noise Control Engineering (INCE), 2010-Present

Member, Acoustical Society of America (ASA), 2006-Present

Secretary, SAE International - A-21 Aircraft Noise Measure Noise Aviation Emission Modeling Committee, 2019-Present

Voting Member, SAE International - A-21 Aircraft Noise Measure Noise Aviation Emission Modeling Committee, 2010-Present

Training

Airport Improvement Program (AIP) 101, Airport Consultants Council (ACC), 2018

PMP Certification Training Course, Simplilearn, 2016

Technical Skills

FAA Aviation Environmental Design Tool (AEDT)

FHWA Traffic Noise Model (TNM)

SoundPLAN

INSUL

AutoDesk AutoCAD

QGIS / ESRI ArcGIS

Microsoft Office Suite and SQL Server

Mr. Justin Cook is a program manager for a wide range of environmental projects for both our aviation and surface transportation groups. He demonstrates excellent leadership skills and has a proven track record of successful program and project management. He creates collaborative environments with his fellow team members and clients, leading to quality projects that are on time and on budget.

Mr. Cook is a performance- and results-driven professional, equipped with multitasking capacities within fiercely competitive environments while maintaining the highest ethical and quality standards, professional demeanor, and cooperative attitude.

He also brings a depth of technical expertise, exceptional organization abilities and effective communication. Before joining HMMH, he worked as the Vice President – Aviation & Surface Transportation at BridgeNet International, an environmental consulting firm based in Newport Beach, California.

Representative Projects

Airport Projects

Community Noise Roundtables/Forums

- Los Angeles International Airport, Los Angeles, CA (2020-Present), *Project Manager*
- Southern San Fernando Valley Airplane Noise Task Force, Burbank, CA (2019-Present), *Project Manager*
- San Francisco International Airport, San Francisco, CA (2017-Present), *Principal-in-Charge*
- San Diego International Airport, San Diego, CA (2015-Present), *Acoustical Expert and Principal-in-Charge*

Noise, Flight Tracking, and/or Complaint Monitoring Systems

- Preventative Maintenance and Technical Support Services, Envirosuite (Formerly EMS Bruel & Kjaer), Western United States (2017-Present), *Principal-in-Charge*
- NOMS Acquisition Assistance, Treasure Coast International Airport, Fort Pierce, FL (2019-2020), *Principal-in-Charge*
- NOMS Acquisition Assistance, Boise Airport, Boise, ID (2017-2018), *Principal-in-Charge*
- NOMS Acquisition Assistance, Baltimore/Washington International Thurgood Marshall Airport, Baltimore, MD, (2017-2018), *Technical Expert*
- NOMS Acquisition Assistance, San Antonio International Airport, San Antonio, TX (2018), *Technical Expert*
- Noise Complaint Management System, Los Angeles World Airports, Los Angeles, CA (2017-2018), *Technical Expert*
- NOMS Decommissioning, Lake Tahoe Airport, South lake Tahoe, CA (2017), *Principal-in-Charge*

On-Call Noise Consulting

- Los Angeles World Airports, Los Angeles, CA (2017-Present), *Principal-in-Charge*

- San Diego International Airport, San Diego, CA (2017-Present), *Principal-in-Charge*
- Mineta San Jose International Airport, San Jose, CA (2019-Present), *Principal-in-Charge*
- Ontario International Airport, Ontario, CA (2019-Present), *Principal-in-Charge*
- Oakland International Airport, Oakland, CA (2017-Present), *Technical Expert*
- Fort Lauderdale-Hollywood International Airport, Broward County, FL (2018-Present), *Technical Expert*

Environmental Impact Report (EIR) and Environmental Assessment (EA) Studies

- Runway EA, Grand Fork International Airport, Grand Forks, ND (2020-Present), *Principal-in-Charge*
- Airfield & Terminal Modernization Project EA, Los Angeles International Airport, Los Angeles, CA (2020-Present), *Principal-in-Charge*
- Airfield & Terminal Modernization Project EIR, San Diego International Airport, San Diego, CA (2019-Present), *Principal-in-Charge*
- Airport Development Plan EA, San Diego International Airport, San Diego, CA (2020-Present), *Principal-in-Charge*
- Airport Development Plan EIR, San Diego International Airport, San Diego, CA (2018-Present), *Principal-in-Charge*

Part 150 Noise Compatibility Planning Studies

- Indianapolis Airport Authority, Indianapolis, IN (2019-Present), *Principal-in-Charge*
- Newark Liberty International Airport and Teterboro Airport, Port Authority of New York and New Jersey (2018-Present), *Technical Expert*

Other Airport Studies

- Flight Track Analysis for Riverside Municipal Airport, Foulger-Pratt, Riverside, CA (2020), *Principal-in-Charge*
- Military Ground Runup Analysis, Phoenix-Mesa Gateway Airport, Mesa, AZ (2019-Present), *Principal-in-Charge*
- John Wayne Airport Noise Abatement Departure Procedure Study, City of Newport Beach, Newport Beach, CA (2018-Present), *Principal-in-Charge*
- Noise Monitoring and Flight Track Analysis, City of Laguna Niguel, CA (2018-2019), *Principal-in-Charge*
- FlyQuiet Program Development for Boston Logan International, Massachusetts Port Authority, Boston, MA (2018-2019), *Technical Expert*
- John Wayne Airport Portable Noise Monitoring, City of Newport Beach, CA (2018), *Principal-in-Charge*
- Litigation Support, Baltimore/Washington International Thurgood Marshall Airport, Baltimore, MD, (2018-Present), *Technical Expert*

Surface Transportation Projects

- Noise and Vibration Construction Noise Monitoring, City of Santa Monica, Santa Monica, CA (2017-Present), *Principal-in-Charge*
- Multiple Architectural/Developer Projects, United States (2017-Present), *Principal-in-Charge*
- Wash N' Go Noise Analyses, Escondido and Chula Vista, CA (2017-2018), *Principal-in-Charge*

- Union Station Noise and Vibration Study, Metrolink, Los Angeles, CA (2017-2018), *Technical Expert*

Federal Programs Projects

- Residential Sound Insulation Program Policy Study, Federal Aviation Administration, United States (2017-Present), *Technical Expert*
- ACRP 02-79: Improving AEDT Modeling for Aircraft Noise Reflection and Diffraction from Terrain and Manmade Structures, Transportation Research Board (2017-2019), *Panelist*

Christopher S. Nottoli
Senior Consultant

Experience

2016-Present, HMMH

2014-2016, Riverbank Acoustical Laboratories.

Education

B.S., Acoustics, Columbia College, Chicago, IL, 2014

Affiliations

Member, Acoustical Society of America

Member, Aircraft Owners and Pilots Association

Chris Nottoli holds a bachelor's degree in acoustics from Columbia College Chicago. Mr. Nottoli's primary responsibility at HMMH includes airport noise modeling and analysis using the Federal Aviation Administration's Aviation Environmental Design Tool (AEDT) and Integrated Noise Model (INM). He is also experienced in SQL, ArcGIS, and highway noise analysis using the Federal Highway Administration's Traffic Noise Model (TNM). He has worked on numerous airport sound insulation programs, including George Bush Intercontinental (IAH), Seattle-Tacoma (SEA), T.F. Green (PVD), and Tweed (HVN).

Representative Projects

Aviation Projects

- PBIA 2018 Annual Noise Report, West Palm Beach, FL (2019-2020), *Project Manager, Data Collection, Noise Modeling and Reporting*
- O'Hare International Airport EIS Re-Evaluation, Chicago, IL (2018 – Present), *Noise Modeling, Data Processing, Technical Analysis*
- Nashville International Airport Runway 02R/20L Runway Reconstruction, Nashville, TN (2019), Assistant Project Manager, *Noise Modeling, Data Processing, Technical Analysis and Review*
- Nashville International Airport Master Plan Update, Nashville, TN (2019 – Present), Assistant Project Manager, *Noise Modeling, Data Processing, Technical Analysis and Review*
- Nashville International Airport Noise Exposure Map Update, Nashville, TN (2018 – Present), Assistant Project Manager, *Noise Modeling, Data Processing, Technical Analysis and Review*
- Winston-Salem Airport Noise and Air Quality Analysis (2019 – Present), *Project Manager*, *Noise Modeling, Data Processing, Technical Analysis and Review*
- 14 CFR Part 150 Noise Study, Port Authority of New York and New Jersey, Newark-Liberty International and Teterboro Airport, Newark, NJ (2016 – present), *Noise modelling, developing public workshop materials*
- Comprehensive Aviation Noise Consulting Services, Maryland Department of Transportation Maryland Aviation Administration, Baltimore, MD (2016-present), *Noise Modeling, Data Processing, Technical Analysis and Review*
- PBIA Noise Monitoring Terminal Evaluation, West Palm Beach, FL (2016-2018), *Assistant Project Manager, Data Collection, Processing, and Reporting*
- London Heathrow Community Noise Evaluation, London, UK (2016 - 2018), *Project Manager, Noise Modeling and Data Processing*
- On-Call Acoustical Consulting Services, Oakland International Airport, Oakland, CA (2016-Present), *Noise Modeling for quarterly noise reports.*
- Palm Beach International Airport Master Plan Update, Palm Beach, FL (2016), *Noise Modeling, Data Processing, and Reporting*
- Fort Lauderdale Executive Airport Environmental Assessment, Fort Lauderdale, FL (2016), *Noise Modeling, Data Processing, and Reporting*
- Dallas Love Field Airport Noise Contour Update, Dallas, TX (2016-Present), *Data Processing, Noise Modeling, and GIS Graphics and Analysis*
- MassDOT Temporary Heliport Analysis, Boston, MA (2016-2017), *Noise Modeling, Measurements, and Data Processing*
- Boston Logan International Airport EDR, Boston, MA (2016-2017), *GIS Graphics and Analysis*
- Eugene Airport Master Plan Update, Eugene OR (2017- 2018), *Noise Modeling and Reporting; Assistant Project Manager*
- Montgomery-Gibbs Executive Airport and Brownfield Airport Master Plan, San

Diego, CA (2017 – Present), *Data Processing, Noise Modeling, and Reporting; Assistant Project Manager*
- Bowling Green Environmental Assessment Support, Bowling Green, KY (2017), *Data Processing, Noise Modeling, and Reporting; Project Manager*

Sound Insulation Projects

- TF Green Sound Mitigation Project for Rhode Island Airport Corporation, Warwick, RI (2016-present), *Noise Measurements and Data Processing*
- Residential Sound Insulation Program, Tweed-New Haven Airport, New Haven, CT (2016-present), *Measurements and Data Analysis; Assistant Project Manager*
- Residential Sound Insulation Program, George W. Bush Intercontinental Airport, Houston, TX (2016-present), *Measurements and Data Analysis*
- Residential Sound Insulation Program, Seattle-Tacoma International Airport, Seattle, WA (2017-present), *Measurements and Data Analysis*

Highway Projects

- I-395 HOT Lanes Environmental Assessment, Arlington and Fairfax Counties, VA (2016-2016), *Data Processing and Noise Barrier Analysis*
- Fairfax Pike (Route 277) Widening Noise Study, Stephen City and Frederick County, VA (2016-2016), *Traffic Analysis and Reporting*
- Hampton Roads Crossing Study, Hampton, Newport News, Norfolk, Portsmouth, Suffolk and Chesapeake VA (2016), *Noise Modeling, Data Processing, Noise Barrier Analysis*
- Spaulding Turnpike Open Road Tolling Noise Study, Dover and Manchester, NH (2016), *Measurements and Data Analysis*
- Rolling Road (Route 638) Improvement Study, Fairfax County, VA (2016), *Noise Modeling*
- I-95 Hard Shoulder Project, Richmond, VA (2017), Traffic Analysis, Modeling*, and Noise Barrier Analysis*

Julia M. Nagy, ENV SP
Senior Consultant

Experience
2018-present, HMMH

2017-2018, International Monetary Fund

2015-2017, U.S. Environmental Protection Agency

2014-2015, Bockorny Group

Education
B.S. in Environmental Science and Policy, University of Maryland, College Park, MD, 2014

Envision Sustainability Professional (ENV SP), Institute of Sustainable Infrastructure, July 2019

Greenhouse Gas Protocol Corporate Accounting and Reporting Standard Training September 2018

Industry and Community Involvement
Transportation Research Board Environmental Impacts of Aviation Committee, Committee Communications Coordinator (2019 – Present)

Airport Consultants Council, Young Professionals Member (2018 – present)

Julia Nagy is a dynamic member of the HMMH team, with a B.S. in Environmental Science and Policy, and strong professional experience in technical writing, regulatory analysis, and project management. At HMMH, Julia's work focuses on environmental and sustainability projects for the aviation and transportation industries, including documentation, research, and innovative problem solving. Julia has environmental analysis experience related to the National Environmental Policy Act (NEPA) and state regulatory processes. She has a depth of data collection and analysis experience, combined with a knack for creative data visualization.

Julia has a strong track record of fostering strong working relationships and enjoys tackling project planning, management, and communications. She spent two years in the Office of the Science Advisor at the U.S. Environmental Protection Agency coordinating intra-agency training initiatives and program development. Julia's passion for sustainable infrastructure and environmental work budded from internships early in her career at Portland International Airport and Airports Council International – North America (ACI-NA) Environmental Affairs Committee.

Representative Experience

Research Projects

- Airport Cooperative Research Program (ACRP) Report 11-08, Support for ACRP Insight Events (2020-present)
    - *ACRP 11-08 (20-01) Forum on Future of Aviation, Insight Event*
- Airport Cooperative Research Program (ACRP) Report 02-76, Optimizing the Use of Electric Pre-Conditioned Air (PCA) and Ground Power Systems at Airports (2018–2019), *Research, Technical Support*
- Airport Cooperative Research Program (ACRP) Report 02-83, Measuring Quality of Life in Communities Surrounding Airports (2018–2019), *Assistant Project Manager, Technical Research and Documentation*
- Airport Cooperative Research Program (ACRP) Report 11-02(30), Research Roadmap in the Area of Airport Design and Construction (2018–2019), *Technical Support*

Sustainability and Energy Projects

- Massachusetts Port Authority Sustainability Rating System Report, Massport, Boston, MA (2019), *Research Support*
- Noise Management Benchmarking Study, Minneapolis, MN (2018), *Assistant Project Manager, Analysis and Documentation Lead*
- L.G. Hanscom Field Environmental Status and Planning Report, Bedford, MA (2018–2019), *Technical Support for Sustainability, EMS, Air Quality and MEPA*
- Fall River Wastewater Treatment Facility Facilities Plan, Fall River, MA (2018–2019), *Technical Support*
- Naples Municipal Airport Solar Feasibility Study, Naples, FL (2018–2019), *Research Support*

Airport Projects

- Airfield & Terminal Modernization Project, Environmental Assessment (EA), Los Angeles International Airport, Los Angeles, CA (2020–present), *NEPA Documentation – Noise and Compatible Land Use*
- Maryland Department of Transportation Maryland Aviation Administration (MDOT MAA), Martin State Airport Noise Zone Update, Baltimore, MD (2019– present), *Project Manager, Documentation*

- O'Hare International Airport Terminal Area Program, Environmental Assessment (EA), Chicago, IL (2019–present), *NEPA Lead – Energy & Natural Resources*

Surface Transportation Projects

- Los Angeles County Metropolitan Transportation Authority (Metro) Link Union Station, Environmental Impact Statement (EIS), Los Angeles, CA (2019–present), N*EPA/California Environmental Quality Act (CEQA) Documentation*
- Federal Highway Administration, State of the Practice – Project-Level Noise Analysis for Multimodal Projects, (2019-Present), *Technical Research and Documentation Lead*
- MassDOT Transit & Rail Engineering Services, Amtrak Vermonter Oversight, Boston, MA (2018–2019), *Technical Support and Data Visualization*
- Norfolk-Southern Railroad, Pittsburgh Vertical Clearance Project Noise and Vibration Analysis, Pittsburgh, PA (2018), *Technical Support*
- Route 1 Widening Preliminary Noise Analysis, Dumfries, VA (2018), *Technical Support*

J. Eric Cox
Senior Consultant

Experience

2007-present, HMMH
2005-2007, Sonoscan

Education

B.A. Mathematics, Berea College, Berea, KY, summa cum laude, 1999

Graduate courses toward M.S., Applied Physics, Northern Illinois University, Dekalb, IL, 2005

Affiliations

Active-for-life Member & Award of Excellence recipient, Phi Kappa Phi 1999-present

Since joining HMMH in 2007, Eric Cox has developed extensive expertise with a variety of acoustic instrumentation and a broad range of experience in collecting and analyzing measurement data for a diverse range of environmental projects.

Mr. Cox has worked on noise studies for airports, rail and transit systems, highways, construction sites, quarries, firing ranges, and wind energy projects. He has a depth of knowledge regarding sound insulation testing, analysis of quiet pavements, and wind turbine compliance monitoring, including involvement with research projects funded by the Federal Aviation Administration, the New Hampshire and Virginia Departments of Transportation, and the Massachusetts Clean Energy Center.

Mr. Cox has also provided noise monitoring training to staff at several major airport noise offices and currently manages the HMMH instrumentation lab, which includes responsibility for equipment calibrations, maintenance, and repairs.

Representative Projects

Sound Insulation Projects

- Residential Sound Insulation Program, Seattle-Tacoma International Airport, Seattle, WA (2018-present), *Measurements and Data Analysis, Project Manager*
- Sound Insulation Research Study “NLR Measurement Method Equalization and Normalization”, Federal Aviation Administration (2017-present), *Measurements and Data Analysis, Project Manager*
- Sound Insulation Research Study “Efficacy of Residential Sound Insulation Treatments for Ranges of Outdoor-to-Indoor Noise Level Reduction”, Federal Aviation Administration (2016-present), *Measurements and Data Analysis, Project Manager*
- Noise Mitigation Program, Tweed-New Haven Airport, New Haven, CT (2014-present), *Measurements, Data Analysis, and Modeling; Project Manager*
- Sound Insulation Programs, Louisville International Airport, Louisville, KY (2011-present), *Measurements and Data Analysis, Project Manager*
- Residential Sound Insulation Program, George W. Bush Intercontinental Airport, Houston, TX (2011-present), *Measurements and Data Analysis, Project Manager*
- Noise Compatibility Program Assessment of Chamberlin Elementary School, Burlington International Airport, Burlington, VT (2018), *Measurements and Data Analysis, Assistant Project Manager*
- Port of Seattle Fire Department Noise Monitoring and Acoustic Design Criteria, Seattle-Tacoma International Airport, Seattle, WA (2018), *Measurements and Data Analysis, Assistant Project Manager*
- Noise Insulation Assessment for Proposed Helipad, Neonatal Intensive Care Unit at St. Joseph's Hospital Health Center, Syracuse, NY (2017-2018), *Modeling and Data Analysis, Project Manager*
- Sound Mitigation Program, Theodore Francis Green State Airport, Warwick, RI (2013-2018), *Measurements, Data Analysis, and Modeling; Project Manager*
- Sound Insulation Research Study “Investigation of ASTM E966 Adjustment Factors”, Federal Aviation Administration (2016-2017), *Measurements and Data Analysis, Project Manager*
- Sound Insulation Research Study “Review and Evaluation of Aircraft Noise Spectra used to Estimate Noise Level Reduction for Airport Sound Insulation Programs based on the Loudspeaker Test Method”, Federal Aviation Administration (2014-2016), *Data Analysis, Assistant Project Manager*

- Sound Insulation Programs, Buffalo Niagara International Airport, Cheektowaga, NY (2008-2014), *Measurements, Data Analysis, Modeling, and Design; Project Manager*
- Residential Sound Insulation Program, Cleveland Hopkins International Airport, Cleveland, OH (2008-2014), *Measurements and Data Analysis, Project Manager*
- Residential Sound Insulation Program, Witham Field, Stuart, FL (2011-2013), *Measurements and Data Analysis*
- Residential Sound Insulation Program, Lambert-St Louis International Airport, St. Louis, MO (2009-2013), *Measurements, Project Manager*
- Sound Insulation Programs, Tulsa International Airport, Tulsa, OK (2009-2012), *Measurements and Data Analysis, Project Manager*
- Pilot Sound Insulation Program, Ft Lauderdale-Hollywood International Airport, Dania Beach, FL (2011), *Measurements and Data Analysis*
- Residential Sound Insulation Program, General Edward Lawrence Logan International Airport, Metro Boston, MA (2008-2011), *Measurements and Data Analysis, Assistant Project Manager*

Aviation Projects

- Part 161 Revised Fly-Friendly Target Noise Level Program, Van Nuys Airport, Van Nuys, CA (2008-2011), *Statistical Analysis*
- Noise Study for Proposed ConRAC Facility, General Edward Lawrence Logan International Airport, Boston, MA (2008-2010), *Modeling and Data Analysis*
- Ivanpah Valley EIS/NSA Study, McCarran International Airport, Las Vegas, NV (2007-2010), *Helicopter Noise Modeling and Operations Development*
- Runway Extension EIS/EIR Study, New Bedford Regional Airport, New Bedford, MA (2008-2009), *Aircraft Noise Modeling and Impact Assessment*
- Runway Extension EIS Study, Theodore Francis Green State Airport, Warwick, RI (2007-2009), *Cargo and Traffic Noise Modeling, Impact Assessment*

Rail and Transit Projects

- MBTA Green Line D Branch Track/Signal Improvements Construction Project, Massachusetts Bay Transportation Authority, Newton, MA (2019-present), *Measurements and Data Analysis*
- MBTA Oak Grove Station Accessibility Improvements Construction Project, Massachusetts Bay Transportation Authority, Malden, MA (2019-present), *Measurements and Data Analysis*
- MBTA Wellington Orange Line Yard Rebuild Construction Project, Massachusetts Bay Transportation Authority, Medford, MA (2017-present), *Measurements and Data Analysis; Project Manager*
- MBTA Cabot Red Line Yard Rebuild Construction Project, Massachusetts Bay Transportation Authority, Boston, MA (2017-present), *Measurements and Data Analysis; Project Manager*
- MBTA Green Line Light Rail Extension, Massachusetts Bay Transportation Authority, Boston, MA (2008-present), *Measurements and Data Analysis*
- MARTA East (Blue) Line Sycamore Street Noise and Vibration Study, Metropolitan Atlanta Rapid Transit Authority, Decatur, GA (2014-2016), *Measurements and Data Analysis*
- LYNX Blue Line Extension, Charlotte Area Transit System (CATS), Charlotte, NC (2010-2013), *Measurements and Data Analysis; Assistant Project Manager*
- Loop Trolley Noise & Vibration Assessment, East-West Gateway Council of Governments, St. Louis, MO (2010), *Measurements, Data Analysis, Modeling, and Impact Assessment; Assistant Project Manager*

- Sheraton Hotel Noise Study, Metro Washington Airports Authority and Washington Metropolitan Area Transit Authority, Tyson's Corner, VA (2010), *Measurements, Data Analysis, and Modeling*
- Cotton Belt Noise & Vibration Assessment, Dallas Area Rapid Transit, Dallas, TX (2010), *Measurements and Data Analysis*
- Burnham Yard Noise Assessment, Denver Regional Transportation District, Denver, CO (2010), *Noise Measurements and Data Analysis*
- Automated People Mover Vibration Study, Phoenix Sky Harbor International Airport, Phoenix, AZ (2009-2010), *Measurements, Data Analysis, and Modeling; Assistant Project Manager*
- MBTA Red-Blue Line Connector Noise and Vibration Study, Massachusetts Bay Transportation Authority, Boston, MA (2009), *Measurements and Data Analysis*
- Northwest Rail Noise Assessment, Denver Regional Transportation District, Denver, CO (2009), *Measurements, Data Analysis, and Modeling*
- DCTA Regional Rail Project, Denton County Transportation Authority, Denton, TX, (2009), *Measurements, Data Analysis, Modeling; Assistant Project Manager*
- Central Broward Transit Noise & Vibration Assessment, Florida Dept. of Transportation, Ft. Lauderdale, FL (2007), *Measurements and Data Analysis*

Highway Projects

- Interstate Route 93 On-Board Sound Intensity (OBSI) Quiet Pavement Study, New Hampshire Dept. of Transportation, I-93, Manchester and Concord, NH (2016), *Measurements and Data Analysis; Project Manager*
- District 5 Resurfacing On-Board Sound Intensity (OBSI) Quiet Pavement Study, New Hampshire Dept. of Transportation, Route 38, Pelham, NH (2012-2015), *Measurements and Data Analysis; Project Manager*
- NCHRP 25-34 Research Study "Supplemental Guidance on the Application of FHWA's Traffic Noise Model", Federal Highway Administration (2011-2014), *Measurements and Data Analysis*
- Interstate Route 195 On-Board Sound Intensity (OBSI) Diamond Grinding Study, Rhode Island Dept. of Transportation, Providence, RI (2012), *Measurements and Data Analysis, Project Manager*
- Esplanade Development Parking Garage Noise Study, The Peterson Companies, National Harbor, MD (2012), *Modeling and Data Analysis, Project Manager*
- On-Board Sound Intensity (OBSI) Quiet Pavement Pilot Project, Virginia Dept. of Transportation, Statewide, VA (2011), *Measurements and Data Analysis*
- On-Board Sound Intensity (OBSI) Quiet Pavement Study, Virginia Dept. of Transportation, Route 7, Leesburg, VA (2011), *Measurements and Data Analysis*
- Noise Barrier Insertion Loss Study, Massachusetts Dept. of Transportation, I-95, Newton, MA (2011), *Measurements and Data Analysis*
- Witchduck Road Noise and Vibration Study, City of Virginia Beach, VA (2010), *Measurements and Data Analysis*
- Interstate Route 95/395 HOT Lanes Study, Virginia Dept. of Transportation, VA (2008-2009), *Modeling and Impact Assessment*

Wind Energy Projects

- Wind Turbine Compliance Noise Study, Massachusetts Clean Energy Center, Kingston, MA (2012-2015), *Measurements and Data Analysis, Project Manager*
- Wind Turbine Feasibility Noise Study, Weymouth, MA (2013), *Measurements, Modeling, and Data Analysis, Project Manager*
- Wind Turbine Compliance Noise Study, Falmouth, MA (2010-2012), *Measurements, Modeling, and Data Analysis, Assistant Project Manager*

- Wind Farm Feasibility Noise Study, Enfield, NY (2011), *Measurements*
- Wind Turbine Feasibility Noise Survey, Swampscott, MA (2011), *Measurements*
- Wind Turbine Energy Production Analysis, University of Massachusetts, Dartmouth, MA (2011), *Data Analysis, Project Manager*
- Wind Turbine Feasibility Noise Survey, Wareham, MA (2011), *Measurements and Data Analysis, Assistant Project Manager*
- Wind Turbine Feasibility Noise Study, North Central Correctional Institute, Gardner, MA (2010), *Measurements and Data Analysis*
- Wind Turbine Feasibility Noise Study, Whole Foods, Gloucester, MA (2009), *Measurements and Data Analysis*
- Wind Turbine Feasibility Noise Survey, College of the Holy Cross, Worchester, MA (2008), *Measurements and Data Analysis, Project Manager*

Commercial/Industrial Projects

- Firing Range Re-zoning Study, G4S International Training Inc., West Point, VA (2012-2013), *Measurements, Data Analysis, Modeling, and Impact Assessment; Project Manager*
- Rock Quarry Noise Survey, Aggregate Industries, Swampscott, MA (2008-2011), *Measurements and Data Analysis, Assistant Project Manager*

Noise Monitoring Training Projects

- Noise Monitoring Training with Larson Davis Model 820 Sound Level Meter, Baltimore/Washington International Airport, Baltimore, MD (2010), *Instructor, Assistant Project Manager*
- Noise Monitoring Training with Larson Davis Model 870 Sound Level Meter, Nashville International Airport, Nashville, TN (2010), *Instructor*
- Noise Monitoring Training with Bruel & Kjaer Model 2250 Sound Level Meter and Spectrum Analyzer, Barnstable Municipal Airport, Hyannis, MA (2010), *Instructor, Assistant Project Manager*

Representative Publications and Presentations

- "Measurement of Noise Reduction of Buildings Exposed to Aircraft Noise", Presented at the Annual Meeting of the Transportation Research Board, Washington, D.C. (January 2019)
- "Investigation of Correlation Between Aircraft Interior Noise Levels and Residential Building Construction Details", paper no. 259, Proceedings of Noise-Con 2016 Congress and Exposition on Noise Control Engineering, Providence, RI (June 2016)
- "Kingston Massachusetts Wind Turbine Acoustical Study", paper no. 428, Proceedings of Inter-Noise 2015 International Congress and Exposition on Noise Control Engineering, San Francisco, CA (August 2015)
- "System-wide OBSI Study to Evaluate Success of Diamond Grinding to Attain Noise Reduction Goal", paper no. 159, Proceedings of Noise-Con 2013 Congress and Exposition on Noise Control Engineering, Denver, CO (August 2013)
- "CTIM Wayside Noise Study for Virginia Quiet Pavement Pilot Project", paper no. 1341, Proceedings of Inter-Noise 2012 International Congress and Exposition on Noise Control Engineering, New York, NY (August 2012)

Michael J. Hamilton

Senior Geographic Information Specialist

Experience

2004-present, HMMH

2001-2003, VHB, Inc.

1984-2001, Sasaki Associates, Inc.

Education

B.S., Geographic Information Systems & Cartography, Salem State College, Salem, MA, 2001, Honors Graduate

A.S., Survey and Highway Engineering Technology, Northeastern University, Boston, MA, 1996

Michael Hamilton's experience at HMMH encompasses a wide array of environmental and transportation noise-related GIS and CAD analysis. Utilizing geo-spatial applications to build and support the decision making process, his responsibilities include noise contour creation, overlay, manipulation, environmental noise impacts, Census data analysis including environmental justice and population impacts, noise sensitive mapping, land use mapping and analysis, noise barrier and noise mitigation mapping.

Mr. Hamilton brings thirty years of experience in environmental, transportation, architectural, landscape and land development consulting practice utilizing GIS, CAD and remote sensing applications. In this capacity, he utilizes GIS to support environmental compliance for private and public development projects. Mr. Hamilton's experience also includes the organization, collection, and creation of spatial data used to streamline existing workflows, facilitate information sharing and develop spatial database queries based on geographic references resulting in enhanced thematic maps, and graphic information products to satisfy project requirements. Clients regularly commend Mr. Hamilton for his clear, convincing, cutting-edge graphical presentation of critical study elements.

Representative Projects

Sustainability and Energy Projects

- Black Oak Wind noise, visual and shadow flicker assessment, Enfield, NY (2014-2017)
- Feasibility of Solar PV Project at General Mitchell Airport, County of Milwaukee Department of Aviation, Milwaukee WI (2014-2015)
- Muskeget Channel Tidal Energy Project, Town of Edgartown, Edgartown, MA (2007-2012)
- Hanscom Field 2012 Environmental Status and Planning Report, Massachusetts Port Authority, Bedford, MA (2012-2014)
- Guidebook for Energy Facilities Compatibility with Airports and Airspace, Airport Cooperative Research Program, Washington, DC (2012-2014)
- Third Party Review of Gloucester Engineering Wind Project, City of Gloucester, Gloucester, MA (2011)

Aviation Projects

- On-Call Noise Consulting, Fort Lauderdale Executive Airport, Fort Lauderdale, FL, (2012-present), *GIS Specialist*
- 14 CFR Part 150 Update, Indianapolis International Airport (IND), (2019-present), *GIS Specialist*
- Baltimore/Washington Thurgood Marshall International Airport (BWI) Airport Noise Zone (ANZ) Update, Maryland Department of Transportation, Maryland Aviation Administration, Baltimore, MD (2019-Present), *GIS Specialist*
- 14 CFR Part 150 Study, Palm Beach County Park Airport, Lantana, FL (2019 - present), *GIS Specialist*
- 14 CFR Part 150 Update Study, Piedmont Triad International Airport, Greensboro, NC (2018 - present), *GIS Specialist*
- 14 CFR Part 150 Update Study, Nashville International Airport, Nashville, TN (2018 - 2020), *GIS Specialist*
- Technical Support to the Charlotte-Douglas International Airport Community Roundtable (2018-present), *GIS Specialist*
- 14 CFR Part 161 Study, East Hampton Airport, East Hampton, NY (2017-

present), *GIS Specialist*

- Technical Support to the San Francisco International Airport Community NOMS Site Location, Baltimore/Washington International, Baltimore, MD (2018-present), *GIS Specialist*
- Chicago O'Hare Terminal Plan EA, O'Hare International Airport, Chicago, IL (2019-present), *GIS Specialist*
- Nashville International Airport Runway 02R/20L Runway Reconstruction, Nashville, TN (2019), *GIS Specialist*
- Nashville International Airport Master Plan Update, Nashville, TN (2019 – Present), *GIS Specialist*
- Nashville International Airport Noise Exposure Map Update, Nashville, TN (2018 – 2020), *GIS Specialist*
- Winston-Salem Airport Noise and Air Quality Analysis (2019 – Present), *GIS Specialist*
- Noise Program Assistance, Westchester County, White Plains, NY (2019), *GIS Specialist*
- O'Hare International Airport EIS Re-Evaluation, Chicago, IL (2017 – 2018), *GIS Specialist*
- BOS RNAV Pilot Study, Boston-Logan International, Boston, MA (2016 - present), *GIS Specialist*
- Oakland International Airport On-Call Airspace and Noise Consultant, Port of Oakland (2016-present), *GIS Specialist*
- Los Angeles World Airports SoCal Metroplex Final EA Review, Los Angeles International Airport, Los Angeles, CA (2016-present), *GIS Specialist*
- Dallas Love Field Annual Noise Reports, Dallas Love Field, Dallas, TX (2013 - present), *GIS Specialist*
- 14 CFR Part 150 Noise Study, Port Authority of New York and New Jersey, Newark-Liberty International and Teterboro Airport, Newark, NJ (2016 – present), *GIS Specialist*
- 14 CFR Part 150 Update Study, Teterboro Airport, Teterboro, NJ (2015-2020), *GIS Specialist*
- London Heathrow Community Noise Evaluation, London, UK (2016 - 2018), *GIS Specialist*
- NEM Update, Centennial Airport, Arapahoe County, CO (2015-2017), *GIS Specialist*
- Helicopter Use Restriction Feasibility Analyses, East Hampton Airport, East Hampton, NY (2016-2017), *GIS Specialist*
- Dallas Love Field Annual Noise Reports, Dallas Love Field, Dallas, TX (2016 - 2017), *GIS Specialist*
- Environmental Data Report, Boston-Logan International, Boston, MA (2015-2017), *GIS Specialist*
- 14 CFR Part 150 Noise Exposure Map Update, Louisville International Airport, Louisville, KY (2015-2017), *GIS Specialist*
- San Diego International Airport Noise Exposure Map Recertification, CA (2016), *GIS Specialist*
- On-Call Acoustical Consulting Services, Oakland International Airport, Oakland, CA (2007-present), *GIS Specialist*
- On-Call Consulting Services, City of San Antonio Aviation Department, TX (2004-2010), *GIS Specialist*
- On-Call Acoustical Consulting Services, San Diego County Regional Airport Authority, San Diego, CA (2004-present), *GIS Specialist*
- Burlington International, VT (2008, 2015-Present), *GIS Specialist*
- Noise Zone Updates, Baltimore/Washington International, Baltimore, MD

(2006-2007, 2013-present), *GIS Specialist*

- 14 CFR Part 150 Study, LA/Ontario International Airport, Ontario, CA (2014-2015), *GIS Specialist*
- 14 CFR Part 150 Study, Great Falls International Airport, Great Falls, MT (2013-2015), *GIS Specialist*
- Noise Exposure Contours for Toronto-Pearson International Airport, Toronto, ON, (2015), *GIS Specialist*
- Houston Optimization of Airspace and Procedures in the Metroplex (OAPM), Houston, TX (2012-2013), *GIS Specialist*
- 14 CFR Part 150 Study, Merrill Field, Anchorage, AK (2012-2013), *GIS Specialist*
- Land Use Compatibility Study, Honolulu, HI (2012-2013), *GIS Specialist*
- 14 CFR Part 161 Study, Los Angeles International Airport, Los Angeles, CA (2011-2013), *GIS Specialist*
- T.F. Green Airport Improvement Program EIS, Providence, RI (2004-2012), *GIS Specialist*
- Aircraft Noise Studies, Vancouver International Airport, Vancouver, B.C. (2011–2013), *GIS Specialist*
- Environmental Assessment for "Greener Skies Over Seattle"; Proposed Arrival Procedures to Seattle-Tacoma International Airport, Seattle WA (2011-2012), *GIS Specialist*
- 14 CFR Part 150 Study, Van Nuys Airport, Los Angeles World Airports, Los Angeles, CA (2010-2011), *GIS Specialist*
- 14 CFR Part 150 Study, Louisville International Airport, Louisville, KY (2010-2011), *GIS Specialist*
- 14 CFR Part 161 Study, Van Nuys Airport, Los Angeles World Airports, Los Angeles, CA (2005-2010), *GIS Specialist*
- Capacity Enhancement Program EIS, Philadelphia International, Philadelphia, PA (2005-2009), *GIS Specialist*
- 14 CFR Part 150 Study, Burlington International Airport, Burlington, VT (2006), *GIS Specialist*
- Runway Extension 17/35, Philadelphia International, Philadelphia, PA (2003-2006), *GIS Specialist*
- Cleveland-Detroit Airspace Redesign EA, MI, OH, and Canada (2005), *GIS Specialist*
- Runway Extension EA, Erie International, Erie PA, (2005), *GIS Specialist*
- 14 CFR Part 150 Study, Baltimore/Washington International, Baltimore, MD (2005), *GIS Specialist*
- Annual Contour Update, Raleigh Durham International, Raleigh, NC (2004), *GIS Specialist*
- 14 CFR Part 150 Study, Portland International Jetport, Portland, ME (2004), *GIS Specialist*
- 14 CFR Part 150 Study Update, Lehigh Valley International, Allentown, PA (2004), *GIS Specialist*
- 14 CFR Part 150 Noise Exposure Map Update, Manchester Airport, Manchester NH (2004), *GIS Specialist*
- 14 CFR Part 150 Study, Piedmont Triad International, Greensboro, NC (2004), *GIS Specialist*
- Airport Improvements Project, New Bedford Regional, New Bedford, MA (2004), *GIS Specialist*
- Modernization EIS, Chicago O'Hare, Chicago, IL (2004), *GIS Specialist*

Highway Projects

- Hampton Roads Bridge Tunnel Expansion, Design Noise Analysis, Hampton and Norfolk, VA (2019-present), *GIS Specialist*
- I-495 and I-270 Widening/Managed Lanes Project, Noise Analysis, Montgomery County, MD (2018-2019), *GIS Specialist*
- I-95 Rappahannock River Crossing SB CD Lanes, Barrier Design Study, Fredericksburg, VA (2018 – present), *GIS Specialist*
- Rolling Road Noise Study and Barrier Design, Fairfax, VA (2018 – 2019), *GIS Specialist*
- Indian River Road Noise Abatement Study, Virginia Beach, VA (2017-2018), *GIS Specialist*
- Dulles Airport Air Cargo Connector Environmental Assessment, Noise and Air Quality Study, Loudoun County, VA (2015), *GIS Specialist*
- Routes I-93/128 Interchange and Widening, Noise Analysis and Abatement Design, Woburn/Stoneham/Reading, MA (2013-present), *GIS Specialist*
- I-95/395 HOT/HOV Lanes Improvements, Noise Analysis and Abatement Design, Arlington to Garrisonville, VA, (2007-2008), *GIS Specialist*
- Bi-County Parkway Location Study, Noise Analysis and Abatement Design, Prince William/Loudoun Counties, VA (2013), *GIS Specialist*
- Route 501 Bridge Replacement Final Design, Virginia Department of Transportation, Snowden, VA (2012), *GIS Specialist*
- I-64 Hampton Roads Bridge-Tunnel EIS, Noise Analysis and Abatement Design, Hampton and Norfolk, VA (2011-2012), *GIS Specialist*
- Route 16, Woods Memorial Bridge Improvements, Noise Analysis and Abatement Evaluation, Medford and Everett, MA (2011), *GIS Specialist*
- I-64/I-264 Improvements Study, Final Noise Barrier Acoustical Design, Norfolk and Virginia Beach, VA (2011), *GIS Specialist*
- I-93/I-95 Improvements Study, Noise Analysis and Abatement Evaluation, Canton and Westwood, MA (2010-2011), *GIS Specialist*
- SR 267 Dulles Connector, Noise Analysis and Barrier Design, McLean, VA (2010-2011), *GIS Specialist*
- I-66 Spot Improvements, Final Noise Barrier Acoustical Design, Arlington County, VA (2010-2011), *GIS Specialist*
- I-495 Capital Beltway Widening EIS Noise Analysis, Fairfax Co., VA (2006-2007), *GIS Specialist*
- New York State Thruway Noise Barrier Final Design Studies, New Rochelle and Bronx, NY (2006), *GIS Specialist*
- Noise Barrier Feasibility and Design Studies in Wellesley, Newton, Woburn, Danvers and Fall River, MA (2004 - 2005), *GIS Specialist*
- Massachusetts Route 18 EA Noise Analysis Study, Weymouth, MA (2006), *GIS Specialist*
- US 50 HOV Noise Study, Sacramento, CA (2005), *GIS Specialist*

Vincent Ma
Consultant

Experience

2018-Present, HMMH

9/2016-12/2016, Cal Poly BioTrek Garden

6/2015-9/2015, Orange County Environmental Resources/Public Works

Education

B.S. in Environmental Biology, emphasis in Ecosystem Ecology and Management, minor in Regenerative Studies, California State Polytechnic University, 2016

Vincent Ma is a graduate of California State Polytechnic University (Cal Poly) with a background in environmental and natural resource conservation. At HMMH, Mr. Ma is conducting noise measurements, data analysis and modeling in AEDT, SoundPLAN, and GIS. For the Orange County Public Works department, he conducted field studies and developed a GIS-based ESRI Story Map of Orange County (CA) flood Control District Channels. He is an enthusiastic consultant with a desire to improve the environment.

Vincent is a certified service delivery technician for Envirosuite, providing preventative maintenance and support services for Airport noise monitoring systems throughout the Western United States.

Representative Projects

Aviation Projects

- Laguna Niguel Acoustical Consulting Services, Laguna Niguel, CA (2018), *Noise measurements, Data analysis and data processing*
- Noise Analysis for San Diego Int'l Airport, San Diego, CA, (2018-present), *Data analysis*
- Salt Lake City Master Plan Update, Salt Lake City, UT (2018-present), *Data analysis and data processing.*
- FAA National Sleep Study Support (2018-2019), *Data analysis and processing in GIS.*
- Oakland Int'l Airport On-Call, Oakland, CA (2018-present), *Data analysis and processing*
- Ontario Int'l Airport On-Call, Ontario, CA (2019), *Data analysis and processing*
- San Francisco Int'l Airport Roundtable Technical Consultant, San Francisco, CA (2019), *Document review.*
- San Antonio Int'l Airport Runway Closure Analysis, San Antonio, TX (2019), *Data analysis in GIS.*
- Quarterly Noise Reports, Ontario International Airport (2019-present), *Data processing, data analysis, documentation*
- Quarterly Noise Reports, Oakland International Airport (2018-present), *Data processing, data analysis, documentation*
- Nashville International Airport Runway 02R/20L Runway Reconstruction, Nashville, TN (2019), *Noise Modeling, Data Processing, and Technical Analysis*
- Nashville International Airport Concourse A Gate Expansion, Nashville, TN (2020), *Noise Modeling, Data Processing, and Technical Analysis*
- Preventative Maintenance and Technical Support Services, Envirosuite (Formerly EMS Bruel & Kjaer), Western United States (2018-Present), *Assistant Project Manager, certified service delivery technician*

Surface Transportation Projects

- I-495/I-90 Interchange Improvements, Preliminary Noise Analysis and Abatement Design, Hopkinton/Southborough/Westborough, MA (2018-present), *data processing and object development in GIS*
- Plano Expressway Corridor Air and Noise Pollution Study, Plano, TX (2018-present), *Noise measurements, data processing, and object development in GIS*
- I-495/I-270 Improvements, Preliminary Noise analysis and Abatement Design, Prince George's and Montgomery Counties, MD, *data processing and object*

development in GIS

- Roy Rogers Road Widening, Preliminary Noise analysis and Abatement Design, Sherwood, OR (2019-2019), *data processing and object development in GIS.*
- Pittsburgh Norfolk Southern Vertical Clearance, Pittsburg, PA (2018-2019) *Data processing and object development in GIS, Mapbook development.*
- Building Architecture Acoustics Program, Exterior and Interior Noise Analyses, Southern California (2018-Present), Assistant *Project Manager, noise modeling and documentation*
- LAX ATMP Project, Roadway and Construction Noise Analysis, Los Angeles, CA (2019-Present), *Data analysis and data processing.*

Prior to joining HMMH, Vincent's experience includes:

California State Polytechnic University, Pomona, CA

Intern, September 2016 – December 2016

- Provided various maintenance of several gardens around the Cal Poly campus.
- Provided educational tours to visiting students and visitors on the botany of different ecosystems displayed.
- Learned how to use ethnobotany to enhance habitats and create engaging opportunities for students.

Orange County Environmental Resources/Public Works, CA

Intern, June 2015 - September 2015

- Conducted field verification of Orange County Flood Control District Channels.
- Provided data management and development of a GIS-based database of flood channels for Adopt-A-Channel program.
- Developed a GIS based ESRI Story Map to be utilized on OC Environmental Resources AAC Program website and created Adopt-A-Channel program materials to be shared with potential Adopters.
- Collected dry weather water samples at sites throughout the county and conducted various water quality tests.

Mariano Sarrate
Consultant

Experience
2017-Present, HMMH

Education
B.S. in Acoustics, Columbia College
Chicago, IL, 2013-2017

Affiliations
Acoustical Society of America
Student Member, 2017

Mariano Sarrate is a consultant under HMMH Aviation Environmental Services. While earning his B.S. in Acoustics at Columbia College, he became proficient with Matlab, SpectraPLUS, SpectraQuest and EASE software. He studied extensively in the areas of environmental and architectural acoustics, vibration analysis and general acoustical testing. While working at HMMH, he became proficient with AEDT, SoundPLAN, and SQL.

Mr. Sarrate has a holistic understanding of acoustical issues, including indoor and outdoor sound propagation as well as various testing methodologies based on the circumstances and instruments being used for specific study areas.

Representative Projects

Aviation

- RealContours™ Support, Los Angeles World Airports, CA (2018 – present), *Noise modeling, Data processing*
- Washington Dulles Airport Noise Contours, Dulles, VA (2018), *Noise modeling*
- Nashville International Airport Noise Exposure Map and Master Plan Update, Nashville, TN (2018 – 2019), *Noise modelling*
- Naples Municipal Airport Master Plan Update, Naples, FL (2018), *Data processing*
- Environmental Status and Planning Report for L.G. Hanscom Field, MA (2018), *Noise modeling*
- Maryland Department of Transportation Maryland Aviation Administration, NOMS Assistance, MD (2018 – present), *Data processing*
- Maryland Department of Transportation Maryland Aviation Administration, Community Coordination, Maryland, MD (2017 – present), *Data processing*
- Dallas Love Field Airport Annual Noise Contours, Dallas, TX (2018 – present), *Noise modeling*
- 14 CFR Part 150 Noise Study, Port Authority of New York and New Jersey, Newark-Liberty International and Teterboro Airports, NJ (2018), *Noise modeling*
- Broward County Aviation Department, Fort Lauderdale Hollywood International Airport Acoustical Consulting Services, Ft. Lauderdale, FL (2018 – present), *Noise modelling, Data processing*
- General Noise Consulting Services, Naples Municipal Airport, Naples, FL (2018), *Data processing*
- On-Call Noise Consulting Services, Oakland International Airport, CA (2018), *Noise modeling*
- Environmental Status and Planning Report for Boston Logan Airport, MA (2018), *Noise modeling*
- O'Hare International Airport EIS Re-Evaluation, Chicago, IL (2018 – 2019), *Technical analysis*
- Philadelphia Cargo Environmental Assessment, Philadelphia, PA (2019), *Noise modeling*
- Seattle-Tacoma International Airport Reflectivity Analysis, Seattle, WA (2020), *Noise modeling*

Sound Insulation

- TF Green Sound Mitigation Project for Rhode Island Airport Corporation, Warwick, RI (2018), *Noise Measurements and Data Processing*
- Chamberlin School Eligibility Testing, Jones Payne Group, Burlington, VT (2018), *Noise Measurements*

- Residential Sound Insulation Program for Louisville Regional Airport Authority, Louisville, KY (2019-2020), *Noise Measurements and Data Processing*
- Residential Sound Insulation Program, George W. Bush Intercontinental Airport, Houston, TX (2019), *Noise Measurements and Data Analysis*
- Residential Sound Insulation Program, Los Angeles World Airports, Los Angeles, CA (2020), *Program Management and Data Analysis*

Rail

- Massachusetts Bay Transportation Authority, Cabot Red Line Yard Noise and Vibration Analysis, Boston, MA (2018), *Data acquisition, Data processing*
- Massachusetts Bay Transportation Authority, Wellington Orange Line Yard Noise and Vibration Analysis, Boston, MA (2018), *Data processing*
- Massachusetts Bay Transportation Authority, Oak Grove Orange Line Accessibility Improvements Noise and Vibration Analysis, Boston, MA (2019), *Data acquisition, Data processing, Noise modelling.*

Highway

- VDOT, Indian River Road (phase 3), Richmond, VA (2017), *Noise Modeling*
- VDOT, VA Route 460-58-13 Connector Study, Richmond, VA (2018), *Noise Modeling*
- MWAA, DCA Roadway Network Improvements, Washington D.C., (2019), *Noise Modeling*

Practical Coursework

- Guitar Resonance Testing, Chicago, IL (2017), Natural frequencies of an acoustic guitar experimentally measured. Unstrung guitar body with accelerometers mounted onto mechanical shaker; acceleration data analyzed to determine resonant frequencies and their respective harmonics, *Data Acquisition*
- Reverberation Chamber Material Study, Chicago, IL (2016), Reverberation curve of a room experimentally derived. ASTM-C423 was followed to determine the absorption coefficient of a material indirectly, *Data Analyst*
- Anechoic Chamber Speaker Study, Chicago, IL (2016), Frequency response and directivity of a loudspeaker were investigated using TEF in an anechoic environment, *Data Acquisition*
- Faulty Bearing Vibration Analysis, Chicago, IL (2016), Good and Faulty bearings in a rotary motor were analyzed with SpectraQuest software. Resonances in bearings were theoretically calculated, then experimentally observed*, Data Analyst*

Dominic M. Scarano
Consultant

Experience
2016-present, HMMH

2015, WSI

Education
B.S., Environmental Science
Concentration in
Atmospheric Science
University of Massachusetts
Lowell,
Lowell, MA, 2015

Affiliations
Member, Air and Waste
Management Association
(2016 – present)

Dominic Scarano joined HMMH with a bachelor's degree in environmental science from the University of Massachusetts Lowell. His atmospheric science background has given him excellent training in air quality analysis and pollution science.

Mr. Scarano's primary responsibility at HMMH includes airport noise and air quality modeling and analysis using the Federal Aviation Administration's Integrated Noise Model (INM) and Aviation Environmental Design Tool (AEDT). Mr. Scarano has worked on a wide variety of aviation noise and air quality projects and has experience with airport sound insulation programs.

Representative Projects

- O'Hare International Airport EIS Re-Evaluation, Chicago, IL (2018 – Present), *Noise Modeling, Data Processing, Technical Analysis*
- RISTANCO Noise Modeling, London, England (2019-Present), *Project Manager*
- Piedmont Triad International Airport 14 CFR Part 150 Update, Greensboro, NC (2019 – present), *Noise Modeling Support*
- Reno – Tahoe International Airport Annual Noise Contours, Reno, NV (2016 – present), *Project Manager*
- Bowman Field Emission Inventory, Bowman Regional Airport, Louisville, KY (2017 – 2018), *Air Quality Modeling Support*
- On-call Noise and Real Estate Consulting Support to the Maryland Department of Transportation Maryland Aviation Administration (2017- present), *Data Analysis and Report Development*
- St. Louis Lambert International Airport VALE Grant Program (2017 – present), *Air Quality Modeling Support*
- San Diego Brown Field and Montgomery-Gibbs Executive Airport Environmental Assessments (2017- present), *Air Quality Modeling Support*
- Port Authority of New York and New Jersey Teterboro Airport 14 CFR Part 150 Study, Teterboro Airport, Teterboro, NJ (2015 - present), *Noise Modeling and Project Support*
- Los Angeles World Airports North Downwind Arrival Study, Los Angeles International Airport, Los Angeles, CA (March 2016 - August 2016), *Technical Support*
- Los Angeles World Airports SoCal Metroplex Review, Los Angeles International Airport, Los Angeles, CA (2016-2017), *Technical Support*
- Dillant – Hopkins Airport Tree Removal Study, Dillant-Hopkins Airport, Keene, NH (2016 - 2017), *Noise Modeling/Technical Support*
- Louisville International Airport Air Quality Emissions Inventory, Louisville International Airport, Louisville, KY (2016 - 2017), *Air Quality Modeling Support*
- Louisville International Airport NEM Update, Louisville International Airport, Louisville, KY (2016 - 2017), *Noise Modeling Support*
- Massport Logan Airport Environmental Data Report, Logan International Airport, Boston, MA (2016 - present), *Technical Support*
- TF Green Sound Mitigation Project for Rhode Island Airport Corporation, Warwick, RI (2016-present), *Noise Measurements and Data Processing*
- Residential Sound Insulation Program, Tweed-New Haven Airport, New Haven, CT (2016-present), *Noise Measurements and Data Analysis*
- Residential Sound Insulation Program, Louisville International Airport, Louisville, KY (2019-present), *Noise Measurements and Data Analysis*