Lake Elmo Airport (21D)
Sound Study Report

November 2024

Community Relations Office

Updated 11/27/2024

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1.0 Introduction

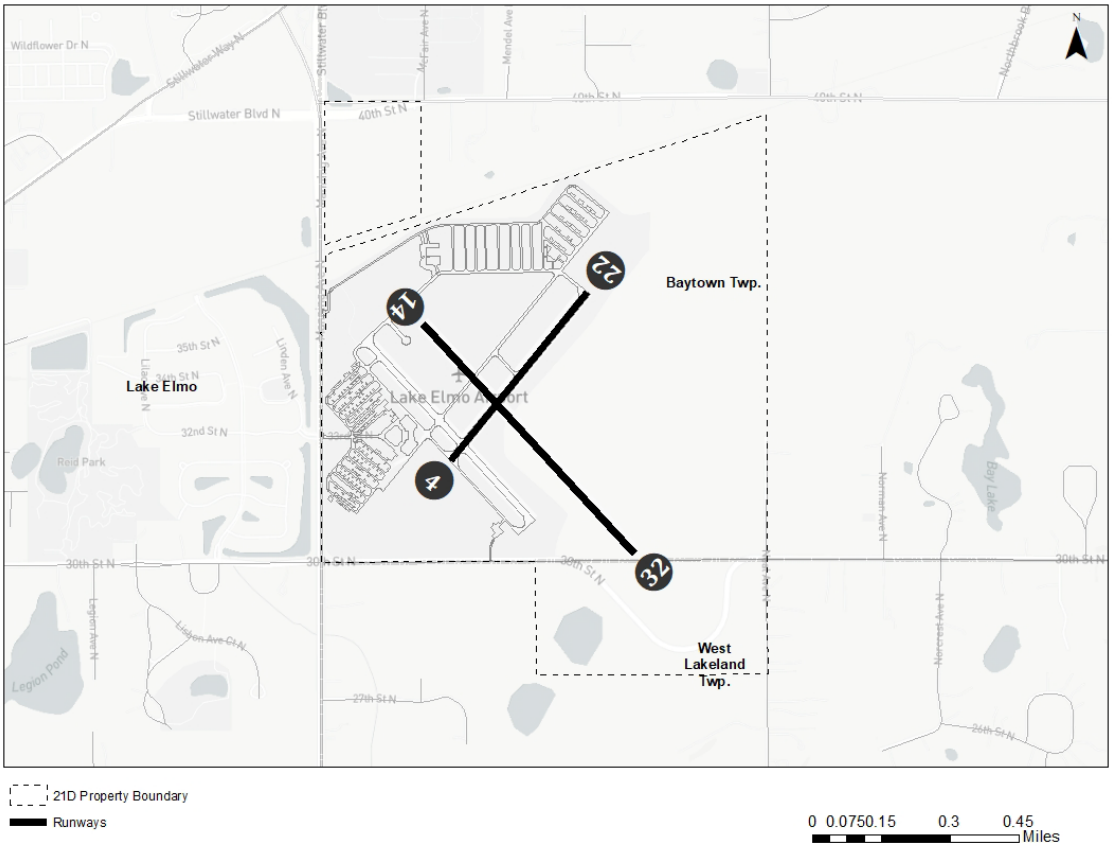
The Metropolitan Airports Commission (MAC) completed the 2024 21D Sound Study in support of the Lake Elmo Airport Advisory Commission (LEAAC) 2023-2024 Work Plan. The study occurred over a seven-day period (August 13-19, 2024) and involved two industry standard methods for assessing aircraft sound: field-measurement and modeling. Field measured sound data, conducted by MAC Community Relations staff, used sound analyzers and best practices to measure and collect data at three locations on Lake Elmo Airport (21D) property.

Modeling of sound for 21D flight activity during the Study period was performed using the Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) modeling software.

The results of this study are intended to enhance communication about sounds associated with aircraft operating to and from 21D.

Figure 1.1 shows the airfield layout for Lake Elmo Airport (21D). The report sections below describe the 21D runway use, aircraft operations, weather, field-measured data collection process and analysis, AEDT modeling data and analysis, a comparison of measured data and modeled data, and a summary of aircraft noise complaints received during the Study period.

Figure 1.1: 2024 Lake Elmo Airport (21D) Airfield Layout



2.0 Aircraft Operations

21D is a general aviation, public-use airport owned and managed by the MAC, and serves as a reliever airport for Minneapolis-St. Paul International Airport (MSP) by accommodating flight training, recreational flying, and business aviation. Aircraft that utilize 21D regularly are fixed-wing single-engine and twin-engine propeller-driven airplanes, and helicopters.

The airport is open for aircraft use 24 hours per day, and two runways are available at 21D for arrivals and departures: Runway 14/32 and Runway 4/22. Helicopters may land and depart from areas other than a runway at 21D.

Flight training at 21D generates multiple takeoffs and landings (called touch and go operations) for proficiency and to meet federal requirements for pilot certification. These types of operations result in the airport being busier in the spring and summer when weather conditions in this geographical region are more conducive to flight training and recreational flying compared to other seasons. The 21D Sound Study was scheduled to capture as much of this type of aircraft activity data as possible.

The MAC Noise and Operations Monitoring System (MACNOMS) collects flight tracking data and reports operations data. During the 2024 Study period, MACNOMS data show 889 total operations occurred at 21D with 445 arrivals and 444 departures. Runway 14/32 was used for 84 percent of the activity during the Study period and Runway 4/22 was used 16 percent.

Table 2.1 shows the number of daily operations on each 21D runway. The first and last days of the Study period show the highest levels of flight activity: August 13 had 92 arrivals and 94 departures, and August 19 had 104 arrivals and 103 departures. The highest levels of 21D runway use overall during the 2024 Study period occurred on Runway 32 with 234 arrivals and 244 departures. Runway 32 is the preferred runway at 21D in accordance with the 21D Noise Abatement Recommended Practices.

Table 2.1: 21D Daily Aircraft Activity per Runway during the 2024 Study Period

Runway	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug	Runway Total
Arrivals	**92**	**58**	**50**	**26**	**31**	**84**	**104**	**445**
4					9	8		**17**
14	47	39	14	2	1		32	**135**
22	11	4	33	5	1	2	3	**59**
32	34	15	3	19	20	74	69	**234**
Departures	**94**	**57**	**49**	**23**	**33**	**85**	**103**	**444**
4					6	4		**10**
14	45	36	13				36	**130**
22	11	1	36	8	1	2	1	**60**
32	38	20		15	26	79	66	**244**
Daily Total	**186**	**115**	**99**	**49**	**64**	**169**	**207**	**889**

There were 19 arrivals and 14 departures that operated between the hours of 10:00 P.M. and 7:00 A.M. during the Study period. A total of 221 aircraft operations occurred during nighttime hours in the third quarter of 2024 at 21D.

Figures 2.1 and 2.2 show the 21D flight tracks for daytime arrivals and departures. Figure 2.3 depicts 21D nighttime activity during the Study period.

Weather during the study week was desirable for flying with typical wind and temperature patterns for this geographical region; very little precipitation occurred during the Study period. Weather conditions (e.g., temperature, precipitation, wind, etc.) affect airport activity, runway use decisions and aircraft performance. In addition to operational factors, weather conditions can also affect the way sound is transmitted and observed. For these reasons, weather data are documented during the Study period. A summary of daily weather conditions is provided in the Appendix.

Figure 2.2: 21D Daytime (7:00 A.M to 10:00 P.M.) Arrival Operations During 2024 Study Period

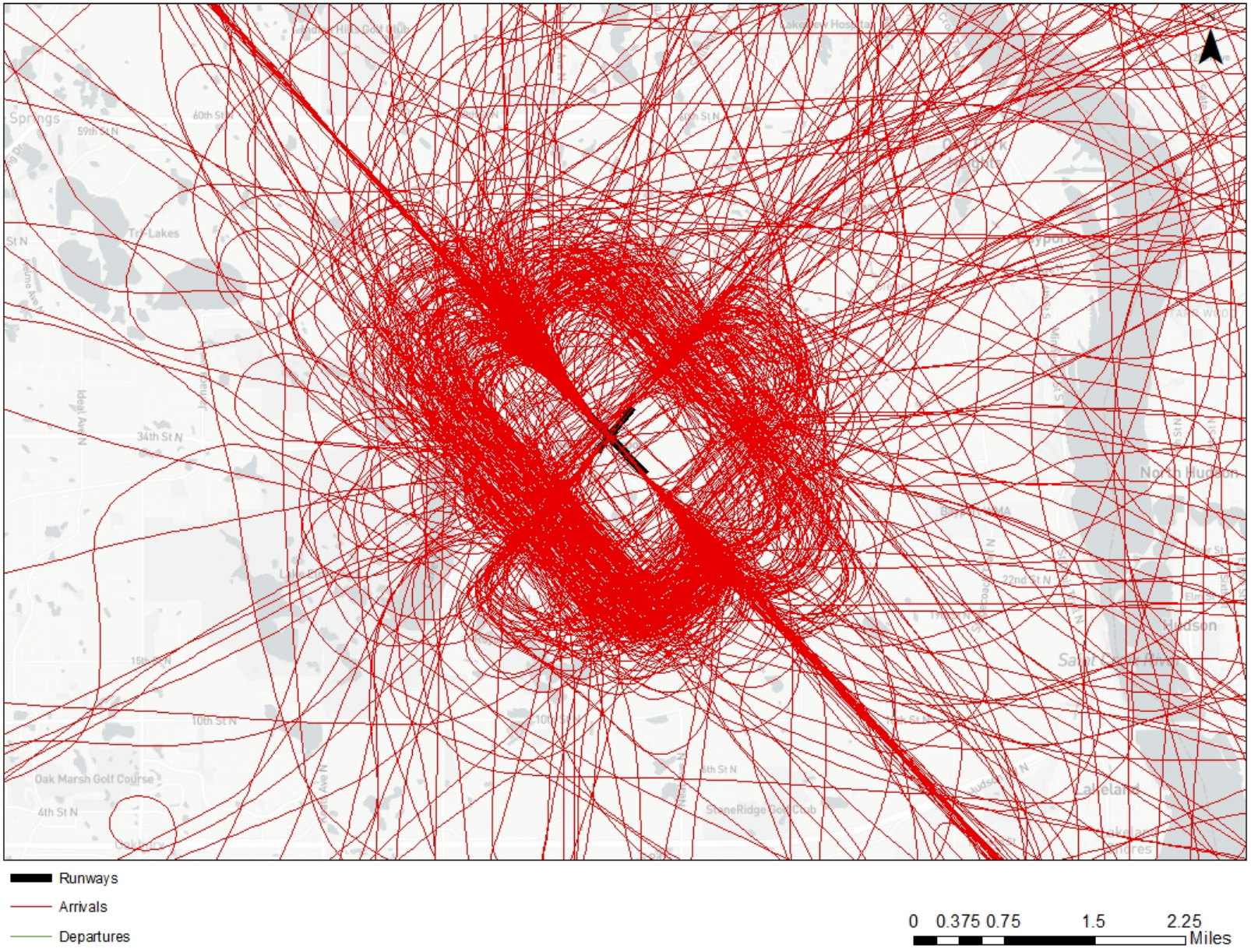
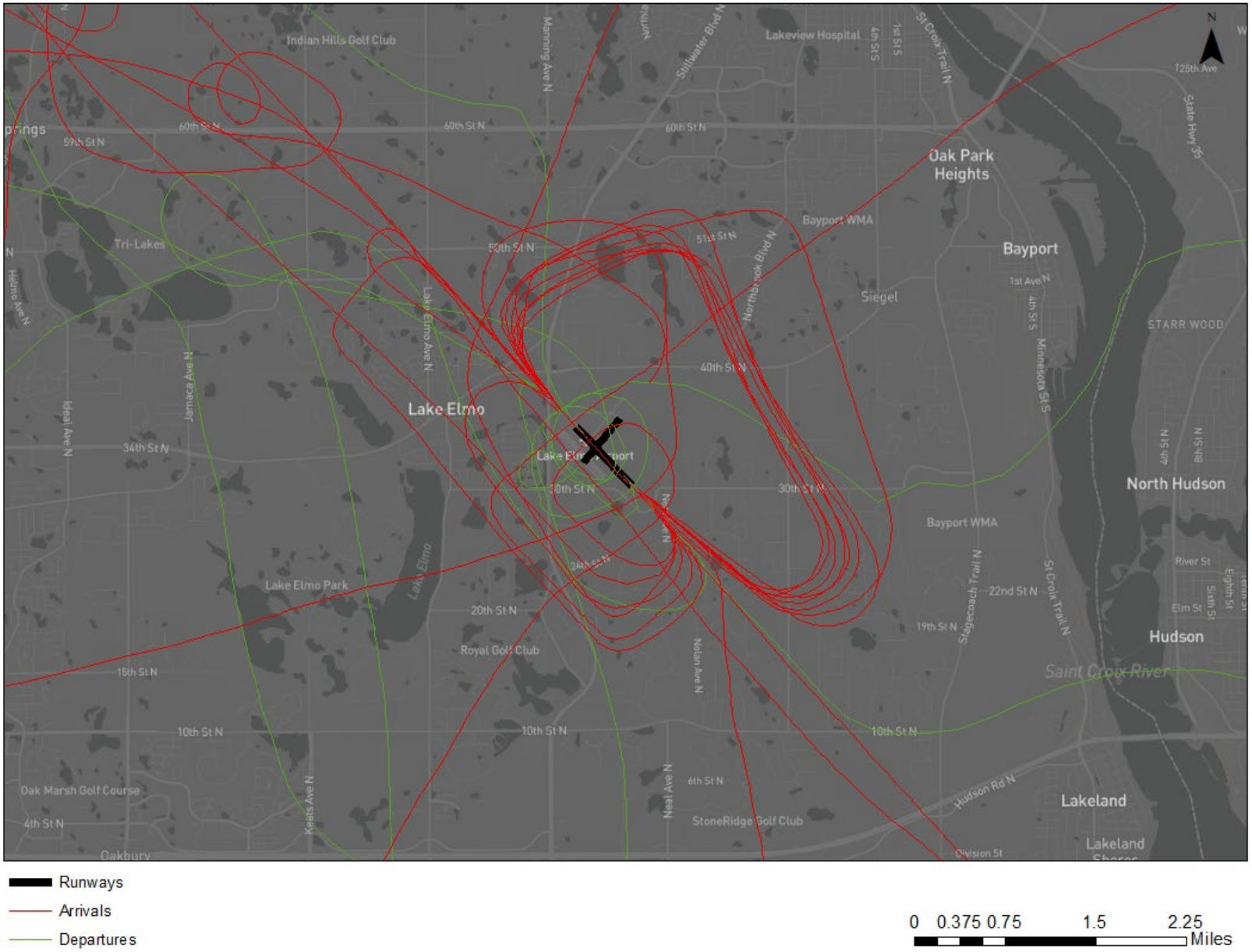


Figure 2.2: 21D Daytime (7:00 A.M to 10:00 P.M.) Departure Operations During 2024 Study Period

Figure 2.3: 21D Nighttime (10:00 PM to 7:00 AM) Operations During 2024 Study Period



3.0 Field-Measured Sound Data

Field measurement sites are positioned consistently with MAC Mobile Sound Monitoring Guidelines. These guidelines are provided in the Appendix.

The dates of this Study period are August 13-19, 2024. Figure 3.1 shows a map of 21D runway layout and the field measurement equipment locations, and Figure 3.2 shows a picture of each field measurement site.

Figure 3.1: 2024 Field Measurement Locations and 21D Runways

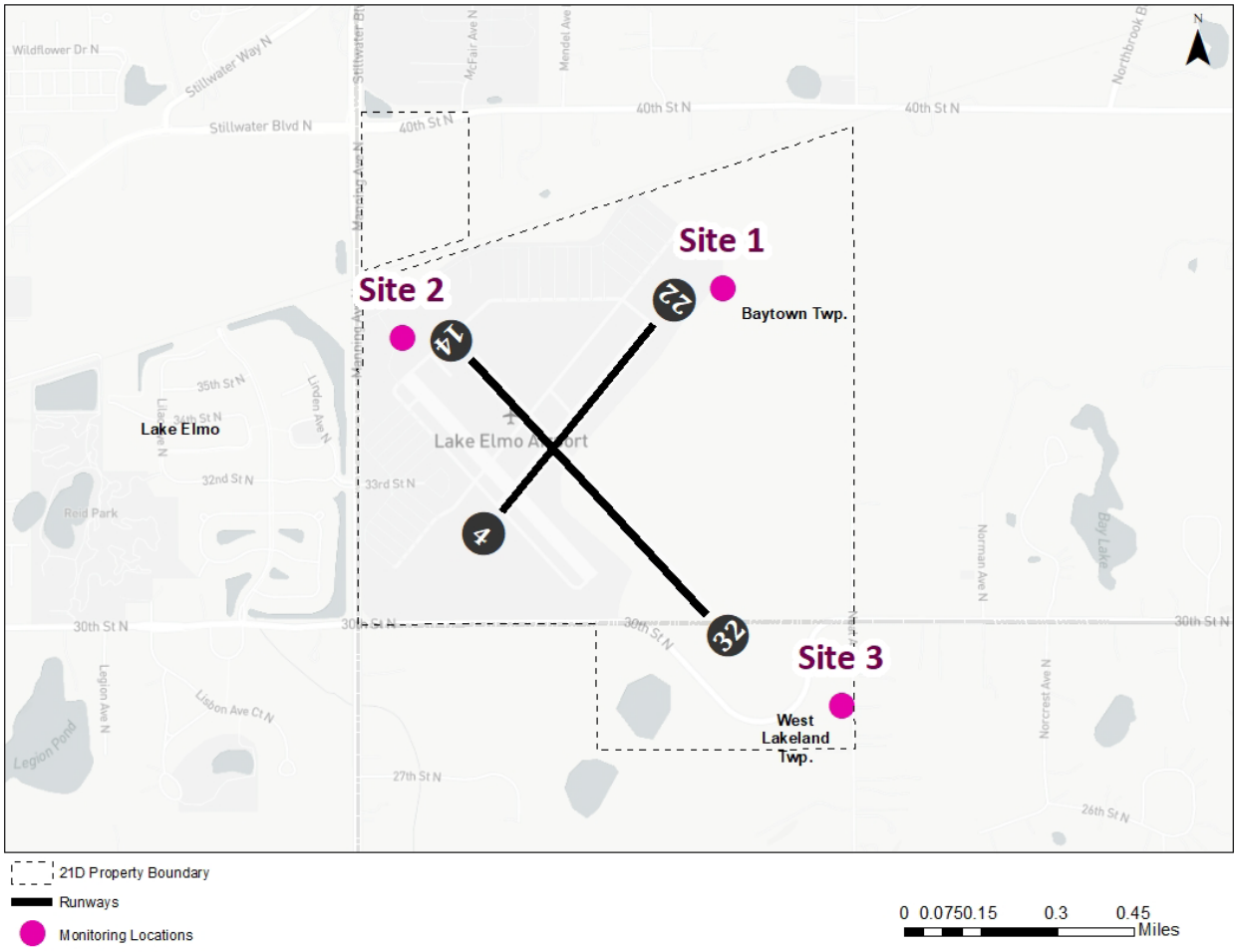


Figure 3.2: 2024 Field-Measurement Site Photos

3.2 Field Measurement Analysis and Parameters

One sound analyzer collected data at each of the field-measurement sites. Each site operated continuously, measuring sound levels utilizing a slow response with A-weighting (dBA), as federally-prescribed by standards for collecting aircraft sounds in the FAA's 14 CFR Part 150. Sound events are identified and documented when the sound level measures 65 dBA or more for four seconds or longer. The parameters used by the sound monitoring instrumentation measure both community and aircraft sounds. Any sound event not correlated with 21D aircraft activity is considered a community event. The equipment and tolerances are set to be sensitive so that aircraft do not have to fly directly over the measurement site to be recorded.

In this study, sound events from aircraft and community sound sources were detected. Sound events were correlated with 21D flight track data, collected by MACNOMS, using temporal and spatial parameters (time and distance). All uncorrelated sound events are referred to in this report as community events.

3.3 Field Measurement Results

There were 333 aircraft sound events and 281 community sound events measured at the three sites during the seven-day Study period. This section summarizes information for both aircraft and community sound sources described in terms of single sound event metrics (LA_{max}, SEL, Event Duration) and summary-based metrics (DNL, ADNL, CDNL and LA_{90}).

3.3.1 Single Sound Event Metrics

Table 3.1 shows the daily number of single aircraft sound events aircraft sounds that exceeded 65 dBA for four seconds. The largest number of aircraft sound events captured during the Study period on a daily basis occurred on Tuesday, August 13 with 75 events. The smallest number of aircraft sound events measured during the Study period occurred on Thursday, August 15 with 15 events.

Table 3.1 also shows a total number of sound events captured for each site. Site 1 measured 18 aircraft sound events. Site 2 measured the most aircraft sound events during the Study period with 209 events. Site 3 measured the second highest number of aircraft sound events during the Study period with 106 events. Both site 2 and 3 measured activity associated with aircraft Runway 14/32, the most heavily used runway during the Study period. More detail about runway use was provided in Section 2.0.

Table 3.1: Number of Measured 21D Aircraft Sound Events per Day

	Tue August 13	Wed August 14	Thur August 15	Fri August 16	Sat August 17	Sun August 18	Mon August 19	Site Total
Site 1	1	2	1	-	7	6	1	18
Site 2	30	22	1	15	26	64	51	209
Site 3	44	25	13	1	-	3	20	**106**
Daily Total	**75**	**49**	**15**	**16**	**33**	**73**	**72**	**333**

Figure 3.3 shows the number of aircraft sound events that were measured each hour during the Study period. The highest number of aircraft sounds were captured during the 10:00 A.M., 3:00 P.M., 6:00 P.M. hours with 34, 27, and 29 aircraft sound events, respectively.

Site 2 measured the highest number of aircraft sound events during a one-hour period with 26 events. There were 16 aircraft sound events measured during the nighttime hours of 10:00 P.M. – 7:00 A.M.

Figure 3.3: Number of 21D Aircraft Sound Events Above 65 dBA per Hour by Site

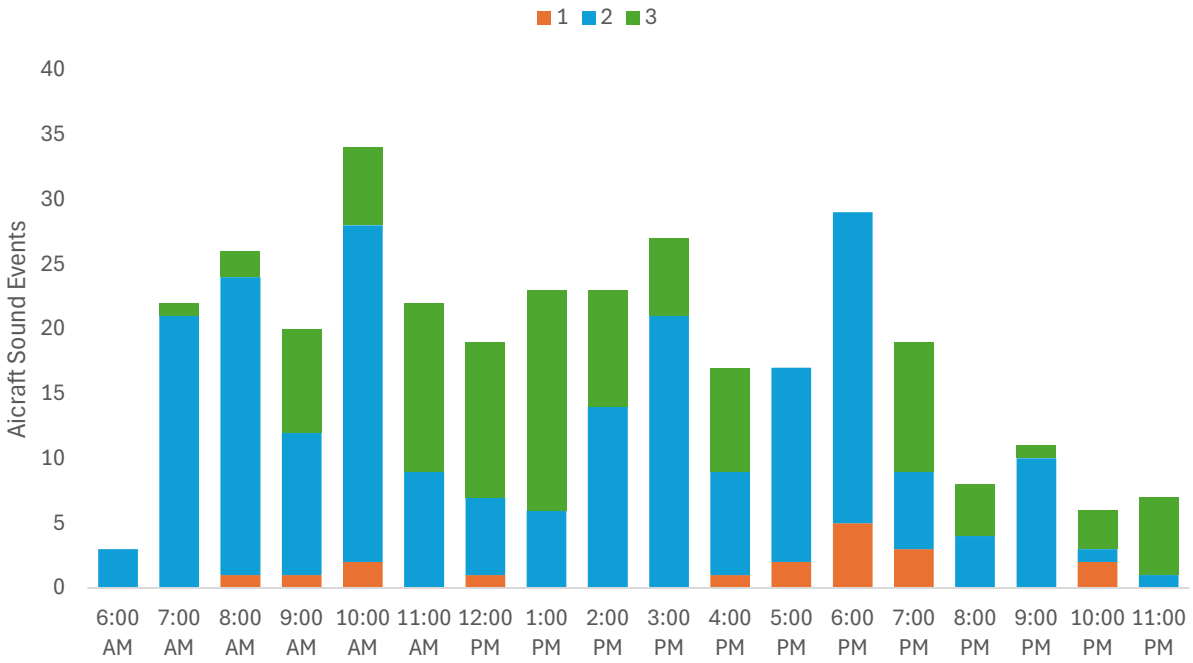


Table 3.2, below, shows the number of measured aircraft arrival and departure sound events with a maximum measured level (LA_{max}) at or above 65 dBA, 80 dBA, 90 dBA, and 100 dBA at each site. A total of 333 aircraft sound events were measured at or above 65 dBA. Of those, 54 events were at or above 80 dBA and 2 were at or above 90 dBA. The loudest sound event was captured at Site 1 and had an LA_{max} of 95.4 dB generated by a Vultee BT-13A Valiant departing on Runway 4. The highest number of arrival sound events was 141, measured at Site 2. The highest number of departure sound events was 68 measured at Site 2.

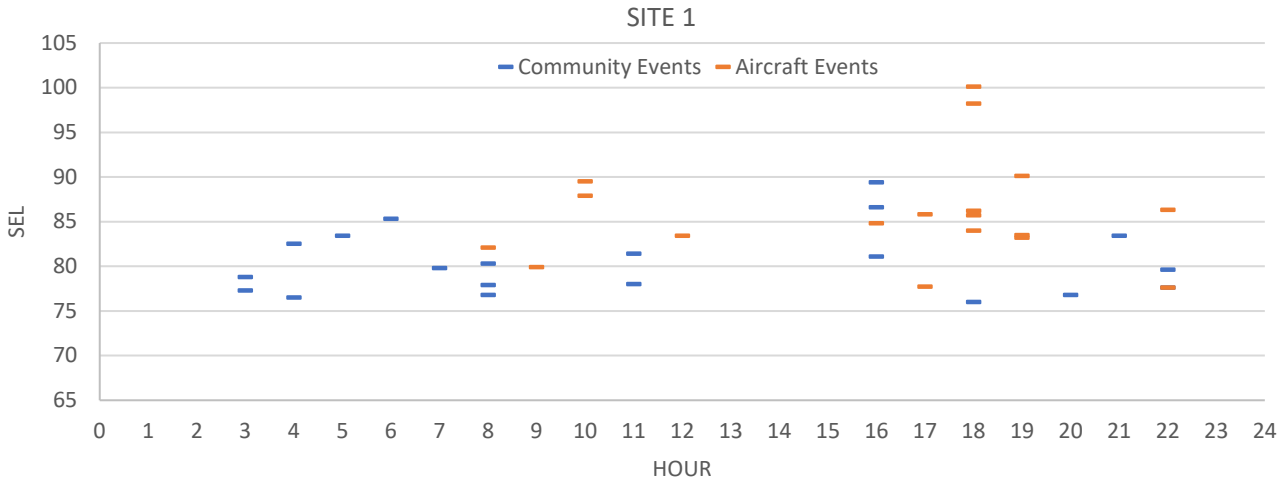
Table 3.2: Number of Measured 21D Aircraft Sound Events by Level (LA_{max})

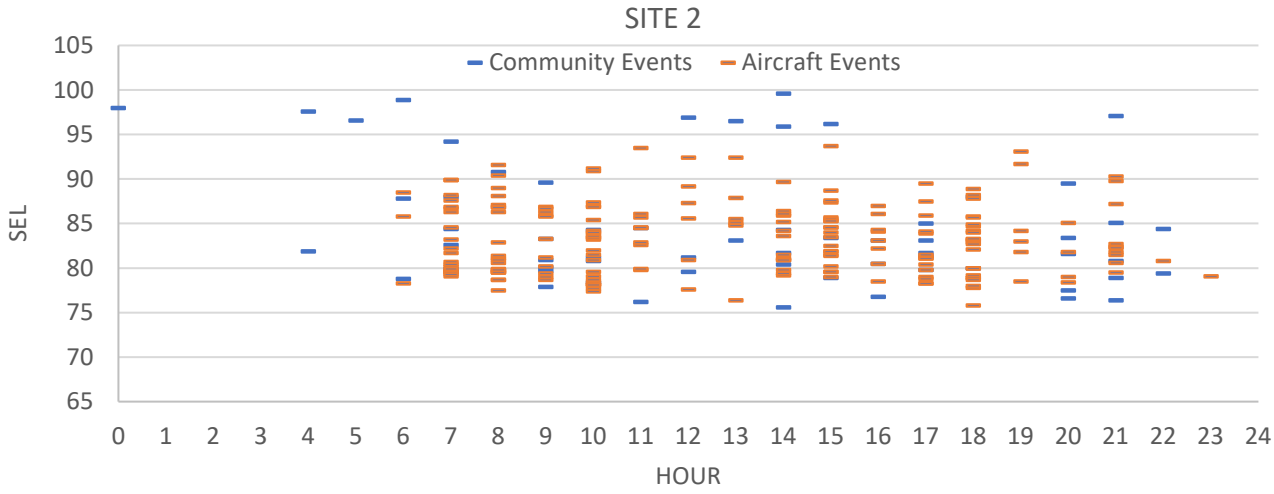
Site	# of Events > 65dBA	# of Events > 80dBA	# of Events > 90dBA	# of Events > 100dBA
Aircraft Arrivals				
1	15	4	1	0
2	141	18	0	0
3	65	9	0	0
Arrival Total	**221**	**31**	**1**	**0**
Aircraft Departures				
1	3	2	1	
2	68	14	0	0
3	41	7	0	0
Departure Total	**112**	**23**	**1**	**0**
Total Aircraft Events	**333**	**54**	**2**	**0**

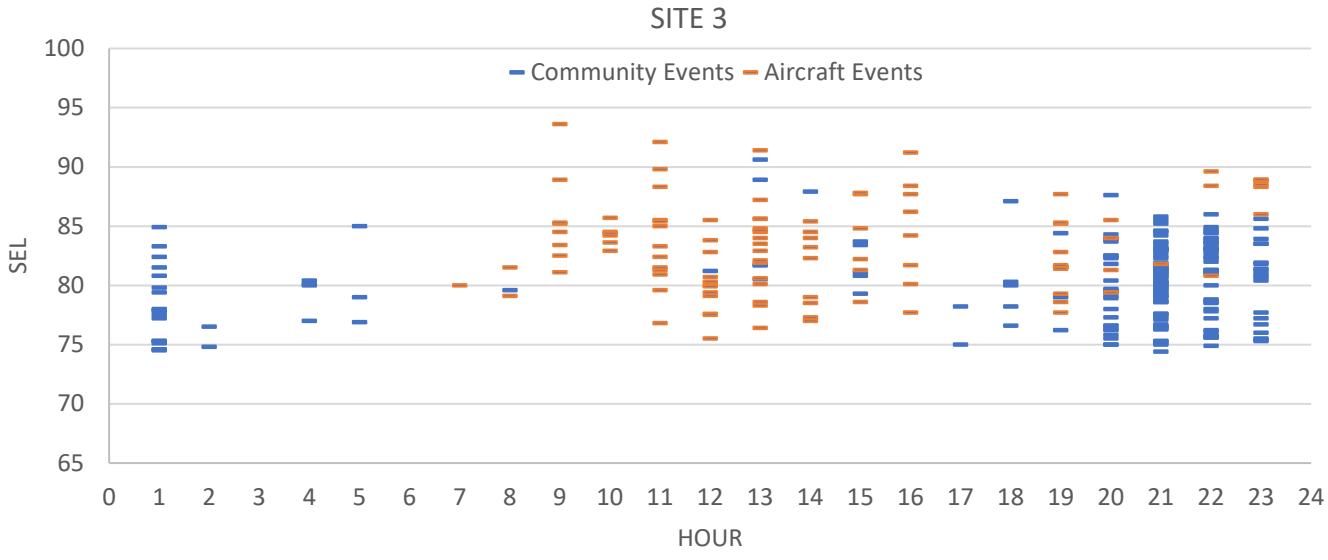
Sound events cannot be directly compared without normalization due to level fluctuations throughout each sound event and variation in the duration of each sound event. Sound Exposure Level (SEL) is a metric that expresses a sound event as a one-second (1s) value, regardless of the actual event duration.

Figure 3.4 shows the measured hourly aircraft and community SEL events for each site.

Figure 3.4: Aircraft and Community Sound Events per Hour (SEL)







Site 3 measured the highest number of community events and the highest number of aircraft events occurred at Site 2.

Table 3.3 shows the types of aircraft associated with highest LA_{max} and SEL at each site during the Study period, ranked by LA_{max}.

The aircraft sound event with the longest duration was measured at 48 seconds and occurred at Site 2 by a Piper PA-28 Cherokee aircraft on August 18, 2024 at 4:08 P.M. with a LA_{max} at 83 dB and a SEL of 88.9.

The loudest aircraft sound event during the Study period occurred at Site 1 with a Vultee BT-13A Valiant aircraft measuring a maximum level at 95.4 dBA on August 13, 2024 at 7:31 A.M. The SEL for this aircraft sound event measured at 100.1.

Table 3.3 Top-Ten Measured 21D Aircraft Sound Events per Site

Site 1							
Date and Time	LA_{max}	Duration	SEL	Aircraft Type	Flight ID	Rank LA_{max}	Rank SEL
8/17/2024 18:05	95.4	21	100.1	VALI	N52411	1	1
8/17/2024 18:15	93.9	21	98.2	VALI	N52411	2	2
8/18/2024 19:02	83	14	90.1	RV9	N208RD	3	3
8/18/2024 10:36	82.3	16	89.5	EN28	N9576	4	4
8/13/2024 10:01	80.4	18	87.9	EN28	N9576	5	5
8/17/2024 18:13	80	12	86.2	C172	N70413	6	7
8/17/2024 17:53	79.2	14	85.8	C172	N70413	7	8
8/15/2024 16:49	78	14	84.8	C172	N61879	8	10
8/17/2024 18:03	76.9	13	84	C172	N70413	9	11
8/18/2024 22:13	76.6	23	86.4	B407	N119SP	10	6

Site 2							
Date and Time	LA_{max}	Duration	SEL	Aircraft Type	Flight ID	Rank LA_{max}	Rank SEL
8/19/2024 19:22	88.3	15	93.1	BE35	N360G	1	3
8/17/2024 15:57	87.7	14	93.7	BE58	N77LB	2	1
8/17/2024 19:11	86.5	13	91.7	BE35	N6269V	3	6
8/18/2024 12:28	86.3	18	92.4	C77R	N1972Q	4	4
8/18/2024 10:15	85.8	14	90.9	BE36	N7385W	5	9
8/16/2024 11:34	85.7	24	93.5	PA30	N7281Y	6	2
8/18/2024 13:52	84.1	21	92.4	PA30	N7281Y	7	5
8/19/2024 10:13	84	16	91.2	RV7	N722DW	8	8
8/13/2024 21:16	83.8	16	90.3	P28A	N9461C	9	11
8/14/2024 8:40	83.7	19	91.6	PA30	N7281Y	10	7

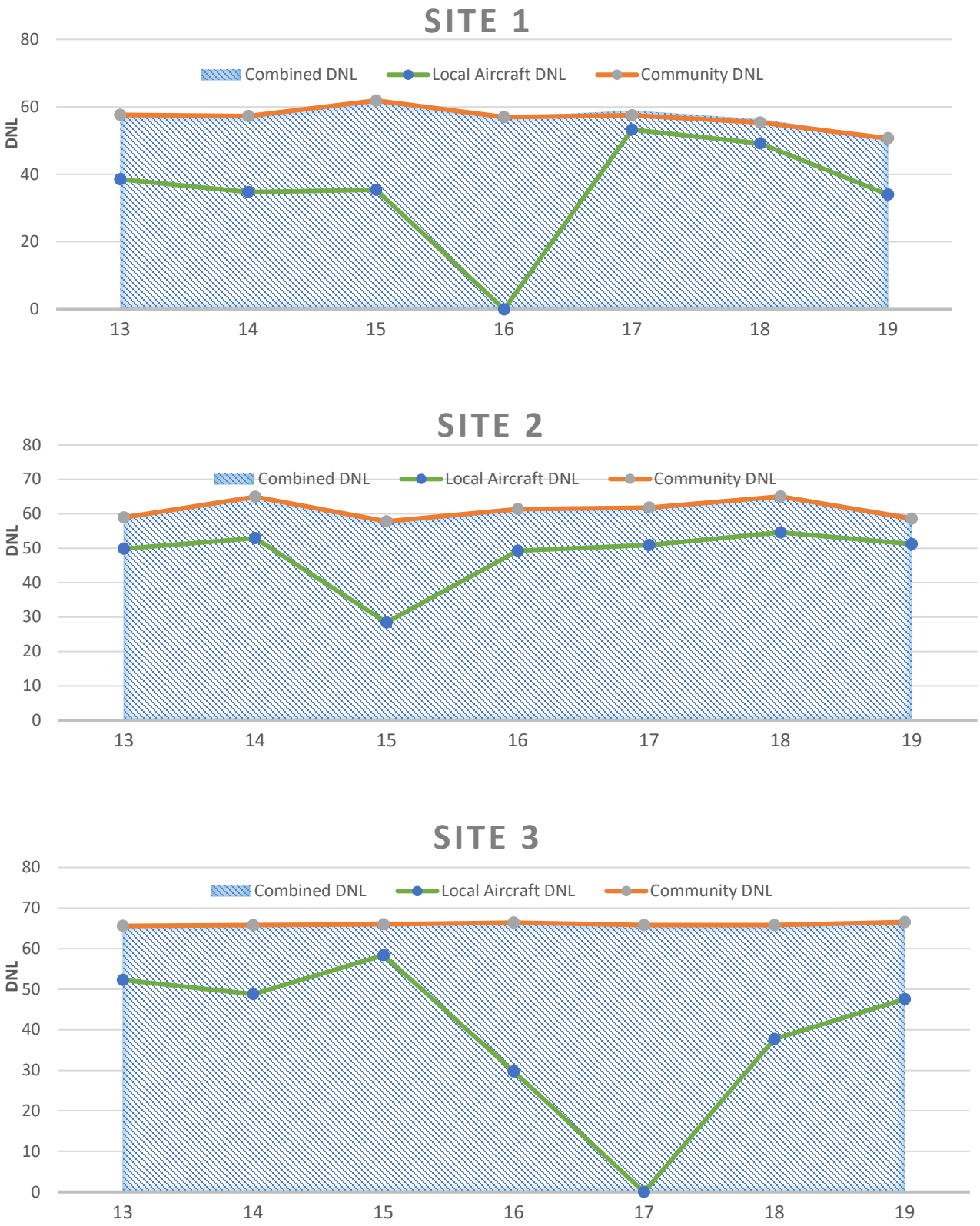
Site 3							
Date and Time	LA_{max}	Duration	SEL	Aircraft Type	Flight ID	Rank LA_{max}	Rank SEL
8/13/2024 11:21	87.5	13	92.1	SR22	N754DJ	1	2
8/15/2024 9:27	86.6	21	93.6	PA30	N7281Y	2	1
8/13/2024 16:45	86.2	14	91.2	BE33	N23TP	3	4
8/13/2024 13:20	85.8	13	91.4	AC11	N5895N	4	3
8/15/2024 22:44	85.1	15	89.6	P28A	N1679H	5	6
8/15/2024 23:47	84.2	14	88.9	P28A	N1679H	6	9
8/15/2024 23:27	83.6	19	88.8	P28A	N1679H	7	10
8/15/2024 23:37	83.4	14	88.5	P28A	N1679H	8	11
8/13/2024 16:48	83.3	11	88.4	BE36	N4608A	9	13
8/15/2024 23:07	83.3	15	88.3	P28A	N1679H	10	15

3.3.2 Summary-Based Metrics

The Day-Night Average sound level (DNL) is an acoustic, summary-based metric that represents the total accumulation of all sound energy during a 24-hour day, including a 10 dB penalty applied to all sounds between 10:00 P.M. and 7:00 A.M. The FAA prescribes the use of DNL to establish a federal aviation threshold of significance of 65 dB DNL. DNL at or above 65 dB are considered incompatible for sensitive land uses such as residences and schools. The MAC distinguishes between aircraft and community-generated sounds using Aircraft DNL (ADNL) and Community DNL (CDNL) respectively.

Figure 3.5 shows the ADNL and CDNL accumulations during the Study period for each site. The highest ADNL occurred at Site 3 with 58.4 dB DNL on August 15, which is below the federal threshold of significance. The CDNL at Site 3 on the same date was 66.0 dB DNL and the Combined DNL was 66.7 dB DNL, which was the highest Combined DNL during the Study period. More detail about the field-measured DNL can be found in the Appendix.

Figure 3.5: Aircraft and Community DNL Accumulations



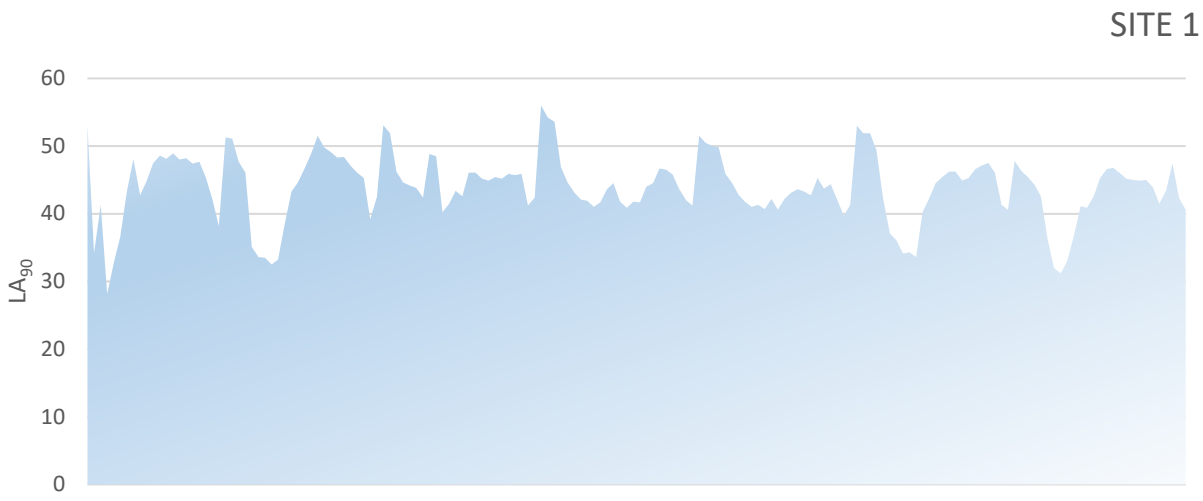
3.3.3 Ambient Sound Levels

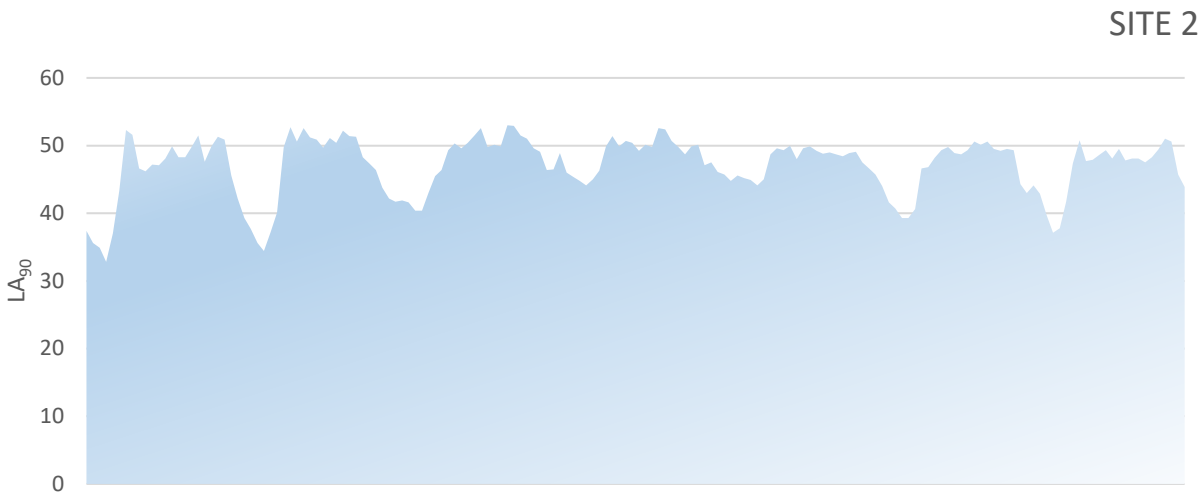
Ambient sounds are continuous; emitted around us by sources in our community and environment. Some of these sounds are emitted by sources we cannot always see, such as wind, mechanical equipment, insects, freeways, etc. Many factors contribute to ambient sound levels (both intensity and frequency) and include both natural and human made sounds. Sound events can be transient and/or cyclical (day/night, morning/afternoon/evening/night, weeks, months, seasons, holidays, etc.). Ambient sound levels are important when observing and comparing sound sources to achieve objectivity.

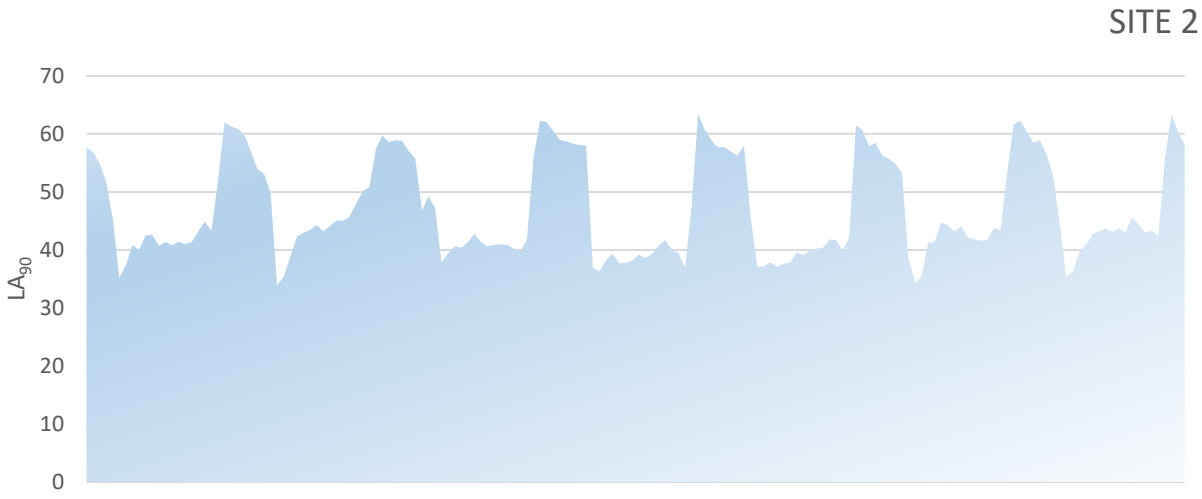
A common method to estimate ambient sound level is to use a statistical metric called the LA_{90}, which is the A-Weighted sound level that is exceeded 90 percent of the time. Figure 3.6 shows the LA_{90} levels measured at each site during the Study period.

The LA_{90} levels were highest in the vicinity of Site 3 on August 16 with 63.4 dB during the 9:00 PM hour most likely as a result of insect activity. As represented by valleys in the charts below, nighttime ambient sound levels are typically lower than daytime ambient sound levels.

Figure 3.6: Hourly Average Ambient Sound Levels




SITE 2
60
50
40
30
20
10
0
LA90


SITE 2
70
60
50
40
30
20
10
0
LA90

4.0 Sound Modeling

In addition to field monitoring, 21D aircraft activity from August 13-19, 2024, was modeled using the FAA's modeling tool, AEDT, Version 3g. The FAA notes in a recent report to Congress,

> "… while the DNL metric is FAA's decision-making metric, other supplementary metrics can be used to support further disclosure and aid in the public understanding of community noise effects."

With actual monitoring, as noted above, events are documented when the analyzer detects a sound level over 65 dBA for four seconds or longer. Due to the nature of environmental monitoring, MACNOMS must take measures to attempt to filter out community and other ambient sounds before assigning aircraft sound events to a specific operation. The AEDT model does not have community and ambient sounds to consider.

Conversely, AEDT must make assumptions about aircraft performance, flap configurations, engine settings, aircraft model types, weight, and weather. AEDT uses standard aircraft thrust settings, standard departure climb rates as well as standard arrival descent rates, which may not represent actual flight operating characteristics. Additionally, certificated sound data are available for many aircraft types in the model, however all aircraft operating at 21D are not represented. In those situations, modeling requires aircraft substitutions be used to represent missing aircraft types.

The goal of conducting field measurement studies and producing modeling results are similar and will often time produce the same sound metric calculations, differences between field measurements and sound modeling will sometimes show variances in the analysis results due to community sounds, measurement parameters, and necessary model assumptions.

The AEDT model can produce various sounds metrics. Two metric options available are the Number Above Noise Level and Time Above Noise Level. For this analysis, MAC staff evaluated the number of operations at or above 65 dB at specific grid points and their duration.

This modeled sound analysis depicts aircraft sound events from actual aircraft activity at 21D from August 13, 2024 through August 19, 2024 using model inputs such as runway use, aircraft fleet mix, aircraft performance and thrust settings, topography, and atmospheric conditions. Quantifying aircraft-specific sound characteristics in AEDT is accomplished using a comprehensive database developed by the FAA under 14 CFR Part 36. As part of the airworthiness certification process, aircraft manufacturers are required to subject aircraft to a battery of sound tests. Using federally-adopted and endorsed algorithms, this aircraft-specific sound information is used in the generation of model outputs. Justification for such an approach is rooted in national standardization of sound quantification at airports. Appendix A.3 includes the fleet mix and Appendix A.4 includes weather data utilized in the AEDT model for this analysis.

AEDT uses a grid pattern of individual noise measurement points, known as receptors, and calculates sound at each of these points. The grid pattern for this study included 90,000 unique points spaced 0.2 nautical miles apart arranged in a 6-mile by 6-mile square centered on the Lake Elmo Airport.

Additionally, AEDT uses standard weather inputs that are typically available for a study comprising a full year of data. For this study, standard weather inputs were changed to represent the average weather conditions for the Study period. These inputs are available in Appendix A.4, Table A.1.

Figure 4.1 shows the modeled grid points by average number of events per day during the Study period. Grid points with the highest number of events per day are all located within airport property.

Table 4.1 below provides the total number of sound events above 65 dBA modeled to occur at a field measurement location during the 2024 21D Study period. The table also provides the number of measured sounds events above 65 dBA correlated to aircraft during the Study period for comparison.

Table 4.1 2024 Measured Vs Modeled Number Above Sound Levels			
Site	N^{65} Measured	N^{65} Modeled	Difference
1	18	108	90
2	209	297	88
3	106	225	119

Figure 4.2 shows the modeled grid points by average time spent above 65 dBA per day during the Study period.

Table 4.2 below provides the total amount of time sound levels were above 65 dBA modeled to occur at a measurement location during the Study period. The table also provides the total monitored time above 65 dBA correlated to aircraft during the Study period for comparison.

Table 4.2 2024 Measured Vs Modeled Time Above Sound Level			
Site	TA^{65} Measured (min)	TA^{65} Modeled (min)	Difference (min)
1	4.7	15.9	11.2
2	45.7	70.9	25.2
3	25.0	48.1	23.1

Figure 4.1: Number of Events Above 65 dB per Day

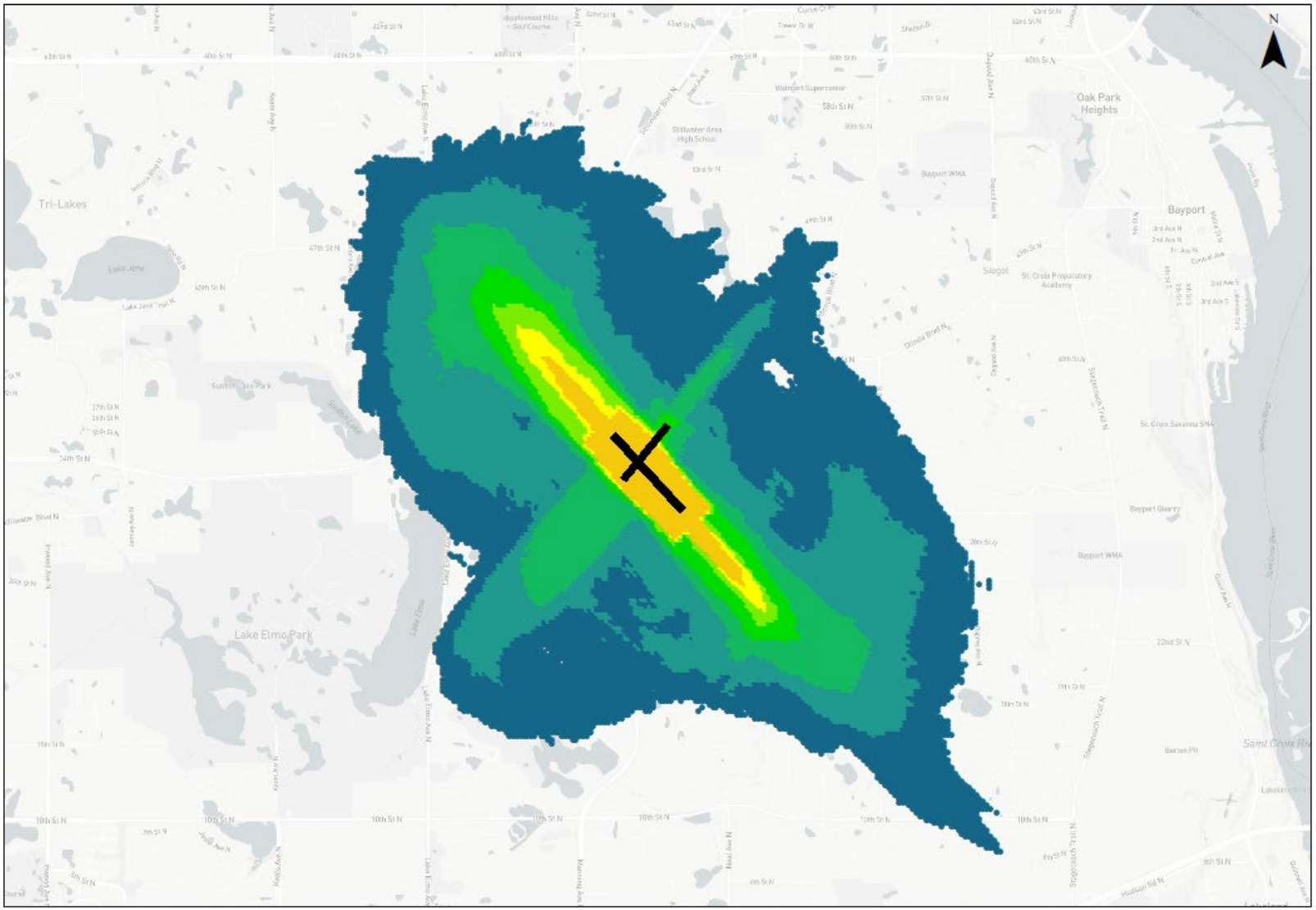
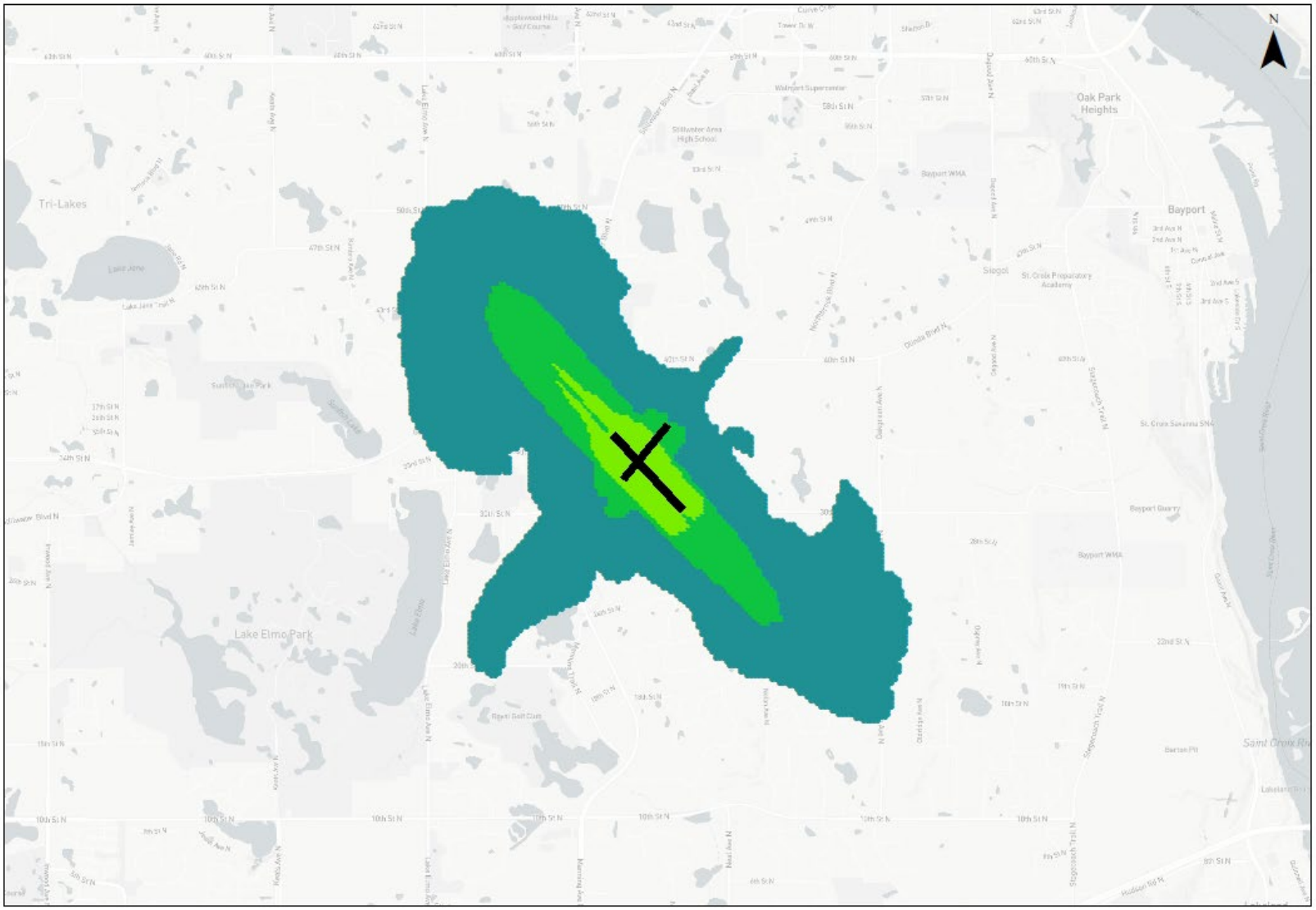


Figure 4.2: Time Above 65 dB per Day (minutes per day)



5.0 Aircraft Activity and Noise Complaints

During the 2024 Study period, 467 aircraft noise complaints were received for the Lake Elmo Airport from 10 households; 36 complaints were associated with flight activity during nighttime hours (10:00 P.M. to 7:00 A.M). The highest level of complaints was 148 received on August 19, which also is the date with the highest level of flight activity during the 2024 Study period. The second highest level of complaints during the Study period was 103 on August 13, which is the day with the second highest level of flight activity during the Study period.

Table 5.1 below details the number of aircraft activity complaints submitted during the Study period and the number of households submitting the complaints.

Table 5.1: Daily Aircraft Activity and Noise Complaint Summary

2024 Study Date	13-Aug	14-Aug	15-Aug	16-Aug	17-Aug	18-Aug	19-Aug
Complaints	103	43	61	28	26	58	148
Households	9	6	6	6	6	7	7

Figure 5.1 shows a complaint heat map representing the number of complaints within a one-kilometer grid square. Figure 5.2 shows complaint totals and the modeled number of events above 65 dB. The highest level of complaints and households in a single grid square is 276 from three households southeast of the airport. Five of the seven grid squares shown have a single household that submitted complaints.

Figure 5.1: 21D 2024 Study Period Complaint Heat Map

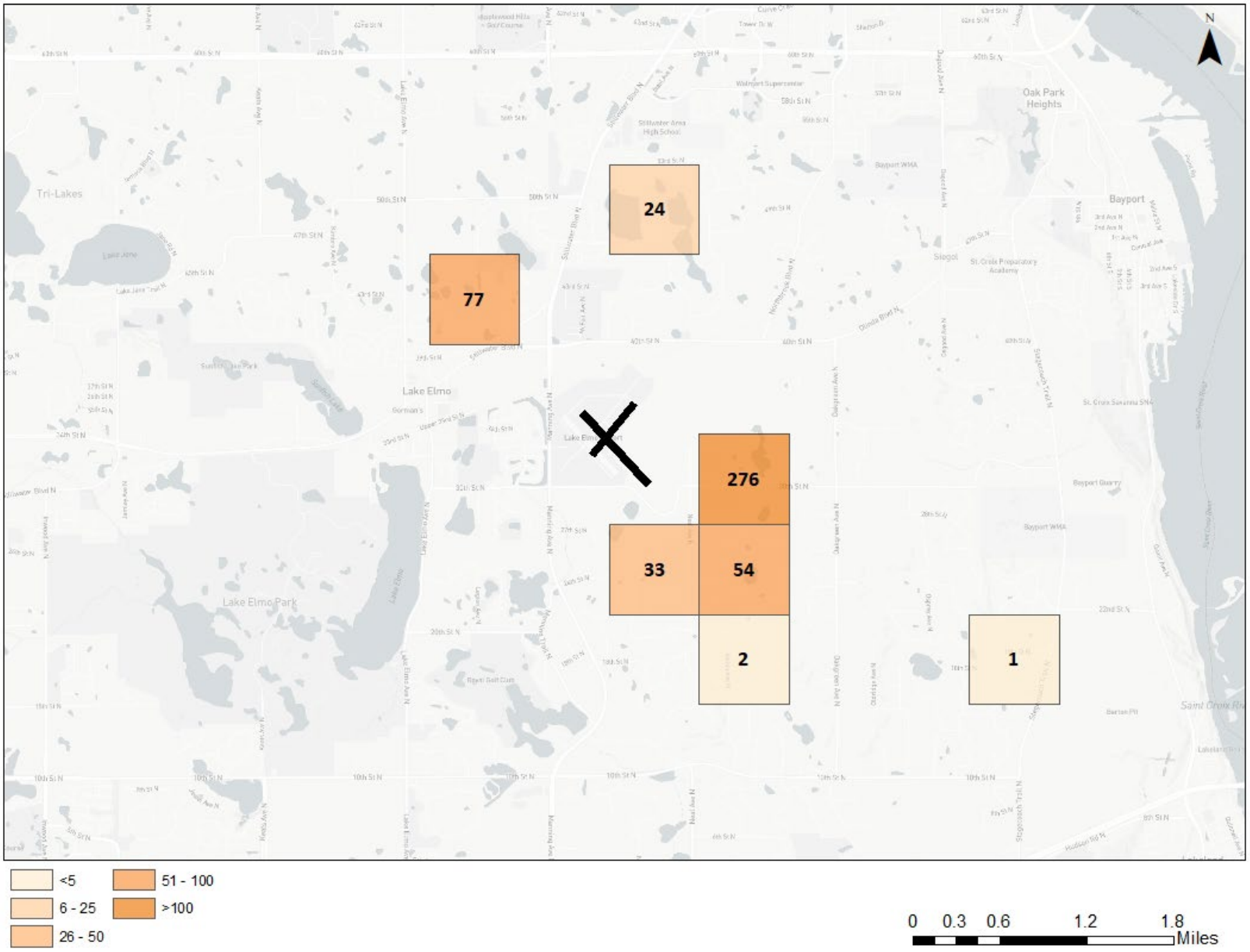
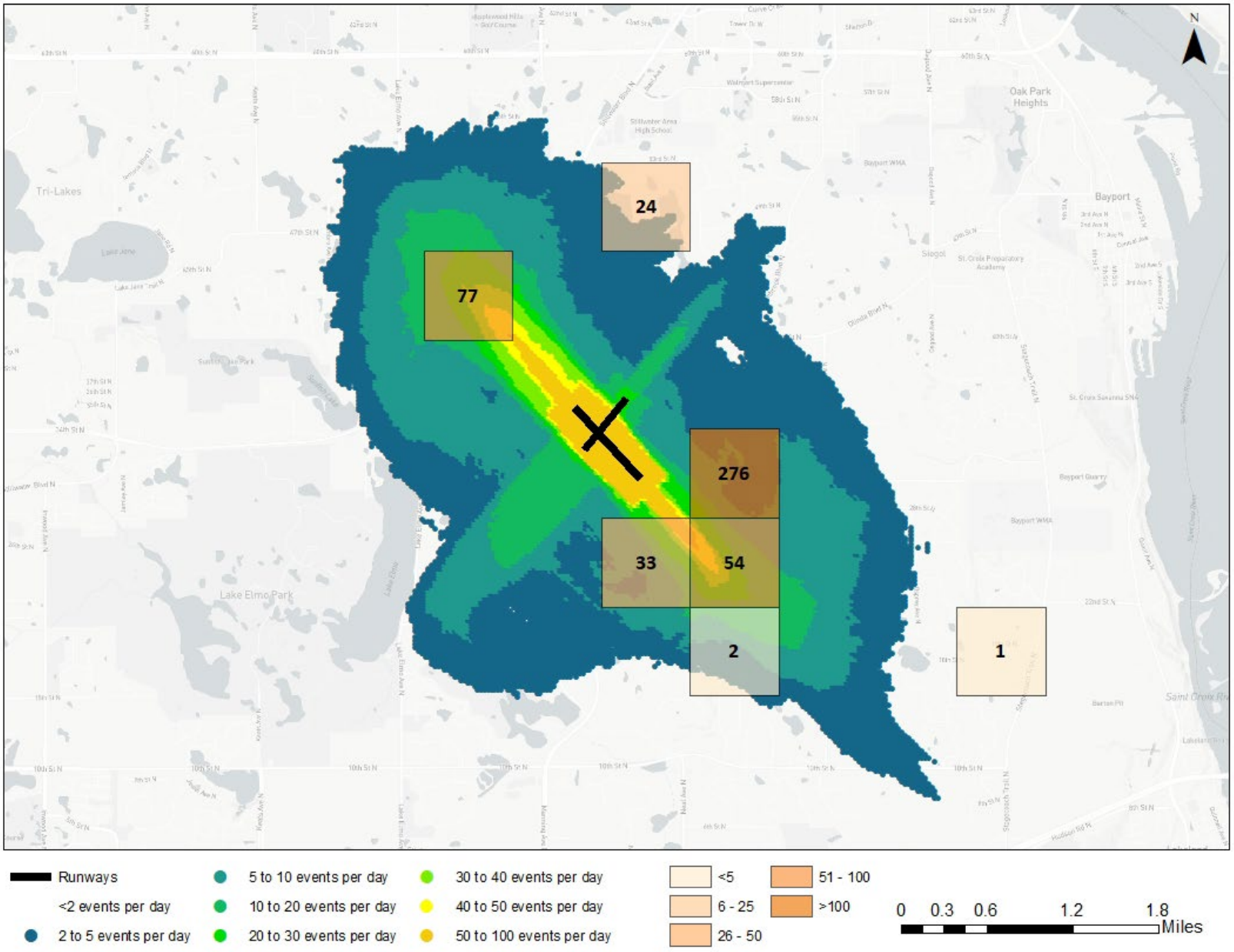


Figure 5.2: 21D 2024 Study Period Complaint Heat Map with Number of Events Above 65 dB



Appendix

A.1 MAC Mobile Sound Monitoring Request Guidelines

Mobile equipment sites are located to measure sounds near known aircraft flight paths:

- Located where flight operations are at altitudes, concentrations, and configurations creating aircraft sound levels above community sound levels.
- Away from known community sound sources (such as large arterial roads, train tracks, factories, transit centers, natural and other gathering spots) that may interfere with gathering aircraft sound data.
- Availability of power source(s).
- On MAC or public owned property (preferred).

A.2 Field-Measured Sound Data: Aircraft and Community DNL

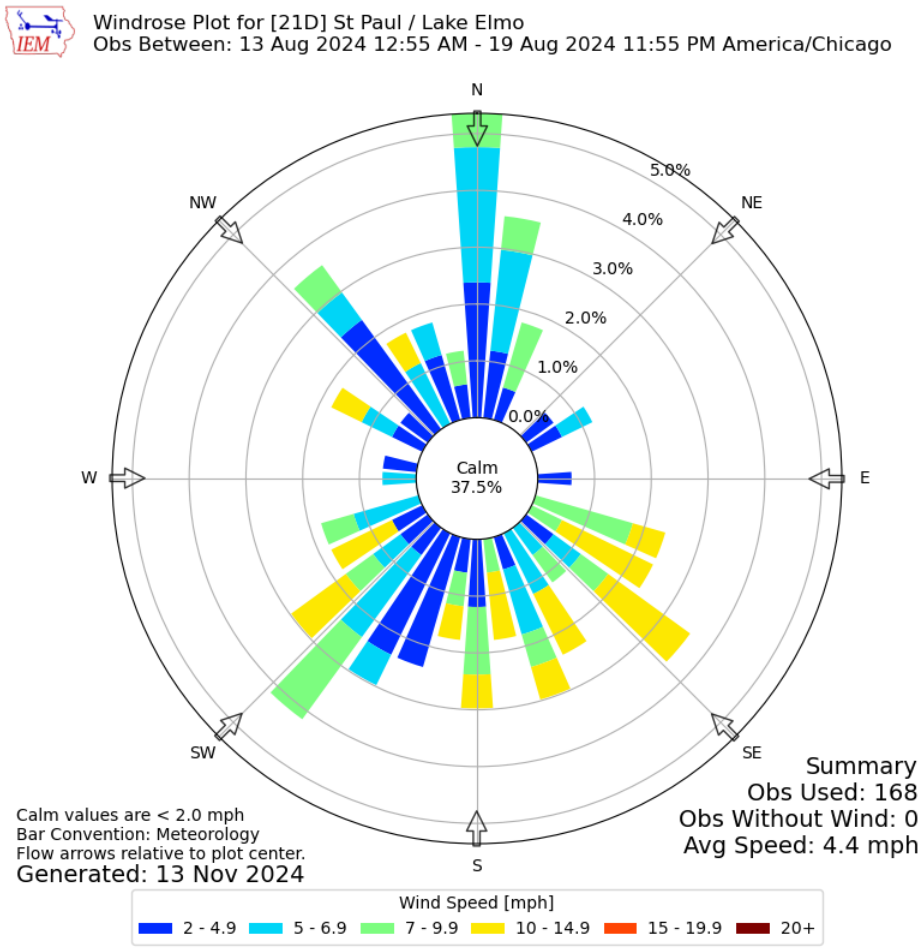
Site	Date (2024)	ADNL	CDNL	Combined DNL
1	13-Aug	38.5	57.6	57.7
1	14-Aug	34.8	57.3	57.3
1	15-Aug	35.4	61.9	61.9
1	16-Aug	0.0	57.0	57
1	17-Aug	53.3	57.5	58.9
1	18-Aug	49.2	55.4	56.3
1	19-Aug	34.0	50.7	50.8
2	13-Aug	49.9	58.9	59.4
2	14-Aug	52.9	64.9	65.2
2	15-Aug	28.4	57.8	57.8
2	16-Aug	49.3	61.3	61.6
2	17-Aug	50.9	61.8	62.1
2	18-Aug	54.6	65.0	65.4
2	19-Aug	51.2	58.6	59.3
3	13-Aug	52.3	65.6	65.8
3	14-Aug	48.8	65.8	65.9
3	15-Aug	58.4	66.0	66.7
3	16-Aug	29.7	66.4	66.4
3	17-Aug	0.0	65.8	65.8
3	18-Aug	37.8	65.8	65.8
3	19-Aug	47.5	66.5	66.6

A.3 Modeled Aircraft Distribution

Aircraft Type	Arrival	Departure	Grand Total
Beech 23 Musketeer Sundowner (FAS)	2	2	5
Beechcraft Bonanza 33 (FAS)	2	1	4
Beechcraft Bonanza 35 (FAS)	2	2	5
Bell 407 / Rolls-Royce 250-C47B	2	2	5
Bellanca 8 Scout Super Decathlon (FAS)	1		1
Cessna 152 (FAS)	46	46	91
Cessna 170 (FAS)	2	2	5
Cessna 172 Skyhawk	282	283	564
Cessna 177 (FAS)	1	1	2
Cessna 180 (FAS)		1	1
Cessna 182	4	2	6
Cessna 206	10	10	20
Cirrus SR20	9	6	15
Pilatus PC-12	1	1	2
Piper PA-18-150 (FAS)	1	2	4
Piper PA-24 Comanche	7	9	16
Piper PA-28 Cherokee Series	45	44	88
Piper PA-30 Twin Comanche	5	5	10
Piper PA-32 Cherokee Six	1		1
Piper PA-34 Seneca	6	7	14
Raytheon Beech Baron 58	1	1	2
Raytheon Beech Bonanza 36	1	1	2
Vans RV12 (FAS)	5	5	10
Vans RV6 (FAS)	2	2	5
Vans RV-7	1	2	4
Vans RV9 (FAS)	2	2	5
Grand Total	**445**	**444**	**889**

Note: Arrival and departure values are shown as whole number and may not equal Grand Total values due to decimal rounding.

A.4 21D Weather Details



Source: [Mesonet Iowa State]

Table A.1: 2024 Model Weather Inputs	
Average Temperature	71.6 degrees F
Average Dew Point	61.7 degrees F
Average Pressure	984.8 Millibars
Average Humidity	71.1%
Average Headwind	7.6 knots

A.5 Glossary

Aircraft Operation

Aircraft arriving or departing from 21D, or an aircraft that performed both an arrival and departure (touch and go).

A-Weighting

A-Weighting is a standard filter used by acoustic measurement devices and can be applied to acoustic measurements. It is frequency filter that attempts to emulate the way human hear.

Day-Night Level (DNL)

The FAA established DNL as the primary metric for aircraft noise analysis and expressing aircraft noise exposure in the United States. "DNL" is the acronym for Day-Night Average Sound Level, which represents the total accumulation of all sound energy, with a 10-decibel penalty applied for each sound event between 10:00 P.M. and 7:00 A.M. DNL has been widely accepted as the best available method to describe aircraft noise exposure and is the industry standard for use in aircraft noise exposure analyses and noise compatibility planning. It also has been identified by the U.S. Environmental Protection Agency as the principal metric for airport noise analyses.

Decibel (dB/dBA)

Sound levels are measured in Decibels, a logarithmic scale of energy referenced to human hearing. Sound levels are reported in dB; dBA is the Decibel value after the A-Weighting filter is applied.

LA_{eq} (Equivalent Sound Level) Equivalent sound level

The representation of a time-varying sound as an equivalent steady state A-weighted sound level for the period or interval of interest.

LA_{max} (Maximum A-weighted Sound Level)

This is maximum A-Weighted Sound Level observed for the period, event, or interval of interest.

LA_{90} (Sound Level Exceeded 90 Percent of the Time)

The LA90 is a common and typical method to estimate ambient sound levels or background sound levels seen most of the time. It is a statistical based metric which provides us with which A-Weighted sound level that is exceeded 90 percent of the time.

Number Above

The "Number Above", also referred to as N-level sound metric or Count Above, is the total number of aircraft sound events that exceeded a specified sound level threshold (LA_{max}). This report contains a count

of departure events and arrival events recorded with field-measurement equipment when the maximum sound level of those events exceeds 65, 80, 90, and 100 dB levels.

SEL (Sound Exposure Level)

Sound Exposure Level is the total sound energy expressed in one second. Numerically, the energy is equivalent but allows for the comparison of sound events with varying durations.

Time Above Metric

The "Time Above" noise metric measures the total time or percentage of time that the A-weighted aircraft noise level exceeds an indicated level. Time Above data are summarized for arrival and departure events based on one-second intervals.

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This report is for informational purposes only.