

St. Paul Downtown Airport (STP) Annual Aircraft Noise Study

August 1–7, 2017



Metropolitan Airports Commission Noise Program Office

6040 28th Avenue South

Minneapolis, MN 55450

September 2017

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1.0 Introduction

The purpose of the St. Paul Downtown Airport (STP) Annual Aircraft Noise Study (study) is to evaluate STP aircraft noise events occurring in surrounding neighborhoods. This report evaluates data for STP aircraft operations, noise recordings, aircraft noise complaints, and weather.

The study period for the Annual Aircraft Noise Study focuses on seven continuous days of data collection. The dates for this data collection and the noise recording locations are selected each year by the St. Paul Downtown Airport Advisory Council (DAAC) members. The 2017 study period began at 12:00 a.m. on Tuesday, August 1 and continued through 11:59 p.m. on Monday, August 7. The data collection was performed by the Metropolitan Airports Commission (MAC) Noise Program Office staff.

The study examines data related to STP aircraft activity only. While the airspace throughout the twin cities metropolitan area accommodates aircraft operating to and from numerous airports and heliports, aircraft noise events recorded during the 2017 study period that were not related to STP arrivals or departures were excluded from this study. Section 2 of this study shares the findings of the analysis and compares those data with historical data.

1.1 Instrumentation

Each noise data collection 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 are certified by an independent accredited laboratory and traceable to National Institute of Standards and Technology (NIST).

1.2 Analysis Parameters

Data collected during the study period include noise events from aircraft and community sources, aircraft arrival and departure flight tracks associated with STP, aircraft noise complaints, and weather conditions.

Noise data analyzers were stationed at six different monitoring locations. Each site operated continuously utilizing slow response with A-weighting, as federally-prescribed by standards for collecting aircraft noise in the Federal Aviation Administration's 14 CFR Part 150. Events were recorded when the site analyzer detected a noise event with a sound pressure level (SPL) threshold of 65 dBA and remained at or above 63 dBA for four seconds or longer. These parameters are consistent with those used for each of the STP Annual Noise Studies conducted since 2007.

Recorded events were correlated with flight track data collected by MAC's Noise and Operations Monitoring System (MACNOMS). Parameters used to correlate noise events and radar flight tracks included range, altitude and time.

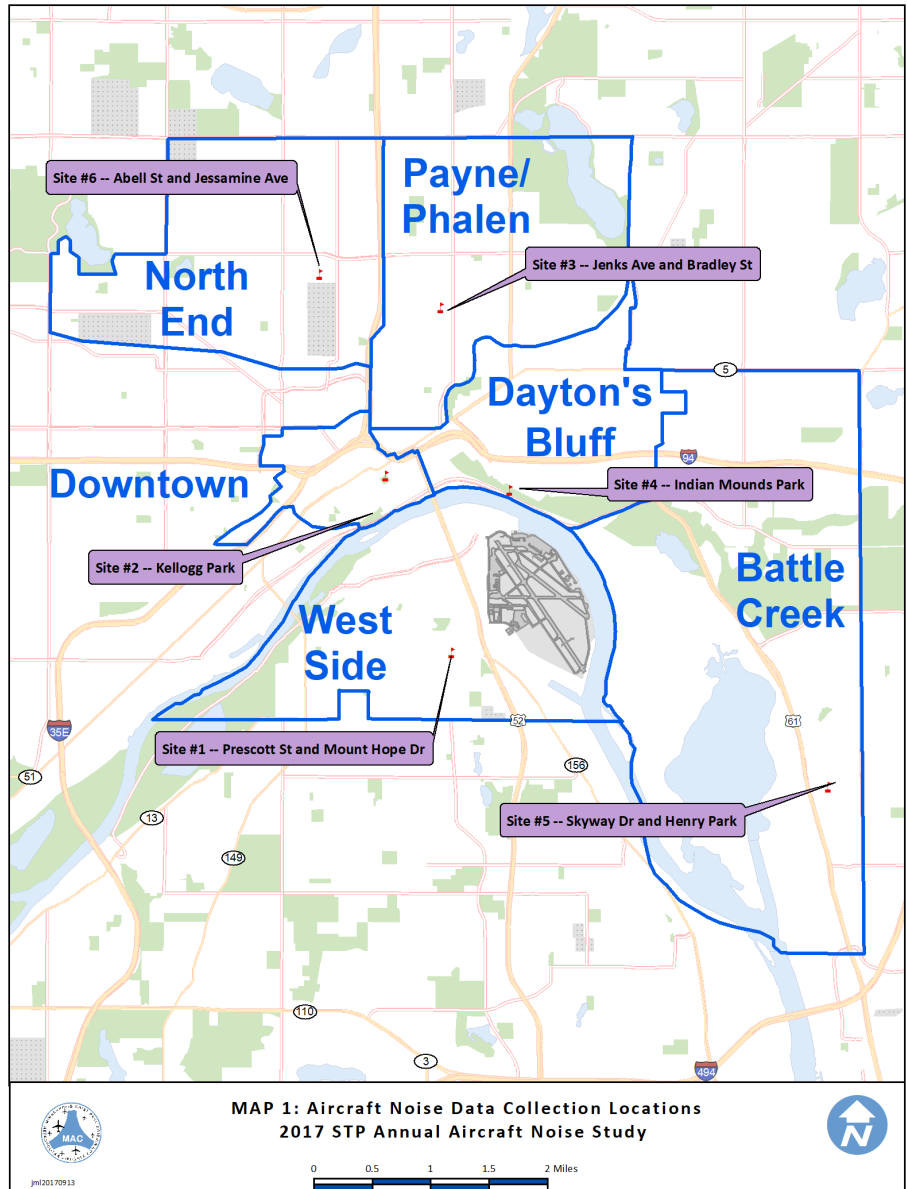
Sources of noises that were unable to be correlated with STP flight tracks are reflected in this report as community events.

1.3 Noise Data Collection Locations

Noise data collection equipment was set-up to record events simultaneously from six different locations. The locations were strategic so that one data collection site was located in each of the St. Paul community districts represented on the DAAC. **Map 1** depicts the locations for all six data collection sites used during the 2017 study period.

Four of the data collection sites were placed in the same location that were used for data collection during the 2016 study period. Two sites were adjusted slightly due to property owner request. Site 1 in 2017 was located across the street from the site location in 2016. Site 3 in 2017 was located two houses away from the site location in 2016.

Photos of each noise data collection site are provided in **Figure 1** on the next page. 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.

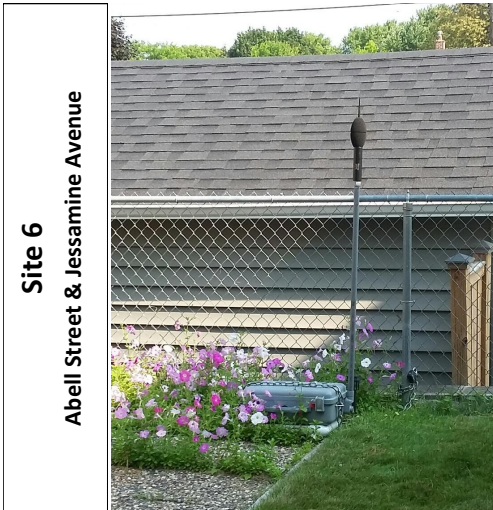


1.4 Weather Data Collection

Weather conditions (e.g.; temperature, precipitation, wind, etc.) affect the way sounds are heard and recorded, as well as runway use decisions and performance of aircraft. For these reasons, weather data are documented during the study period. Weather conditions documented during the study period are summarized in **Table 1** found on page 19 this report.

Figure 1: Noise Data Collection Location Photos

8/1/2017-8/7/2017



2.0 Summary of Findings

The following information summarizes the findings of the 2017 STP Annual Aircraft Noise Study.

2.1 Noise Data Collection Site Inspections and Condition

During the study period of August 1-7, 2017, MAC staff conducted site inspections daily—except on the weekend—to evaluate the condition of each site and equipment, and to ensure the equipment was continuing to collect data. A calibration was performed during the initial equipment set-up on July 31 and again before removal of the equipment on August 8.

There were no issues with data collection or site condition, except for damage to Site 2 discovered on August 8 (See **Figure 2**). No data loss was experienced during the study period.

Damage to Site 2 was observed by staff after the conclusion of the data collection period, when staff arrived to pick-up the equipment. It appears the damage was limited to the microphone pole that is normally attached to the exterior of the main data collection box. The microphone did not sustain damage. The exact time that the damage occurred could not be established, however, the damage was estimated to have occurred sometime after 1 p.m. on August 7 (the final day of data collection) and before the equipment was removed on August 8. Before removing the equipment, staff checked the calibration and found it to be within standards; therefore, data from August 7 at Site 2 is included in this study.

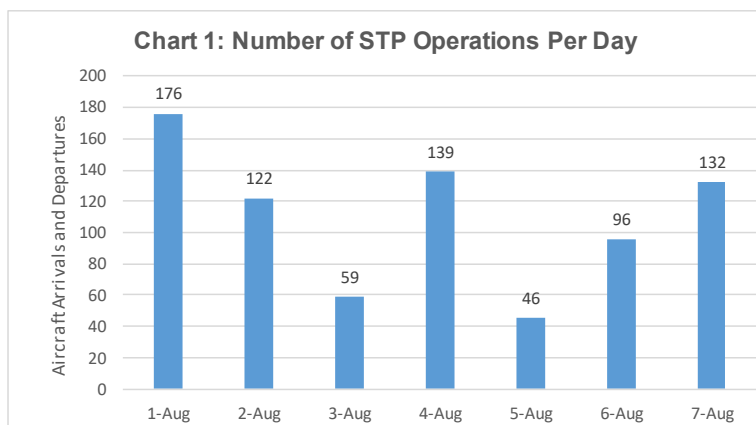


Figure 2: Site 2 Damage

2.2 Aircraft Operations

Total STP flight activity was 13.9 percent greater during the 2017 study period than during the 2016 study period. There were 770 operations at STP during the 2017 study period compared to 676 operations during the study period in 2016. There were 857 operations during the study period in 2010—when the STP Annual Aircraft Noise Study was previously conducted during August.

There were a total of 384 arrivals and 386 departures at STP during the 2017 study period; of these, 41 arrivals

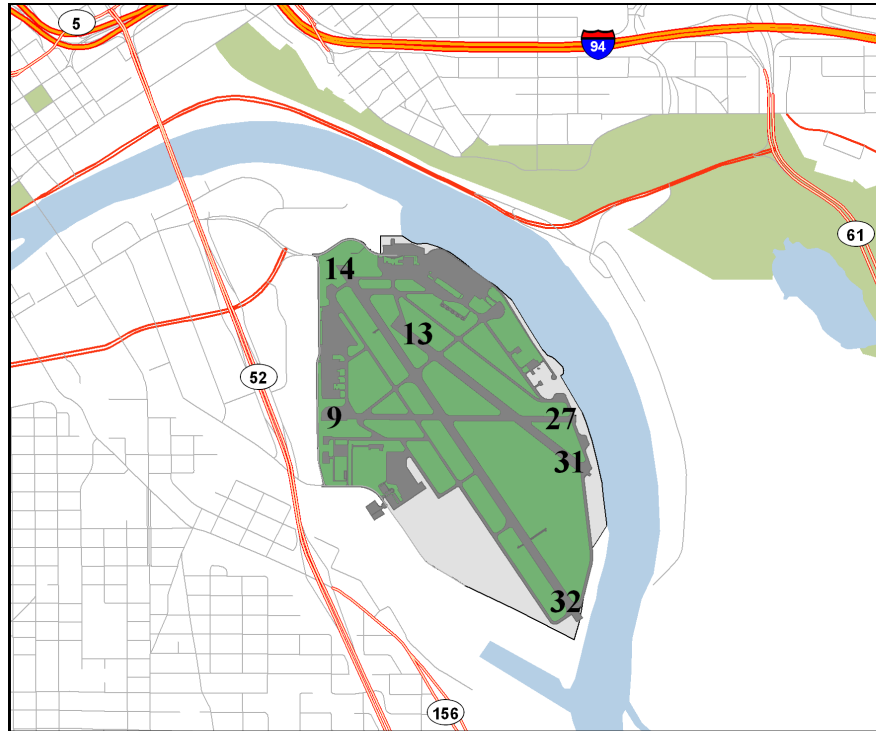


and 46 departures operated during the nighttime hours of 10 p.m. –7 a.m. Runway 14-32 was the most heavily used runway at STP during the study period.

Figure 3 details the counts and percentages of operations for each of STP’s runways. **Figure 4** shows the flight tracks associated with the STP during the study period.

Figure 3: Runway Use

8/1/2017-8/7/2017



Operations (24 Hour Days)		
Arrivals		
Runway	Count	Percent
9	10	2.6%
13	7	1.8%
14	63	16.4%
27	7	1.8%
31	28	7.3%
32	267	69.5%
Unknown	2	0.5%
Total Arrivals	384	100.0%
Departures		
9	10	2.6%
13	6	1.6%
14	73	18.9%
27	7	1.8%
31	63	16.3%
32	226	58.5%
Unknown	1	0.3%
Total Departures	386	100.0%
Total Operations	770	

Nighttime Operations (10 p.m. - 7:00 a.m.)		
Nighttime Arrivals		
Runway	Count	Percent
9	0	0.0%
13	4	9.8%
14	16	39.0%
27	0	0.0%
31	1	2.4%
32	20	48.8%
Unknown	0	0.0%
Total Arrivals	41	100%
Nighttime Departures		
9	0	0.0%
13	0	0.0%
14	17	37.0%
27	1	2.2%
31	6	13.0%
32	22	47.8%
Unknown		0.0%
Total Departures	46	100.0%
Total Nighttime Operations	87	

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

Figure 4: Flight Tracks for STP Study Period

8/1/2017-8/7/2017

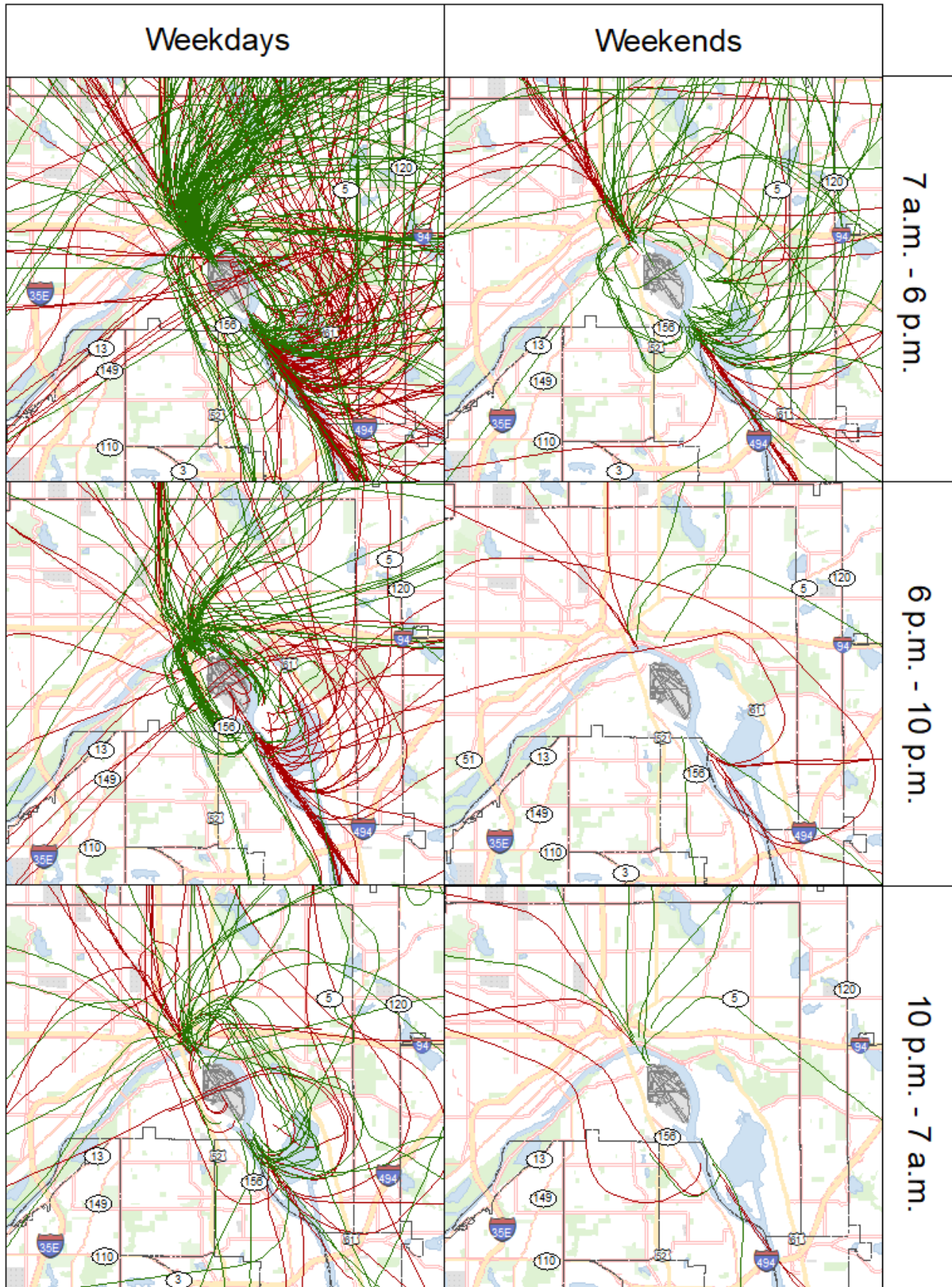
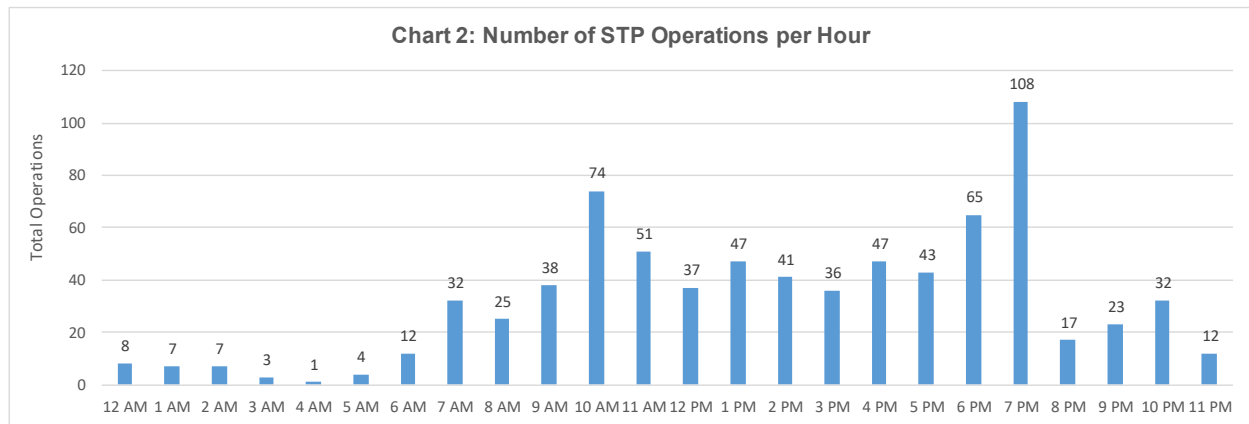


Chart 1 shows the daily summary of STP aircraft operations during the study period. The highest use of STP occurred on August 1, 2017 with a total of 90 arrivals and 86 departures.



The hours that netted the highest volume of aircraft operating at STP during the study period were 7 p.m. on August 1 (38), August 4 (26), and August 6 (24), and 10 a.m. on August 6 (45). The hourly operation details are shown below in **Chart 2**.

2.3 Noise Events

During the 2017 study period there were a total of 341 aircraft noise events recorded above 65 dBA, which is 5.0 percent fewer noise events when compared to the 359 events recorded during the last year’s study period. However, when comparing the 341 events in the August 2017 study period to the August 2010 with 440 recorded events during the study period there were 22.5 percent fewer noise events in 2017. **Chart 3** provides a comparison of events recorded in the 2017 Noise Study compared with studies conducted since 2007.

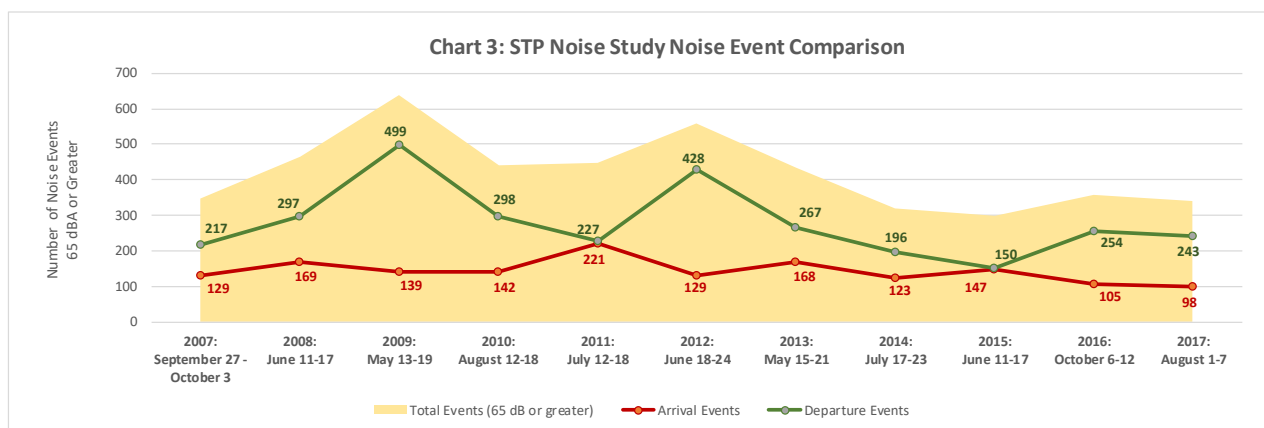


Figure 5 details the number of aircraft noise events that exceeded 65 dBA, 80 dBA, 90 dBA, and 100 dBA. There were 98 arrival noise events above 65 dBA DNL and 243 departure noise events during the 2017 study period ranging from 10 events at Sites 1, 2, and 3 to 34 events at Site 6. There were 243 aircraft departure noise events exceeding 65 dBA during the 2017 study period, ranging from nine events at Site 6 to 143 at Site 4. **Figure 6** provides a list of the top ten aircraft noise events at each site.

Figure 5: Aircraft Noise Events

8/1/2017-8/7/2017

Arrival-Related Events

Site	Location	>=65dBA LA _{max}	>=80dBA LA _{max}	>=90dBA LA _{max}	>=100dBA LA _{max}
1	Prescott Street and Mt. Hope Drive	10	0	0	0
2	Kellogg Park	10	0	0	0
3	Jenks Avenue and Bradley Street	10	0	0	0
4	Indian Mounds Park	11	1	0	0
5	Skyway Drive and Henry Park	23	0	0	0
6	Abell Street and Jessamine Avenue	34	0	0	0
Total Arrival Noise Events		98	1	0	0

Departure-Related Events

Site	Location	>=65dBA LA _{max}	>=80dBA LA _{max}	>=90dBA LA _{max}	>=100dBA LA _{max}
1	Prescott Street and Mt. Hope Drive	14	0	0	0
2	Kellogg Park	14	0	0	0
3	Jenks Avenue and Bradley Street	51	1	0	0
4	Indian Mounds Park	143	4	0	0
5	Skyway Drive and Henry Park	12	0	0	0
6	Abell Street and Jessamine Avenue	9	0	0	0
Total Departure Noise Events		243	5	0	0

Figure 6: Top 10 Loudest Aircraft Noise Events

8/1/2017 - 8/7/2017

Site 1 - Prescott Street & Mt. Hope Drive

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA _{max} (dBA)	Duration (seconds)
8/2/2017 22:20	Unknown	UKN	A	32	78.4	27
8/1/2017 19:02	Unknown	UKN	A	32	77.7	27
8/6/2017 10:40	Unknown	UKN	D	31	76	16
8/1/2017 15:22	Unknown	UKN	D	27	75.4	16
8/1/2017 22:02	Unknown	UKN	A	32	73.9	19
8/1/2017 14:05	Unknown	UKN	D	31	72.5	12
8/2/2017 17:08	Unknown	UKN	D	32	71.7	19
8/2/2017 19:11	Unknown	UKN	A	32	71.5	29
8/7/2017 19:01	Unknown	UKN	D	32	71.3	13
8/2/2017 7:19	Unknown	UKN	D	32	70.9	12

Site 2 - Kellogg Park

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA _{max} (dBA)	Duration (seconds)
8/2/2017 22:20	Unknown	UKN	A	32	74.2	21
8/6/2017 10:21	N2050A	BE9L	D	32	74.2	22
8/1/2017 19:02	Unknown	UKN	A	32	73.2	23
8/2/2017 12:13	Unknown	UKN	A	31	71.3	26
8/6/2017 10:29	Unknown	UKN	D	14	71.3	16
8/6/2017 10:10	Unknown	UKN	D	9	70.5	11
8/7/2017 10:11	Unknown	UKN	A	32	69.7	22
8/5/2017 19:38	N49KC	BE20	A	32	69.3	18
8/7/2017 22:46	N200PZ	BE20	D	14	69	9
8/2/2017 12:19	Unknown	B407	D	9	68.8	16

Site 3 - Jenks Avenue & Bradley Street

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA _{max} (dBA)	Duration (seconds)
8/1/2017 16:24	JUS827	FA20	D	32	81.2	21
8/5/2017 10:43	Unknown	UKN	D	32	79.4	15
8/1/2017 15:56	Unknown	BE20	D	32	77.5	10
8/1/2017 7:05	Unknown	UKN	D	32	77.2	24
8/7/2017 9:59	N59BR	H25B	D	31	77.1	14
8/2/2017 7:58	N549CP	GLF5	D	32	76.8	15
8/1/2017 19:30	N287LS	BE40	D	31	75.3	29
8/7/2017 16:59	N598DR	BE40	D	32	75.2	20
8/2/2017 17:56	N564HV	C56X	D	32	74.4	12
8/1/2017 18:51	Unknown	UKN	A	32	74.3	17

**Figure 6: Top 10 Loudest Aircraft Noise Events — Continued from Previous
8/1/2017 - 8/7/2017**

Site 4 - Indian Mounds Park

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA _{max} (dBA)	Duration (seconds)
8/3/2017 11:11	N414GK	S22T	D	32	84.7	17
8/4/2017 16:28	Unknown	UKN	D	32	83.8	29
8/2/2017 6:49	Unknown	UKN	D	32	82.1	17
8/4/2017 12:39	Unknown	UKN	D	32	80.2	37
8/1/2017 18:52	Unknown	UKN	A	32	80.1	29
8/4/2017 11:47	Unknown	UKN	D	32	78.5	23
8/1/2017 10:06	N14MN	BE36	D	32	78.5	17
8/2/2017 13:05	N586ES	UKN	D	32	78.4	22
8/3/2017 14:31	XOJ546	CL30	D	32	78.3	23
8/4/2017 2:03	N911VM	PC12	D	32	78.2	10

Site 5 - Skyway Drive & Henry Park

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA _{max} (dBA)	Duration (seconds)
8/7/2017 10:54	Unknown	BE20	D	14	76.8	12
8/6/2017 10:47	N49KC	BE20	D	14	74.4	11
8/6/2017 20:14	NUS80	C550	A	32	73.8	14
8/1/2017 7:19	N521BB	PC12	A	32	73	20
8/4/2017 15:08	N478DR	BE40	A	32	72.2	12
8/5/2017 7:51	N701AV	TBM7	D	14	72.1	10
8/6/2017 21:34	SWD7	C25B	A	32	71.9	13
8/1/2017 9:27	N3M	GLF5	A	32	71.4	14
8/7/2017 16:59	N385H	B350	A	32	71.2	11
8/2/2017 7:40	N564HV	C56X	A	32	71.1	9

Site 6 - Abell Street & Jessamine Avenue

Date/Time	Flight Number	Aircraft Type	Arr/Dep	Runway	LA _{max} (dBA)	Duration (seconds)
8/6/2017 7:53	N315KA	B350	A	14	78.3	14
8/2/2017 22:19	Unknown	UKN	A	32	77.3	21
8/7/2017 8:14	N49LD	C560	A	14	77.1	12
8/6/2017 22:43	LN904SH	BE20	A	14	77	15
8/6/2017 10:17	N49KC	BE20	A	14	76.6	15
8/2/2017 23:30	N57ME	C550	A	14	76.4	12
8/7/2017 9:27	N70MN	BE20	A	14	76.3	18
8/4/2017 14:32	N115SP	UKN	D	32	75	21
8/7/2017 12:38	N488VC	CL30	A	14	74.9	13
8/2/2017 22:08	Unknown	UKN	A	13	74.8	15

Figures 7-8 summarize aircraft and community noise data collected during the study period. The Day-Night Average Noise Level (DNL) calculations for Aircraft DNL in **Figure 9** reflect aircraft noise only, and community DNL in **Figure 6** reflects all other noises —non-STP aircraft noises— recorded during the study period. Based on data collected during the 2017 noise study period, 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.

DNL noise contours are not part of this annual 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 2018.

2.4 Aircraft Noise Complaints

There were 16 aircraft STP noise complaints from four households documented during the 2017 study period. Five of these complaints were correlated with STP aircraft activity; the remaining complaints were uncorrelated and related to unknown noise events. **MAP 2** found on page 18 shows the locations and detail related to those complaints.

Figure 7: Aircraft and Community DNL by Site
8/1/2017 - 8/7/2017

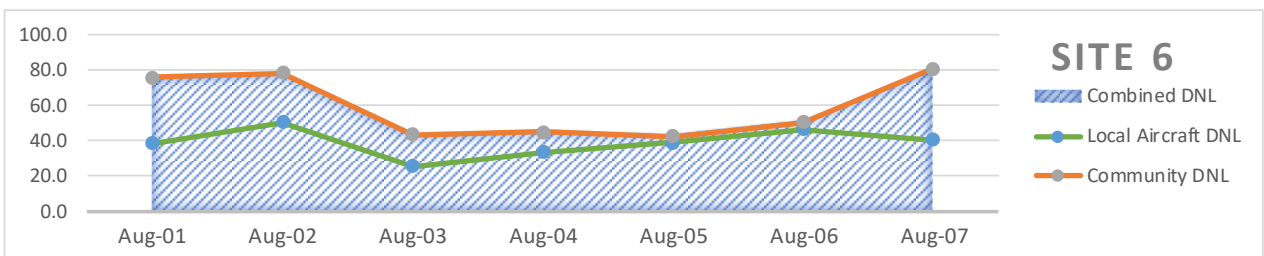
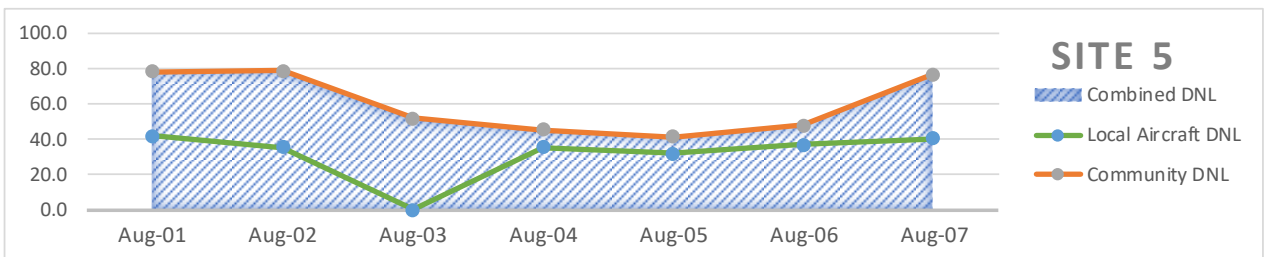
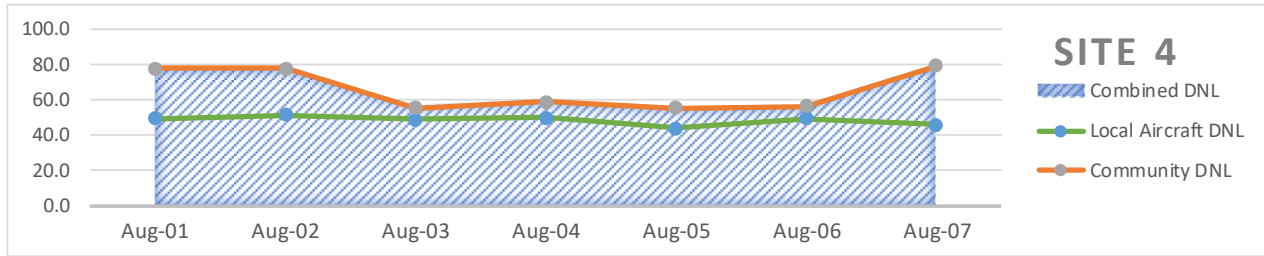
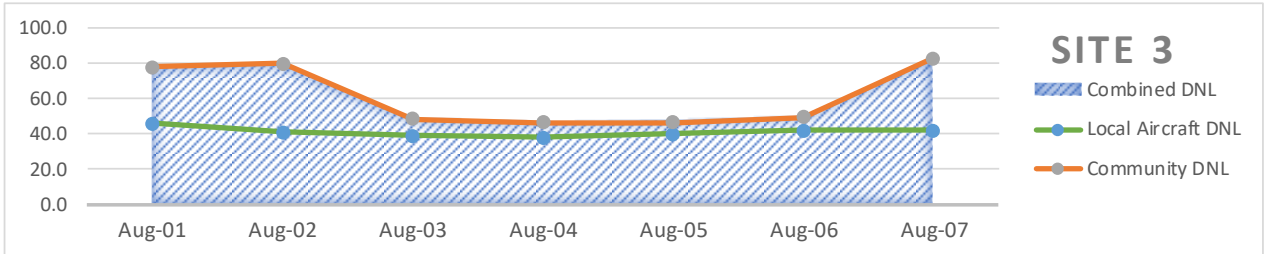
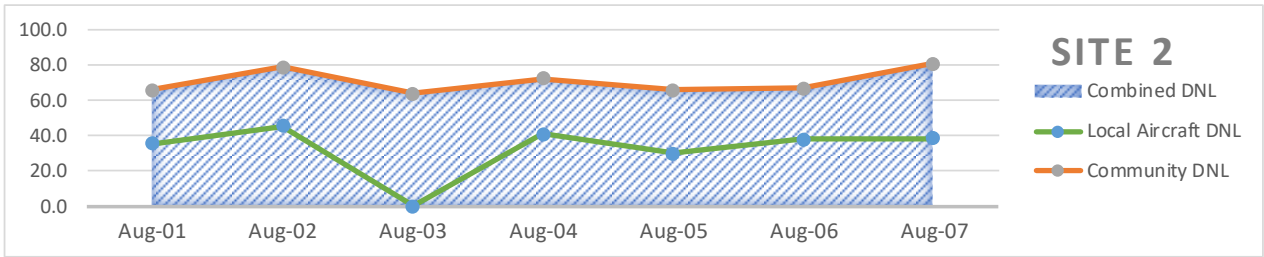
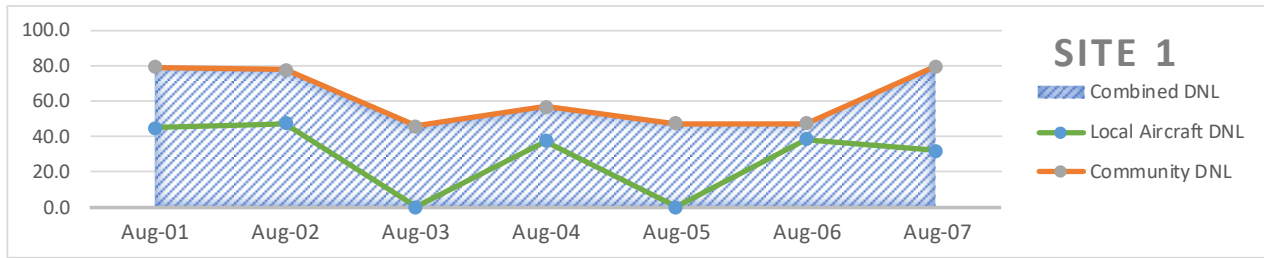


Figure 8: Average Background Noise Levels (LA₉₀)

8/1/2017 - 8/7/2017

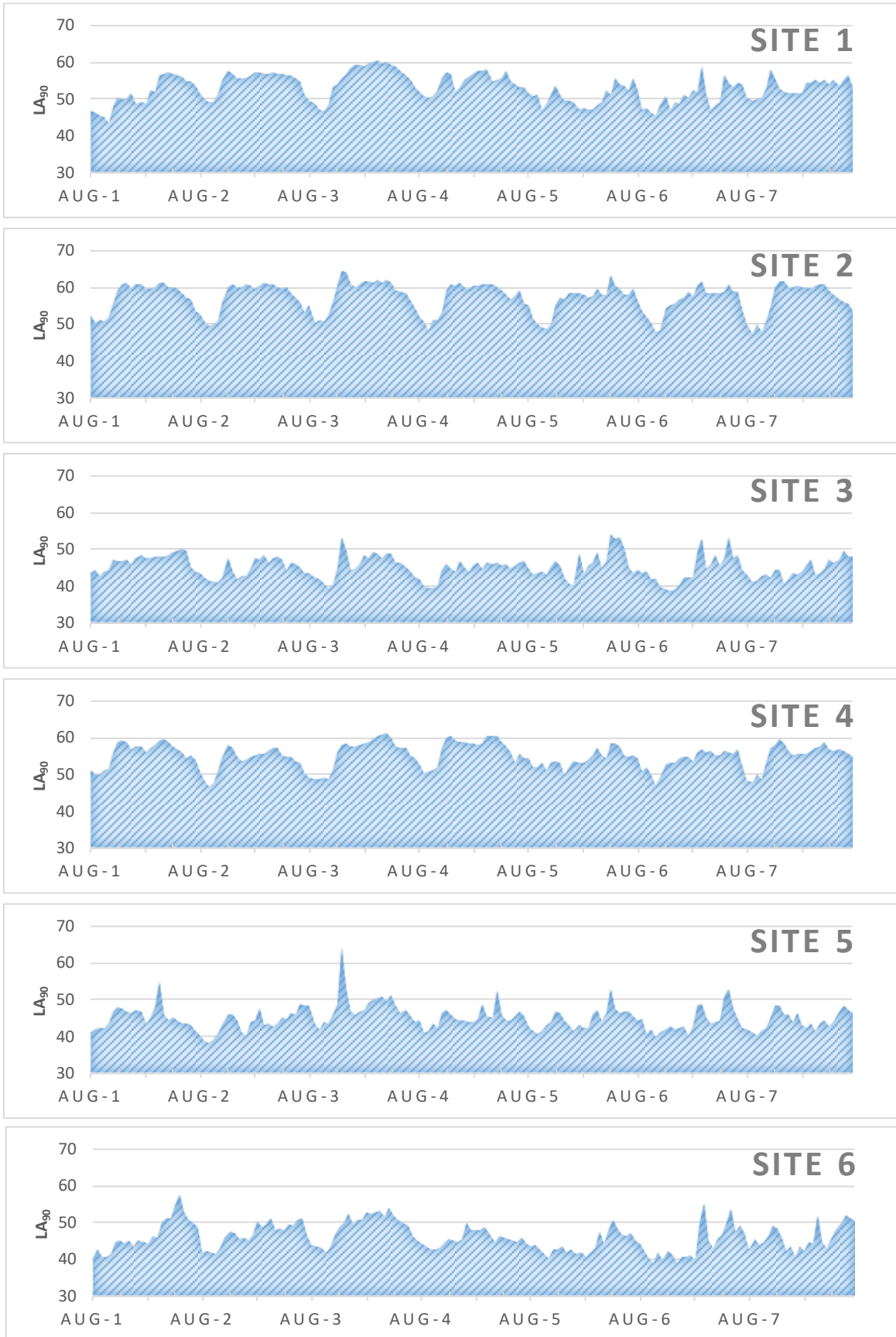


Figure 9: Hourly Distribution of Noise Events (SEL)

8/1/2017 - 8/7/2017

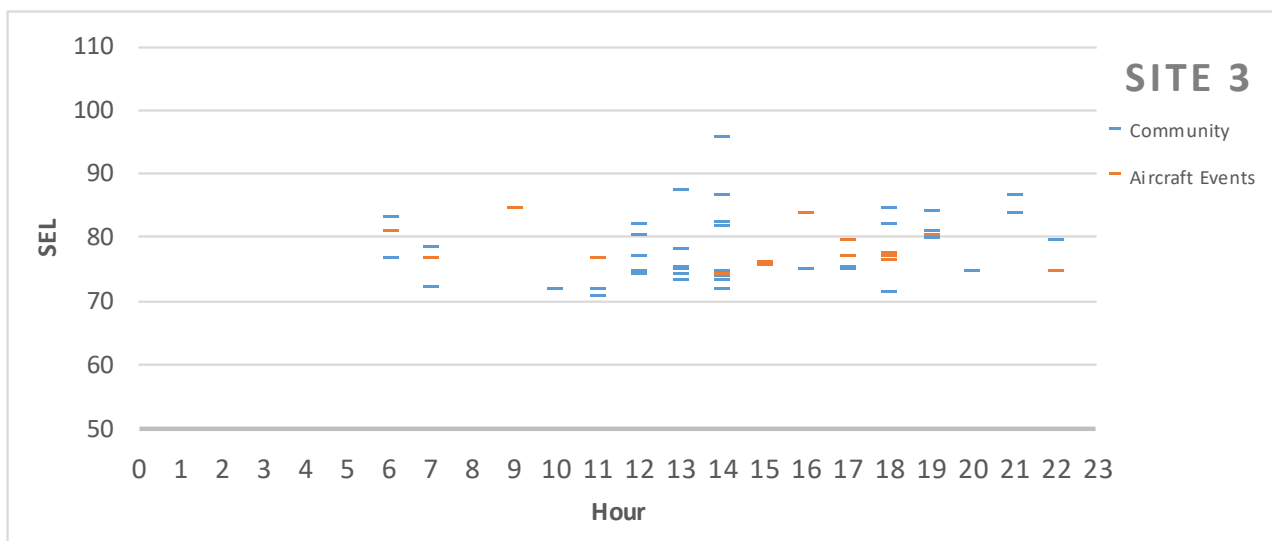
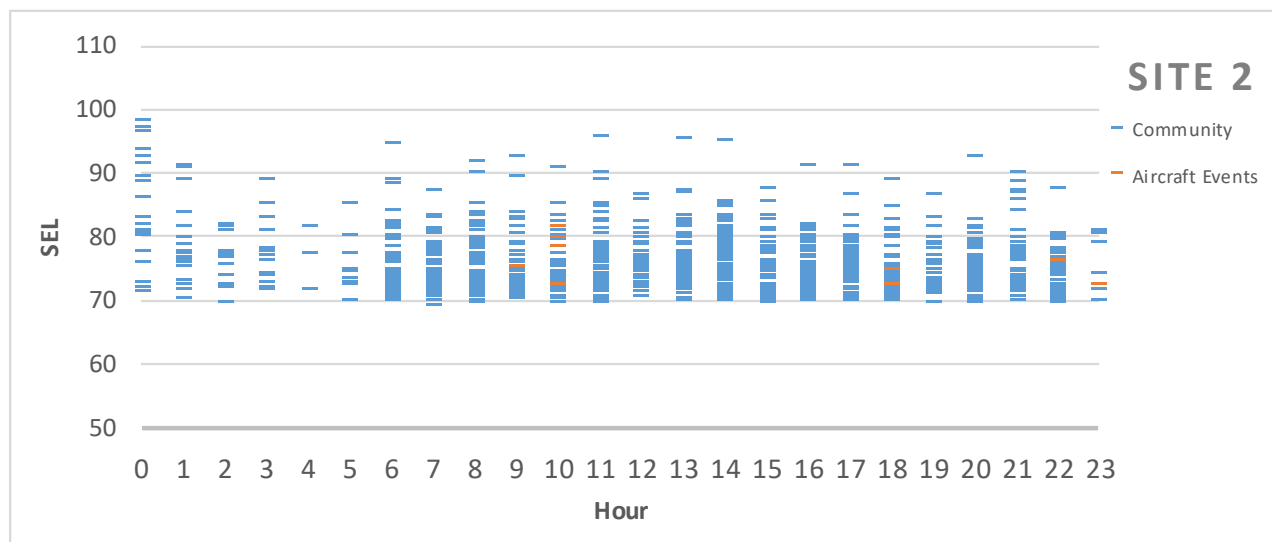
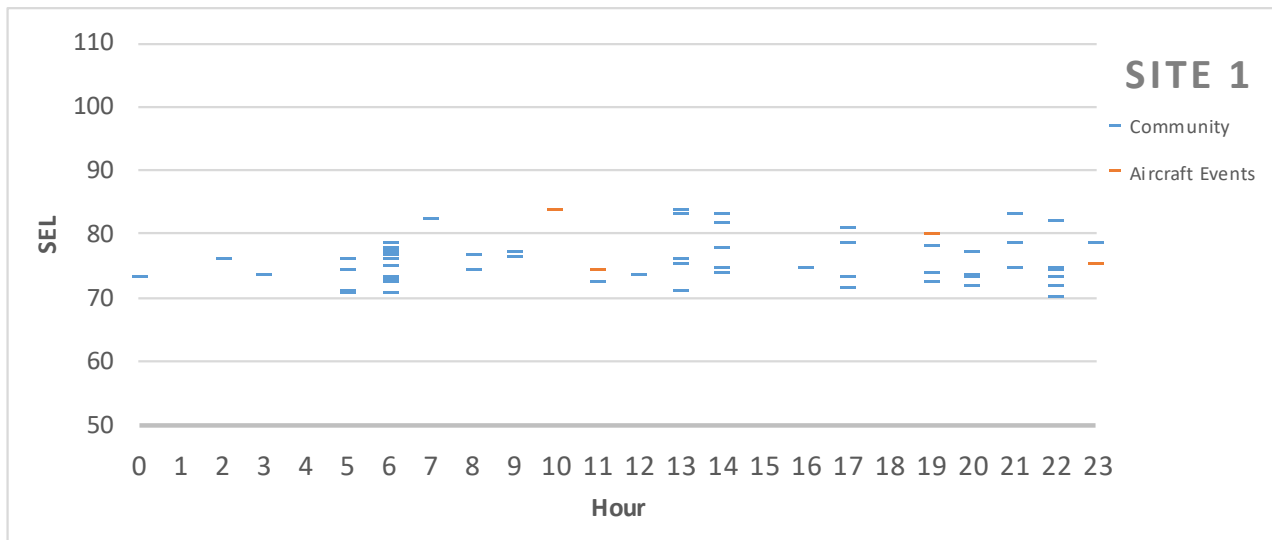
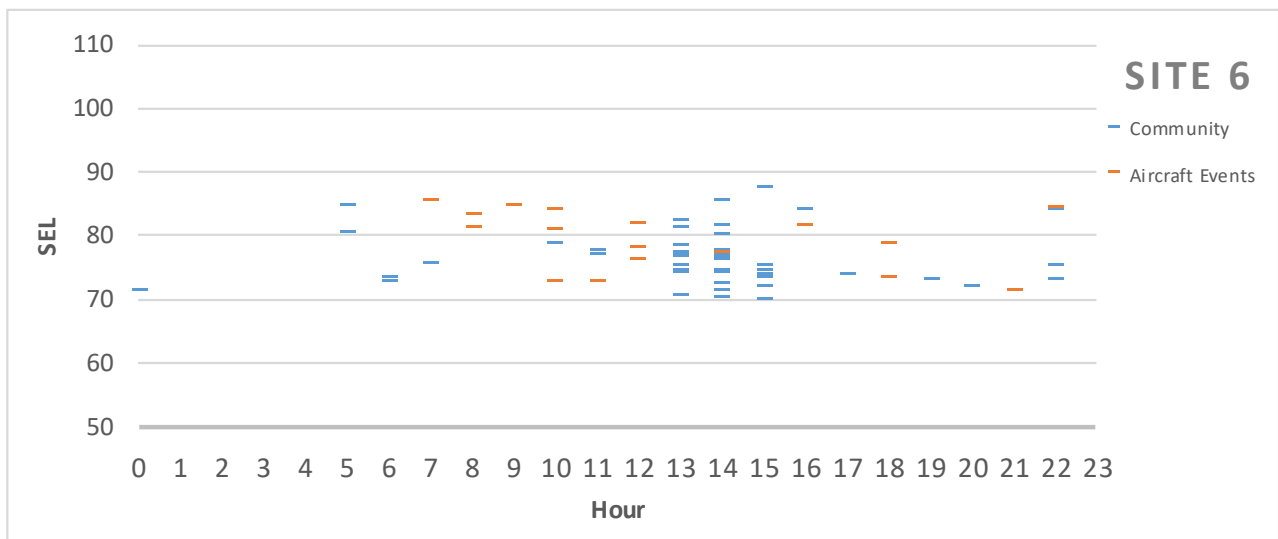
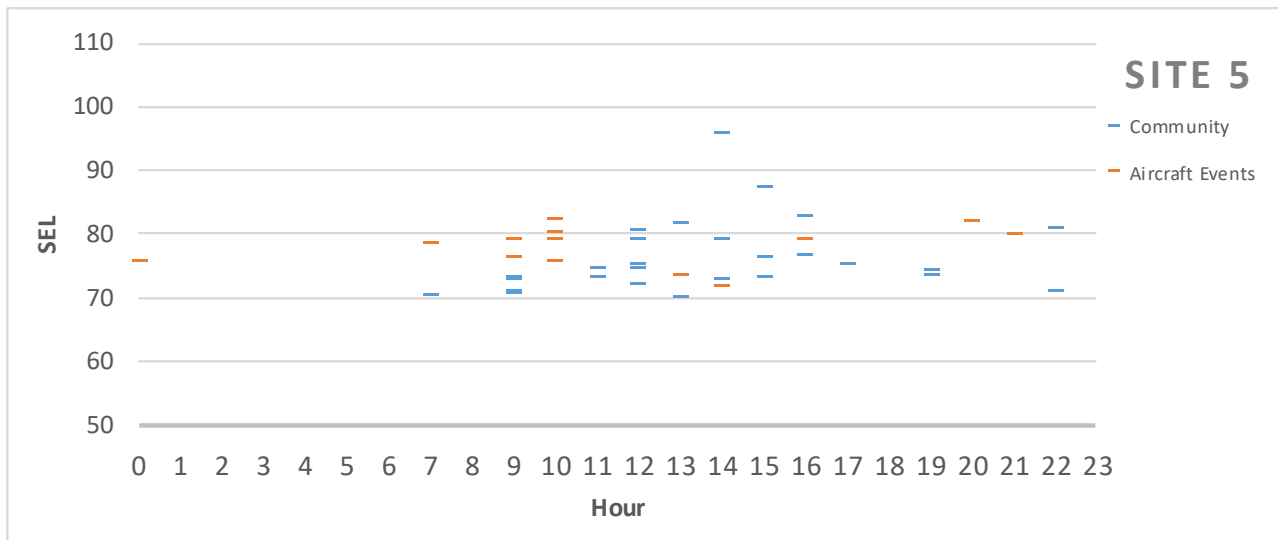
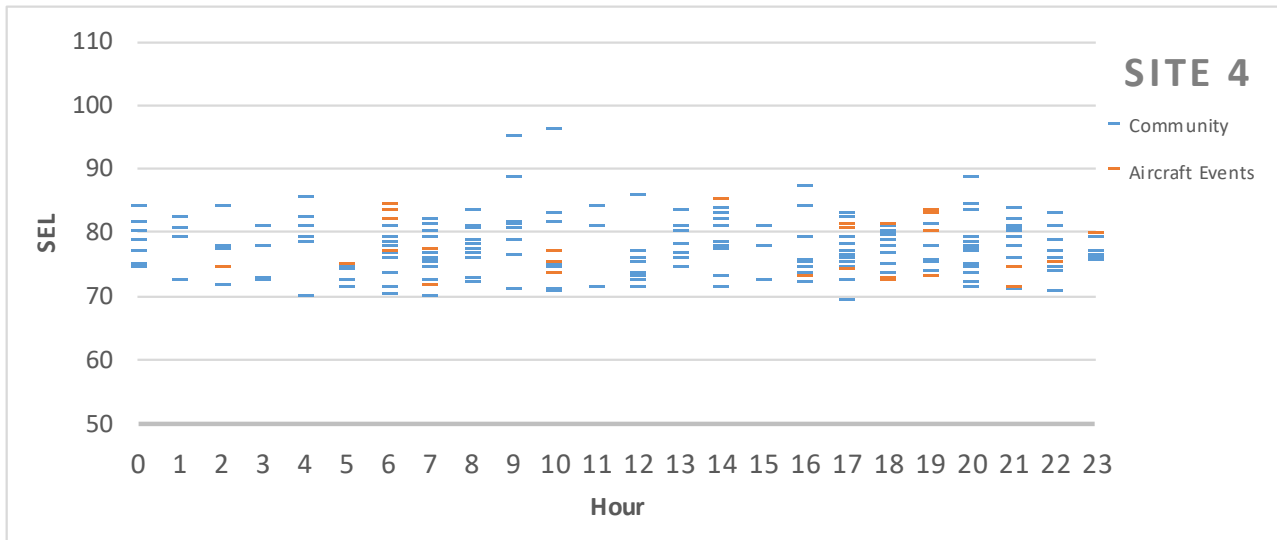


Figure 9: Hourly Distribution of Noise Events (SEL) — Continued from Previous
 8/1/2017 - 8/7/2017



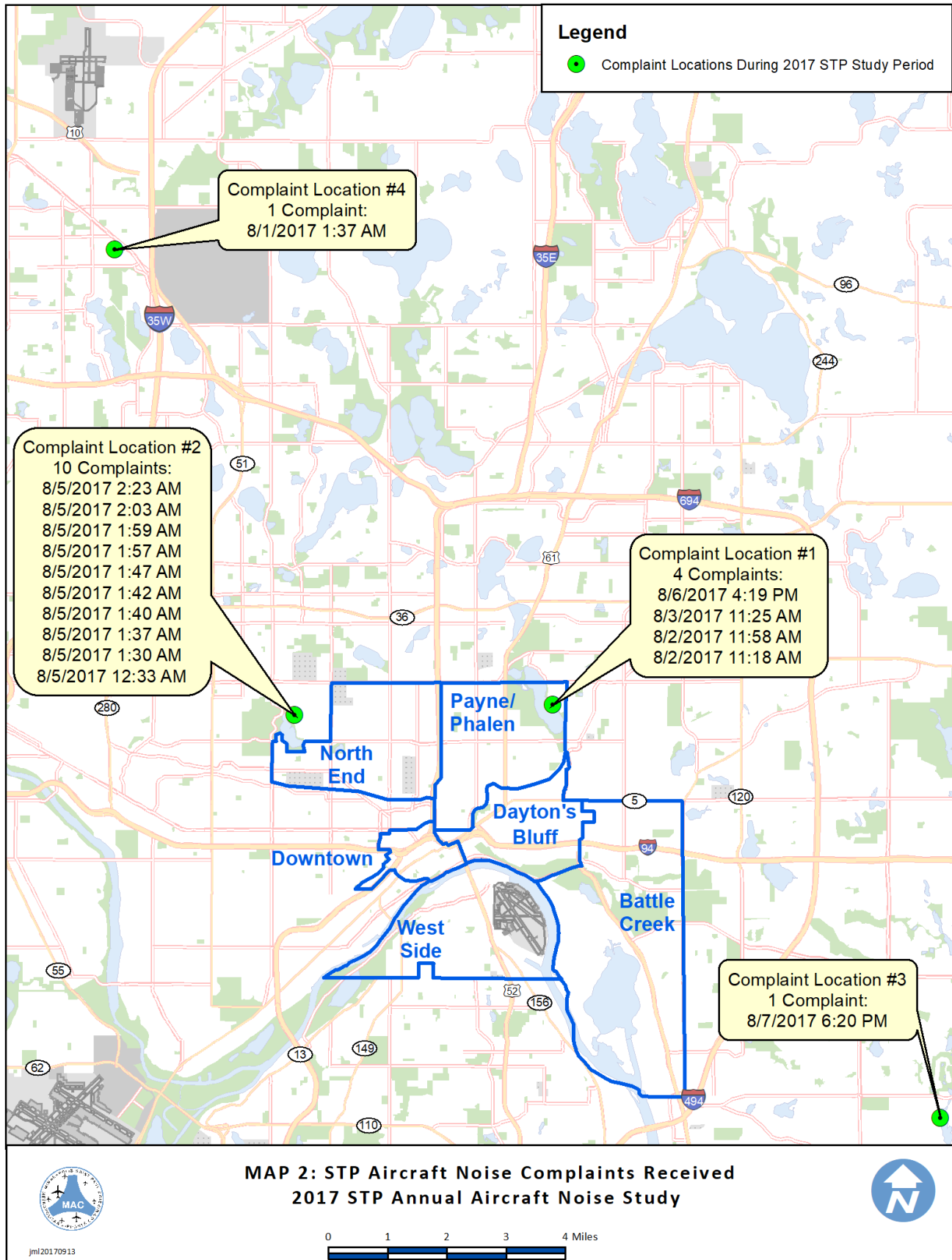


Table 1: Weather Observations
(8/1/2017 - 8/7/2017)

August 2017	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	
Tuesday August 1	88	77	66	68	62	56	93	61	35	30.06	30.01	29.94	10	10	10	16	5	24	0	
	Thunderstorm																			
Wednesday August 2	82	74	66	62	59	54	81	62	42	30.08	30.05	30.02	10	10	10	14	7	20	0	
Thursday August 3	66	60	54	64	55	47	100	85	63	30.05	29.96	29.88	10	7	1	25	11	36	0.64	
	Rain, Thunderstorm																			
Friday August 4	77	64	54	57	52	48	84	64	42	30.04	30	29.94	10	10	10	16	11	32	0	
Saturday August 5	78	65	55	63	58	53	100	79	45	30.01	29.99	29.98	10	9	2	9	2	-	0.14	
	Rain, Thunderstorm																			
Saturday August 6	75	66	60	63	60	57	100	87	59	30.07	30.03	29.99	10	8	3	20	3	24	0.17	
Rain, Thunderstorm																				
Monday August 7	80	68	55	62	56	49	100	85	35	30.15	30.12	30.08	10	5	0	8	0	-	0	
	Fog																			

3.0 Glossary of Terms

A-weighted Noise level

The noise 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 noise level of a given environment that excludes the noise source of interest.

Decibel (dB)

Decibel is a unit of measurement for sound and noise. dBA is used when noises and sounds are measured using an A-weighted scale (see A-weighted noise level definition above).

DNL (Day-Night Average Noise Level)

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

- **Aircraft DNL** - DNL for aircraft sound and noise events only
- **Community DNL** - DNL for community sounds and noises 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 Noise Level)

Equivalent noise level, the representation of a time-varying noise as an equivalent steady-state A-weighted noise 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 sound monitoring instrument manufactured by Larson Davis that is used for the measurement of specific decibel 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 levels over wide temperature and humidity ranges.

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

Maximum sound level on an A-weighted scale. Also known as the peak or maximum level (dBA) during a particular noise event.

LA₉₀ (Noise Level Exceeded 90 Percent of the Time)

The noise level exceeded 90 percent of the time. Values of LA₉₀ are often used to represent the background noise, or levels of sound that are present most of the time.

SEL (Noise Exposure Level)

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

SPL (Noise Pressure Level)

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

STP (St. Paul Downtown Airport)

The aeronautical abbreviation for Holman Field, which is also known as St. Paul Downtown Airport is STP. The abbreviation may also be shown as KSTP, which denotes that the airport is located in the United States.