St. Paul Downtown Airport (STP)

Annual Aircraft Noise Study

October 6– 12, 2016

Metropolitan Airports Commission Noise Program Office
6040 28th Avenue South
Minneapolis, MN 55450

March 2017

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Annual Aircraft Noise Study 2016

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1.0 Project Description

The 2016 St. Paul Downtown Airport (STP) Annual Aircraft Noise Study (study) reports the results of the aircraft noise data collected during October 6-12, 2016 that is associated with STP runway operations and complaints received during the data collection period.

Aircraft noise events were documented from six separate noise monitoring locations beginning at 12:00 a.m. on Thursday, October 6 and continuing through 11:59 p.m. on Wednesday, October 12.

The airspace throughout the twin cities metropolitan area accommodates aircraft operating to and from numerous airports and heliports; however, aircraft noise events recorded at the noise data collection locations during the 2016 study period were excluded from this study if the aircraft did not arrive or depart at STP. In other words, this study reports aircraft noise events only for aircraft operating at STP. This monitoring project was conducted by the Metropolitan Airports Commission (MAC) Noise Program Office.

1.1 Instrumentation

Each site consists of laboratory-quality noise monitoring instrumentation manufactured by Larson Davis Incorporated (LD) and PCB. The main components of each site consisted of a type-1 noise analyzer (LD 831), a preamplifier (LD PRM831), and a microphone (LD 377B02). These instruments used are certified and traceable to National Institute of Standards and Technology (NIST) and within specifications.

1.2 Analysis Parameters

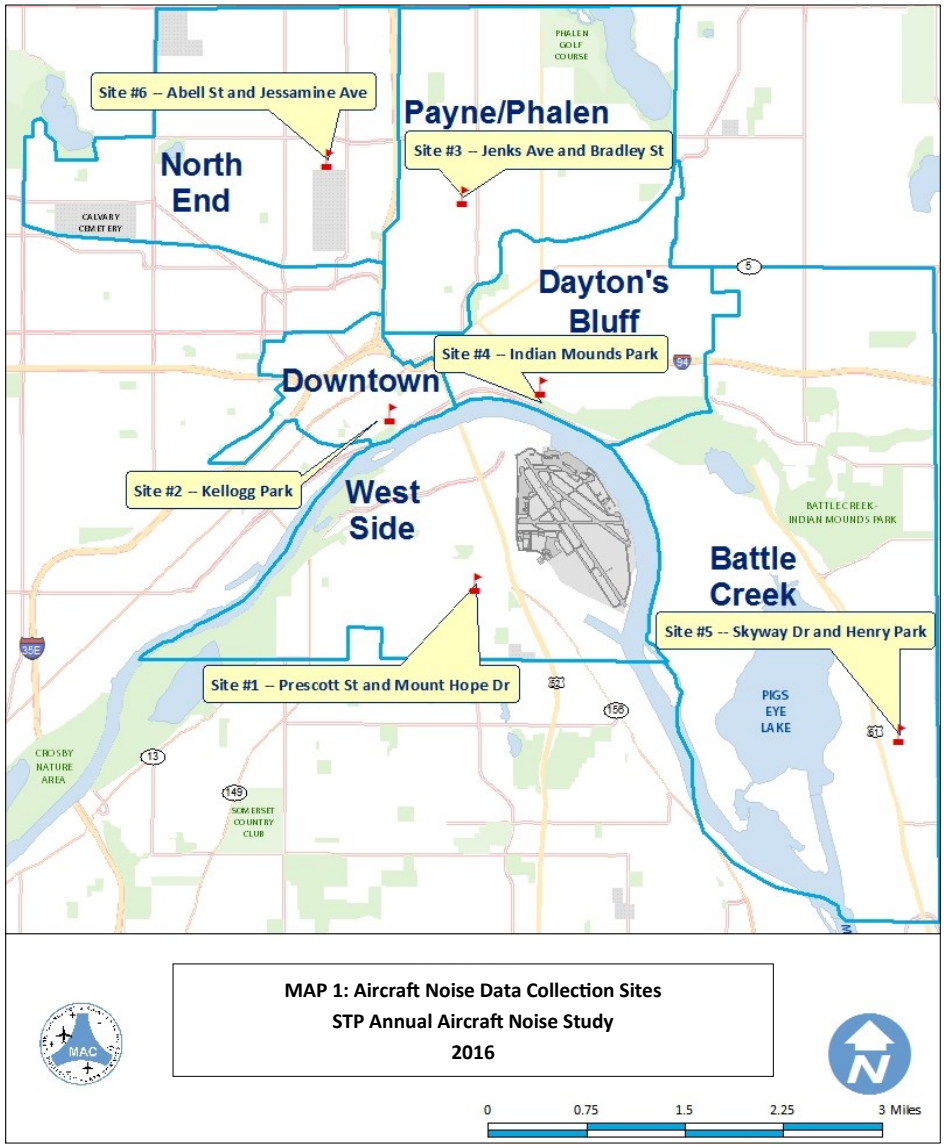
The analyzer at each site monitored noise levels continuously utilizing slow response with A-weighting, as directed by 14 CFR Part 150. The analyzer detected an event when the sound pressure level (SPL) reached a threshold of 65 dB and recorded events when the SPL remained at or above 63 dB for four seconds or longer. Recorded events were then correlated with flight track data obtained from the MAC's Noise and Operations Monitoring System (MACNOMS)[1] to determine whether the noise source was associated with a specific aircraft operation associated with STP or a community event. Parameters used to correlate noise events and radar flight tracks included range, altitude and time.

Weather conditions affect sound measurement and propagation, therefore weather data were documented during each day of the study. A summary of these weather data may be found in **Table 1** near the end of this report.

1.3 Noise Monitoring Sites

Six monitoring sites were used simultaneously to record noise events. One noise monitoring site was selected for each of the St. Paul community districts represented on the St. Paul Downtown Airport Advisory Council (DAAC). **Map 1** depicts the locations for all six noise data collection sites used during the 2016 study period; these were the same locations as were used for data collection during the 2015 study period.

[1]FAA Opsnet data counts may be different from MACNOMS data counts



Photos of each site are provided in **Figure 1**. All sites were inspected before the data collection commenced and each site was found to be acceptable for this monitoring project. Noise levels and weather data were recorded in accordance with normal monitoring practices. During the study period, site inspections were conducted daily except on the weekend days. None of the sites experienced damage or data loss during the monitoring project.

1.4 DNL Noise Metric

The Day-Night Average Sound Level (DNL) metric is utilized by the Federal Aviation Administration (FAA) to assess aircraft noise impact. The DNL is a cumulative measure of noise exposure during a 24-hour day with a 10 dB penalty added to noise events occurring between the hours of 10:00 p.m. and 7:00 a.m. Aircraft DNL reflects only aircraft events, while community DNL reflects everything except aircraft events.

Aircraft noise is generally considered by the FAA to be significant when levels reach an annual DNL (cumulative measure of 365 days) of 65 dB or greater. An annual aircraft DNL at or above 65 dB is considered by the FAA to be incompatible with residential areas and other noise sensitive land uses. DNL noise contours are not part of this an-

Figure 1: Noise Data Collection Site Location Photos
10/6/2016 - 10/12/2016

Site 1
Prescott Street & Mt. Hope Drive

Site 4
Indian Mounds Park

Site 2
Kellogg Park

Site 5
Skyway Drive & Henry Park

Site 3
Jenks Avenue & Bradley Street

Site 6
Abell Street & Jessamine Avenue

nual noise study; however, noise contours are generated with the software developed by the FAA and calculated using historical aircraft operations data as a normal process within the STP Long Term Comprehensive Planning (LTCP) Update. Preparation of the 2035 STP LTCP Update will begin in 2017.

2.0 Summary of Results

STP flight activity was greater during the 2016 study period than during the 2015 study period. **Figure 2** details the number of STP aircraft arrivals and departures between October 6-12, and shows a break out of activity that occurred during the nighttime hours of 10 p.m.-7 a.m. There were a total of 341 arrivals and 335 departures at STP during the 2016 study period, which represents approximately a 11 percent increase in arrivals and 6 percent increase in departures compared to the 2015 study period. During the nighttime hours, there were 30 arrivals and 34 departures during the 2016 study period, which represents a 50 percent increase in arrivals and 100 percent increase in departures over the 2015 study period.

Charts 1 and 2 show a daily and hourly summary of STP operations during the study period. The highest use of STP occurred on October 9, 2016 with a total of 116 arrivals and departures. The hours that netted the highest volume of aircraft operating at STP during the study period were 2-4 p.m. with a combined total of 191 operations during those hours.

During the 2016 study period there were a total of 359 aircraft noise events recorded above 65 dB. **Figure 3** details the number of aircraft noise events that exceeded 65 dB, 80 dB, 90 dB, and 100 dB.

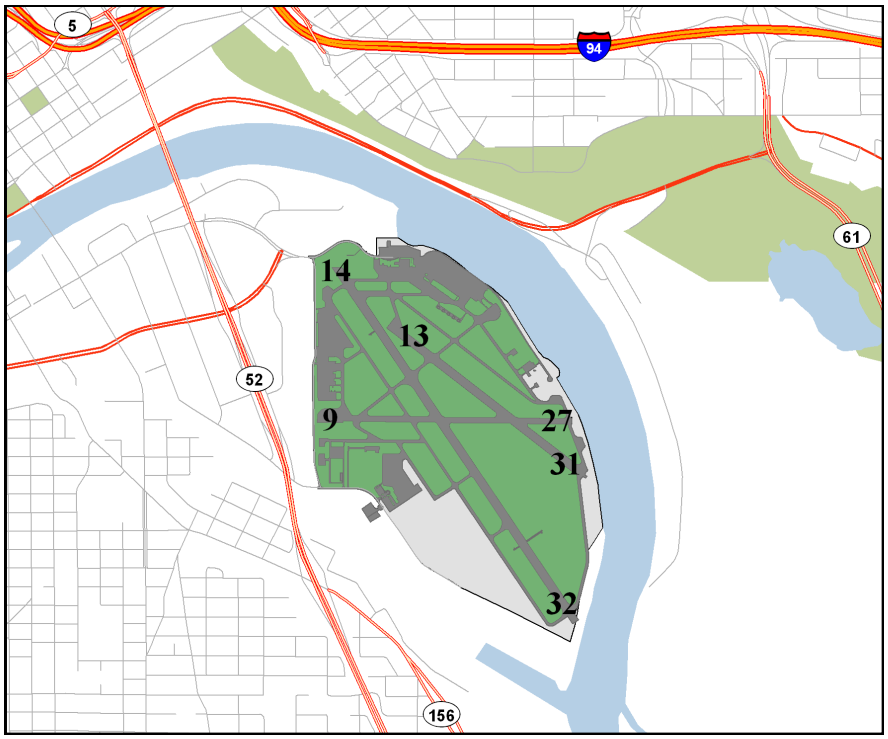
The number of aircraft arrival events exceeding 65 dB during the study period in 2016 ranged from four at Site 2 and 64 at Site 6. Aircraft departure noise events exceeding 65 dB during the 2016 study period ranged from 13 events at Site 1 to 129 at Site 4. **Figure 4** provides a list of the top ten aircraft noise events at each site, and **Figure 5** shows the flight tracks associated with the STP during the study period.

Figures 6-8 summarize aircraft and community noise data collected during the study period. Based on the aircraft activity and associated noise, the data collected during the 2016 noise study period show daily average aircraft noise levels from operations associated with STP do not meet the FAA's criteria of significance for noise-sensitive land uses. However, it is important to note that single events may at times be considered significant by individuals based on the intrusiveness of events and varying individual tolerance levels.

Chart 3 provides a comparison of events recorded in the 2016 Noise Study compared with studies conducted since 2007.

There were no aircraft noise complaints associated with STP flight operations during the 2016 study period.

Figure 2: Runway Use
10/6/2016 - 10/12/2016



Operations (24 Hour Days)			Nighttime Operations (10 p.m. - 7:00 a.m.)		
Arrivals			**Nighttime Arrivals**		
Runway	Count	Percent	Runway	Count	Percent
9	0	0%	9	0	0%
13	5	1.5%	13	0	0%
14	140	40.9%	14	13	41.9%
27	13	3.8%	27	0	0%
31	18	5.3%	31	0	0%
32	164	48.2%	32	17	58.1%
Unknown	1	0.3%	Unknown	0	0%
Total Arrivals	**341**	100.0%	Total Arrivals	**30**	100%
Departures			**Nighttime Departures**		
9	6	1.8%	9	3	3.4%
13	1	0.3%	13	0	6.9%
14	145	43.3%	14	14	34.5%
27	8	2.4%	27	0	3.4%
31	12	3.6%	31	1	48.3%
32	160	47.8%	32	15	3.4%
Unknown	3	0.9%	Unknown	1	0%
Total Departures	**335**	100.0%	Total Departures	**34**	100.0%
Total Operations	**676**		**Total Nighttime Operations**	**64**	

Note: Sum of runway use % may not equal 100% due to rounding.

Figure 3: Aircraft Noise Events
10/6/2016 - 10/12/2016

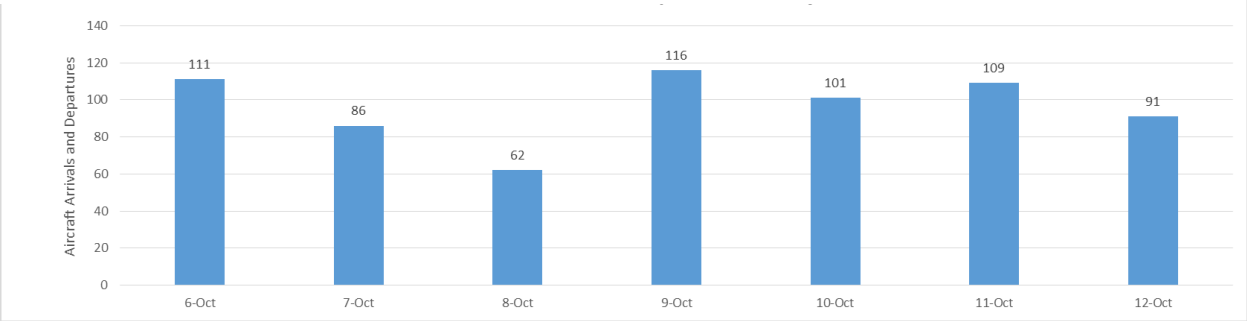
Arrival-Related Events

Site	Location	>=65dB LA_{max}	>=80dB LA_{max}	>=90dB LA_{max}	>=100dB LA_{max}
1	Prescott Street and Mt. Hope Drive	5	0	0	0
2	Kellogg Park	4	0	0	0
3	Jenks Avenue and Bradley Street	12	0	0	0
4	Indian Mounds Park	8	1	0	0
5	Skyway Drive and Henry Park	12	0	0	0
6	Abell Street and Jessamine Avenue	64	5	0	0
	Total Arrival Noise Events	105	6	0	0

Departure-Related Events

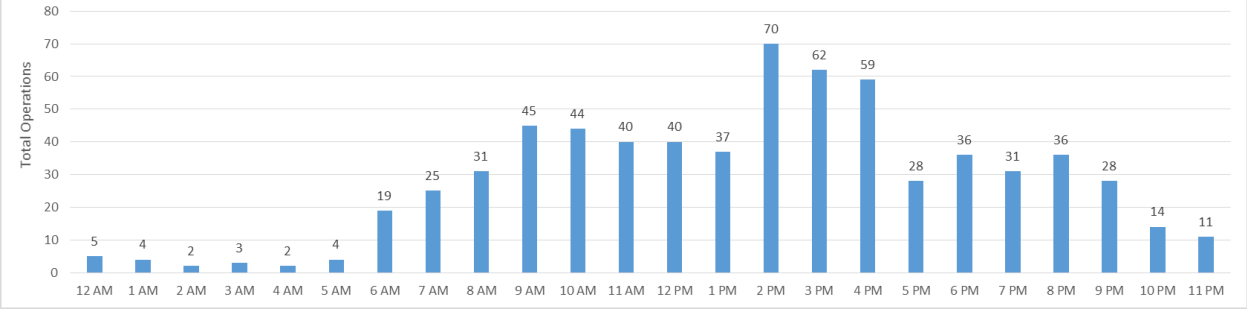
Site	Location	>=65dB LA_{max}	>=80dB LA_{max}	>=90dB LA_{max}	>=100dB LA_{max}
1	Prescott Street and Mt. Hope Drive	13	0	0	0
2	Kellogg Park	14	1	0	0
3	Jenks Avenue and Bradley Street	38	2	0	0
4	Indian Mounds Park	129	6	0	0
5	Skyway Drive and Henry Park	45	0	0	0
6	Abell Street and Jessamine Avenue	15	1	1	0
	Total Departure Noise Events	254	10	1	0

Chart 1: Number of STP Operations per Day



Note: The sum of operations per day may not equal runway use totals due to operations that extend from one day to next.

Chart 2: Number of STP Operations per Hour



Note: The sum of operations per hour may not equal runway use totals due to operations that extend across multiple hours or into the next day.

Chart 3: STP Noise Event Comparison

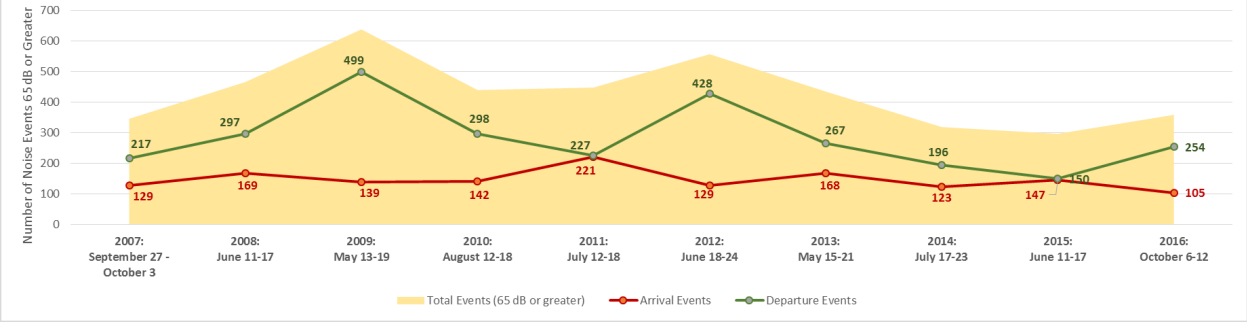


Figure 4: Top 10 Loudest Aircraft Noise Events
10/6/2016 - 10/12/2016

Site 1 - Prescott Street & Mt. Hope Drive

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA_{max} (dB)	Duration (seconds)
10/7/2016 9:44	Unknown	Unknown	D	27	77.1	13
10/11/2016 19:50	Unknown	Unknown	D	32	74.8	25
10/12/2016 14:18	N76AZ	C208	A	32	74.1	7
10/11/2016 11:59	Unknown	Unknown	A	14	74.0	20
10/7/2016 20:50	N549CP	GLF5	A	32	73.9	10
10/7/2016 8:55	Unknown	Unknown	D	27	73.8	11
10/11/2016 19:53	Unknown	Unknown	D	32	73.7	23
10/5/2016 16:46	EJA873	H25B	A	32	72.9	12
10/5/2016 19:50	Unknown	Unknown	D	32	71.7	15
10/11/2016 20:02	Unknown	Unknown	D	32	70.4	16

Site 2 - Kellogg Park

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA_{max} (dB)	Duration (seconds)
10/10/2016 14:05	Unknown	HELO	D	14	80.0	23
10/5/2016 15:25	Unknown	Unknown	D	9	77.7	41
10/7/2016 14:11	Unknown	Unknown	D	31	75.5	19
10/7/2016 13:18	N55MN	BE9L	A	32	74.3	9
10/6/2016 10:21	N57PM	Unknown	D	32	73.5	22
10/12/2016 20:02	Unknown	Unknown	D	32	72.3	10
10/5/2016 15:22	Unknown	Unknown	D	9	72.2	14
10/5/2016 20:52	Unknown	Unknown	D	32	71.7	16
10/12/2016 20:08	Unknown	Unknown	D	32	71.1	24
10/10/2016 15:11	Unknown	HELO	A	14	70.9	19

Site 3 - Jenks Avenue & Bradley Street

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA_{max} (dB)	Duration (seconds)
10/12/2016 15:03	N650CH	C650	D	32	85.4	26
10/7/2016 15:57	CGPCZ	AEST	D	32	83.2	14
10/8/2016 15:47	N411SC	BE40	D	32	79.9	22
10/11/2016 19:54	N741VR	H25B	D	32	79.3	16
10/5/2016 15:01	N20H	C680	D	32	78.6	11
10/12/2016 12:46	EJM249	F2TH	D	32	75.8	14
10/6/2016 17:08	N727KB	BE40	D	32	75.2	16
10/5/2016 13:58	N83M	GLF5	D	32	75.1	13
10/12/2016 14:02	Unknown	Unknown	A	27	74.7	23
10/6/2016 7:32	Unknown	Unknown	A	13	74.4	12

Figure 4: Top 10 Loudest Aircraft Noise Events (Continued)
10/6/2016 - 10/12/2016

Site 4 - Indian Mounds Park

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA_{max} (dB)	Duration (seconds)
10/7/2016 20:01	N115SP	SR22	D	32	84.6	15
10/13/2016 1:09	N371CF	BE40	D	32	84.2	32
10/7/2016 9:37	N6563K	BE9L	D	32	84.1	16
10/7/2016 18:09	N115SP	SR22	D	32	83.5	21
10/8/2016 16:39	N597KC	PA46	D	32	82.2	15
10/6/2016 22:30	N86MJ	SR22	D	32	80.7	32
10/6/2016 7:33	Unknown	Unknown	A	13	80.7	14
10/8/2016 15:05	N654ND	C172	D	32	79.9	18
10/7/2016 7:38	N55MN	BE9L	D	32	79.8	23
10/7/2016 9:03	N77ND	C25A	D	32	79.5	19

Site 5 - Skyway Drive & Henry Park

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA_{max} (dB)	Duration (seconds)
10/10/2016 7:47	N549CP	GLF5	D	14	79.3	11
10/11/2016 9:35	N727KB	BE40	D	14	79.1	16
10/9/2016 17:07	N478DR	BE40	D	14	78.6	19
10/11/2016 7:15	N53KV	C525	D	14	77.7	14
10/9/2016 15:06	N370EL	CL30	D	14	77.5	16
10/13/2016 9:26	N370EL	CL30	D	14	76.4	18
10/11/2016 12:07	N598DR	BE40	D	14	76.3	15
10/8/2016 15:51	N318GA	FA50	A	32	76.3	13
10/8/2016 17:24	N767WT	SR22	A	32	76.2	9
10/9/2016 11:28	N753MB	C560	D	14	76.1	14

Site 6 - Abell Street & Jessamine Avenue

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA_{max} (dB)	Duration (seconds)
10/7/2016 11:48	N917CB	S92	D	32	91.6	23
10/8/2016 13:10	LN100KB	BE9L	A	14	81.4	9
10/12/2016 14:02	Unknown	Unknown	A	27	80.8	17
10/9/2016 10:04	N425EV	PC12	A	14	80.4	16
10/9/2016 9:46	CGKXS	C56X	A	14	80.3	14
10/10/2016 16:02	N70MN	BE20	A	14	80.0	11
10/7/2016 21:35	LN100KB	BE9L	A	14	79.8	9
10/13/2016 1:46	LN9WW	BE40	D	32	79.5	34
10/11/2016 10:32	N847BA	BE20	A	14	79.3	13
10/9/2016 9:37	N97TE	C56X	A	14	79.2	13

Figure 5: Flight Tracks for STP Study Period
10/6/2016 - 10/12/2016

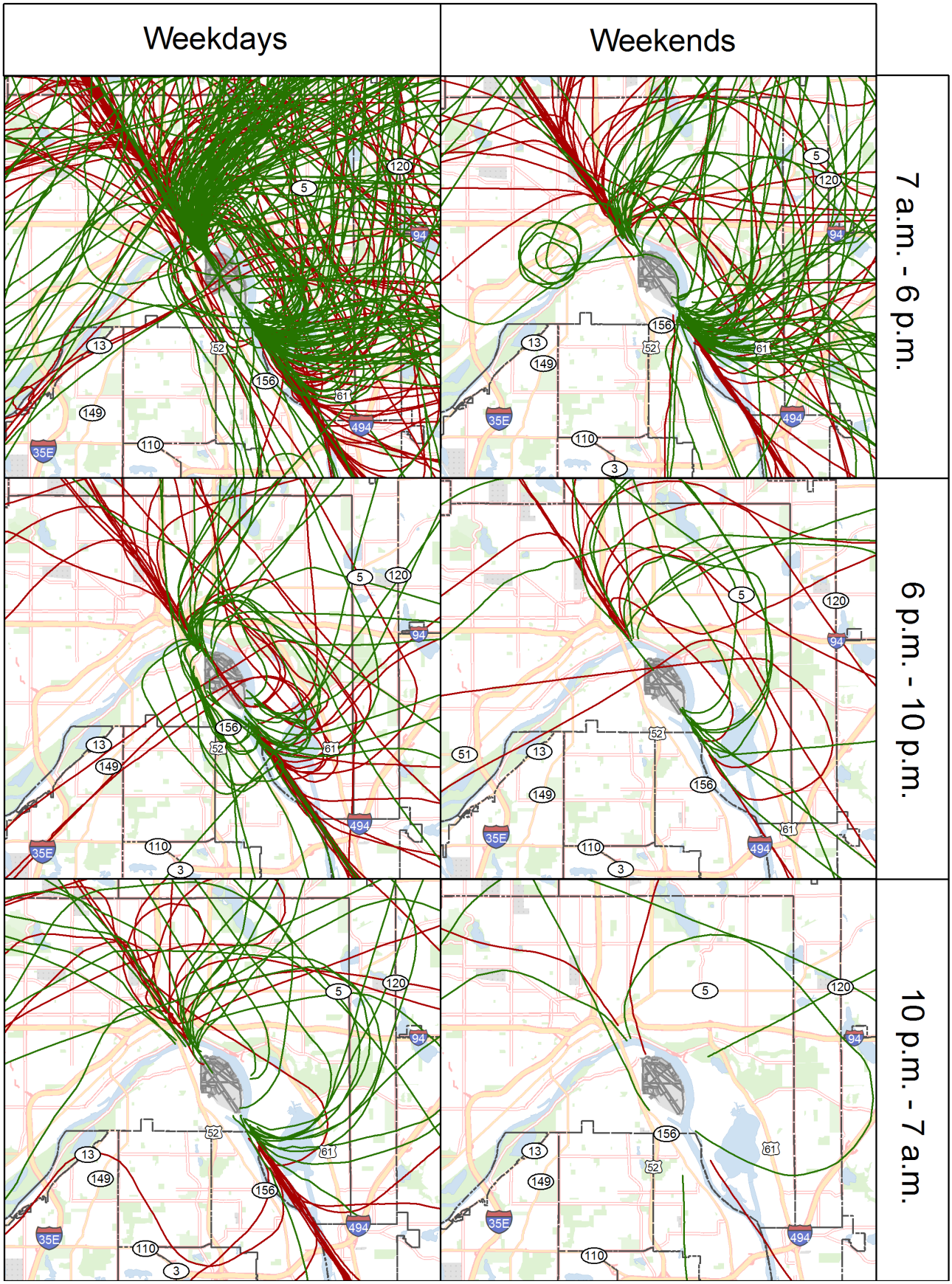
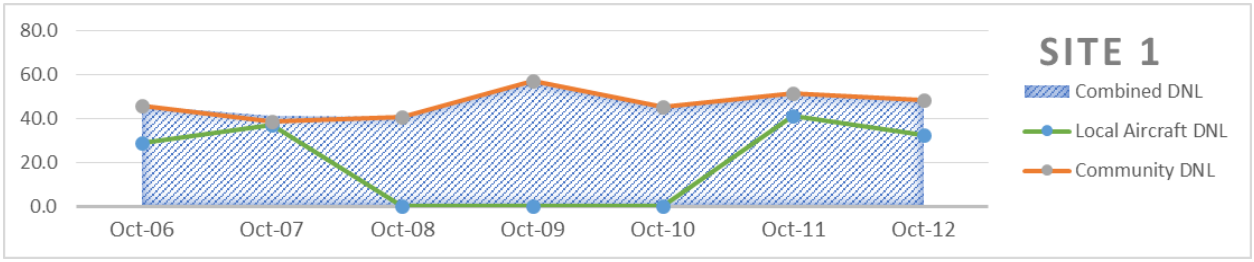
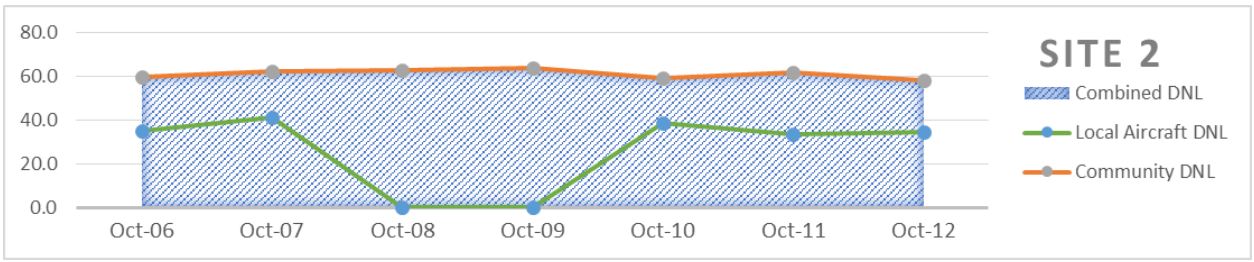
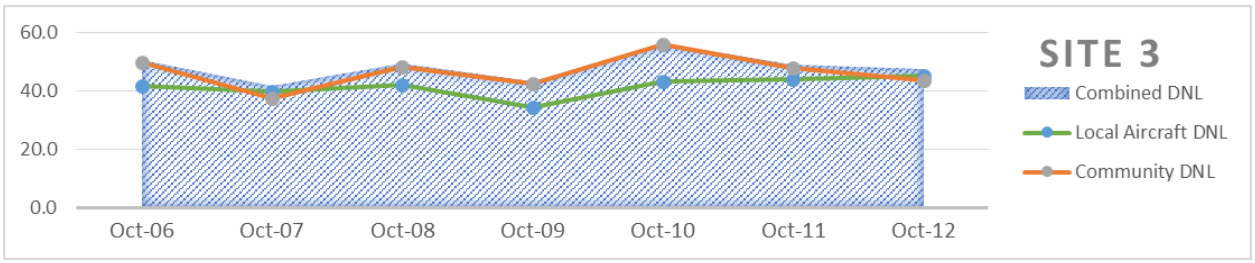


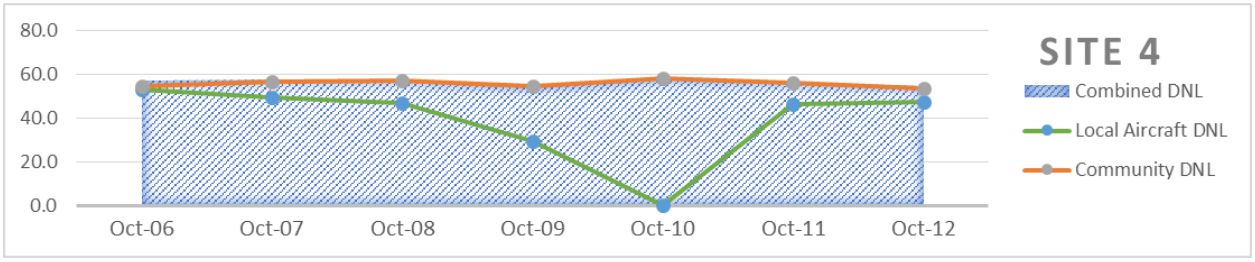
Figure 6: Aircraft and Community DNL by Site

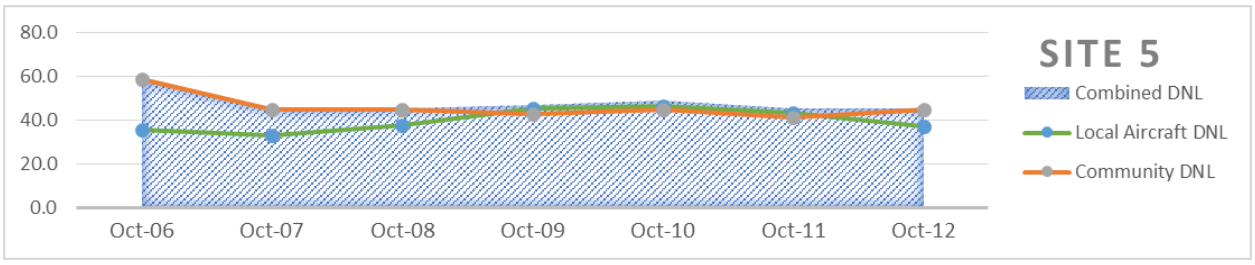
10/6/2016 - 10/12/2016











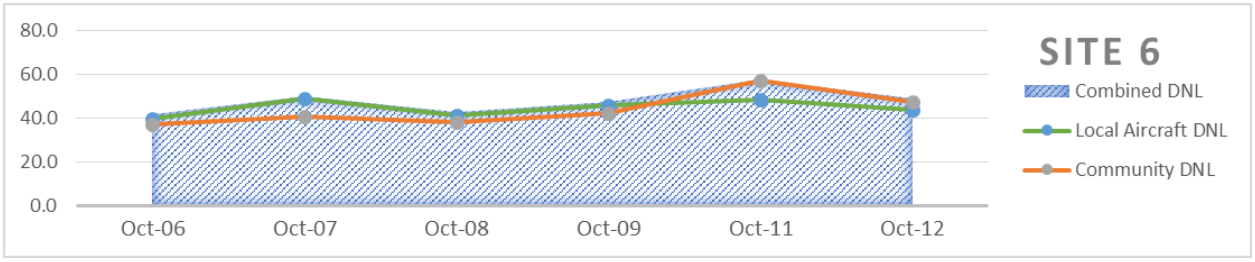


Figure 7: Average Background Noise Levels

10/6/2016 - 10/12/2016

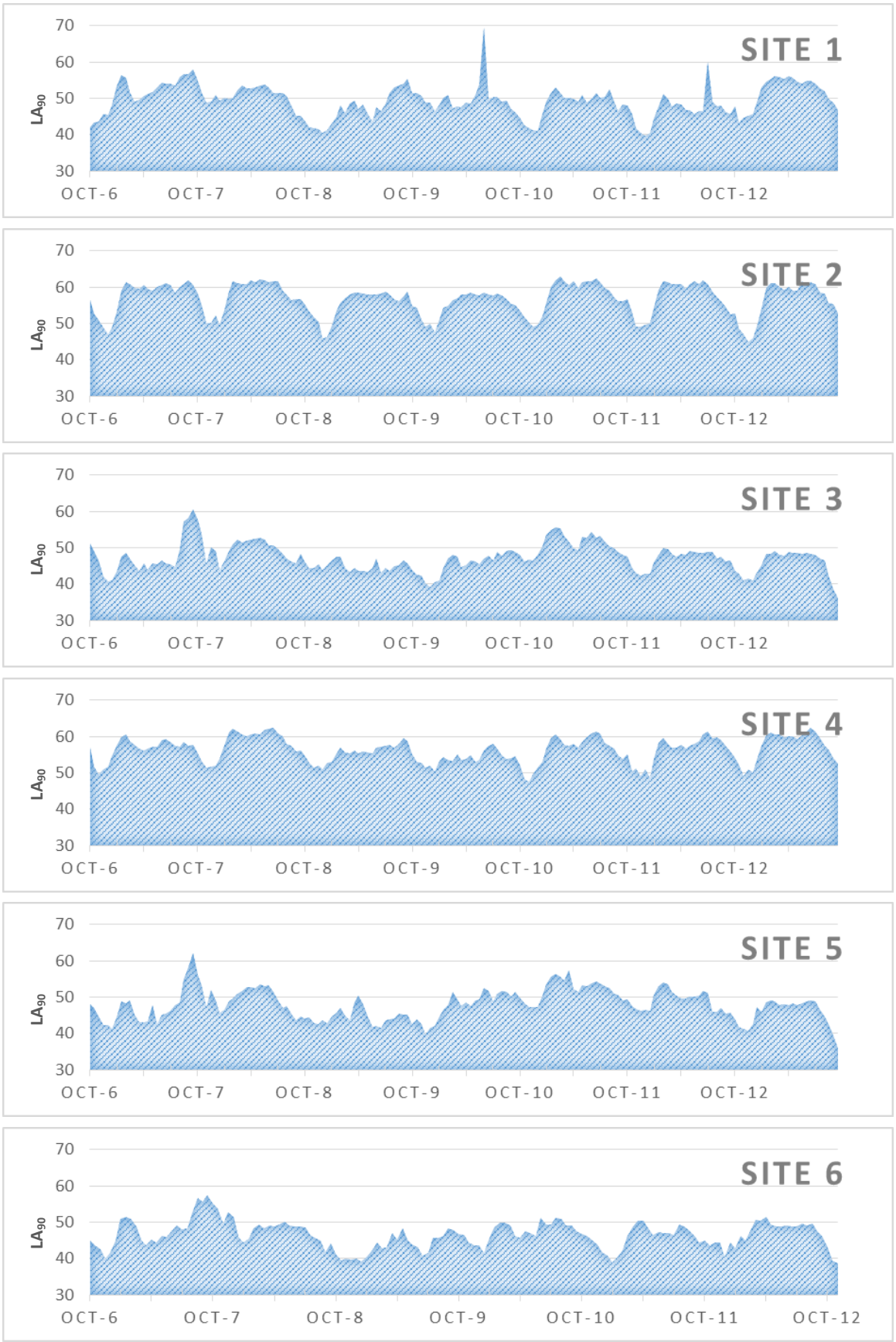
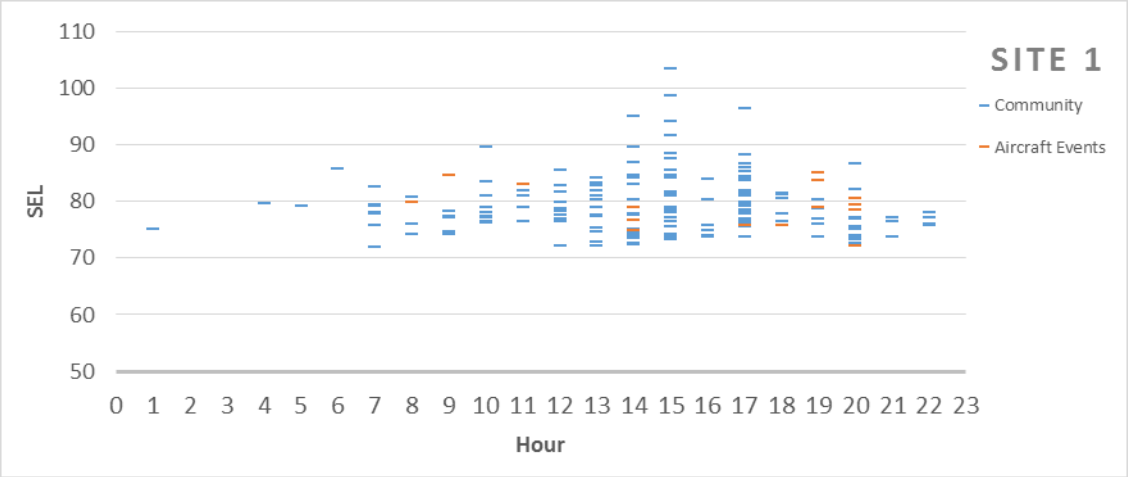
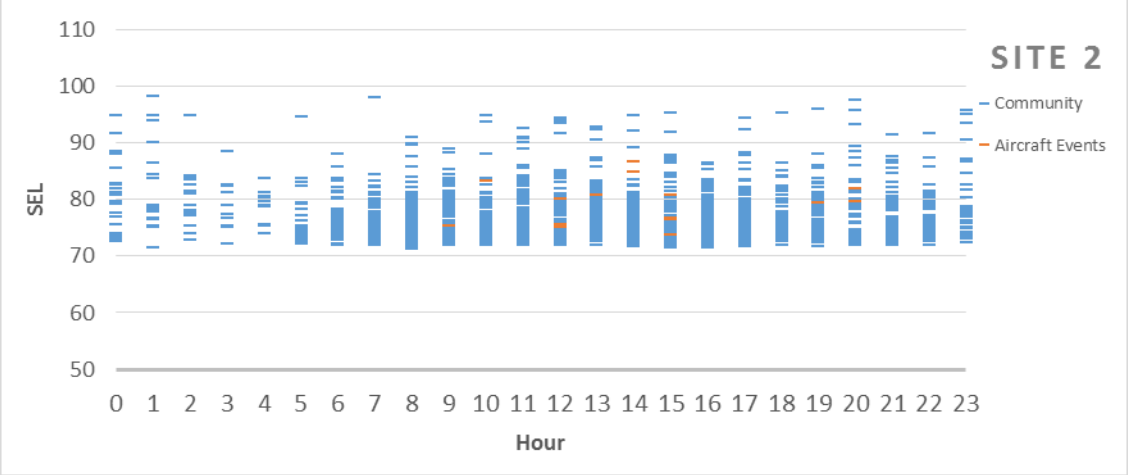


Figure 8: Hourly Distribution of Noise Events
10/6/2016 - 10/12/2016





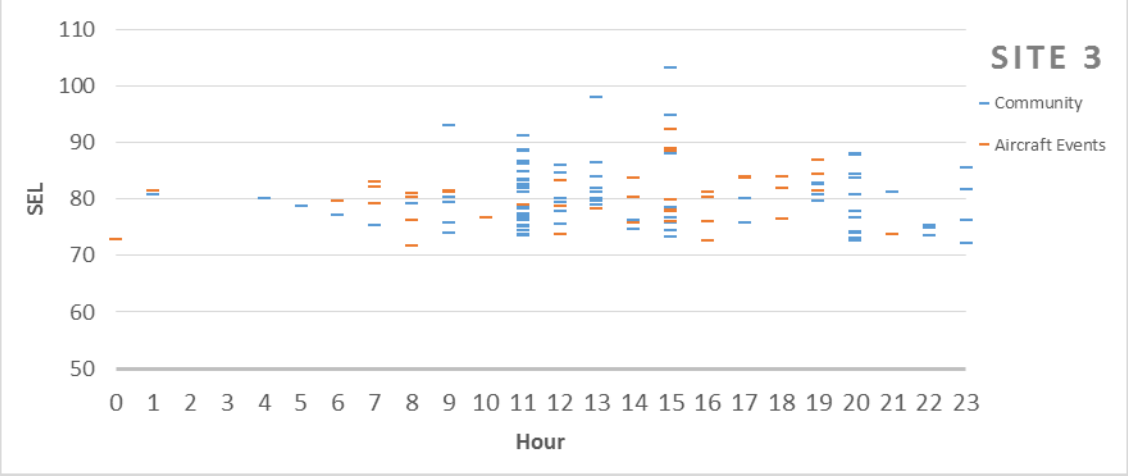
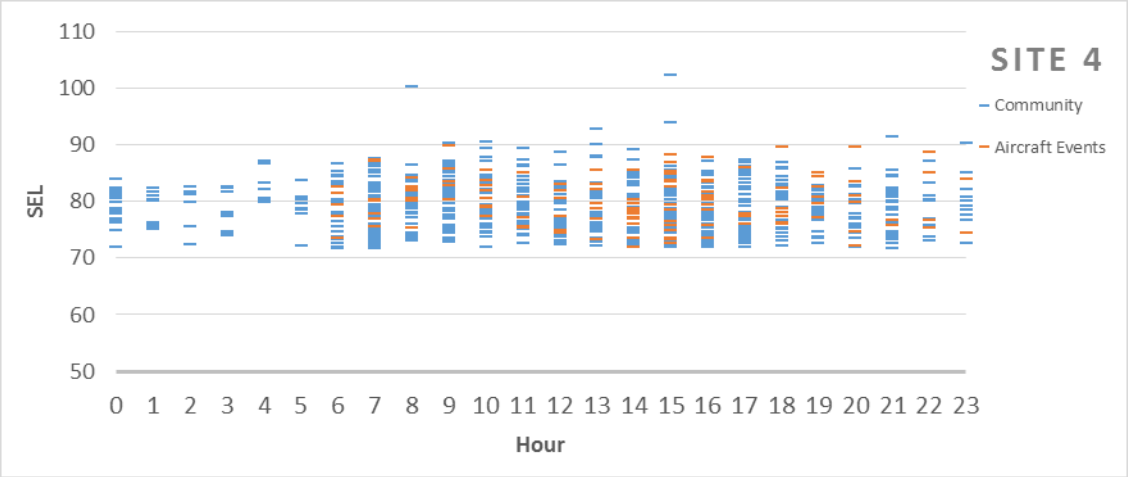
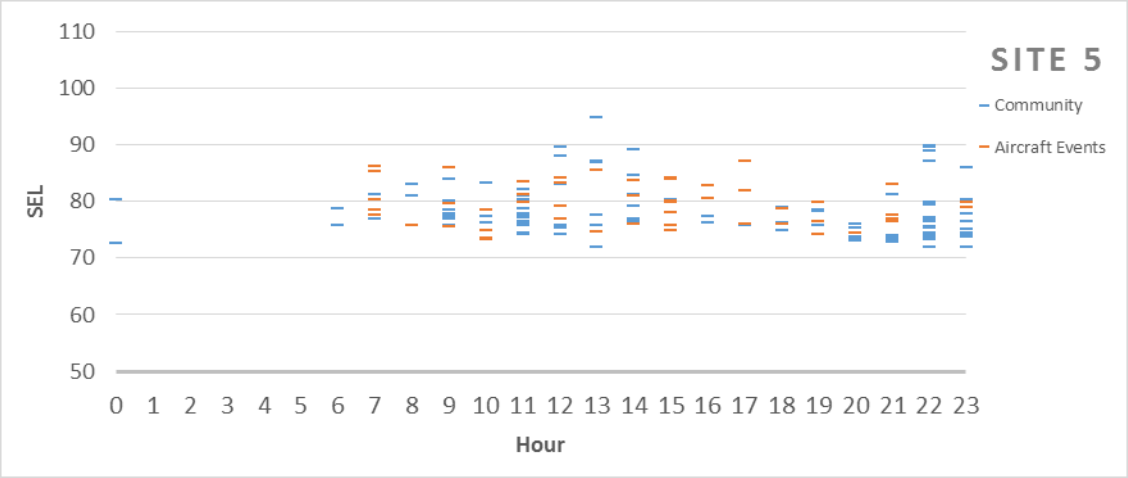


Figure 8: Hourly Distribution of Noise Events (Continued)
10/6/2016 - 10/12/2016





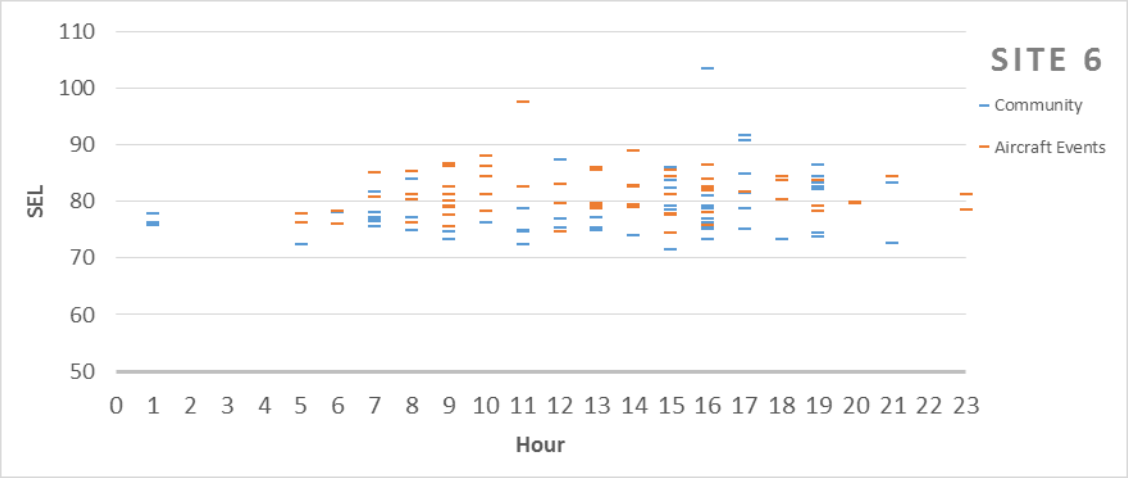


Table 1: Weather Observations
(10/6/2016 - 10/12/2016)

October 2016	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Press. (in)			Visibility (mi)			Wind (mph)			Precip. (in)
	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	Dir	sum
Thursday October 6	62	53	45	48	42	33	93	73	41	30.13	30.01	29.91	10	8	2	26	7	34	0.87
	Rain																		
Friday October 7	50	44	37	43	34	29	93	71	52	30.26	30.14	29.94	10	10	3	22	16	32	0.15
Saturday October 8	52	44	35	37	32	28	89	69	43	30.36	30.29	30.25	10	10	4	8	3	-	0
	Rain																		
Sunday October 9	59	46	36	42	38	34	97	73	51	30.43	30.34	30.2	10	10	8	14	4	-	0
Monday October 10	73	60	48	51	47	42	86	64	41	30.19	30.08	29.99	10	10	10	20	11	29	0
Tuesday October 11	72	61	50	55	52	47	89	75	57	30.01	29.93	29.84	10	10	10	16	11	-	0
Wednesday October 12	50	46	41	47	38	29	97	77	54	30.31	30.13	29.98	10	10	5	20	14	26	0.02
	Rain																		

3.0 Glossary of Terms

A-weighted sound level

The sound level obtained by the use of A-weighting. Unit: dB. Unit symbol: dBA. A-weighting significantly de-emphasizes noise at low and high frequencies and is most commonly used when evaluating environmental noise to account for human sensitivity.

Background Noise Level

Total hourly LA_{eq} minus aircraft noise events (Community Hourly LA_{eq}). The overall sound level of a given environment that excludes the sound source of interest.

Decibel (dB)

Decibel is a unit of measurement for sound.

DNL

Day-night average sound level, used to describe the cumulative or total noise exposure during an average annual day. DNL is an energy average noise level over a 24-hour period, with a 10 dB penalty for noise events occurring between 10:00 p.m. and 7:00 a.m.

- **Aircraft DNL** - DNL for aircraft noise events only
- **Community DNL** - DNL for community noise events only (everything but aircraft events)

FAA (Federal Aviation Administration)

The federal agency that is responsible for the safe and efficient movement of aircraft through the National Airspace System. The FAA has broad legislative authority to create and enforce Federal Aviation Regulations.

FAR Part 150

Federal Aviation Regulations 14 CFR Part 150, Airport Noise Compatibility Planning.

LA_{eq}

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.

INM (Integrated Noise Model)

The Integrated Noise Model is a computer program developed and distributed by the FAA for the analysis of subsonic aircraft noise exposure around the nation's airports.

LD 824 Noise Analyzer

A noise monitoring instrument manufactured by Larson Davis that is used for the measurement of sound levels, with standard frequency weighting and standard, exponentially-weighted time averaging. A general purpose microphone (LD 2541) and preamplifier (PRM 902) operate with the noise analyzer to measure sound levels over wide temperature and humidity ranges.

LA_{max}

Maximum Sound Level, the maximum sound level (dB) during a particular noise event.

LA_{90}

The noise level exceeded 90% of the time. Values of L_{90} are often used to represent the background noise, or noise that is present most of the time.

SEL (Sound Exposure Level)

Sound Exposure Level is the total sound level someone would experience if all of the sound energy occurred in one second. This allows for the comparison of sound events that have different durations.

SPL (Sound Pressure Level)

Sound Pressure Level is a measure of the sound pressure of a given noise source relative to a standard reference value (typically the quietest sound that a young person with good hearing can detect).

STP

The aeronautical abbreviation for Holman Field, which is also known as St. Paul Downtown Airport.