Evaluation of Existing Ambient Sound Levels for STAMP

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Summary

This memorandum presents the ambient sound measurements collected in the vicinity of the proposed STAMP project area near the hamlet of Alabama, New York. The purpose of this effort was to document the range in existing sound levels.

The ambient sound level monitoring was conducted between December 1 and December 10, 2010 at six locations. Sound level metrics collected included L_{eq} (average) and L_{90} (residual or background) levels. The resulting trends are as expected: noise levels are generally greater during the day than at night. Weather during the monitoring event was variable and included periods of snow. Sound levels reported during the monitoring period ranged from approximately 18 dBA to 73 dBA.

Noise Survey

The ambient noise survey was conducted between December 1 and December 10, 2010 at six locations. Continuous, ten-minute average noise measurements were collected at the six monitoring stations indicated in Figure 1 using Larson Davis 820 and 824 Type 1 (precision) and Larson sound level meters. Each sound level meter was programmed to record a number of statistical parameters including A-weighted L_{eq} and L_{90}.

Each meter had been factory calibrated within the previous 12 months and was field calibrated before and after each measurement series with a Larson Davis CAL200 field calibrator. The sound level meters were housed in waterproof enclosures and the microphones were mounted at an approximate height of 5 feet within a Larson Davis environmental protection shroud.

A Davis Vantage Pro Weather Station was deployed to document local weather conditions within the project area. Weather conditions during the monitoring were variable, and typical of winter conditions. Precipitation events, including snow, occurred at the beginning and at the end of the monitoring period.

FIGURE 1
Monitoring Locations

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Monitoring Results

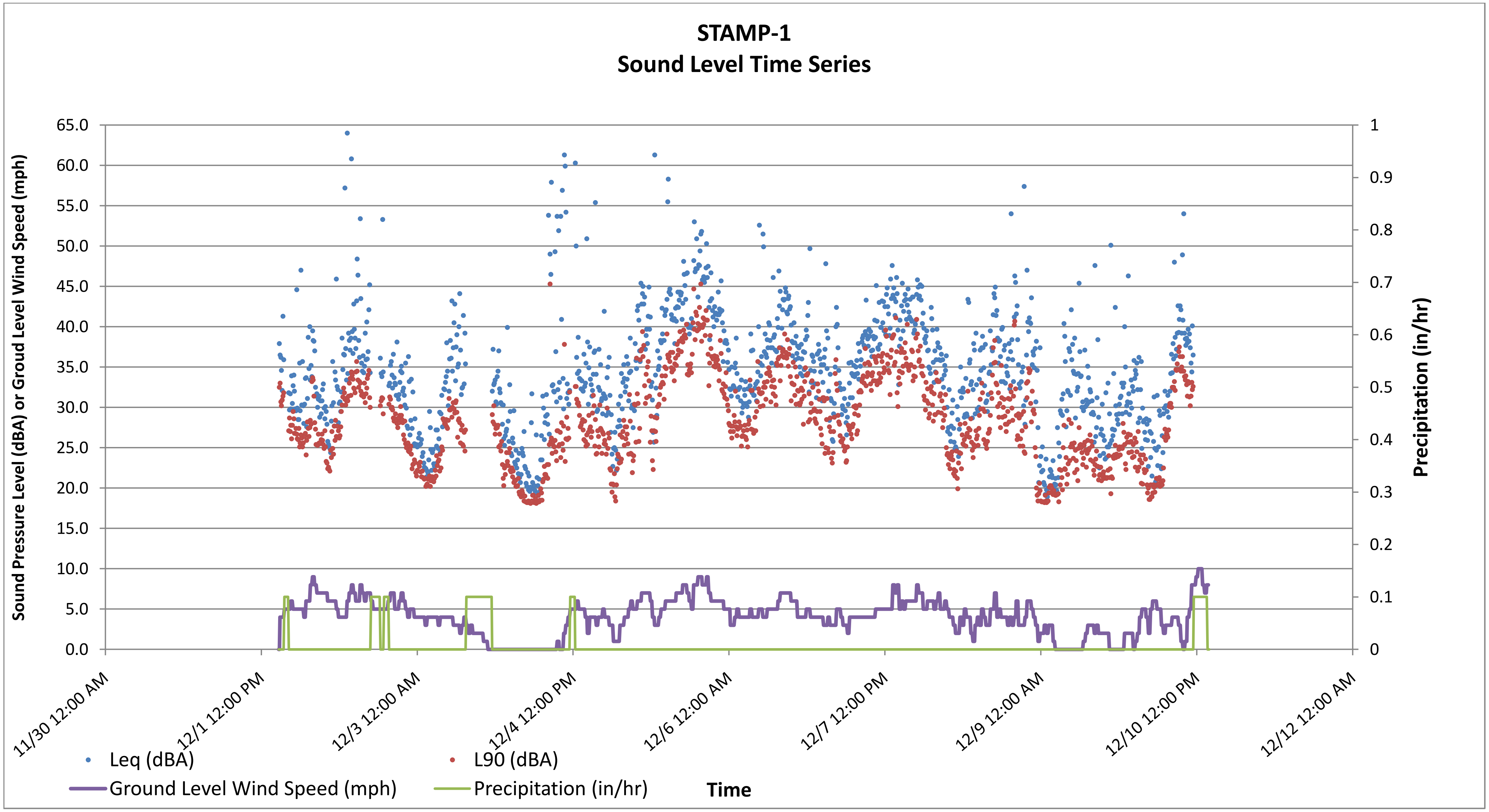
Table 1 presents maximum and minimum sound levels during the monitoring period. The measured L_{eq} and L_{90} were plotted as time series for each monitoring station and are presented in Appendix A. The results indicate that the sound level at any single location will vary substantially over time.

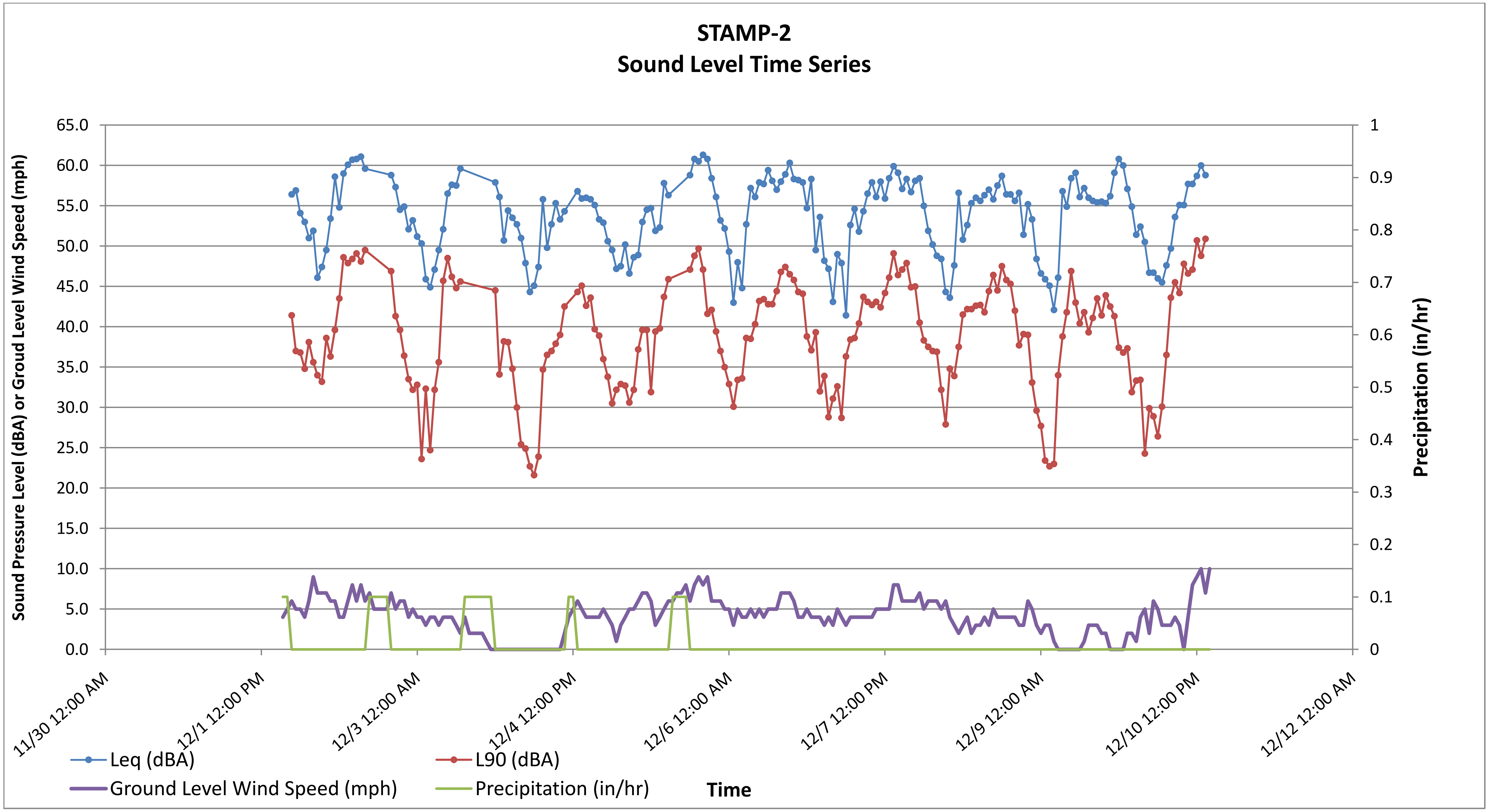
TABLE 1
Summary of Measured Sound Levels (dBA)

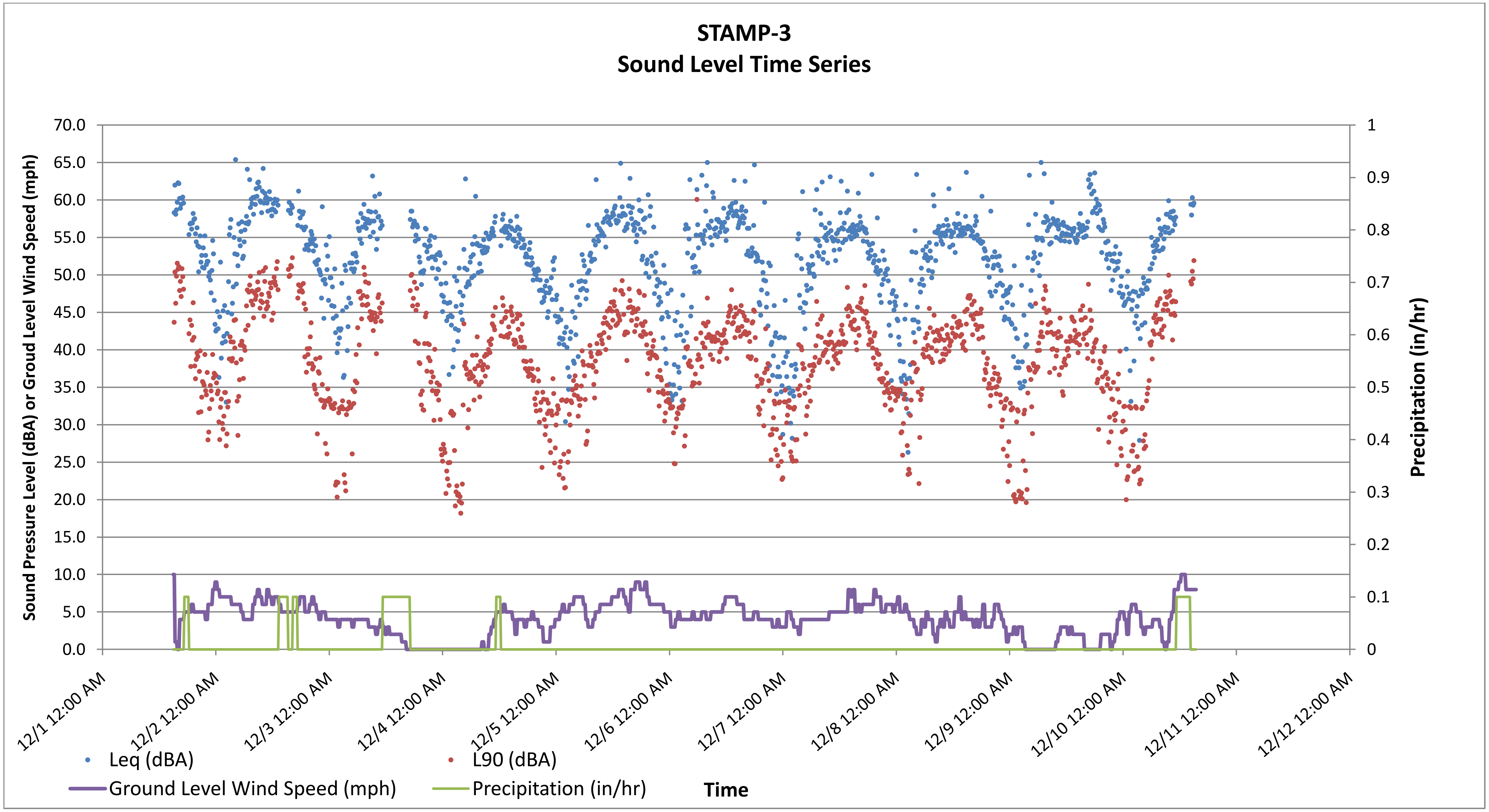
Monitoring Station	Maximum L_{eq}	Minimum L_{eq}	Maximum L_{90}	Minimum L_{90}
1	64	19	45	18
2	63	41	52	22
3	66	26	60	18
4	63	18	43	17
5	72	25	46	23
6	73	20	48	18

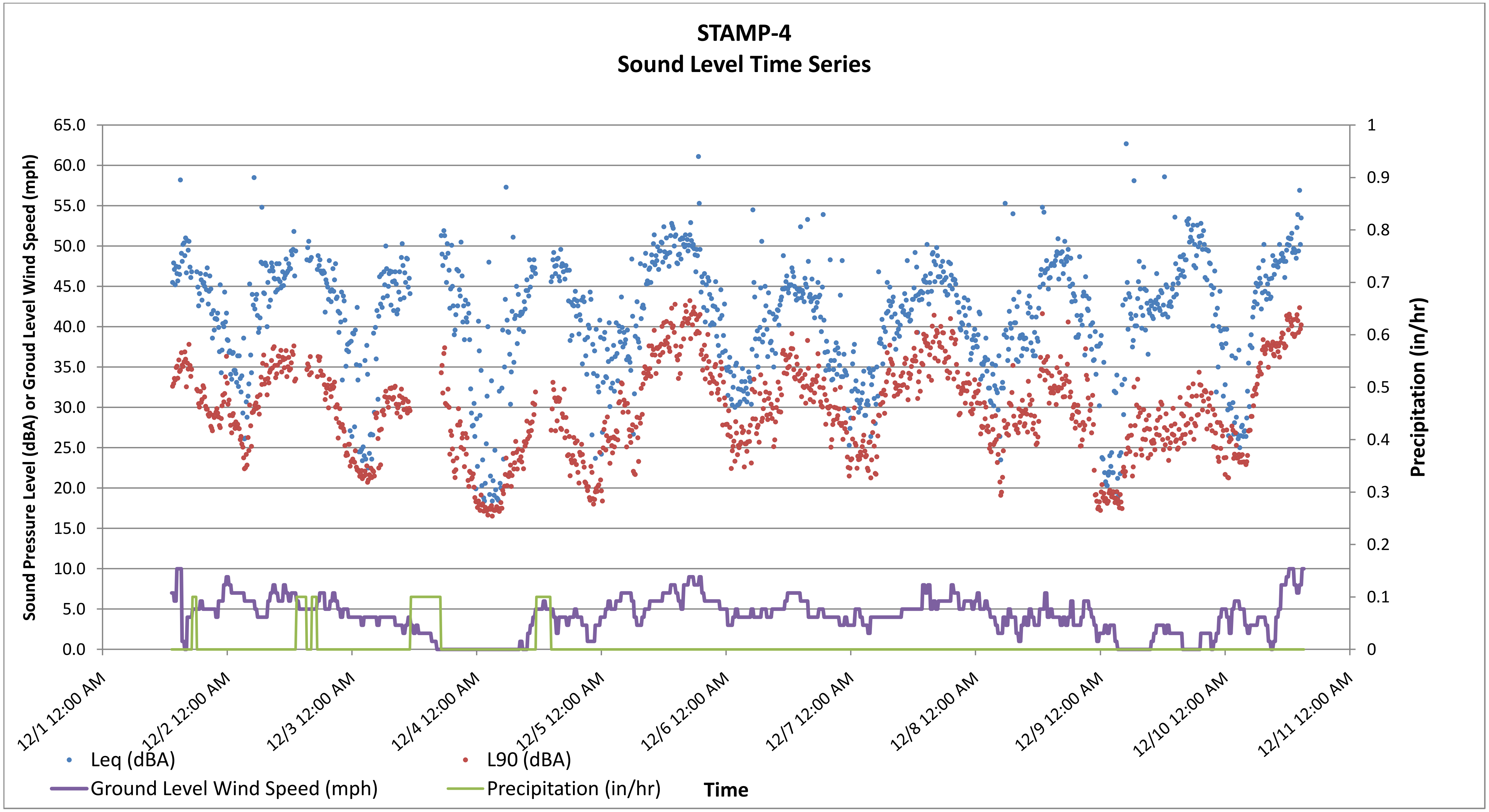
Appendix B provides a general description of the metrics presented in this analysis, such as the L_{eq}, and L_{90}.

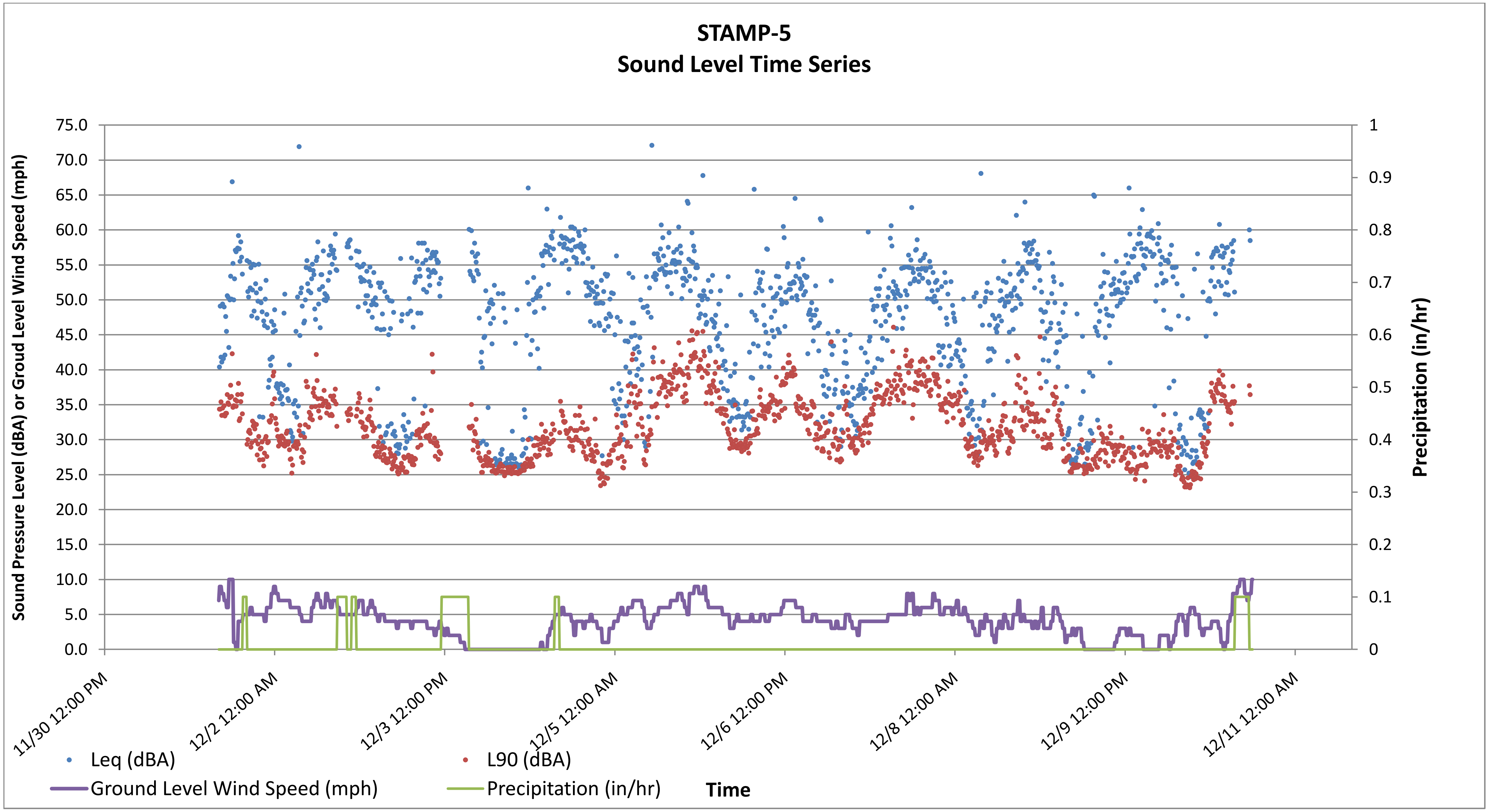
Appendix A
Measurement Results

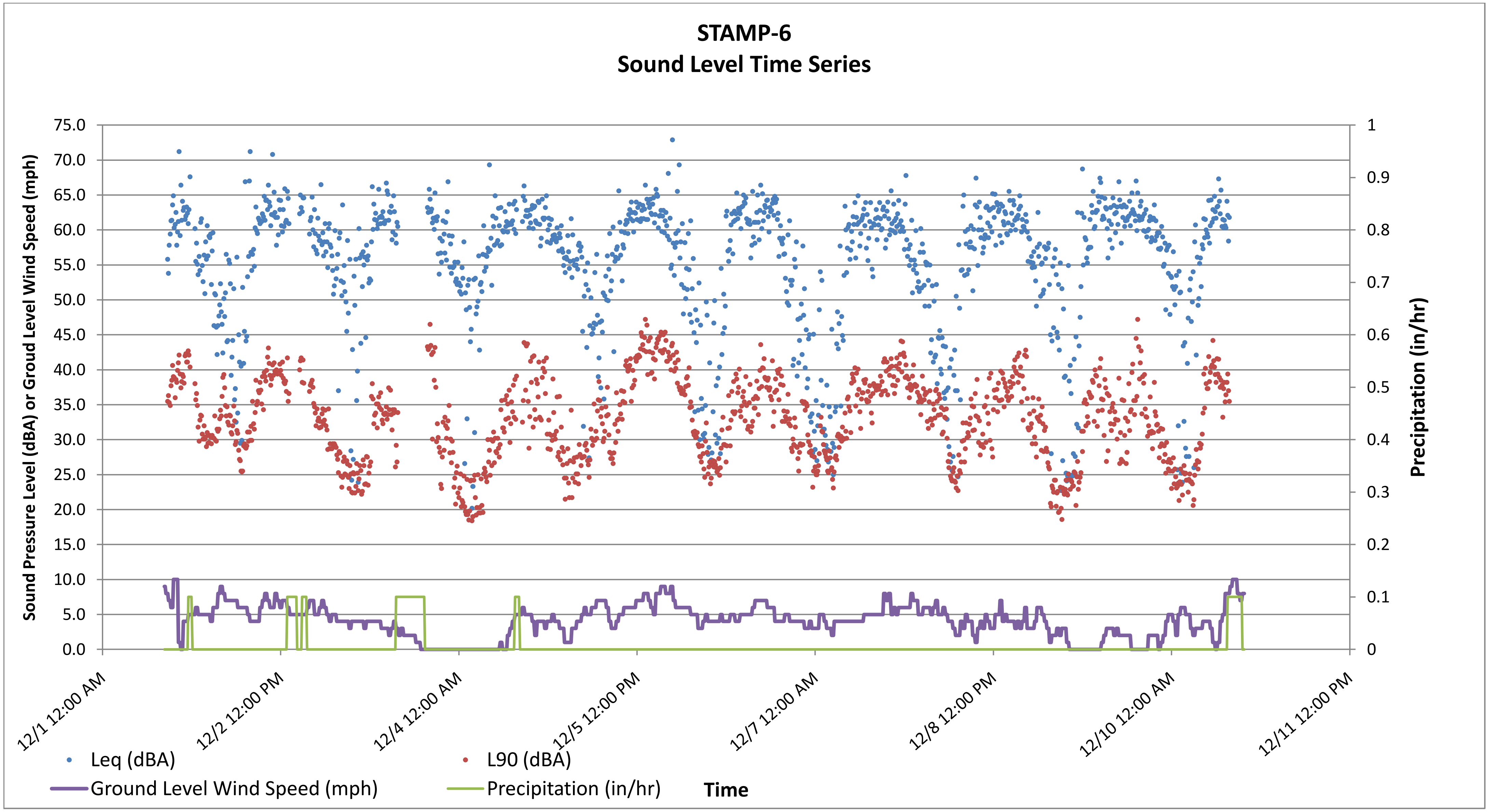

STAMP-1
Sound Level Time Series
Sound Pressure Level (dBA) or Groud Level Wind Speed (mph)
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Precipitation (in/hr)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
11/30 12:00 AM
12/1 12:00 PM
12/3 12:00 AM
12/4 12:00 PM
12/6 12:00 AM
12/7 12:00 PM
12/9 12:00 AM
12/10 12:00 PM
12/12 12:00 AM
Time
Leq (dBA)
L90 (dBA)
Ground Level Wind Speed (mph)
Precipitation (in/hr)


STAMP-2
Sound Level Time Series
Sound Pressure Level (dBA) or Groud Level Wind Speed (mph)
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Precipitation (in/hr)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
11/30 12:00 AM
12/1 12:00 PM
12/3 12:00 AM
12/4 12:00 PM
12/6 12:00 AM
12/7 12:00 PM
12/9 12:00 AM
12/10 12:00 PM
12/12 12:00 AM
Time
Leq (dBA)
L90 (dBA)
Ground Level Wind Speed (mph)
Precipitation (in/hr)


STAMP-3
Sound Level Time Series
Sound Pressure Level (dBA) or Groud Level Wind Speed (mph)
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Precipitation (in/hr)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12/1 12:00 AM
12/2 12:00 AM
12/3 12:00 AM
12/4 12:00 AM
12/5 12:00 AM
12/6 12:00 AM
12/7 12:00 AM
12/8 12:00 AM
12/9 12:00 AM
12/10 12:00 AM
12/11 12:00 AM
12/12 12:00 AM
Time
Leq (dBA)
L90 (dBA)
Ground Level Wind Speed (mph)
Precipitation (in/hr)


STAMP-4
Sound Level Time Series
Sound Pressure Level (dBA) or Groud Level Wind Speed (mph)
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Precipitation (in/hr)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12/1 12:00 AM
12/2 12:00 AM
12/3 12:00 AM
12/4 12:00 AM
12/5 12:00 AM
12/6 12:00 AM
12/7 12:00 AM
12/8 12:00 AM
12/9 12:00 AM
12/10 12:00 AM
12/11 12:00 AM
Time
Leq (dBA)
L90 (dBA)
Ground Level Wind Speed (mph)
Precipitation (in/hr)


STAMP-5
Sound Level Time Series
Sound Pressure Level (dBA) or Groud Level Wind Speed (mph)
Precipitation (in/hr)
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
11/30 12:00 PM
12/2 12:00 AM
12/3 12:00 PM
12/5 12:00 AM
12/6 12:00 PM
12/8 12:00 AM
12/9 12:00 PM
12/11 12:00 AM
Leq (dBA)
L90 (dBA)
Ground Level Wind Speed (mph)
Precipitation (in/hr)
Time


STAMP-6
Sound Level Time Series
Sound Pressure Level (dBA) or Groud Level Wind Speed (mph)
Precipitation (in/hr)
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12/1 12:00 AM
12/2 12:00 PM
12/4 12:00 AM
12/5 12:00 PM
12/7 12:00 AM
12/8 12:00 PM
12/10 12:00 AM
12/11 12:00 PM
Leq (dBA)
L90 (dBA)
Ground Level Wind Speed (mph)
Precipitation (in/hr)
Time

APPENDIX B
Fundamentals of Acoustics

Fundamentals of Acoustics

It is useful to understand how noise is defined and measured. Noise is generally defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. There are several ways to measure noise, depending on the source of the noise, the receiver, and the reason for the noise measurement. Table 1 summarizes the technical noise terms typical discussed in environmental noise analysis.

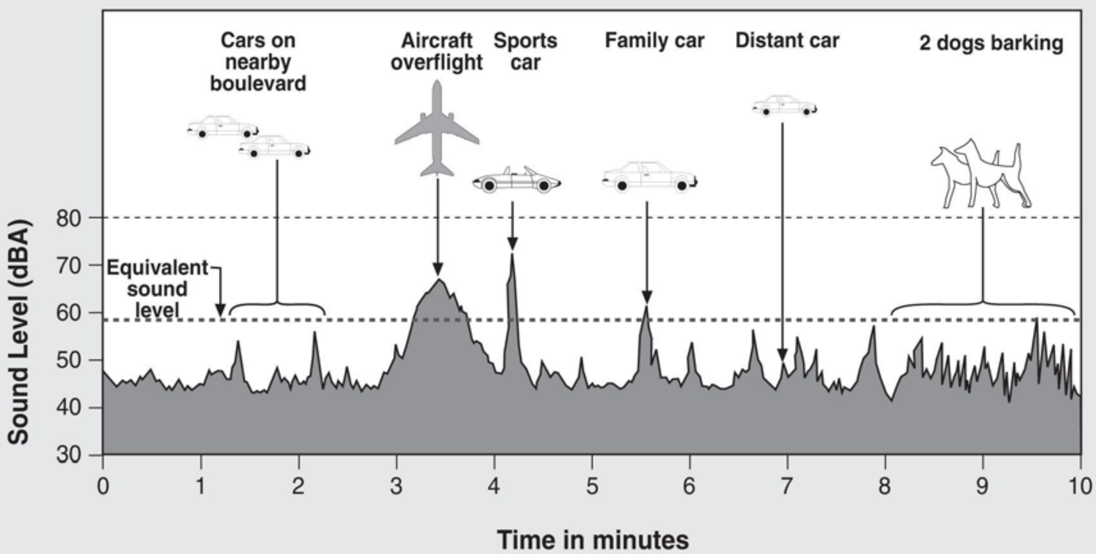
TABLE 1
Definitions of Common Acoustical Terms

Term	Definitions
Ambient noise level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the measured pressure to the reference pressure, which is 20 micropascals.
A-weighted sound pressure level (dBA)	The sound pressure level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Sound Level (L_{eq})	The L_{eq} integrates fluctuating sound levels over a period of time to express them as a steady-state sound level. As an example, if two sounds are measured and one sound has twice the energy but lasts half as long, the two sounds would be characterized as having the same equivalent sound level
Day–Night Level (L_{dn} or DNL)	The Day-Night level (L_{dn} or DNL) is a 24-hour average L_{eq} where 10 dBA is added to nighttime levels between 10 p.m. and 7 a.m. For a continuous source that emits the same noise level over a 24-hour period, the L_{dn} will be 6.4 dB greater than the L_{eq}.
Statistical noise level (L_n)	The noise level exceeded during n percent of the measurement period, where n is a number between 0 and 100 (for example, L_{50} is the level exceeded 50 percent of the time)

The measurement and description of environmental sound levels is not a simple task. Consider typical sounds in a suburban neighborhood on a normal or “quiet” afternoon. If a short time in history of those sounds is plotted on a graph, it would look very much like Figure 2. In Figure 2, the background, or residual sound level in the absence of any identifiable noise sources, is approximately 45 dB. During roughly three-quarters of the time, the sound level is 50 dB or less. The highest sound level, caused by a nearby sports car, is approximately 70 dB, while an aircraft generates a maximum sound level of about 68 dB. The following provides a discussion of how variable community noise is quantified.

Figure 2

NOISE METRICS—COMPARATIVE NOISE LEVELS



Source: *Protective Noise Levels, Condensed Version of EPA Levels Document,* United States Environmental Protection Agency, November 1978.

One obvious way of describing noise is to measure the maximum sound level (L_{max})—in the case of Figure 2, the nearby sports car at 70 dBA. The maximum sound level measurement does not account for the duration of the sound. For example, the aircraft in this case is not as loud as the sports car, but the aircraft sound lasts longer.

A-weighted sound levels typically are measured or presented as equivalent sound pressure level (L_{eq}), which is defined as the average noise level, on an equal energy basis for a stated period of time, and is commonly used to measure steady-state sound or noise that is usually dominant. Statistical methods are used to capture the dynamics of a changing acoustical environment. Statistical measurements are typically denoted by $L_{xx,}$ where xx represents the percentile of time the sound level is exceeded. The L_{90} is a measurement that represents the noise level that is exceeded during 90 percent of the measurement period. Similarly, the L_{10} represents the noise level exceeded for 10 percent of the measurement period.