aci Acoustical Consultants Inc.
5031-210 Street
Edmonton, Alberta, Canada T6M 0A8
Phone: (780) 414-6373, Fax: (780) 414-6376
www.aciacoustical.com

Environmental Noise Monitoring

For

Northwest Stoney Trail
in
Calgary, AB

Prepared for:
Alberta Transportation

Prepared by:
P. Froment, B.Sc., B.Ed.
aci Acoustical Consultants Inc.
Edmonton, Alberta

Reviewed by:
S. Bilawchuk, M.Sc., P.Eng.
aci Acoustical Consultants Inc.
Edmonton, Alberta
APEGGA Permit to Practice #P7735

aci Project #: 10-031
April 30, 2011

Executive Summary

aci Acoustical Consultants Inc., of Edmonton AB, was retained by Alberta Transportation (AT) to conduct a environmental noise monitorings along the northeast and northwest sections of Stoney Trail in Calgary, Alberta. The purpose of this work was to conduct 24-hour noise monitorings at a total of 25 locations along Stoney Trail to be used as a calibration tool for a computer noise model of the study area. This report pertains to the 16 noise monitoring locations along the northwest section of Stoney Trail. The site work was conducted for aci by P. Froment, B.Sc., B.Ed. under the supervision of S. Bilawchuk, M.Sc., P.Eng.

The results of the baseline noise monitoring indicated sound levels ranging from 48.3 – 67.6 dBA $L_{eq}24$[1]. At all locations, the noise climate was dominated by Stoney Trail or by local traffic on the adjacent roads. The monitoring indicated the noise climate was generally broadband in nature with no tonal components and no dominant stationary sources. Finally, it has been indicated by Alberta Transportation that additional noise monitoring are to be conducted along Stoney Trail between Country Hills Boulevard NW and the Bow River upon completion of the interchanges at Crowchild Trail and Nose Hill Drive.

[1] The term L_{eq} represents the energy equivalent sound level. This is a measure of the equivalent sound level for a specified period of time accounting for fluctuations.

Table of Contents

List of Tables

List of Figures

1.0 Introduction

aci Acoustical Consultants Inc., of Edmonton AB, was retained by Alberta Transportation (AT) to conduct a environmental noise monitorings along the northeast and northwest sections of Stoney Trail in Calgary, Alberta. The purpose of this work was to conduct 24-hour noise monitorings at a total of 25 locations along Stoney Trail to be used as a calibration tool for a computer noise model of the study area. This report pertains to the 16 noise monitoring locations along the northwest section of Stoney Trail. The site work was conducted for aci by P. Froment, B.Sc., B.Ed. under the supervision of S. Bilawchuk, M.Sc., P.Eng.

2.0 Location Description

The current sections of Stoney Trail span from 17 Avenue SE (on the east side of Calgary) to Highway 1 NW (on the west side of Calgary), as indicated in Figs. 1A & 1B. Throughout the entire span (approximately 45 km), Stoney Trail is a twinned road with at least 2-lanes in each direction and some sections with 3-lanes in each direction. The posted speed limit throughout is 100 km/hr. The current and future interchanges/intersections are as follows:

- 17 Avenue SE (currently a light-controlled intersection. Scheduled to be an interchange in the near future)
- 16 Avenue NE (grade separated interchange)
- McKnight Blvd NE (grade separated interchange)
- Airport Trail NE (grade separated interchange not yet operational)
- Country Hills Blvd NE (grade separated interchange)
- Deerfoot Trail (grade separated interchange)
- 11 Street NE (currently no intersection. Future grade separated interchange)
- Harvest Hills Blvd NE (currently a light-controlled intersection. Grade separated interchange under construction)
- 14 Street NW (currently no intersection. Future grade separated interchange)
- Beddington Trail NW (grade separated interchange)
- Shaganappi Trail NW (Fly-over with westbound Stoney Trail Access. Full interchange access under construction)
- Sarcee Trail NW (grade separated interchange)
- Country Hills Blvd NW (grade separated interchange)
- Crowchild Trail NW (currently a light-controlled intersection. Grade separated interchange under construction)
- Scenic Acres Link (grade separated interchange with modifications related to the Crowchild Trail Interchange)

- Nose Hill Drive (currently a light-controlled intersection. Scheduled to be an interchange in the near future)
- Highway 1 (grade separated interchange)

There will therefore be 18 grade separated interchanges within the study area for the future case assessment scenario[1].

The study area is primarily composed of single family detached residential areas with houses that back onto Stoney Trail. At some locations, there are houses that side or front onto Stoney Trail. There are also sections with multi-family 3 and 4 storey residential buildings adjacent to Stoney Trail. Finally, there are commercial areas and areas which have yet to be developed. In particular, there are no residential receptors adjacent to Stoney Trail between Airport Trail NE and 11 Street NE.

Topographically, the land in between Stoney Trail and the residential receptors for northeast Stoney Trail is relatively flat with no significant berms for shielding. Most of the residential lots have direct line-of-sight to Stoney Trail. For the northwest portion of Stoney Trail, there are sections with relatively flat ground in between the road and the adjacent houses and other sections with significant berms blocking the line-of-sight. In addition, for the northwest section, there are significant changes in elevation throughout. The vegetation in the areas between the residential locations and Stoney Trail consists mainly of field grasses with small sections of bushes and trees.

[1] The Interchange at Metis Trail has been ignored because it is too far from the NE and NW residential study areas to have an impact on the noise climate.

3.0 Measurement Methods

As part of the study a total of twenty-five (25) 24-hour environmental noise monitorings were conducted throughout the study area. Sixteen (16) of these locations were in the northwest portion of Stoney Trail. The noise monitoring locations, as indicated in Fig. 1, were selected based on their proximity to Stoney Trail and adjacent interchanges. A detailed description of each location for northwest Stoney Trail is provided below. Refer to Appendix I for a detailed description of the measurement equipment used, Appendix II for a description of the acoustical terminology, and Appendix III for a list of common noise sources. All noise measurement instrumentation was calibrated at the start of the measurements and then checked afterwards to ensure that there had been negligible calibration drift over the duration of the measurements.

Monitor 10

Noise Monitor 10 was located approximately 75 m south of Stoney Trail EB and 3.2 km west of Hwy. 2 NE as shown in Figs. 1 and 2. This placed the monitor approximately 10 m north of the house at 175 Coville Close. At this location, there was a partial fence and a slight berm between the monitor and Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 17:12 on Thursday October 21, 2010 and ran for 24-hours until 17:12 on Friday October 22, 2010.

Monitor 11

Noise Monitor 11 was located on public land approximately 95 m east of Stoney Trail NB and 950 m northeast of Beddington Trail NW as shown in Figs. 1 and 3. At this location, there was direct line-of-sight to Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 12:55 on Thursday July 29, 2010 and ran for 24-hours until 12:55 on Friday July 30, 2010.

Monitor 12

Noise Monitor 12 was located on public land approximately 120 m west of Stoney Trail SB and 1.2 km northeast of Beddington Trail NW as shown in Figs. 1 and 4. At this location, there was direct line-of-sight to Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 13:30 on Monday June 28, 2010 and ran for 24-hours until 13:30 on Tuesday June 29, 2010.

Monitor 13

Noise Monitor 13 was located approximately 110 m north of Stoney Trail WB and 500 m west of Beddington Trail NW as shown in Figs. 1 and 5. This put the monitor approximately 5 m southeast of the house at 129 Kincora Bay. At this location, there was not direct line-of-sight to Stoney Trail as there was a significant berm between the resident and Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 12:55 on Monday June 28, 2010 and ran for 24-hours until 12:55 on Tuesday June 29, 2010.

Monitor 14

Noise Monitor 14 was located approximately 85 m south Stoney Trail EB and 480 m east of Shaganappi Trail NW as shown in Figs. 1 and 6. This placed the monitor just east of a storm water retention pond. This location had direct line-of-sight to the road. Additionally, there was no significant vegetation between the monitor and the road. The noise monitor was started at 12:02 on Thursday September 9, 2010 and ran for 24-hours until 12:02 on Friday September 10, 2010.

Monitor 15

Noise Monitor 15 was located on the top of the embankment for the Sarcee Trail EB off-ramp. This placed the monitor approximately 120 m south of Stoney Trail EB and 110 m east of Sarcee Trail NW as shown in Figs. 1 and 7. At this location, there was direct line-of-sight to Stoney Trail. In addition, there was no significant vegetation between the monitor and the road. The noise monitor was started at 12:55 on Thursday July 29, 2010 and ran for 24-hours until 12:55 on Friday July 30, 2010.

Monitor 16

Noise Monitor 16 was located on public land approximately 210 m north of Stoney Trail WB and 560 m west of Shaganappi Trail NW as shown in Figs. 1 and 8. At this location, there was direct line-of-sight to Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 12:25 on Monday June 28, 2010 and ran for 24-hours until 12:25 on Tuesday June 29, 2010.

Monitor 17

Noise Monitor 17 was located on public land approximately 65 m south of Stoney Trail EB and 840 m west of Sarcee Trail NW as shown in Figs. 1 and 9. At this location the monitor was placed at the foot of a slight berm and therefore did not have direct line-of-sight to Stoney Trail. The noise monitor was started at 11:30 on Thursday September 9, 2010 and ran for 24-hours until 11:30 on Friday September 10, 2010.

Monitor 18

Noise Monitor 18 was located on public land approximately 30 m southeast of Stoney Trail NB and 650 m north of Country Hills Blvd NW as shown in Figs. 1 and 10. At this location, there was direct line-of-sight to Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 11:45 on Thursday July 29, 2010 and ran for 24-hours until 11:45 on Friday July 30, 2010.

Monitor 19

Noise Monitor 19 was located on public land approximately 250 m east of Stoney Trail NB and 300 m south of Country Hills Blvd NW as shown in Figs. 1 and 11. There was not direct line-of-sight to Stoney Trail because of a significant berm between the monitor and Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 11:05 on Thursday July 29, 2010 and ran for 24-hours until 11:05 on Friday July 30, 2010.

Monitor 20

Noise Monitor 20 was located on public land approximately 85 m southeast of Stoney Trail EB and 615 m northeast of Crowchild Trail NW as shown in Figs. 1 and 12. At this location the monitor was placed at the foot of a small hill and therefore did not have direct line-of-sight to Stoney Trail. The noise monitor was started at 16:40 on Thursday October 21, 2010 and ran for 24-hours until 16:40 on Friday October 22, 2010.

Monitor 21

Noise Monitor 21 was located on public land approximately 175 m northwest of Stoney Trail SB and 640 m southwest of Country Hills Blvd NW as shown in Figs. 1 and 13. At this location, there was direct line-of-sight to Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 11:35 on Monday June 28, 2010 and ran for 24-hours until 11:35 on Tuesday June 29, 2010.

Monitor 22

Noise Monitor 22 was located on public land approximately 200 m west of Stoney Trail SB and 150 m north of Tuscany Blvd NW shown in Figs. 1 and 14. At this location, there was direct line-of-sight to Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 16:15 on Thursday October 21, 2010 and ran for 24-hours until 16:15 on Friday October 22, 2010.

Monitor 23

Noise Monitor 23 was located on public land approximately 80 m east of Stoney Trail NB and 600 m north of Scenic Acres Link NW as shown in Figs. 1 and 15. At this location, there was a slight berm between the monitor and Stoney Trail which blocked the line-of-sight. There was no significant vegetation between the monitor and the road. The noise monitor was started at 10:40 on Thursday September 9, 2010 and ran for 24-hours until 10:40 on Friday September 10, 2010.

Monitor 24

Noise Monitor 24 was located on public land approximately 130 m east of Stoney Trail NB and 660 m north of Nose Hill Drive NW as shown in Figs. 1 and 16. There was not direct line-of-sight to Stoney Trail due to the significant berm between the monitor and Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 11:00 on Monday June 28, 2010 and ran for 24-hours until 11:00 on Tuesday June 29, 2010.

Monitor 25

Noise Monitor 25 was located on public land approximately 220 m west of Stoney Trail SB and 590 m north of Hwy. 1 NW as shown in Figs. 1 and 17. At this location, there was direct line-of-sight to Stoney Trail. There was no significant vegetation between the monitor and the road. The noise monitor was started at 10:20 on Monday June 28, 2010 and ran for 24-hours until 10:20 on Tuesday June 29, 2010.

4.0 Results and Discussion

4.1. Noise Monitoring

The results obtained from the environmental noise monitorings are shown in Table 1 and Figs. 18 – 49 (broadband A-weighted L_{eq} sound levels and 1/3 octave band L_{eq} sound levels provided). It should be noted that the data have been adjusted by the removal of non-typical noise events such as loud aircraft flyovers (the noise modeling does not account for aircraft), pedestrians making noise nearby, abnormally loud vehicle passages, etc.

Table 1. Baseline Noise Monitoring Results

Monitor	L_{eq}24 (dBA)	L_{eq}Day (dBA)	L_{eq}Night (dBA)
M10	56.5	57.4	54.5
M11	58.8	59.6	56.8
M12	57.0	58.4	52.7
M13	53.3	54.7	48.8
M14	60.1	61.5	55.6
M15	59.9	61.2	56.1
M16	51.6	52.9	47.6
M17	54.1	55.5	50.0
M18	67.6	69.0	63.3
M19	48.3	48.8	47.2
M20	51.9	52.7	50.2
M21	53.0	54.3	48.9
M22	50.2	51.2	47.8
M23	52.7	54.0	48.7
M24	49.1	49.7	48.1
M25	51.9	53.1	48.4

Monitor 10 was dominated by traffic along Stoney Trail. Lower noise levels at this location can be attributed to the monitor being placed in the backyard of a residential location (i.e. further away from the road, small amount of shielding provided by the fence). A sharp rise in the 25 Hz 1/3 octave band can be seen in Fig. 46. After reviewing the associated audio recording it was concluded that the tone could be attributed to unidentified low frequency machinery (not related to road noise) operating in the vicinity of the monitor. This tone did not influence the broadband A-weighted sound levels.

The noise climate at Monitors 11, 12, 14, 16 – 25 was determined entirely by traffic along Stoney Trail. Again, this was expected due to the current traffic volumes on Stoney Trail and the absence of any other major noise sources. The higher noise levels at Monitor 18 were a result of its proximity (30 m) and direct line-of-sight to Stoney Trail. Lower levels at other Monitors (those below 55 dBA) can be attributed to their increased distance from Stoney Trail and/or shielding from berms.

Monitor 25 has two minor spikes in the 5 kHz and 8 kHz 1/3 octave bands. These spikes are not related to road noise. Again, this did not influence the broadband A-weighted sound levels.

Monitor 13 was also dominated by traffic along Stoney Trail. Lower noise levels at this location despite its proximity to Stoney Trail, can be attributed to the monitor being placed in the backyard of a residential location in addition to it being shielded by a small hill as seen in Fig.14.

The noise climate at Monitor 15 was determined by traffic along Sarcee Trail in combination with Stoney Trail. The noise monitor at this location was elevated and thus had direct line-of-sight to both roadways.

Lastly, Monitor 19 resulted in the lowest measured noise levels due to the significant shielding provided by the large hill found between the monitor and Stoney Trail. At this location Stoney Trail was again the dominant source but subjectively it was substantially quieter than at other monitoring locations.

At all locations, the resultant 1/3 octave band L_{eq} sound levels were very similar. All locations show the typical trend of low frequency noise (near 63 – 80 Hz) resulting from engines and exhaust, mid-high frequency noise (near 1,000 Hz) resulting from tire noise. These results confirm that the noise levels being measured by the noise monitors were largely attributed to Stoney Trail in addition to the other major roadways.

4.2. Weather Conditions

Subjectively, the weather conditions for Monitors 12, 13, 16, 21, 24 and 25 to start were sunny with a light south wind. The wind remained calm while shifting from various directions until the early morning when it increased for approximately 3 hours. By the end of the monitoring the weather was sunny with a light east wind. The weather for Monitors 15, 18 and 19 started with an overcast sky and a calm west wind. The wind periodically increased but remained predominantly from the west for the entire monitoring period. The weather conditions for Monitors 14, 17 and 23 were overcast with light wind from the west. The weather remained from the west-northwest throughout the entire monitoring period for these locations. The weather conditions for Monitors 10, 20 and 22 were partially cloudy to start with a light northwest wind. The wind shifted from various directions but remained predominantly from the north. There was partial sun and calm conditions the following afternoon. Weather data for the duration of the environmental noise monitorings is presented in Appendix IV.

5.0 Conclusion

The results of the baseline noise monitoring indicated sound levels ranging from 48.3 – 67.6 dBA L_{eq}24. At all locations, the noise climate was dominated by Stoney Trail or by local traffic on the adjacent roads. The monitoring indicated the noise climate was generally broadband in nature with no tonal components and no dominant stationary sources. Finally, it has been indicated by Alberta Transportation that additional noise monitoring are to be conducted along Stoney Trail between Country Hills Boulevard NW and the Bow River upon completion of the interchanges at Crowchild Trail and Nose Hill Drive.

6.0 References

- International Organization for Standardization (ISO), *Standard 1996-1, Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures, 2003*, Geneva Switzerland.
- International Organization for Standardization (ISO), *Standard 9613-1, Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of absorption of sound by the atmosphere, 1993*, Geneva Switzerland.
- International Organization for Standardization (ISO), *Standard 9613-2, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, 1996*, Geneva Switzerland.

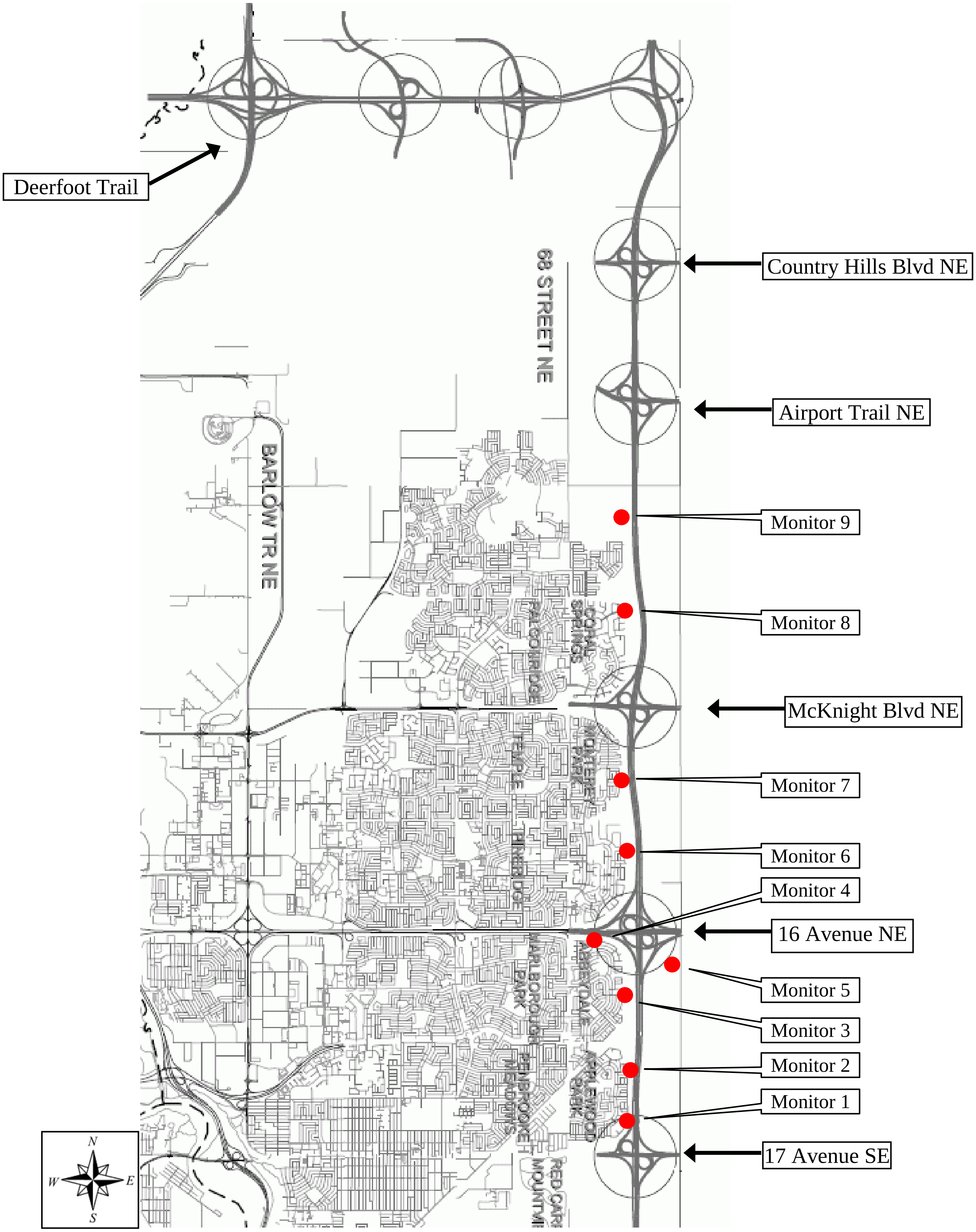

Figure 1A. Stoney Trail Northeast

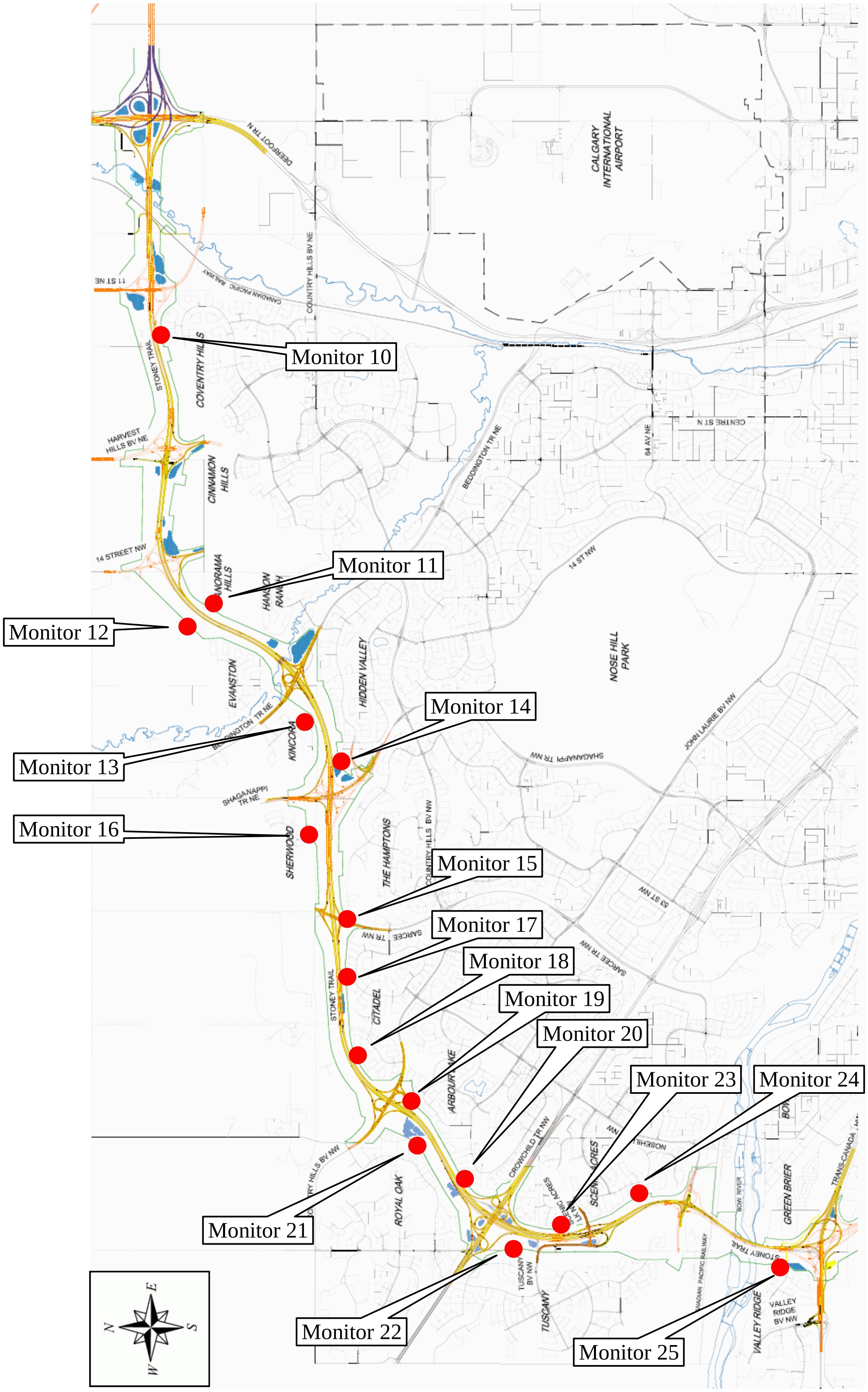

Figure 1B. Stoney Trail Northwest

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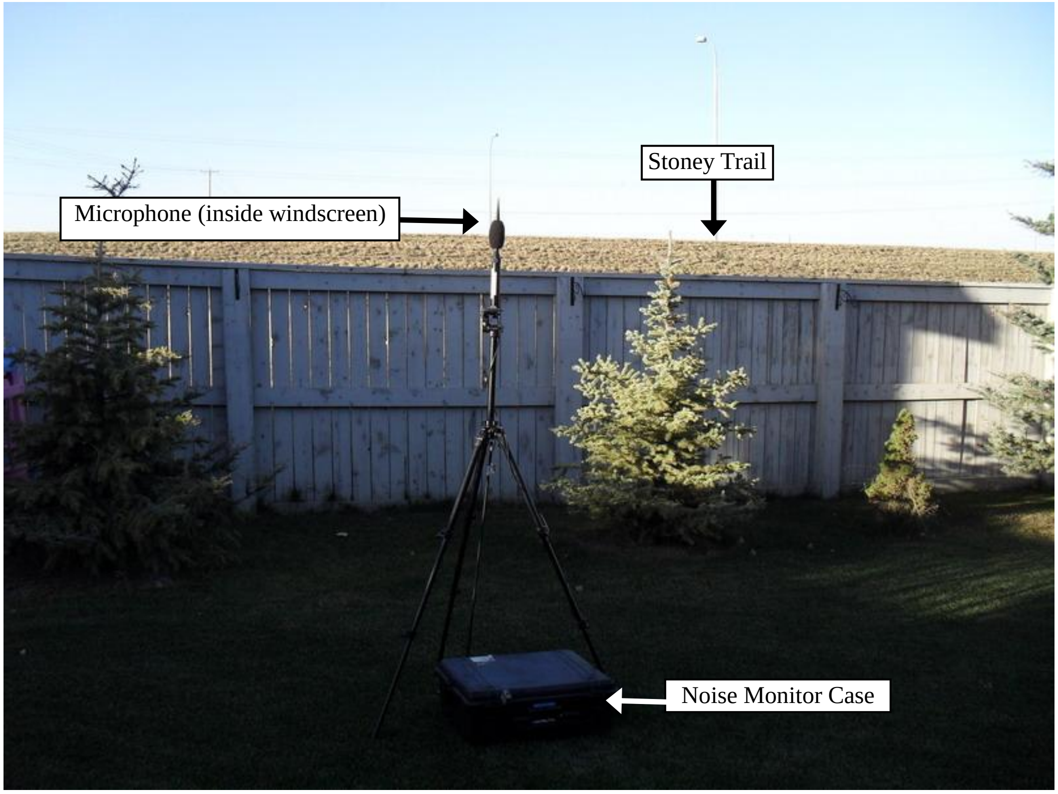

Figure 2. Noise Monitor at Location 10

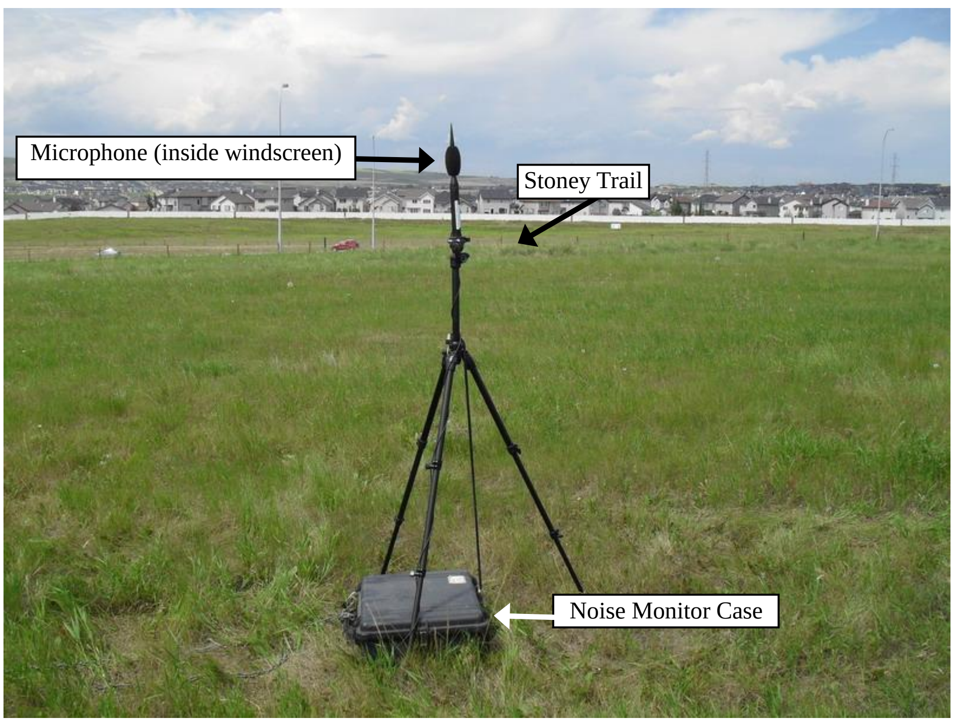

Figure 3. Noise Monitor at Location 11

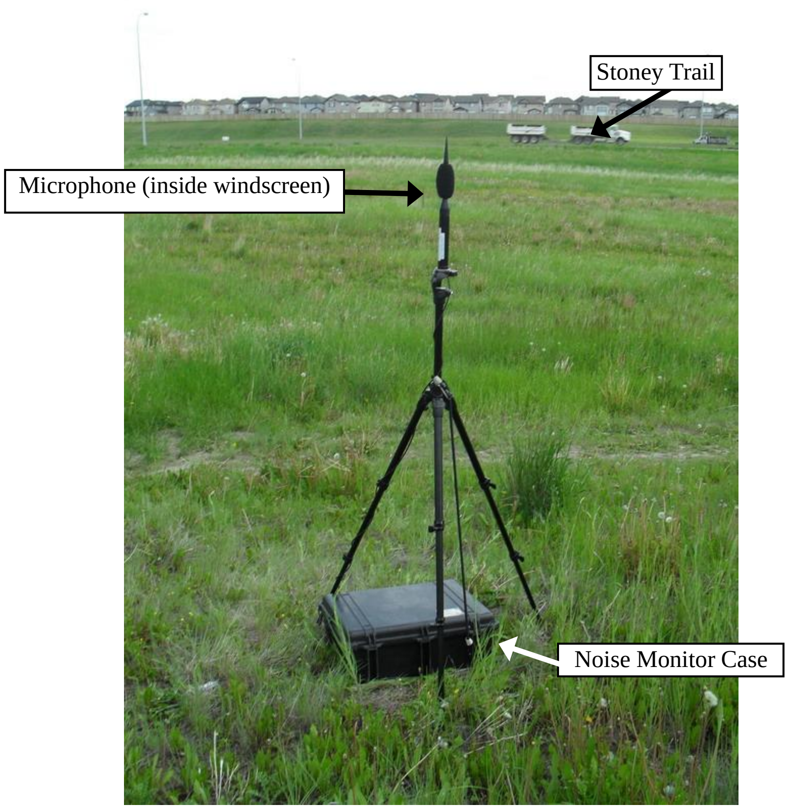

Figure 4. Noise Monitor at Location 12

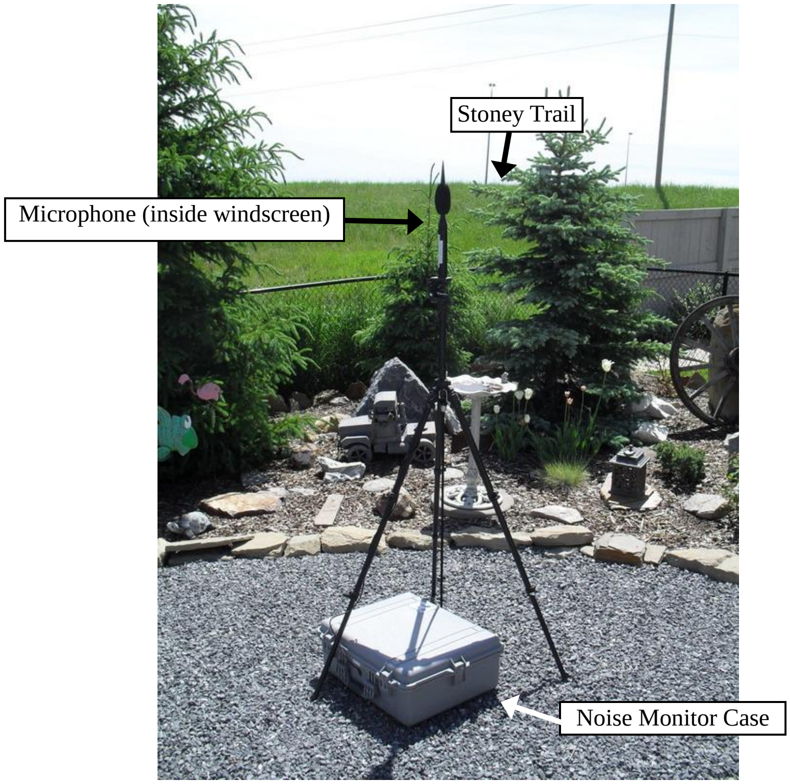

Figure 5. Noise Monitor at Location 13

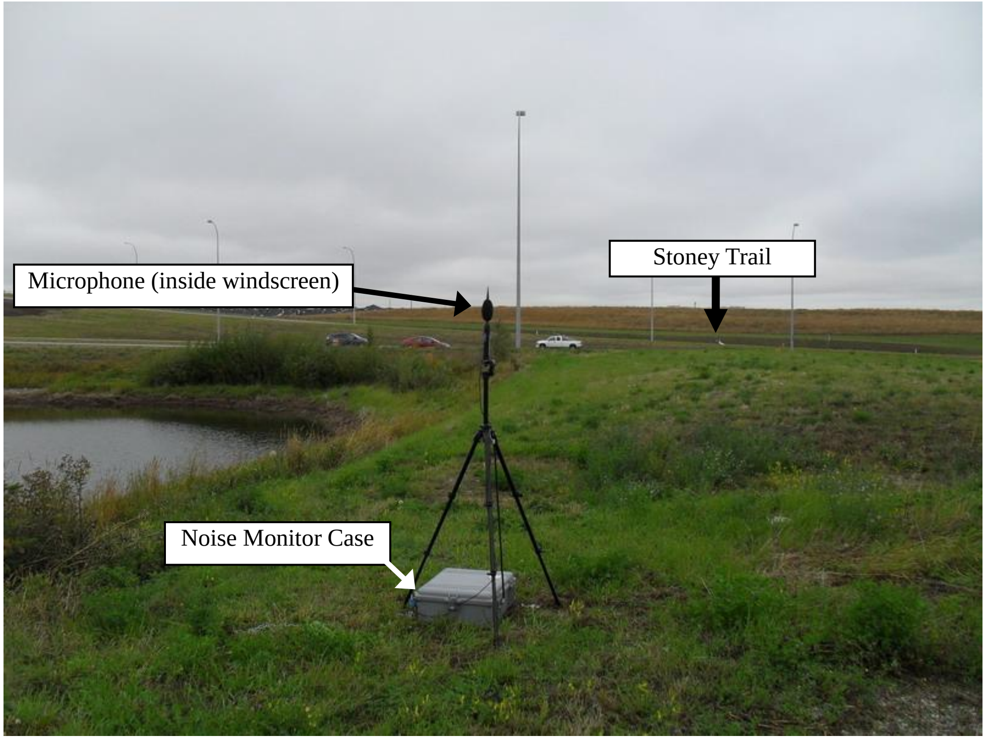

Figure 6. Noise Monitor at Location 14

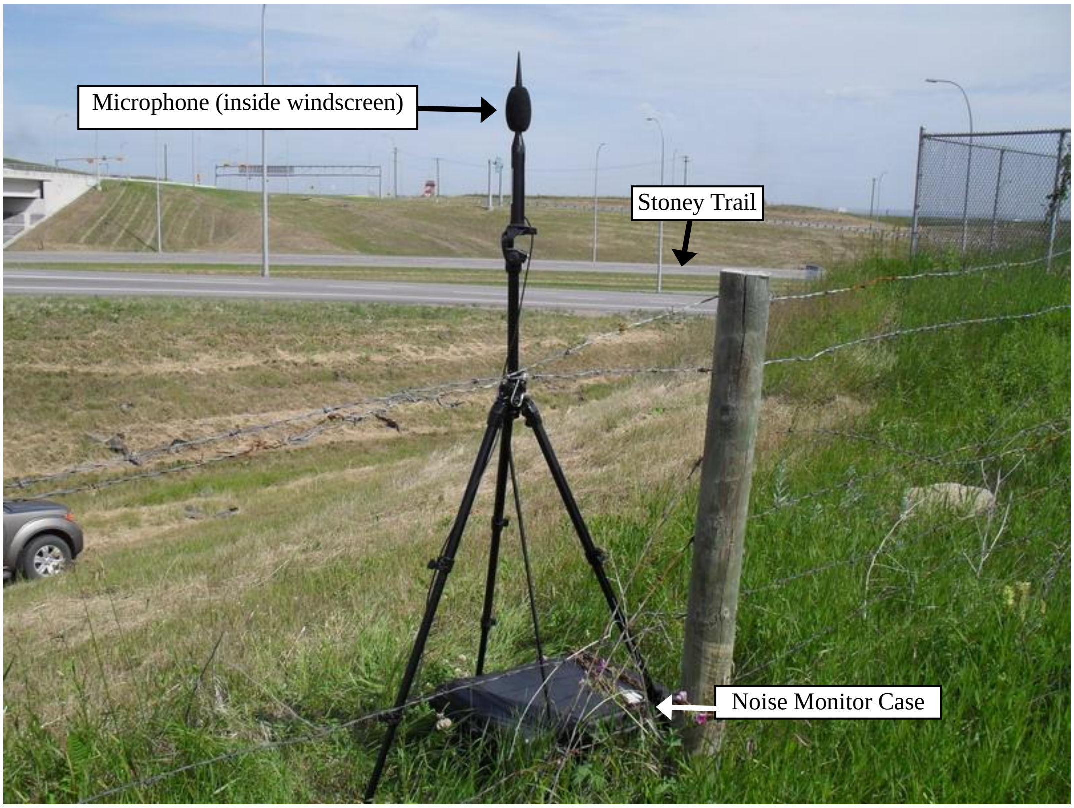

Figure 7. Noise Monitor at Location 15

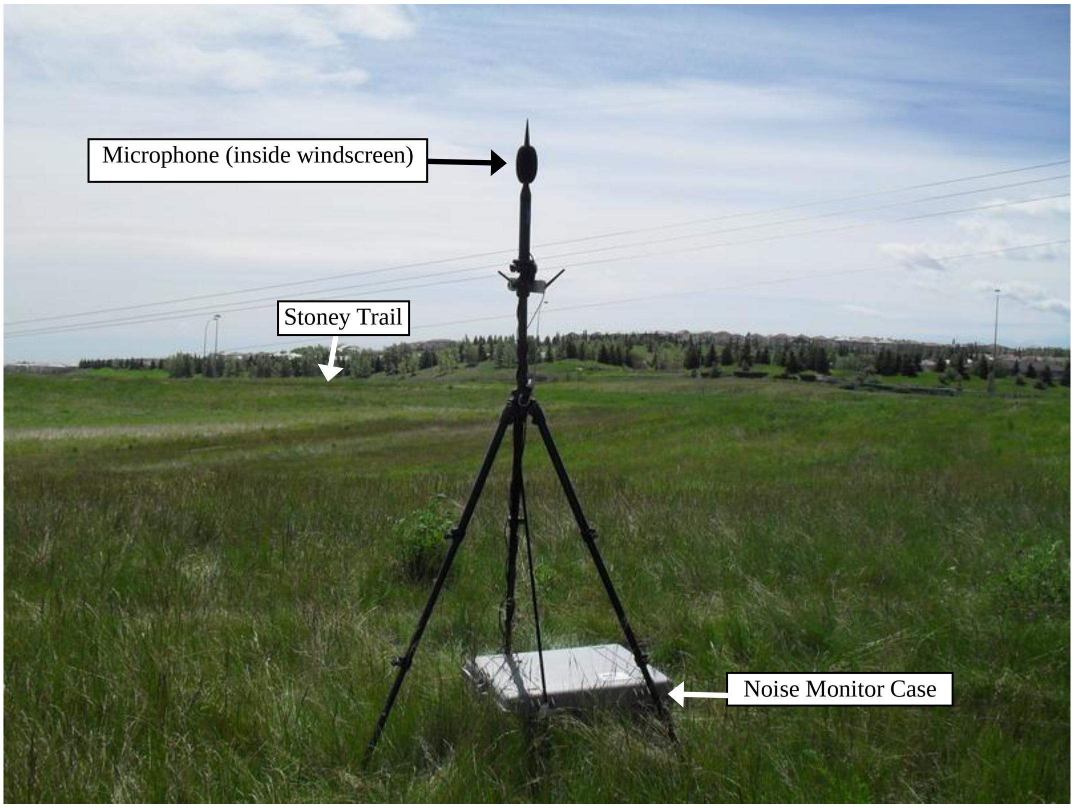

Figure 8. Noise Monitor at Location 16

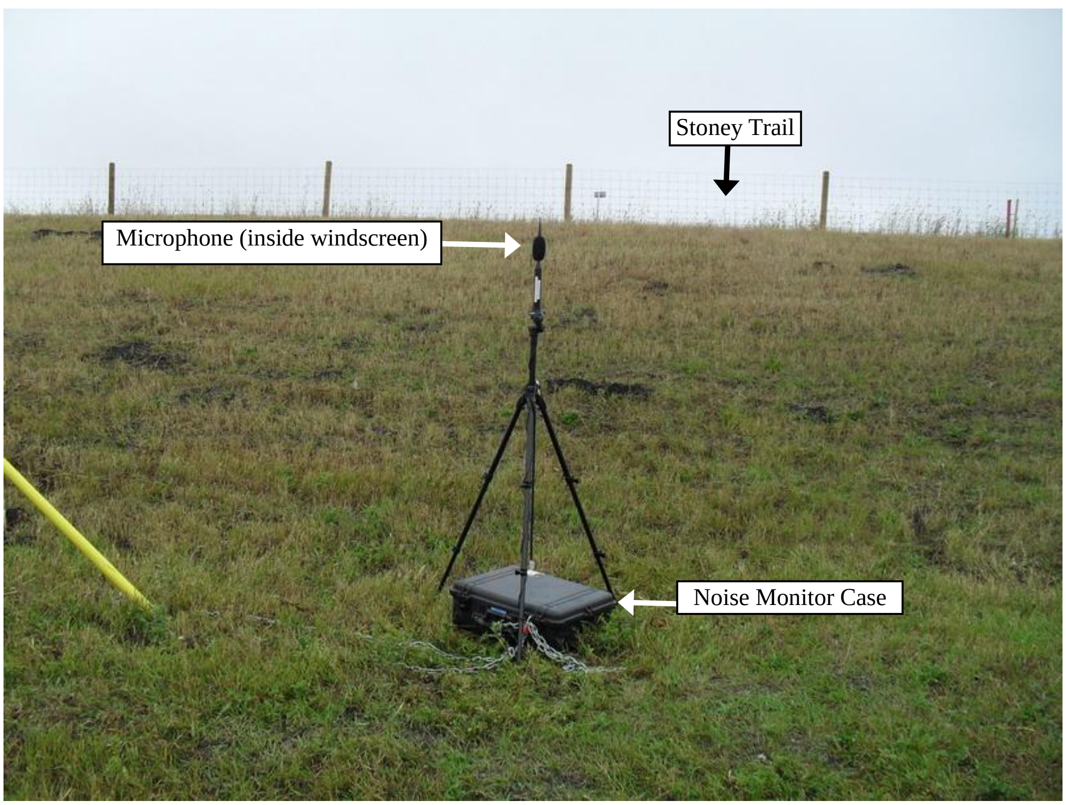

Figure 9. Noise Monitor at Location 17

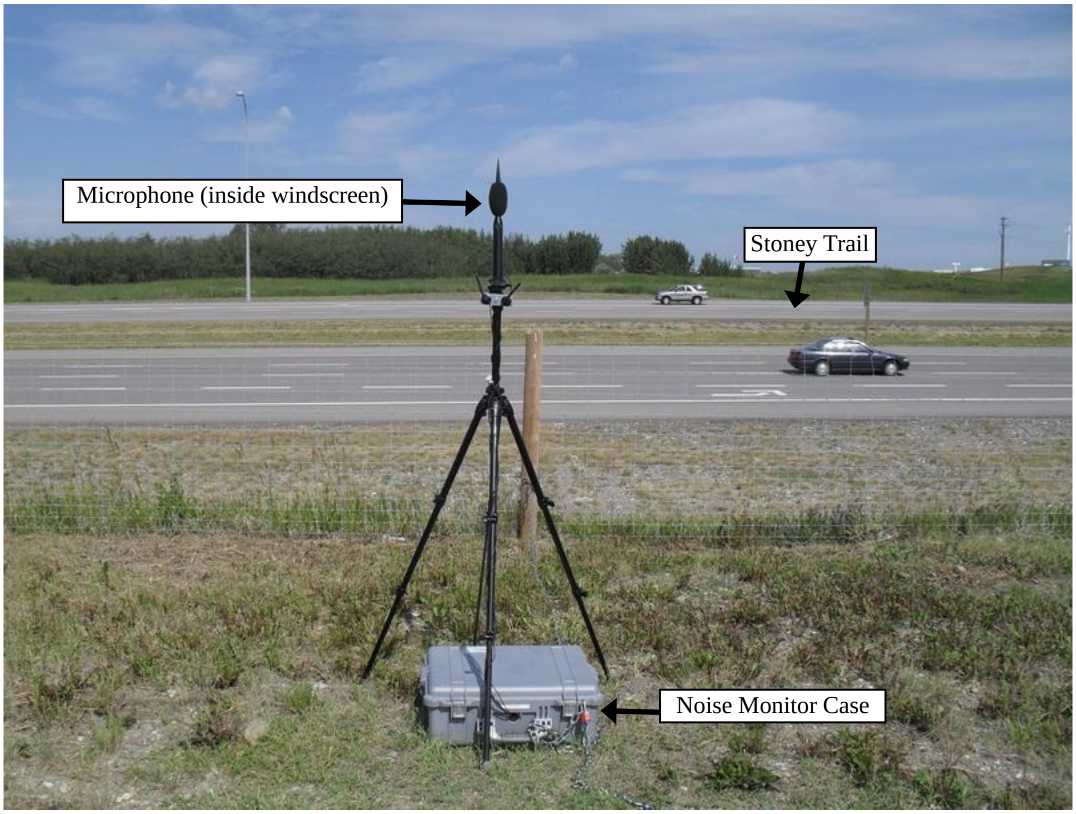

Figure 10. Noise Monitor at Location 18

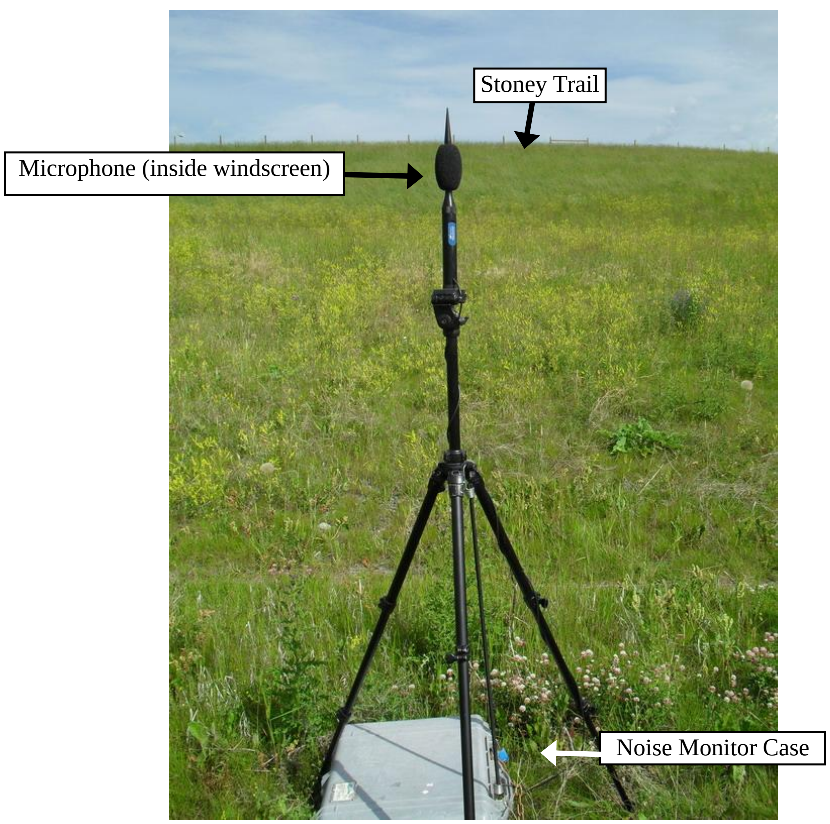

Figure 11. Noise Monitor at Location 19

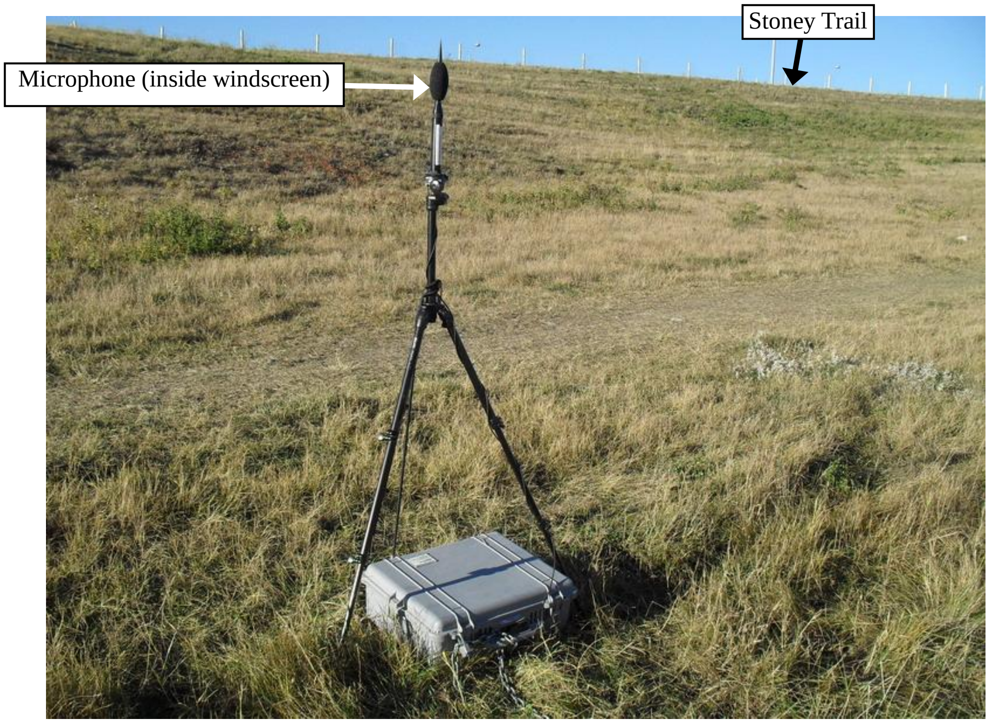

Figure 12. Noise Monitor at Location 20

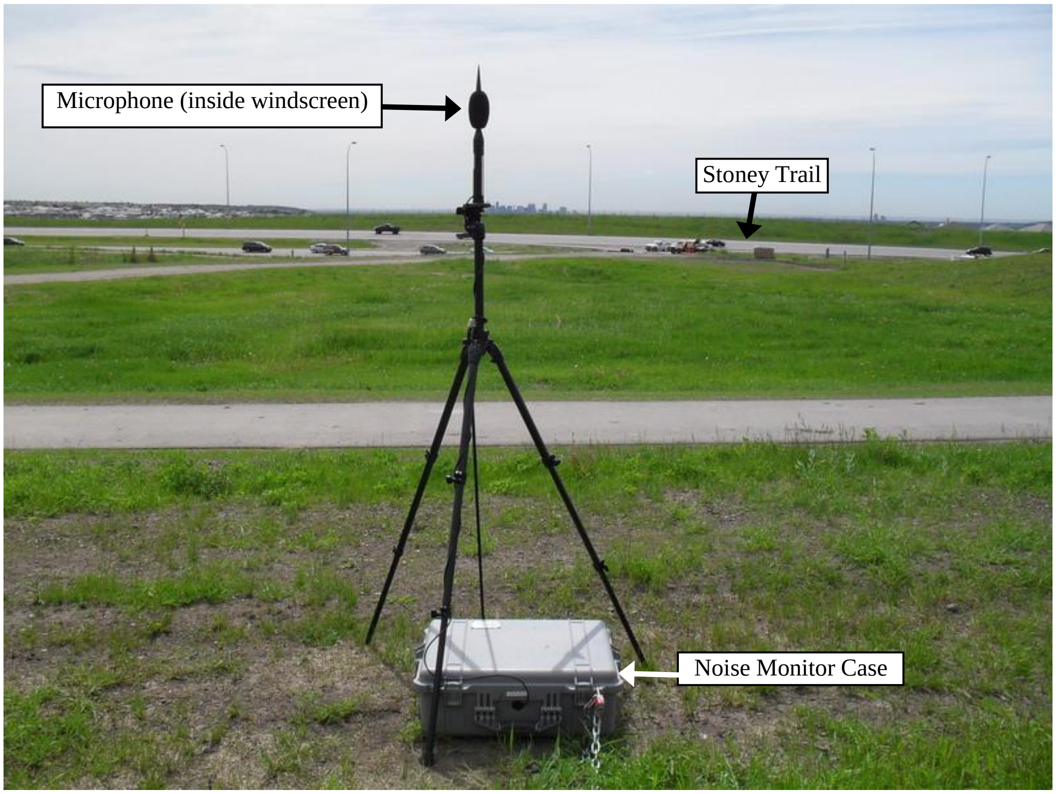

Figure 13. Noise Monitor at Location 21

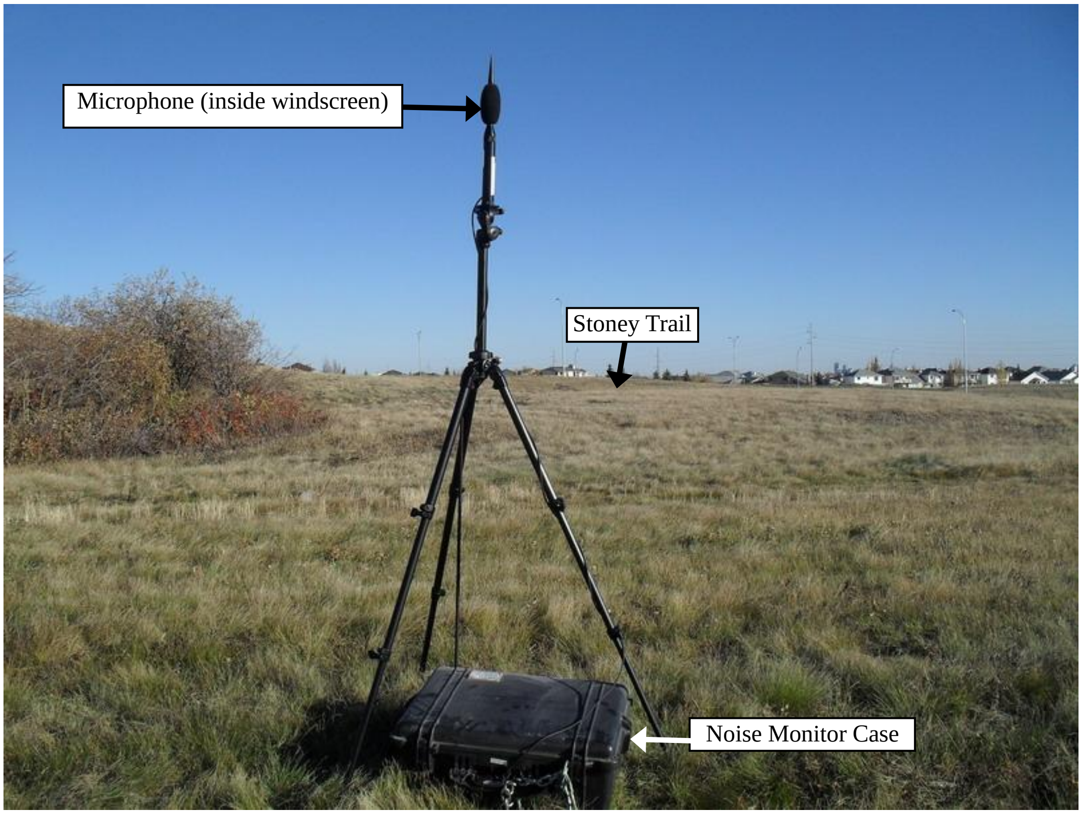

Figure 14. Noise Monitor at Location 22

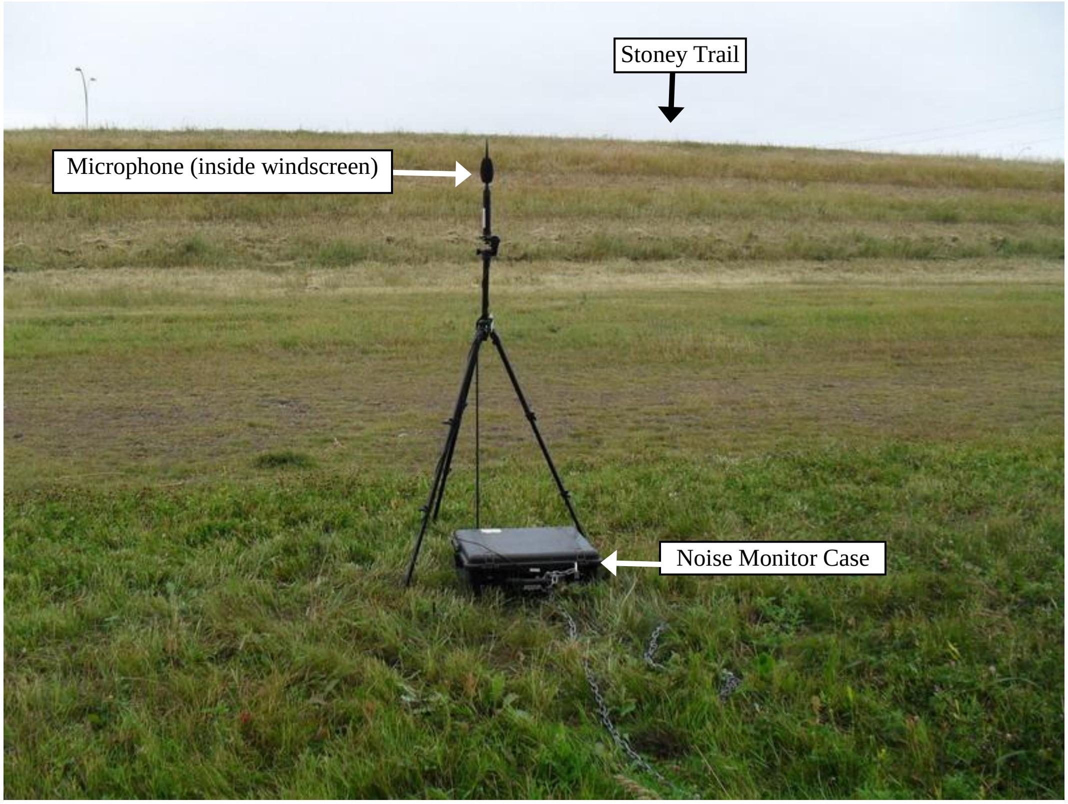

Figure 15. Noise Monitor at Location 23

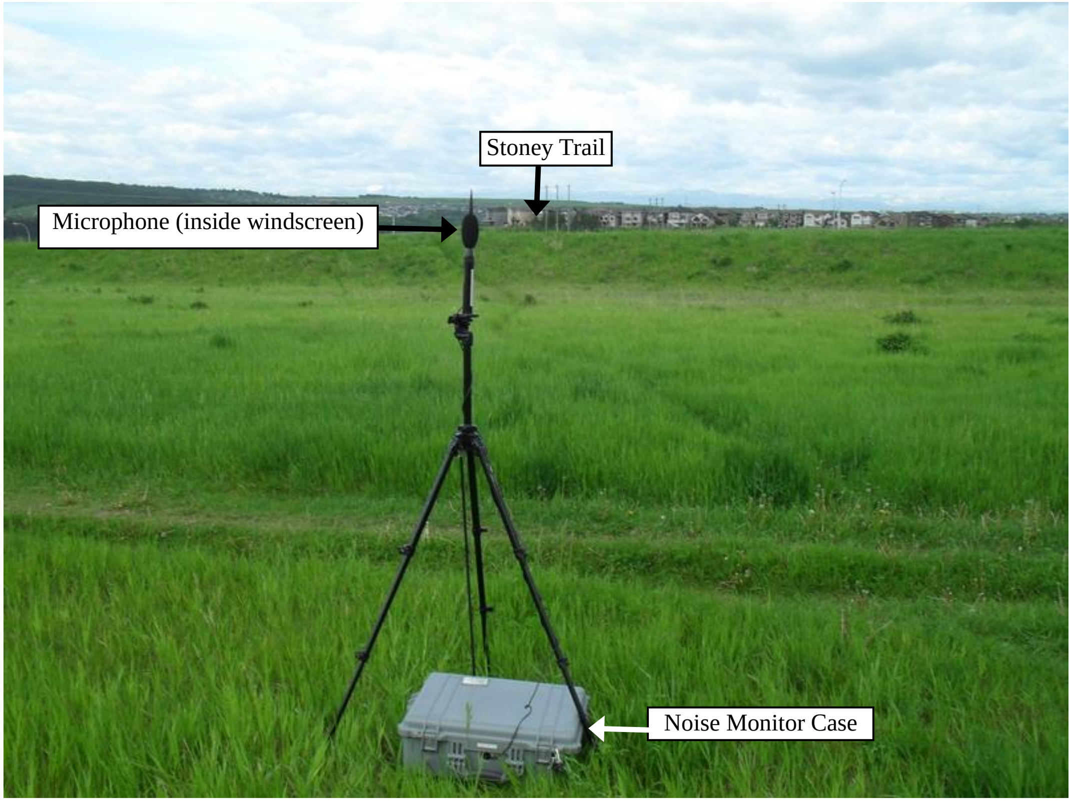

Figure 16. Noise Monitor at Location 24

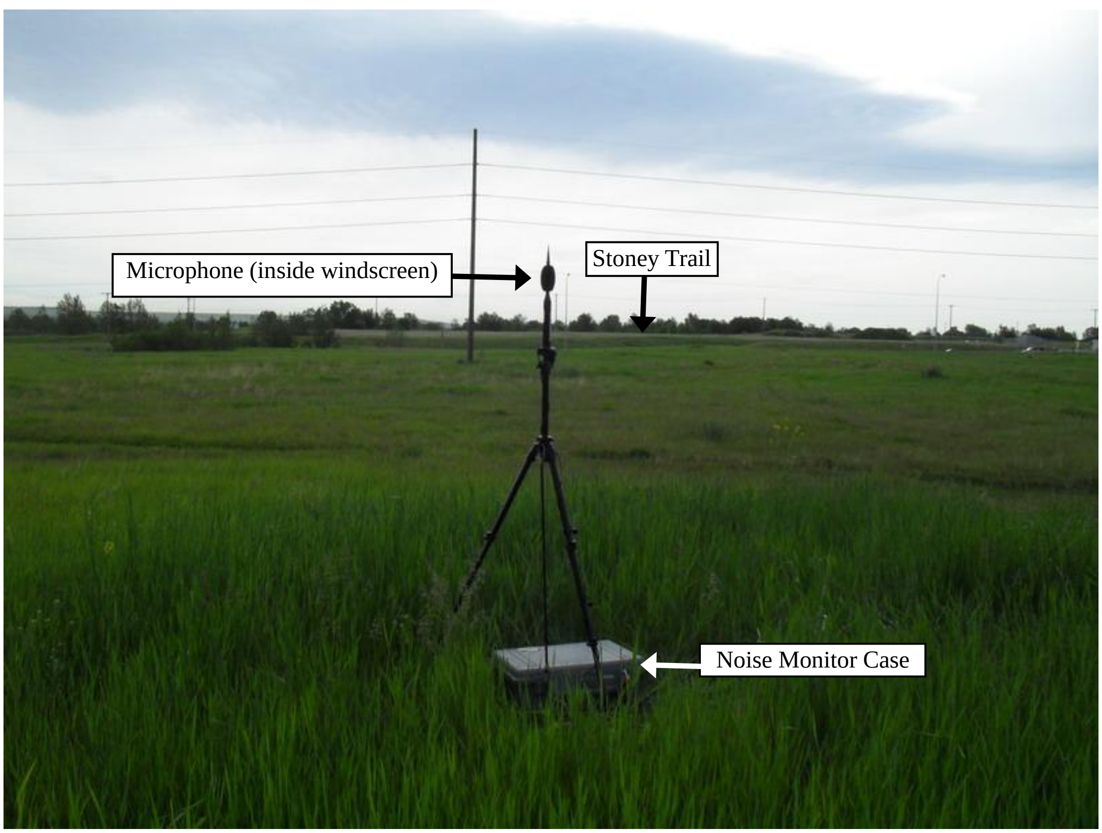

Figure 17. Noise Monitor at Location 25

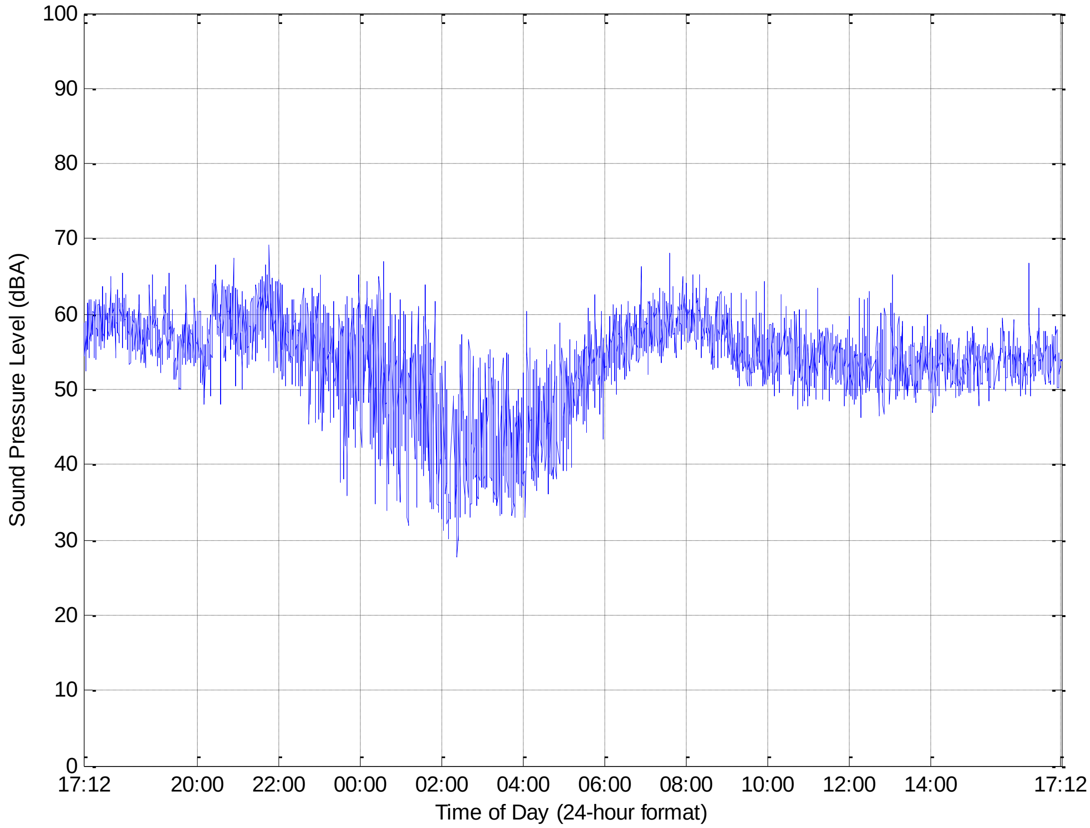

Figure 18. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 10

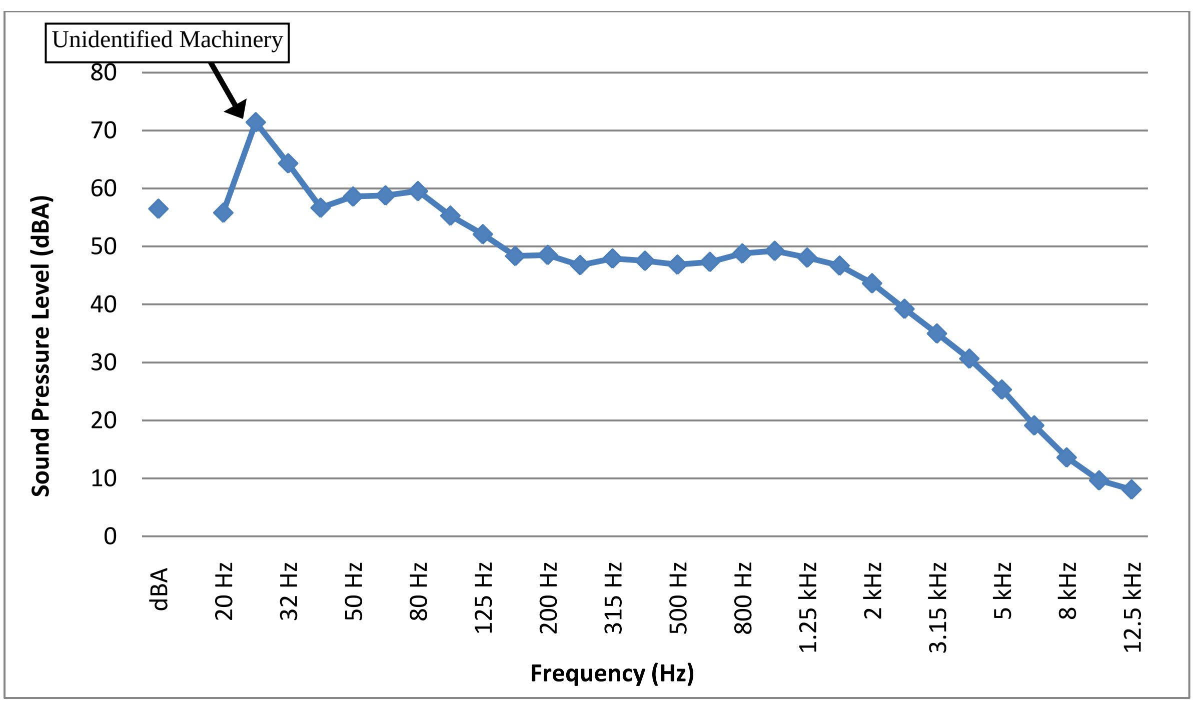

Figure 19. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 10

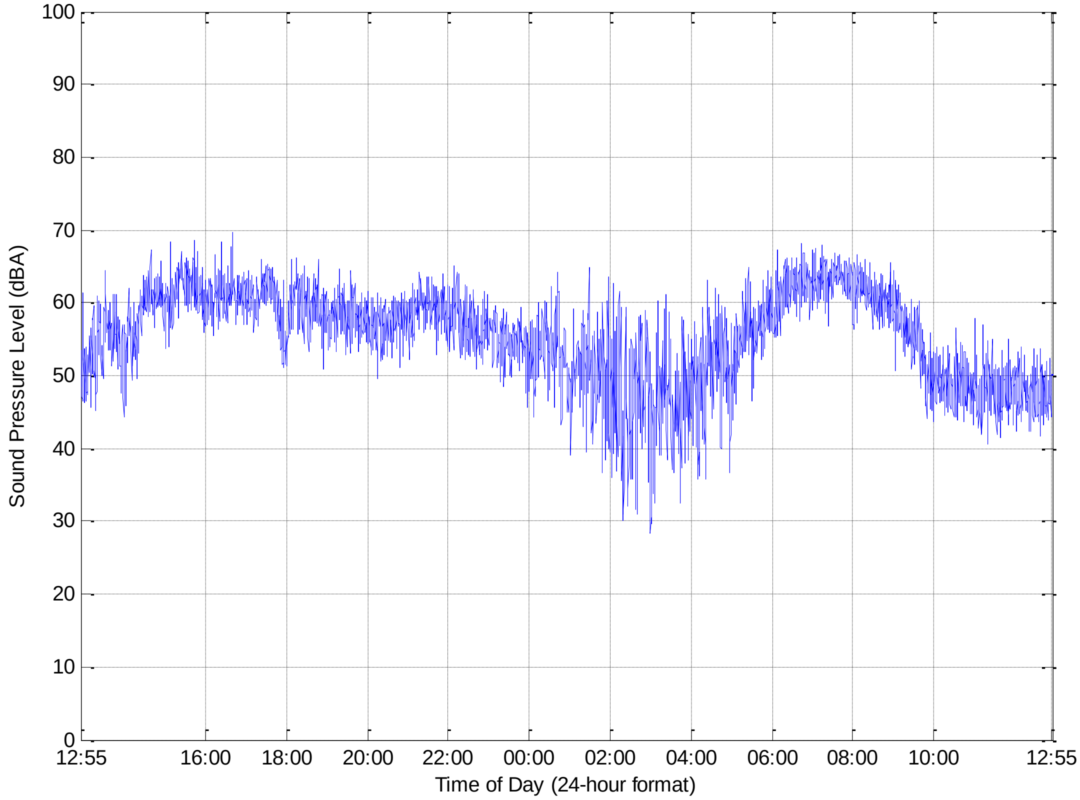

Figure 20. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 11

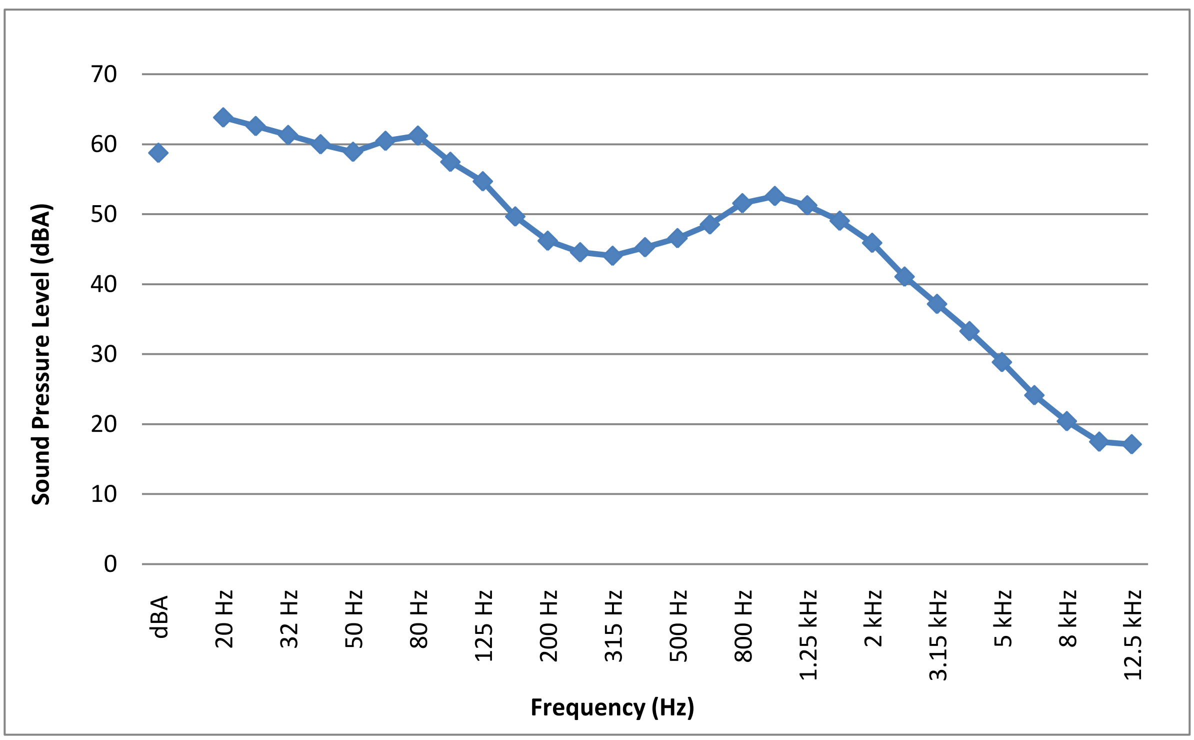

Figure 21. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 11

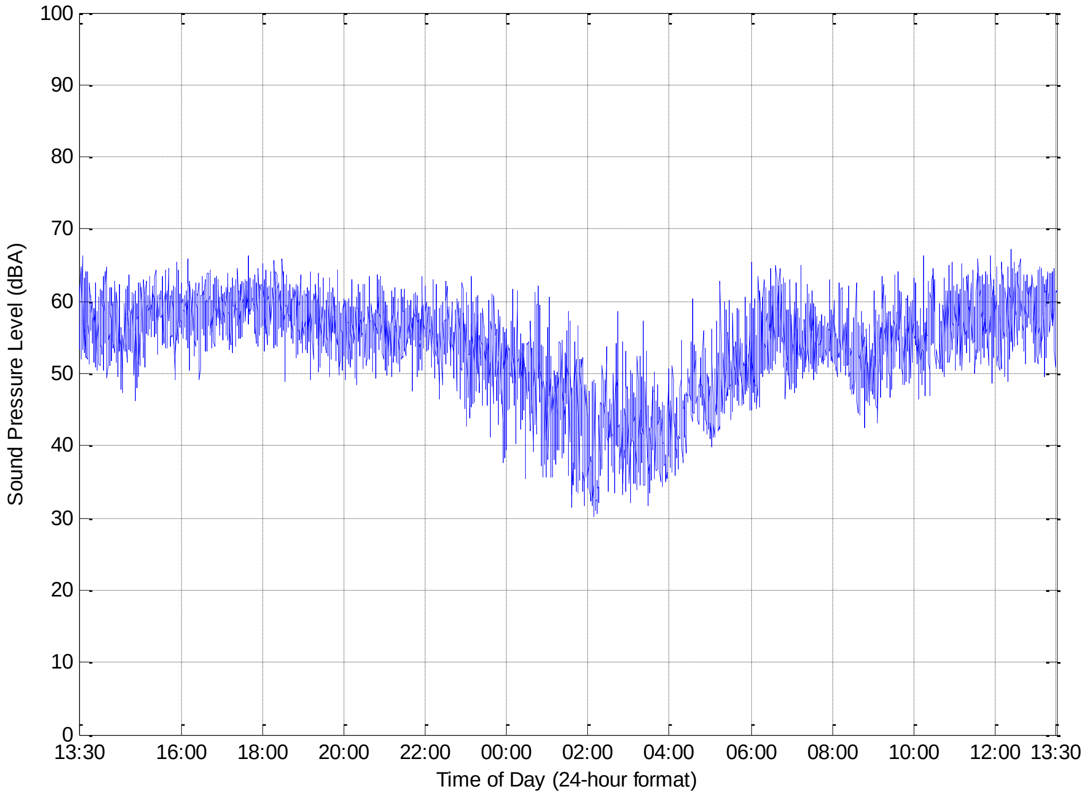

Figure 22. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 12

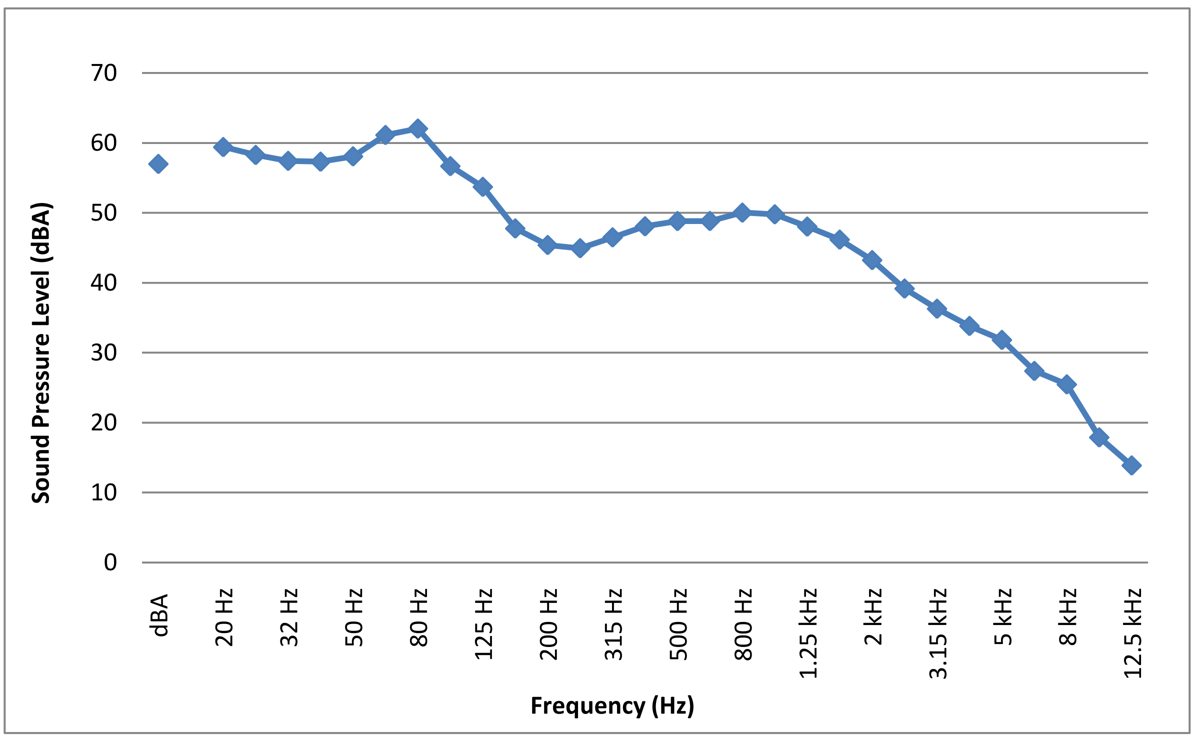

Figure 23. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 12

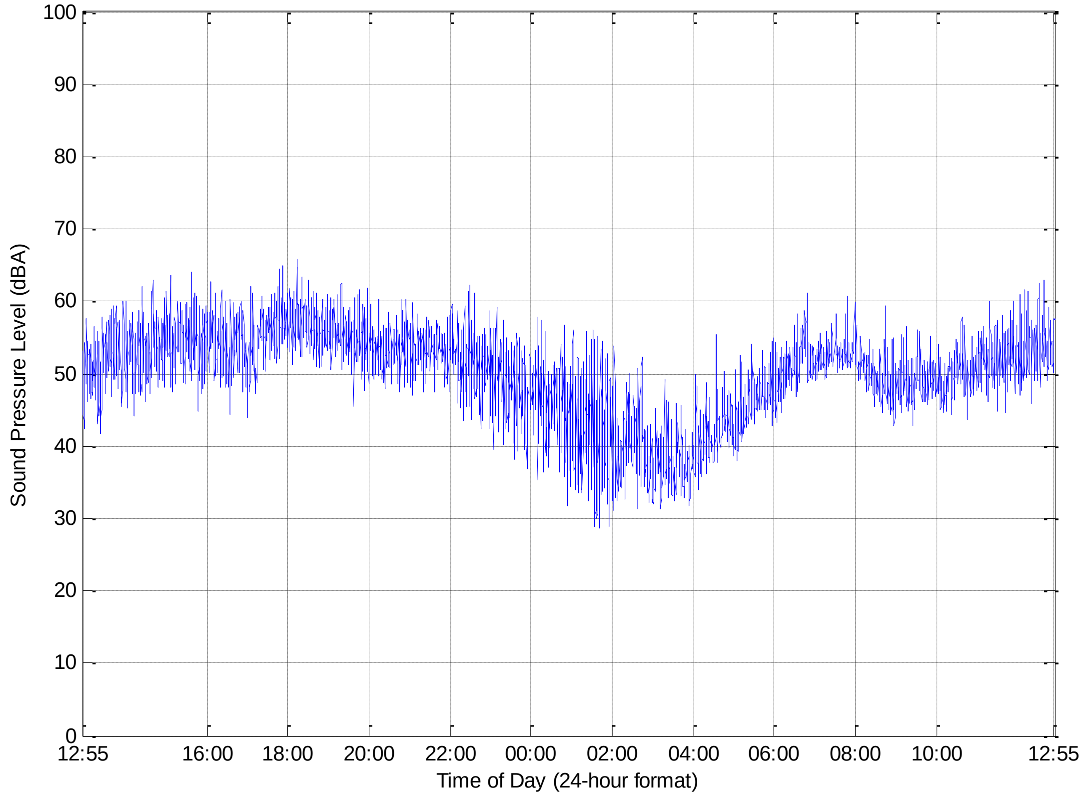

Figure 24. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 13

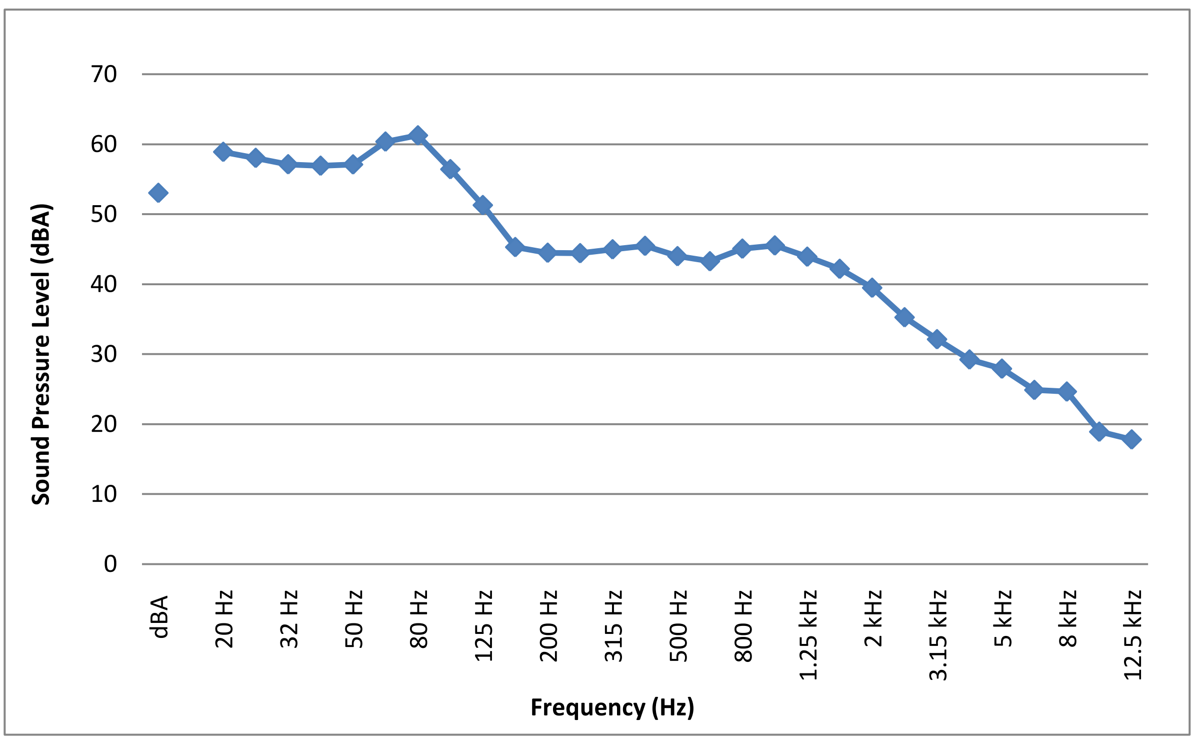

Figure 25. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 13

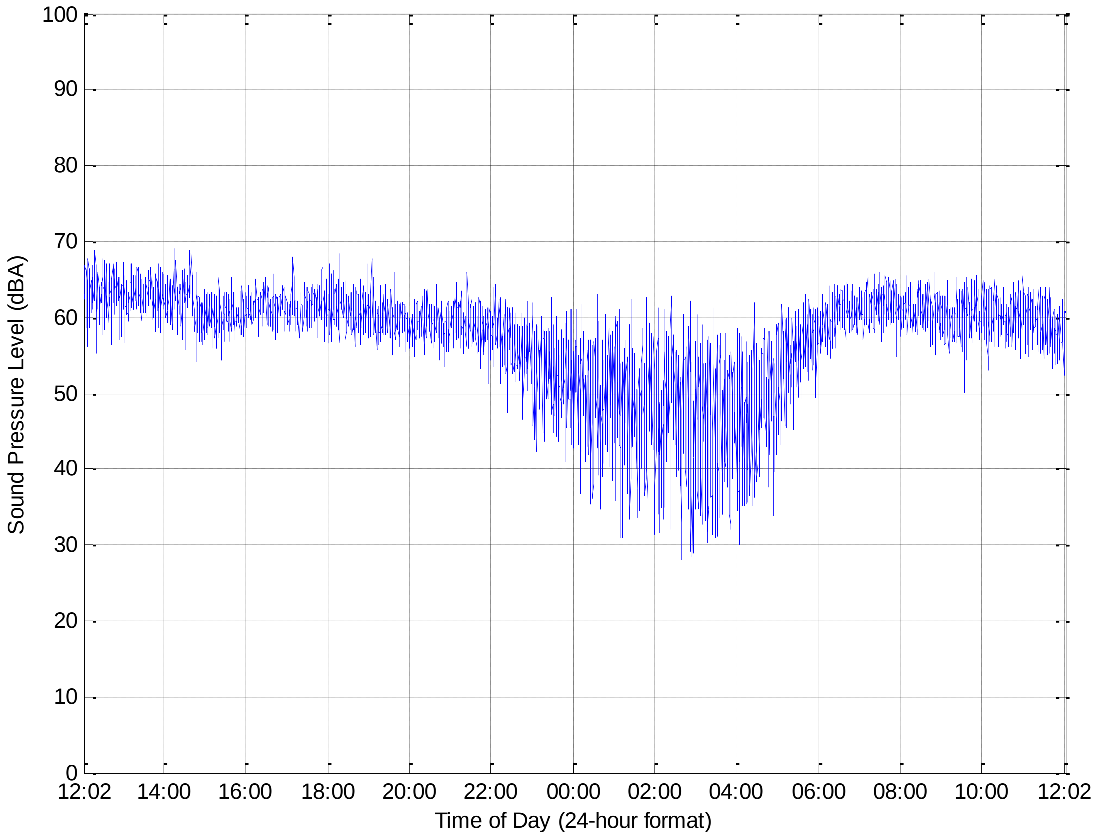

Figure 26. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 14

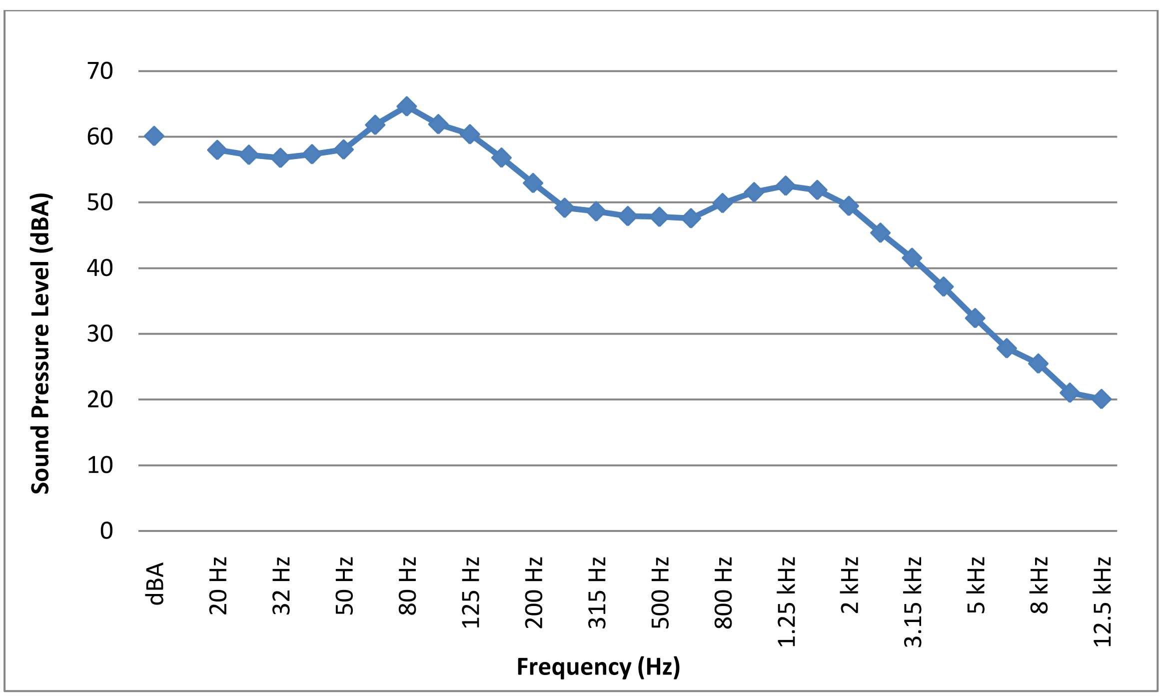

Figure 27. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 14

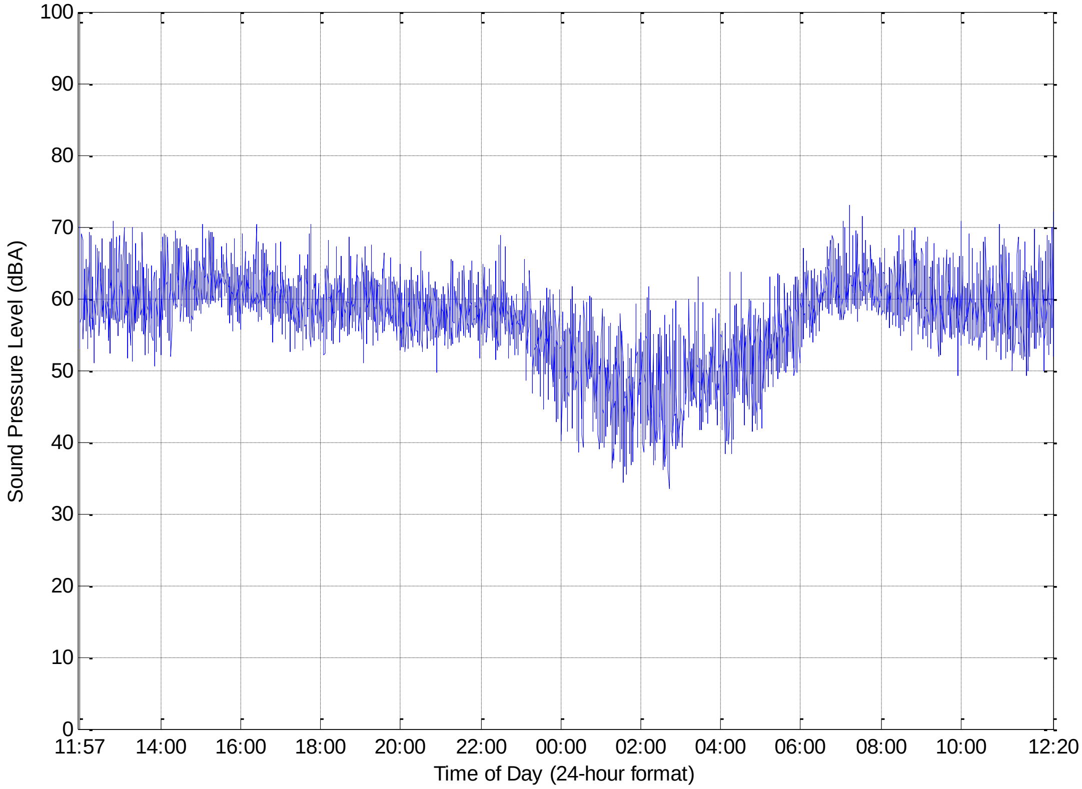

Figure 28. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 15

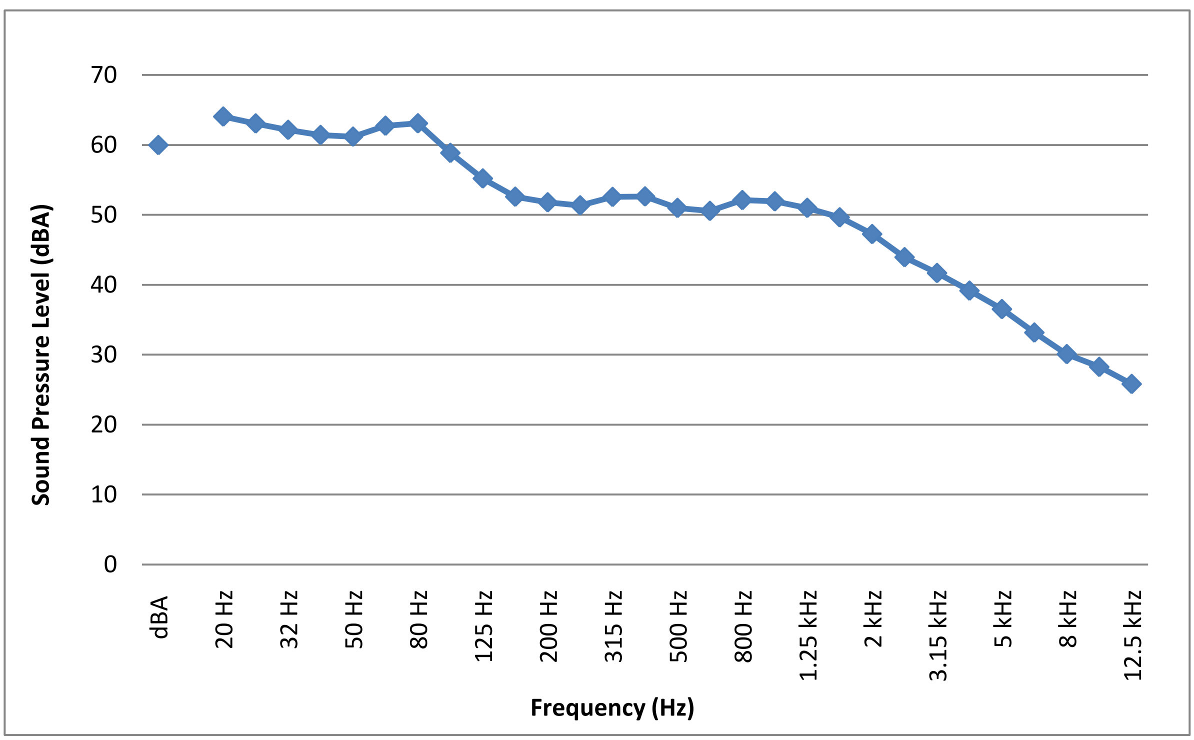

Figure 29. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 15

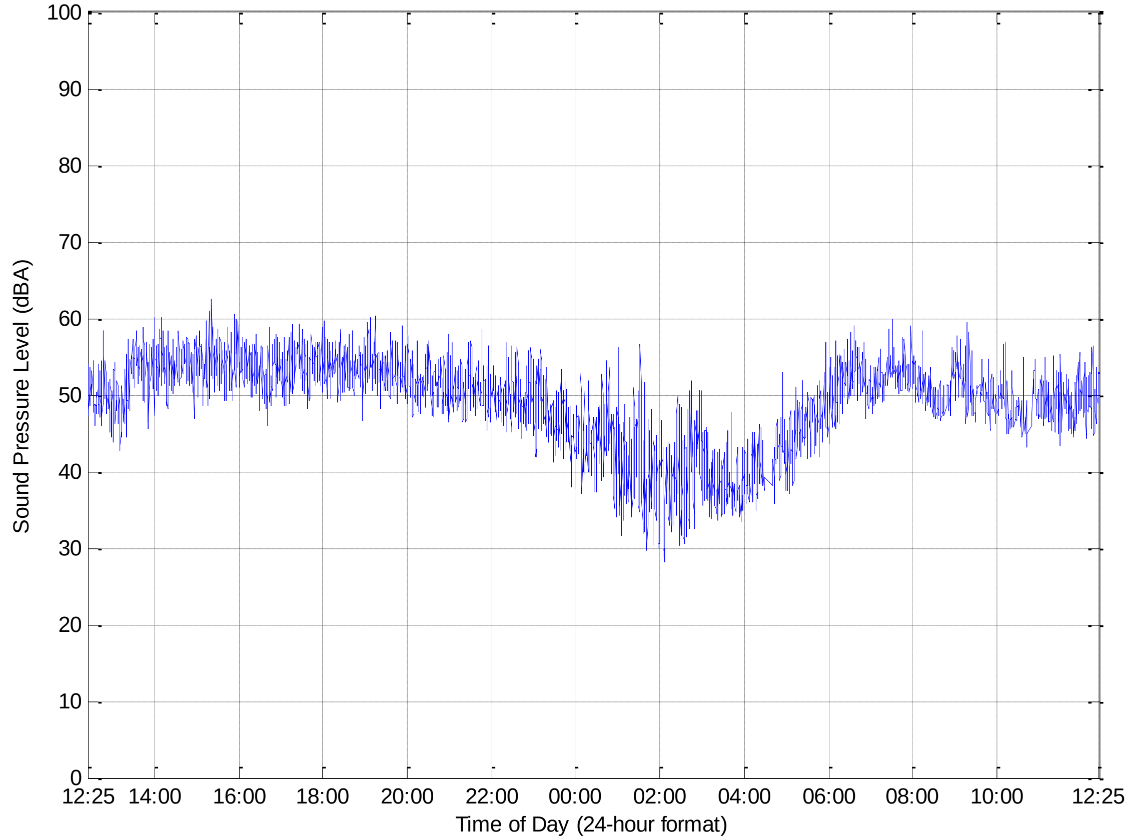

Figure 30. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 16

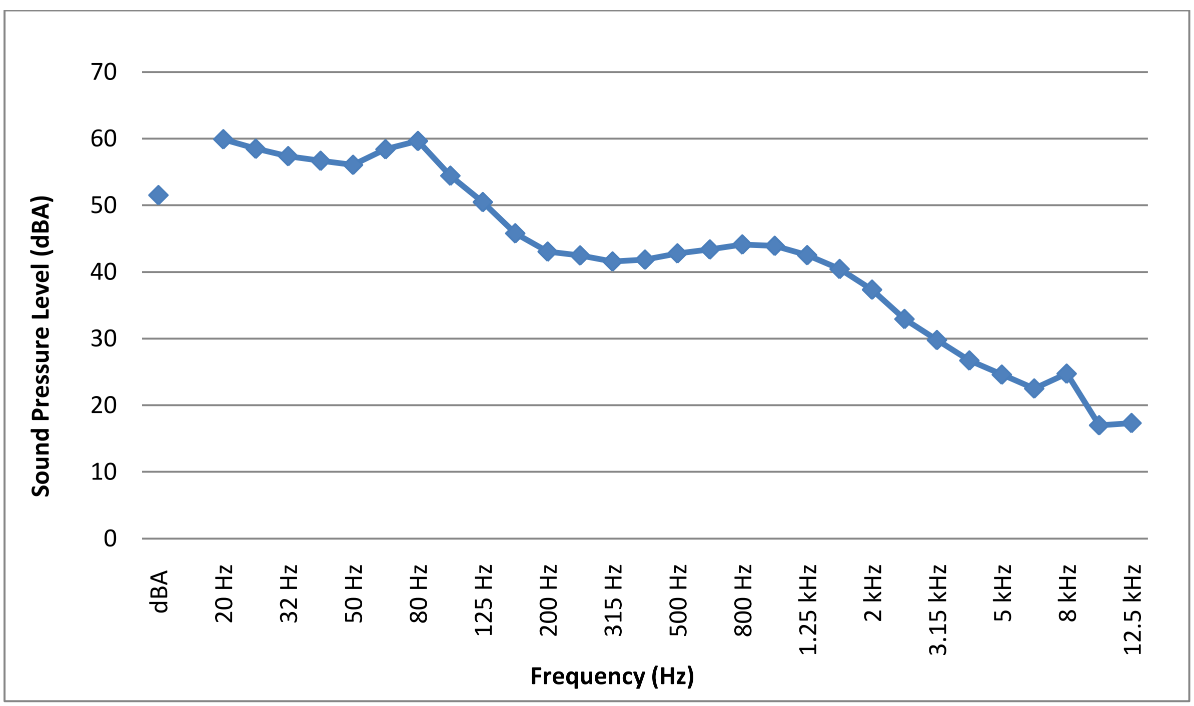

Figure 31. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 16

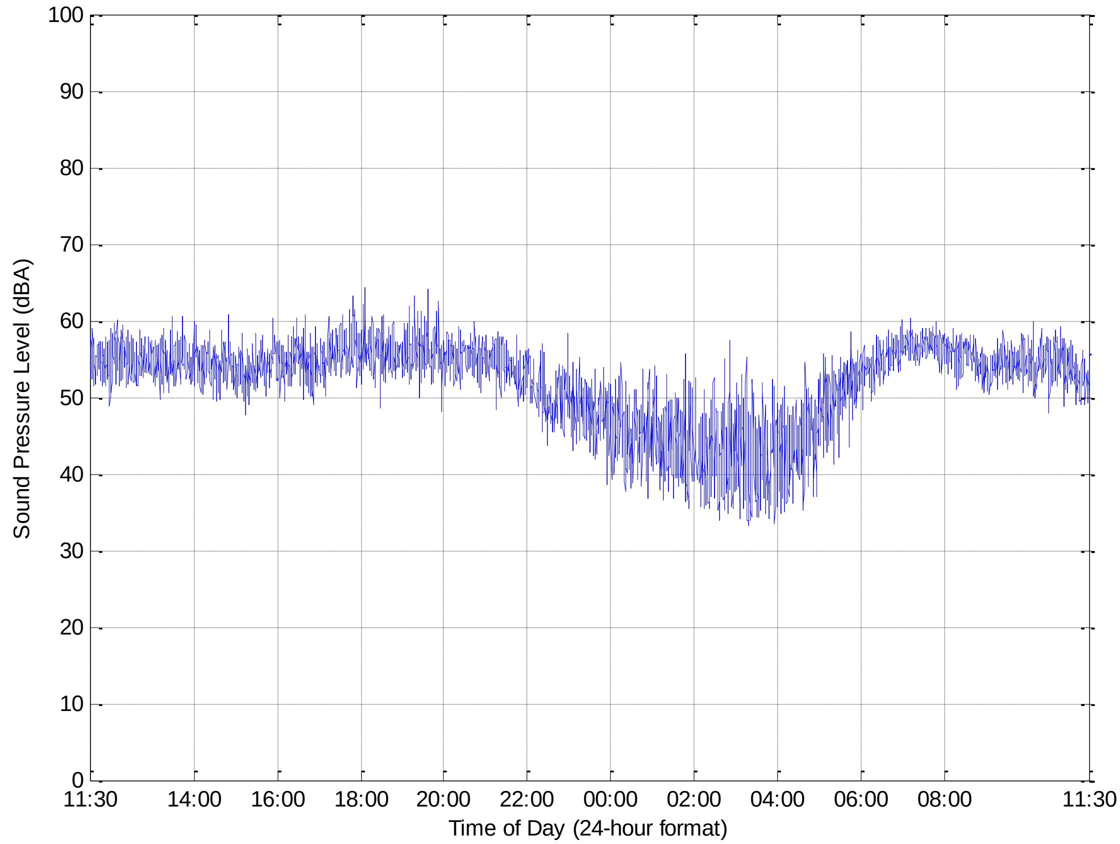

Figure 32. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 17

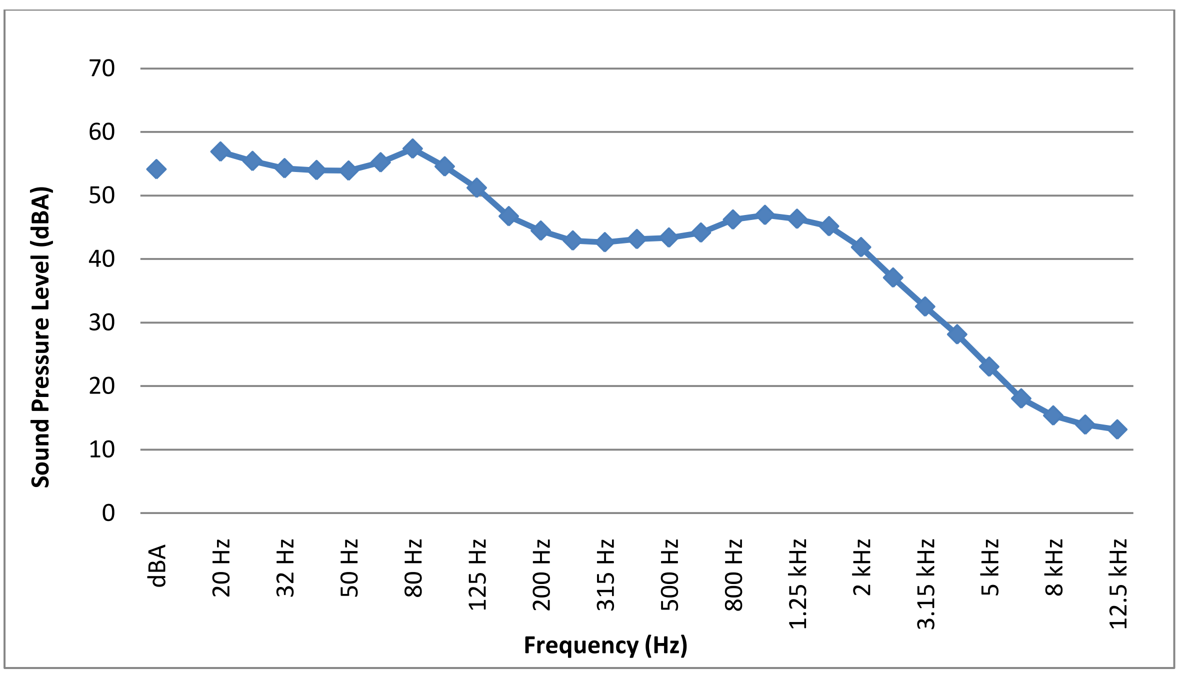

Figure 33. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 17

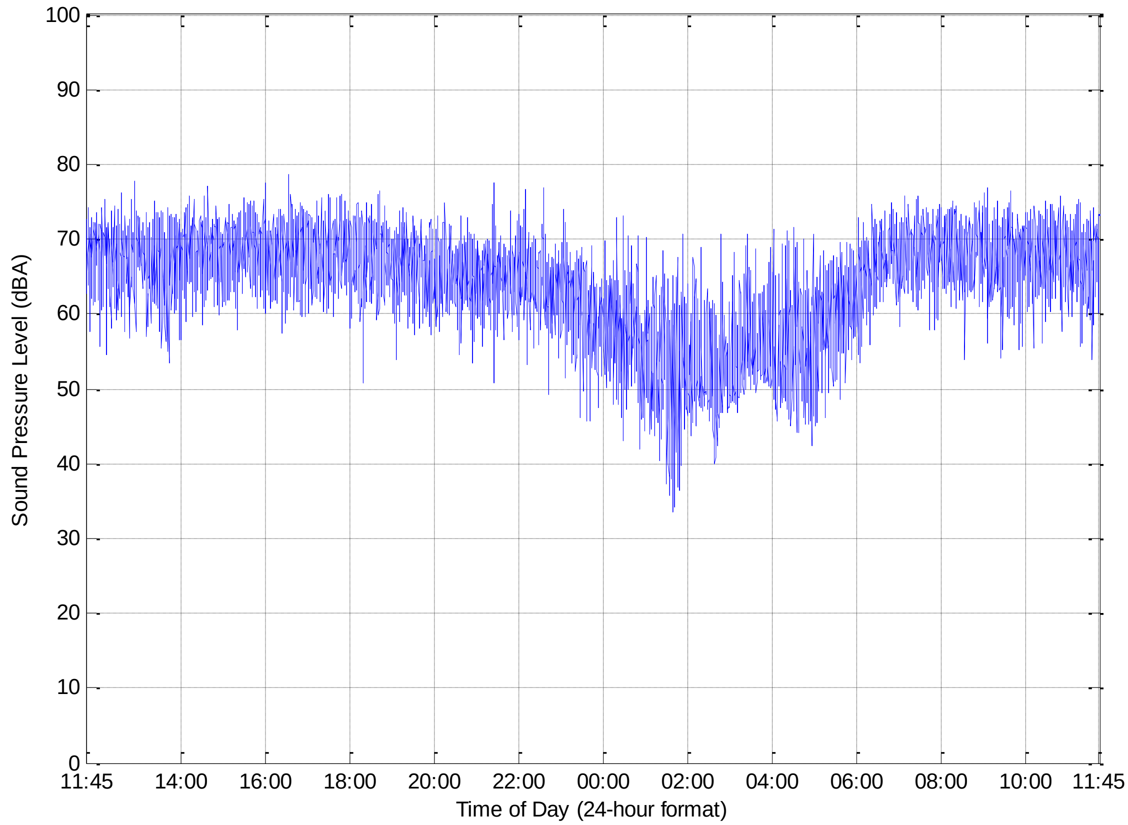

Figure 34. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 18

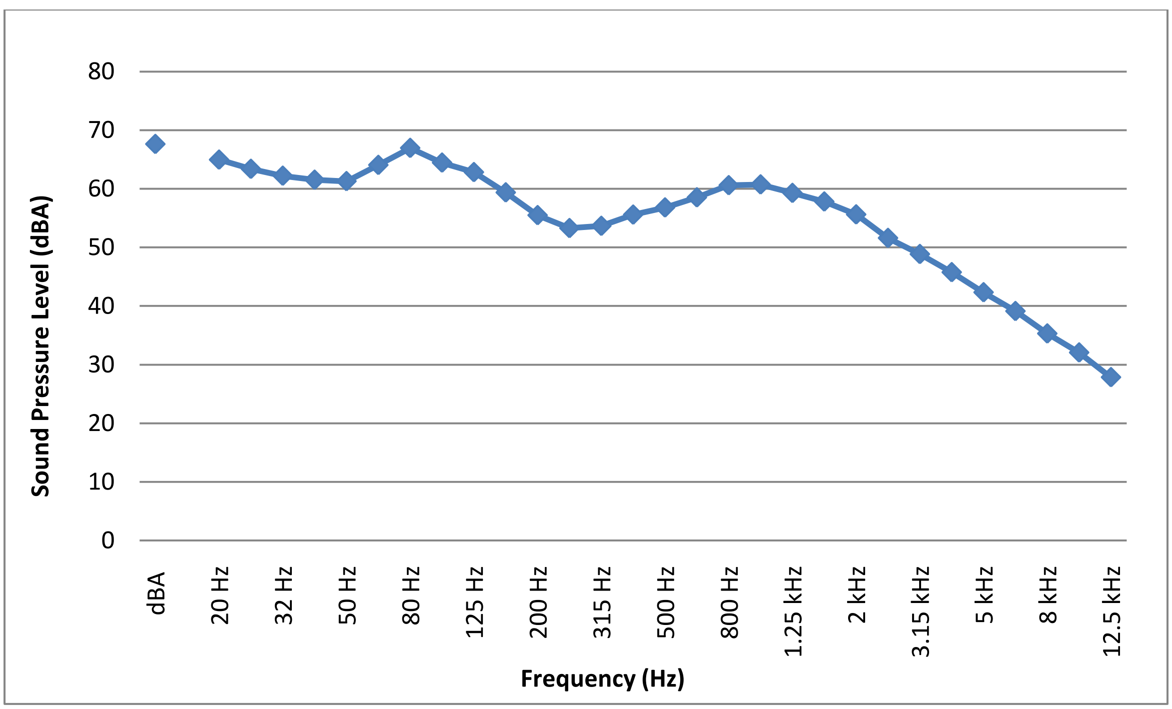

Figure 35. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 18

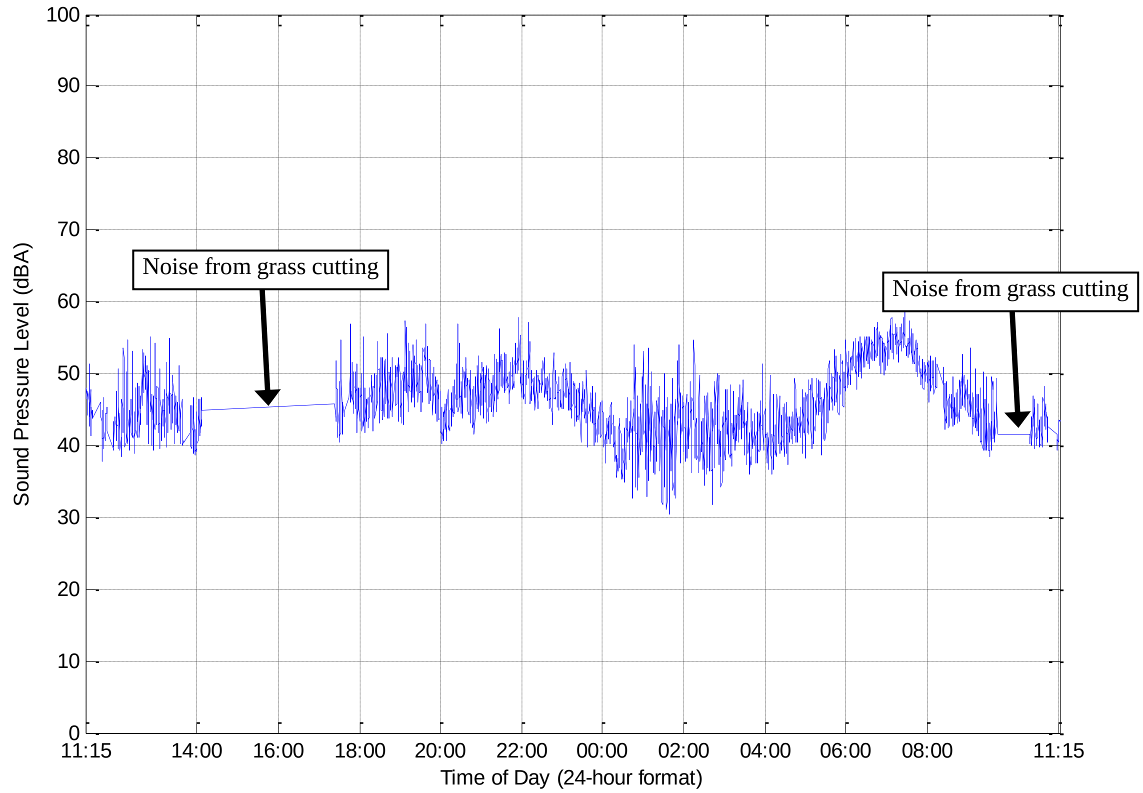

Figure 36. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 19

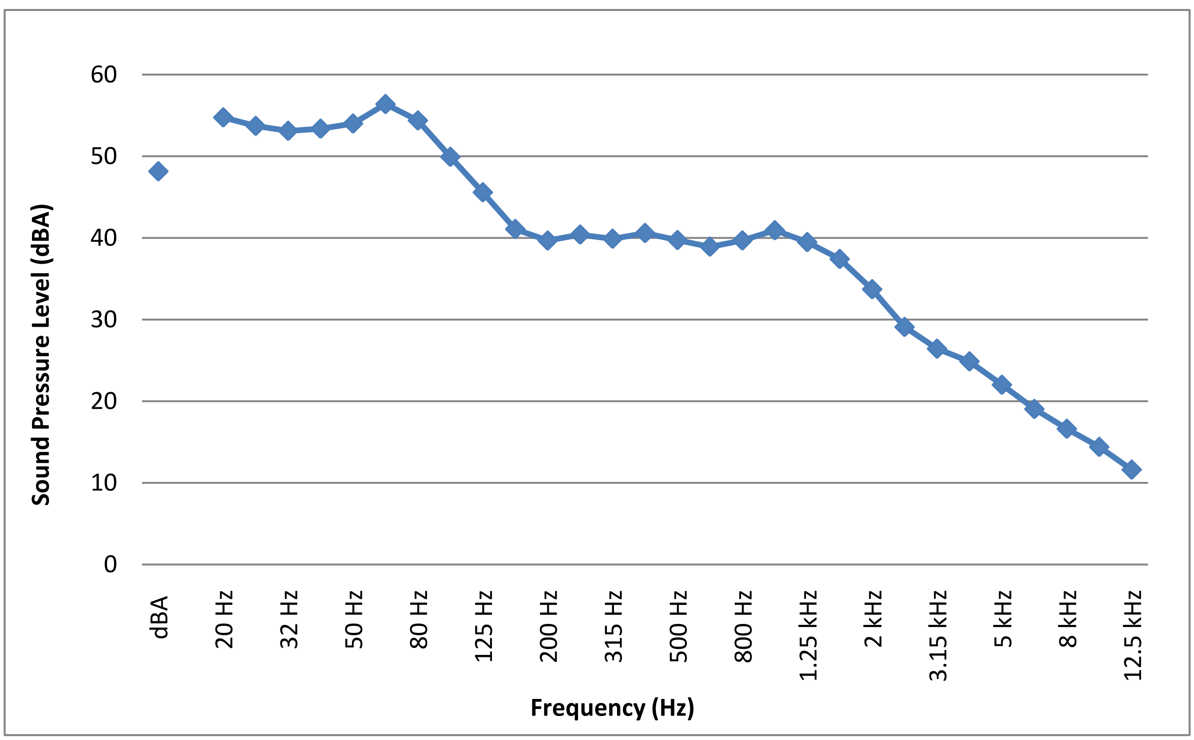

Figure 37. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 19

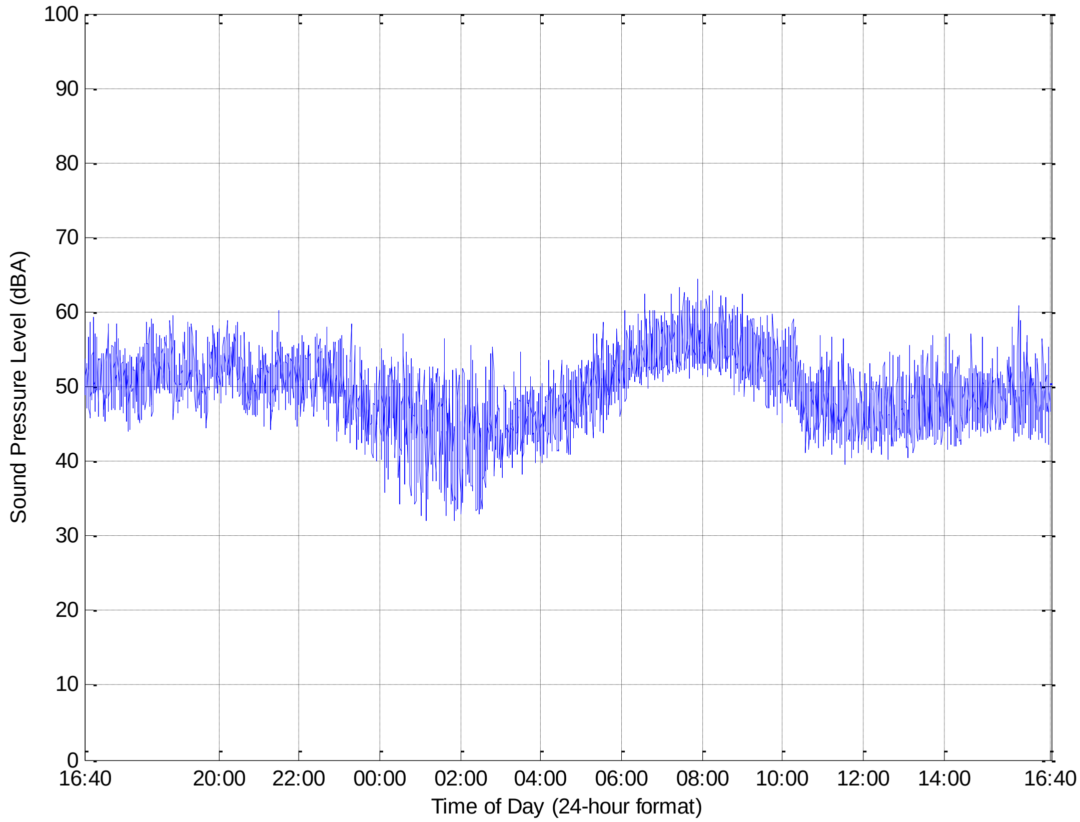

Figure 38. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 20

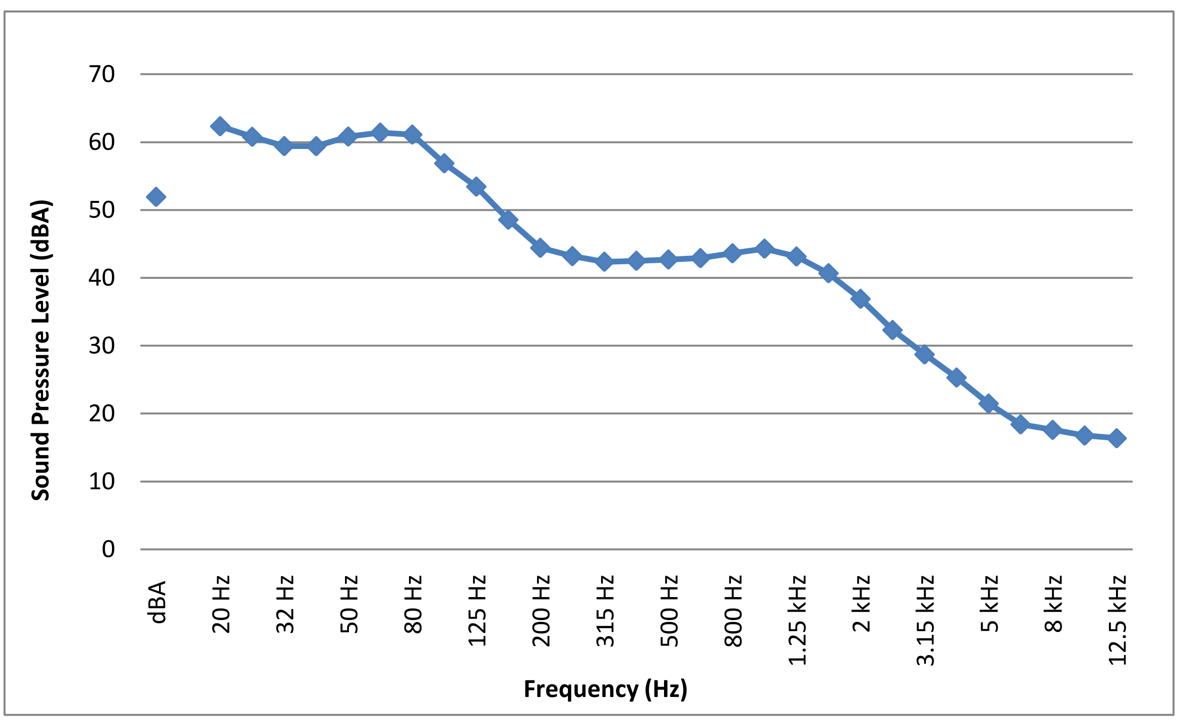

Figure 39. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 20

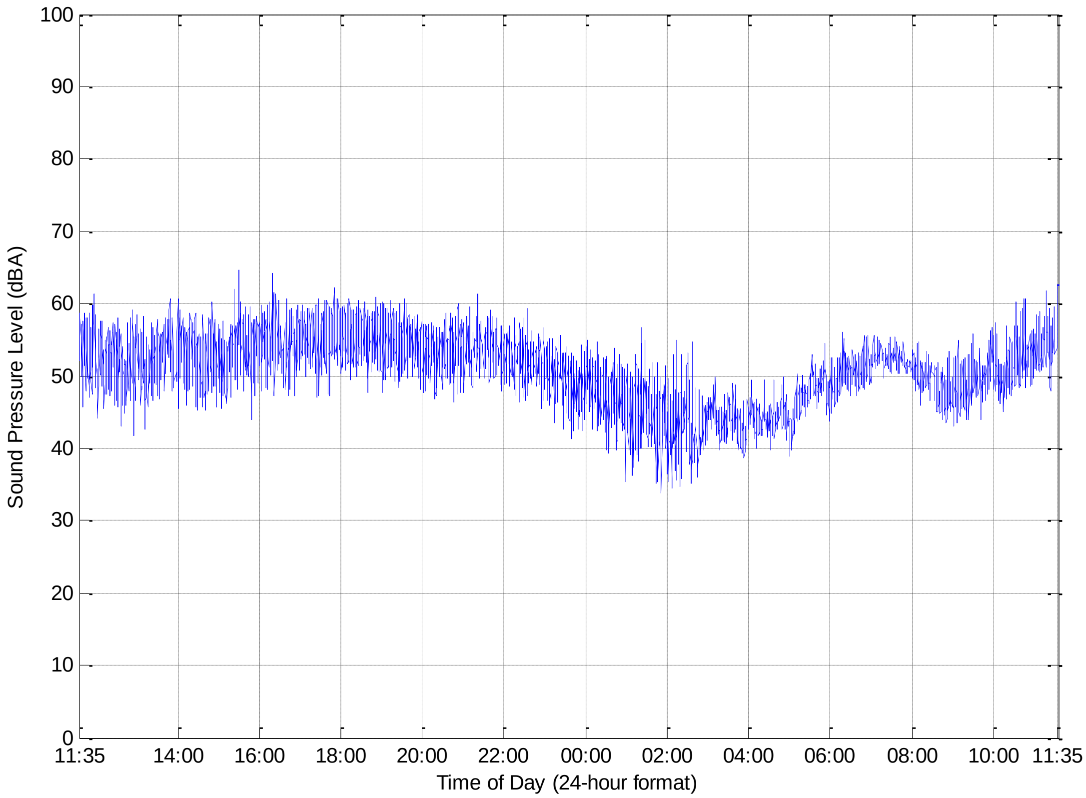

Figure 40. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 21

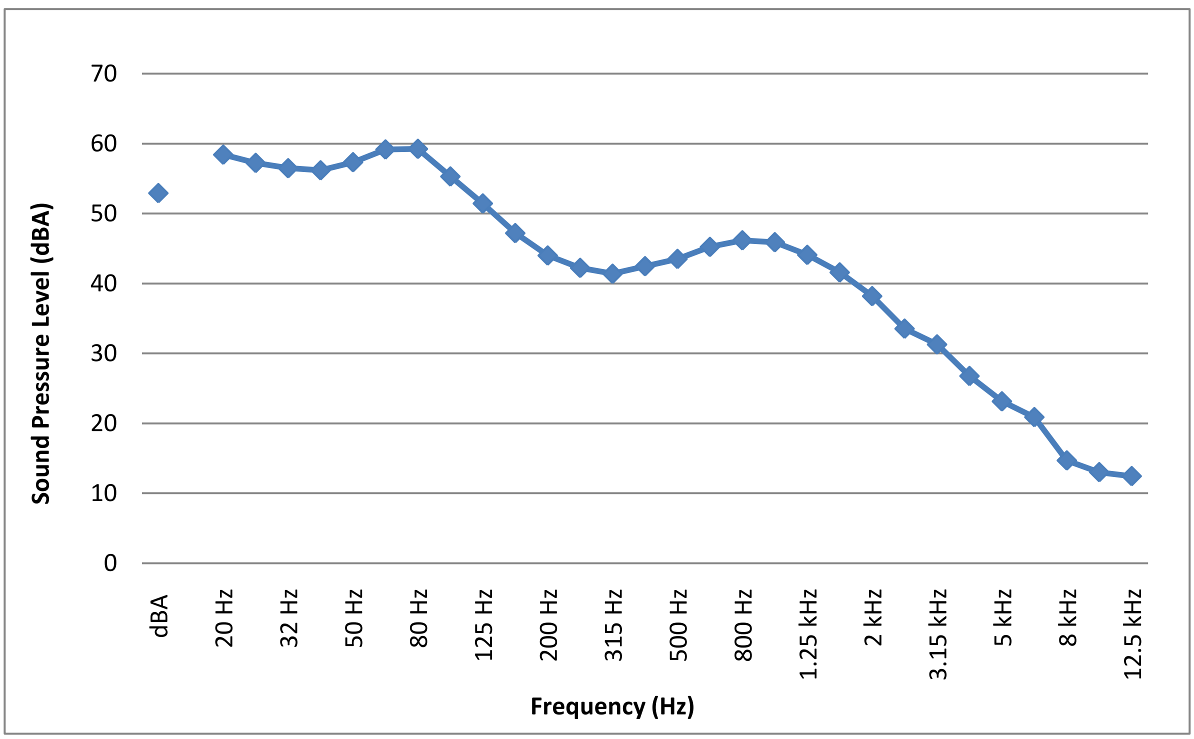

Figure 41. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 21

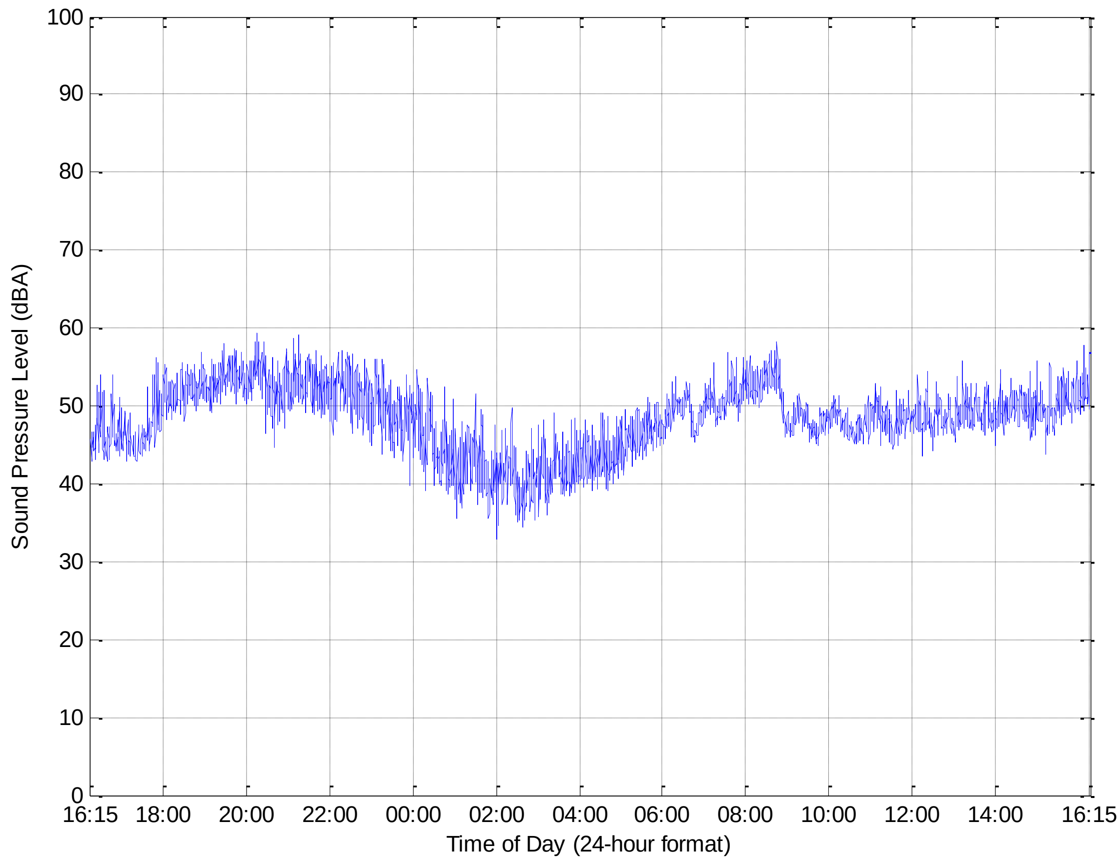

Figure 42. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 22

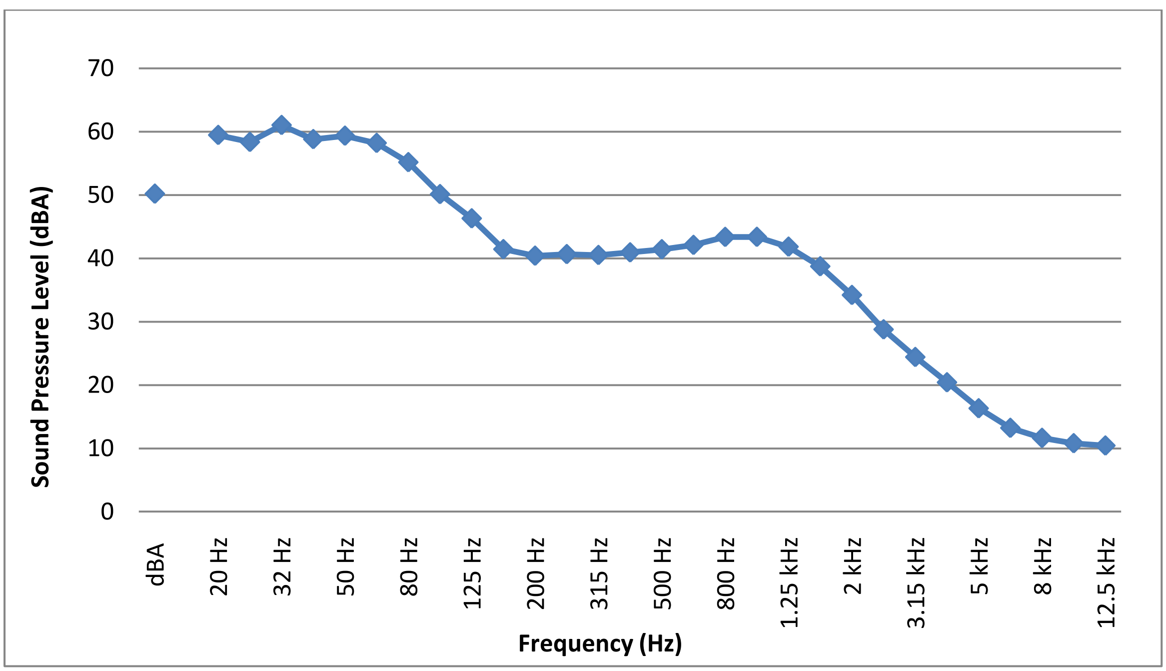

Figure 43. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 22

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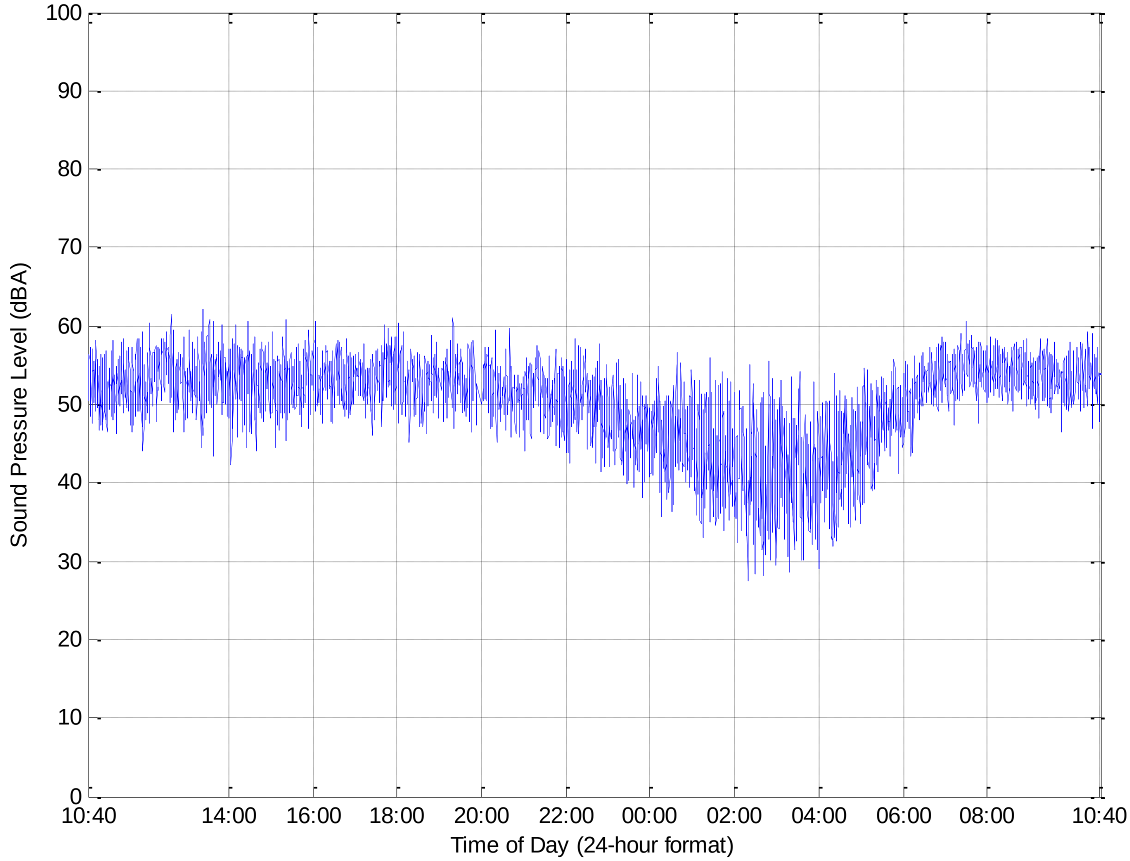

Figure 44. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 23

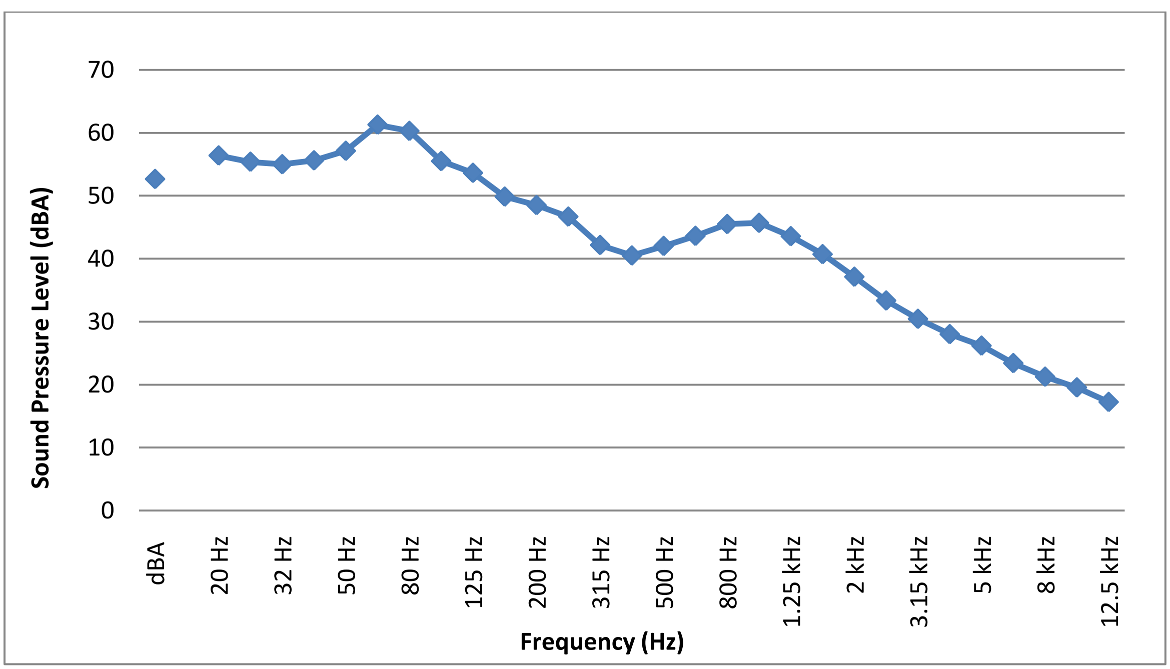

Figure 45. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 23

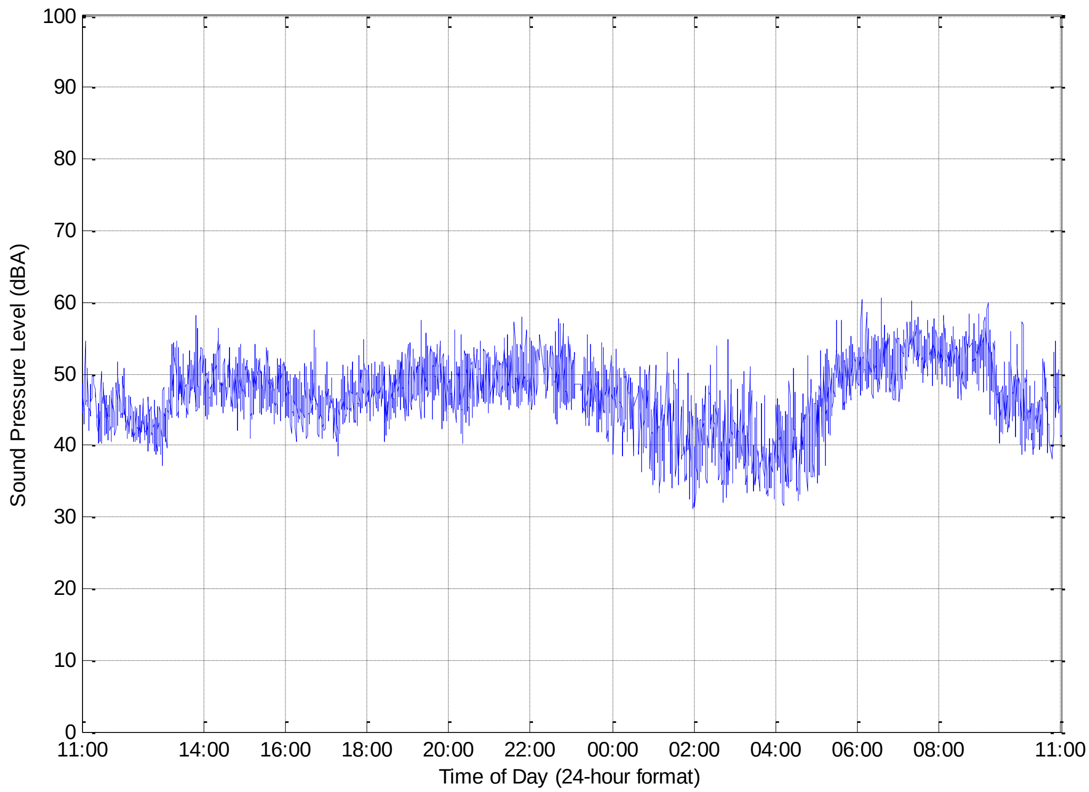

Figure 46. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 24

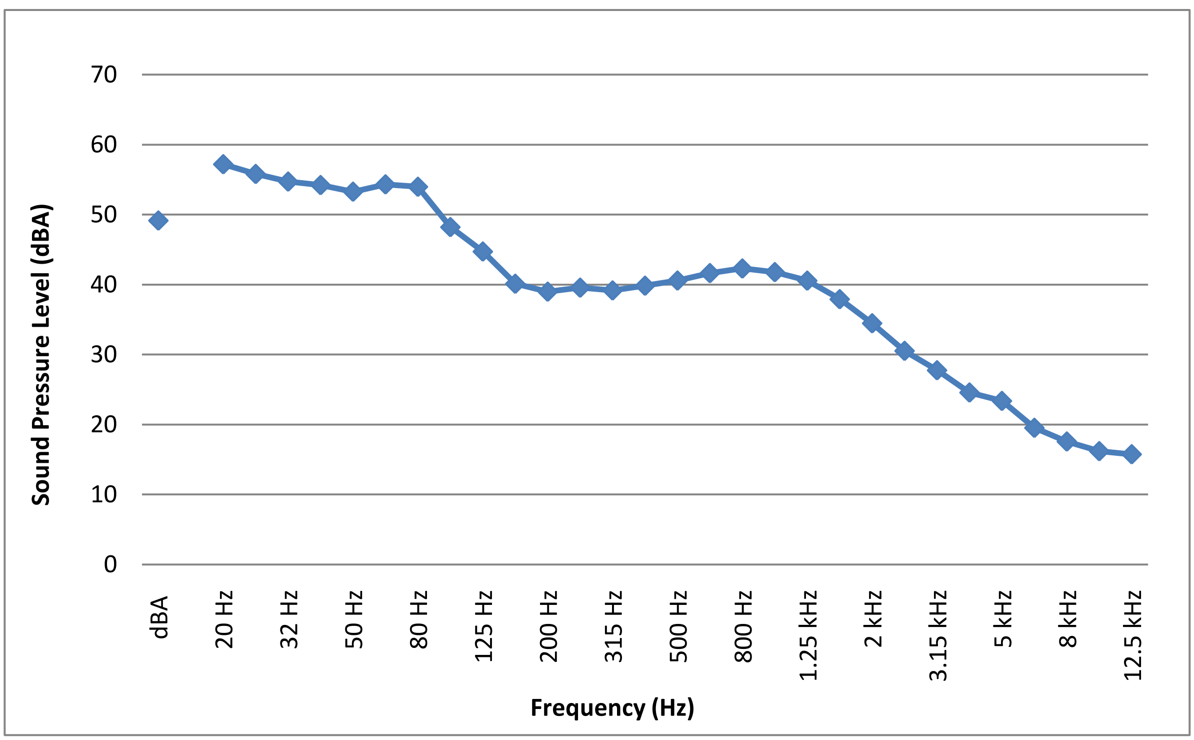

Figure 47. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 24

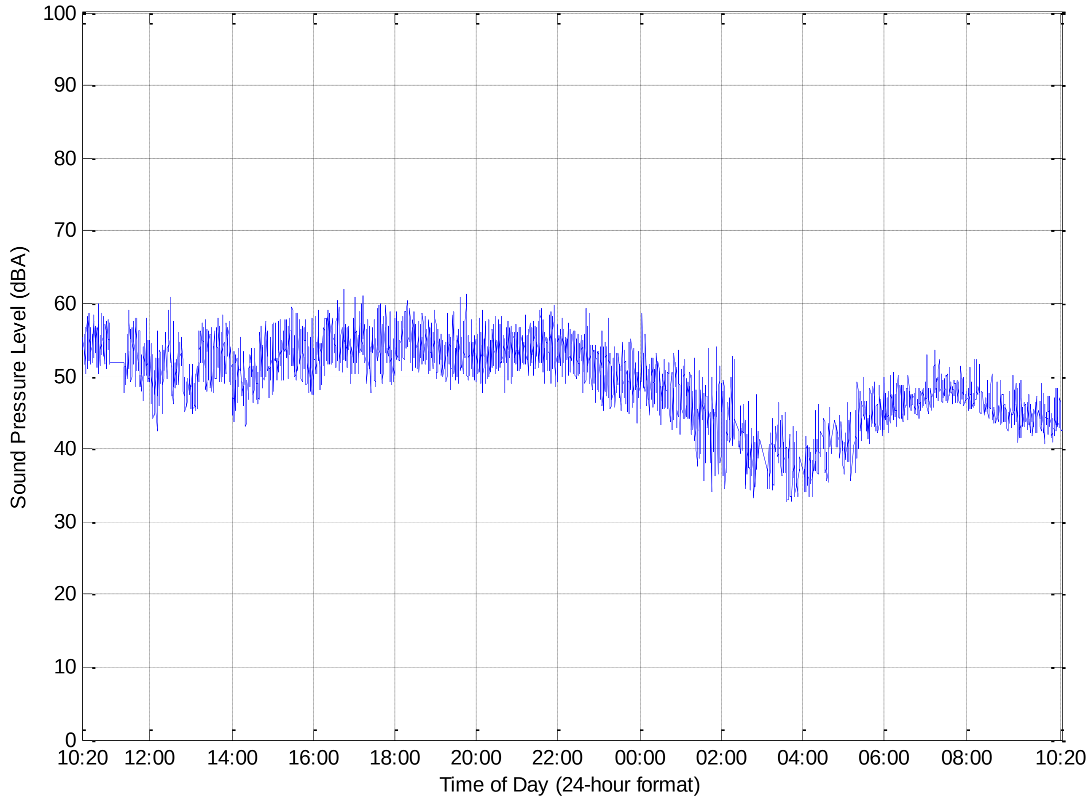

Figure 48. 24-Hour Broadband A-Weighted L_{eq} Sound Levels at Monitor Location 25

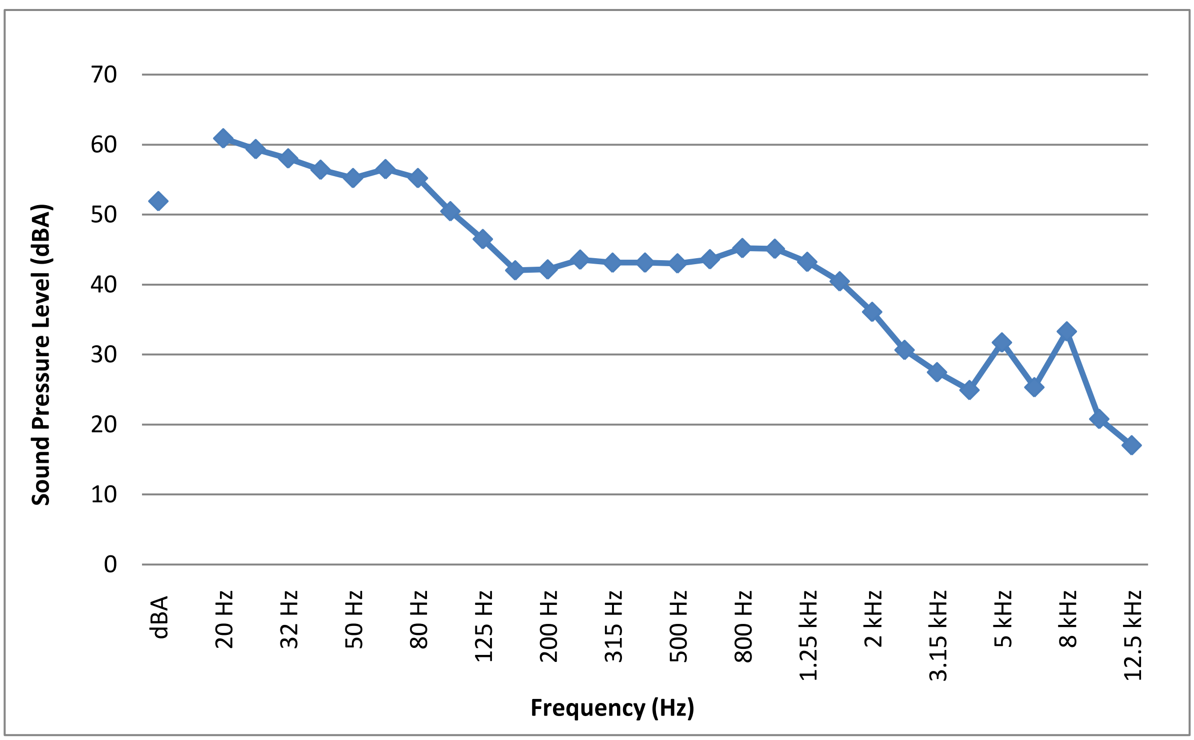

Figure 49. 24-Hour 1/3 Octave Band L_{eq} Sound Levels at Monitor Location 25

Appendix I. MEASUREMENT EQUIPMENT USED

Brüel and Kjær 2250/2270 (Unit 1 / Unit 2/ Unit 3/ Unit 4 / Unit 5 / Unit 6 / Unit 7)

The environmental noise monitoring equipment used during the monitorings consisted of a Brüel and Kjær Type 2250 Precision Integrating Sound Level Meter enclosed in an environmental case, a tripod, a weather protective microphone hood. The system acquired data in 15-second L_{eq} samples using 1/3 octave band frequency analysis and overall A-weighted and C-weighted sound levels. The sound level meter conforms to Type 1, ANSI S1.4, ANSI S1.43, IEC 61672-1, IEC 60651, IEC 60804 and DIN 45657. The 1/3 octave filters conform to S1.11 – Type 0-C, and IEC 61260 – Class 0. The calibrator conforms to IEC 942 and ANSI S1.40. The sound level meter, pre-amplifier and microphone were certified on May 29, 2009 / May 15, 2009 / November 2, 2009 / August 13, 2008 / October 27, 2008 / October 27, 2008 / June 29, 2010 and the calibrator (type B&K 4231) was certified on June 21, 2010 / June 21, 2010 / November 2, 2009 / November 2, 2009 / November 2, 2009 / November 2, 2009 by a NIST NVLAP Accredited Calibration Laboratory for all requirements of ISO 17025: 1999 and relevant requirements of ISO 9002:1994, ISO 9001:2000 and ANSI/NCSL Z540: 1994 Part 1. Simultaneous digital audio was recorded directly on the sound level meter using a 3.3 kHz sample rate for more detailed post-processing analysis. Refer to the next section in the Appendix for a detailed description of the various acoustical descriptive terms used.

Brüel and Kjær 2260

The environmental noise monitoring equipment used during the monitorings consisted of a Brüel and Kjær Type 2260 Precision Integrating Sound Level Meter enclosed in an environmental case, a tripod, a weather protective microphone hood, and an external battery. The system acquired data in 15-second L_{eq} samples using 1/3 octave band frequency analysis and overall A-weighted and C-weighted sound levels. The sound level meter conforms to Type 1, ANSI S1.4, ANSI S1.43, IEC 61672-1, IEC 60651, IEC 60804 and DIN 45657. The 1/3 octave filters conform to S1.11 – Type 0-C, and IEC 61260 – Class 0. The calibrator conforms to IEC 942 and ANSI S1.40. The sound level meter, pre-amplifier, and microphone were certified on January 16, 2009 by a NIST NVLAP Accredited Calibration Laboratory for all requirements of ISO 17025: 1999 and relevant requirements of ISO 9002:1994, ISO 9001:2000 and ANSI/NCSL Z540: 1994 Part 1. Simultaneous digital audio recording was conducted with a Marantz PMD-670 professional grade audio recorder utilizing a sample rate of 48 kHz and an MP3 conversion rate of 80 kbps. The audio signal was passed directly from the sound level meter. Refer to the next section in the Appendix for a detailed description of the various acoustical descriptive terms used.

Record of Calibration Results

Description	Date	Time	Pre / Post	Calibration Level	Calibrator Model	Serial Number
Location #10 Noise Monitor	October 21 2010	17:10	Pre	93.9 dBA	B&K 4231	2575493
Location #10 Noise Monitor	October 22 2010	17:15	Post	93.8 dBA	B&K 4231	2575493
Location #11 Noise Monitor	July 29 2010	12:50	Pre	93.9 dBA	B&K 4231	2575493
Location #11 Noise Monitor	July 30 2010	13:00	Post	93.9 dBA	B&K 4231	2575493
Location #12 Noise Monitor	June 28 2010	13:30	Pre	93.9 dBA	B&K 4231	2575493
Location #12 Noise Monitor	June 29 2010	13:35	Post	93.9 dBA	B&K 4231	2575493
Location #13 Noise Monitor	June 28 2010	12:55	Pre	93.9 dBA	B&K 4231	2575493
Location #13 Noise Monitor	June 29 2010	13:00	Post	93.8 dBA	B&K 4231	2575493
Location #14 Noise Monitor	September 9 2010	15:35	Pre	93.9 dBA	B&K 4231	2656414
Location #14 Noise Monitor	September 10 2010	15:45	Post	93.8 dBA	B&K 4231	2656414
Location #15 Noise Monitor	July 29 2010	12:00	Pre	93.9 dBA	B&K 4231	2575493
Location #15 Noise Monitor	July 30 2010	12:20	Post	93.9 dBA	B&K 4231	2575493
Location #16 Noise Monitor	June 28 2010	12:20	Pre	93.9 dBA	B&K 4231	2575493
Location #16 Noise Monitor	June 29 2010	12:25	Post	93.8 dBA	B&K 4231	2575493
Location #17 Noise Monitor	September 9 2010	11:25	Pre	93.9 dBA	B&K 4231	2656414
Location #17 Noise Monitor	September 10 2010	11:40	Post	93.8 dBA	B&K 4231	2656414
Location #18 Noise Monitor	July 29 2010	11:30	Pre	93.9 dBA	B&K 4231	2575493
Location #18 Noise Monitor	July 30 2010	11:55	Post	93.9 dBA	B&K 4231	2575493
Location #19 Noise Monitor	July 29 2010	11:05	Pre	93.9 dBA	B&K 4231	2478139
Location #19 Noise Monitor	July 30 2010	11:30	Post	93.8 dBA	B&K 4231	2478139
Location #20 Noise Monitor	October 21 2010	16:35	Pre	93.9 dBA	B&K 4231	2656414
Location #20 Noise Monitor	October 22 2010	16:45	Post	93.8 dBA	B&K 4231	2656414
Location #21 Noise Monitor	June 28 2010	11:35	Pre	93.9 dBA	B&K 4231	2575493
Location #21 Noise Monitor	June 29 2010	11:40	Post	93.8 dBA	B&K 4231	2575493
Location #22 Noise Monitor	October 21 2010	16:15	Pre	93.9 dBA	B&K 4231	2656414
Location #22 Noise Monitor	October 22 2010	16:20	Post	93.8 dBA	B&K 4231	2656414
Location #23 Noise Monitor	September 9 2010	10:30	Pre	93.9 dBA	B&K 4231	2656414
Location #23 Noise Monitor	September 10 2010	11:55	Post	93.7 dBA	B&K 4231	2656414

Location #24 Noise Monitor	June 28 2010	10:55	Pre	93.9 dBA	B&K 4231	2575493
Location #24 Noise Monitor	June 29 2010	11:10	Post	93.9 dBA	B&K 4231	2575493
Location #25 Noise Monitor	June 28 2010	10:00	Pre	93.9 dBA	B&K 4231	2575493
Location #25 Noise Monitor	June 29 2010	10:45	Post	93.8 dBA	B&K 4231	2575493

B&K 2250/2270 Unit #1 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1 and relevant requirements of ISO 9002:1994 ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.19848

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **2488495**
Tested with: **Microphone 4189 s/n 2471133**
Preamplifier ZC0032 s/n 3271
Type (class): **1**
Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/ -6376**

Date Calibrated: **5/29/2009**

Status:	**Received**	**Sent**
In tolerance:	**X**	**X**
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes **X** No
Calibration service: __ **Basic** **X** **Standard**

Address: **Suite 107, 9920-63 Ave**
Edmonton, Alberta
CANADA T6E 0G9

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., 06/07/2005
SLM & Dosimeters – Acoustical Tests, Scantek Inc., 06/15/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function Generator	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1019 Norsonic	Calibration software	v.46	Validated Dec 2006	-	-
1253-Norsonic	Calibrator	25726	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.3 °C	99.377 kPa	65.2 %RH

Calibrated by	Valentin Buzduga	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	5/29/2009	Date	5/29/2009

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B&K 2250/2270 Unit #1 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
and relevant requirements of ISO 9002:1994
ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.19849

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2471133**

Date Calibrated: **5/29/2009**

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/ -6376**

Address: **Suite 107, 9920-63 Ave**
Edmonton, Alberta
CANADA T6E 0G9

Tested in accordance with the following procedures and standards:
Procedure for Calibration of Measurement Microphones, Scantek Inc., 06/15/2005

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function Generator	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1017 Norsonic	Calibration software	v.46	Validated Feb 2006	-	-
1253-Norsonic	Calibrator	28326	Feb 16, 2009	Scantek, Inc. / NVLAP	Feb 16, 2010
1203-Norsonic	Preamplifier	14051	Jan 2, 2009	Scantek, Inc./ NVLAP	Jan 2, 2010
4180-Bruel&Kjaer	Microphone	2246115	Mar 7, 2008	NPL (UK) / UKAS	Mar 7, 2010

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by	Valentin Buzduga	Checked by	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	5/29/2009	Date	5/29/2009

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This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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Page 1 of 2

B&K 2250/2270 Unit #1 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1 and relevant requirements of ISO 9002:1994 ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.21909

Instrument:	**Acoustical Calibrator**	*Date Calibrated:*	**6/21/2010**	
Model:	**4231**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**2478139**	*Out of tolerance:*		
Class (IEC 60942):	**1**	*See comments:*		
Barometer type:		*Contains non-accredited tests:* __Yes _X_ No		
Barometer s/n:				

Customer:	**Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street**
Tel/Fax:	**780-414-6373 / -6376**		**Edmonton, Alberta**
			Canada T6M0A8

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., 06/06/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Jan 20, 2010	Scantek, Inc./NVLAP	Jan 20, 2011
DS-360-SRS	Function Generator	33584	Oct 5, 2009	ACR. Env / A2LA	Oct 5, 2011
34401A-Agilent	Digital Voltmeter	US36120731	Aug 27, 2009	ACR Env. / A2LA	Aug 27, 2010
HM30-Thommen	Meteo Station	1040170/39633	Jul 10, 2009	Transcat / A2LA	Jul 10, 2010
8903-HP	Audio Analyzer	2514A05691	Jan 2, 2008	Transcat / A2LA	Jan 2, 2011
PC Program 1018 Norsonic	Calibration software	v.5.0	Validated July 2009	-	-
1253-Norsonic	Calibrator	31959	Dec 7, 2009	Scantek, Inc./ NVLAP	Dec 7, 2010
1203-Norsonic	Preamplifier	14059	Jan 4, 2010	Scantek, Inc./ NVLAP	Jan 4, 2011
4180-Bruel&Kjaer	Microphone	2246115	Dec 14, 2009	NPL (UK) / UKAS	Dec 14, 2011

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by	Javier Albarracin	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	6/21/2010	Date	6/21/2010

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This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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Page 1 of 2

B&K 2250/2270 Unit #2 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1 and relevant requirements of ISO 9002:1994 ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.19785

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **2575774**
Tested with: **Microphone 4189 s/n 2573766**
Preamplifier ZC0032 s/n 5842
Type (class): **1**
Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/ -6376**

Date Calibrated: **5/15/2009**

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard

Address: **Suite 107, 9920-63 Ave**
Edmonton, Alberta
CANADA T6E 0G9

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., 06/07/2005
SLM & Dosimeters – Acoustical Tests, Scantek Inc., 06/15/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function Generator	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1019 Norsonic	Calibration software	v.46	Validated Dec 2006	-	-
1253-Norsonic	Calibrator	25726	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.1 °C	101.069 kPa	59.1 %RH

Calibrated by	Valentin Buzduga	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	5/15/2009	Date	5/18/2009

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Page 1 of 2

B&K 2250/2270 Unit #2 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
and relevant requirements of ISO 9002:1994
ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.19786

Instrument:	**Microphone**	*Date Calibrated:*	**5/15/2009**	
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**2573766**	*Out of tolerance:*		
		See comments:		
		Contains non-accredited tests:	__Yes _X_ No	

Customer:	**Acoustical Consultants Inc.**	*Address:*	**Suite 107, 9920-63 Ave Edmonton, Alberta CANADA T6E 0G9**
Tel/Fax:	**780-414-6373/ -6376**		

Tested in accordance with the following procedures and standards:
Procedure for Calibration of Measurement Microphones, Scantek Inc., 06/15/2005

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function Generator	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1017 Norsonic	Calibration software	v.46	Validated Feb 2006	-	-
1253-Norsonic	Calibrator	28326	Feb 16, 2009	Scantek, Inc. / NVLAP	Feb 16, 2010
1203-Norsonic	Preamplifier	14051	Jan 2, 2009	Scantek, Inc./ NVLAP	Jan 2, 2010
4180-Bruel&Kjaer	Microphone	2246115	Mar 7, 2008	NPL (UK) / UKAS	Mar 7, 2010

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by	Valentin Buzduga	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	5/15/2009	Date	5/18/2009

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Page 1 of 2

B&K 2250/2270 Unit #2 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1 and relevant requirements of ISO 9002:1994 ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.21910

Instrument: **Acoustical Calibrator**
Model: **4231**
Manufacturer: **Brüel and Kjær**
Serial number: **2575493**
Class (IEC 60942): **1**
Barometer type:
Barometer s/n:

Date Calibrated: **6/21/2010**

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __ **Yes** _X_ **No**

Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**
Address: **5031 - 210 Street, Edmonton, Alberta, Canada T6M0A8**

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., 06/06/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Jan 20, 2010	Scantek, Inc./NVLAP	Jan 20, 2011
DS-360-SRS	Function Generator	33584	Oct 5, 2009	ACR. Env / A2LA	Oct 5, 2011
34401A-Agilent	Digital Voltmeter	US36120731	Aug 27, 2009	ACR Env. / A2LA	Aug 27, 2010
HM30-Thommen	Meteo Station	1040170/39633	Jul 10, 2009	Transcat / A2LA	Jul 10, 2010
8903-HP	Audio Analyzer	2514A05691	Jan 2, 2008	Transcat / A2LA	Jan 2, 2011
PC Program 1018 Norsonic	Calibration software	v.5.0	Validated July 2009	-	-
1253-Norsonic	Calibrator	31959	Dec 7, 2009	Scantek, Inc./ NVLAP	Dec 7, 2010
1203-Norsonic	Preamplifier	14059	Jan 4, 2010	Scantek, Inc./ NVLAP	Jan 4, 2011
4180-Bruel&Kjaer	Microphone	2246115	Dec 14, 2009	NPL (UK) / UKAS	Dec 14, 2011

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by	Javier Albarracin	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	6/21/2010	Date	6/21/2010

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Page 1 of 2

B&K 2250/2270 Unit #3 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
and relevant requirements of ISO 9002: 1994
ACCREDITED by NVLAP
(an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.20669

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **2600498**
Tested with: **Microphone 4189 s/n 2595637**
Preamplifier ZC0032 s/n 6434
Type (class): **1**
Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/ -6376**

Date Calibrated: **11/2/2009**

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard
Address: **Suite 107, 9920-63 Ave**
Edmonton, Alberta
CANADA T6E 0G9

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., 06/07/2005
SLM & Dosimeters – Acoustical Tests, Scantek Inc., 06/15/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function Generator	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1019 Norsonic	Calibration software	v.46	Validated Dec 2006	-	-
1253-Norsonic	Calibrator	25726	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.9 °C	100.926 kPa	40.3 %RH

Calibrated by	Valentin Buzduga	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	11/02/2009	Date	11/3/2009

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Page 1 of 2

B&K 2250/2270 Unit #3 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540: 1994 Part 1
and relevant requirements of ISO 9002: 1994
ACCREDITED by NVLAP
(an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.20670

Instrument:	**Microphone**	*Date Calibrated:*	**11/2/2009**	
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**2595637**	*Out of tolerance:*		
		See comments:		
		Contains non-accredited tests:	__Yes _X_ No	

Customer:	**Acoustical Consultants Inc.**	*Address:*	**Suite 107, 9920-63 Ave** **Edmonton, Alberta** **CANADA T6E 0G9**
Tel/Fax:	**780-414-6373/ -6376**		

Tested in accordance with the following procedures and standards:
Procedure for Calibration of Measurement Microphones, Scantek Inc., 06/15/2005

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function Generator	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1017 Norsonic	Calibration software	v.46	Validated Feb 2006	-	-
1253-Norsonic	Calibrator	28326	Feb 16, 2009	Scantek, Inc. / NVLAP	Feb 16, 2010
1203-Norsonic	Preamplifier	14051	Jan 2, 2009	Scantek, Inc./ NVLAP	Jan 2, 2010
4180-Bruel&Kjaer	Microphone	2246115	Mar 7, 2008	NPL (UK) / UKAS	Mar 7, 2010

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by	Valentin Buzduga	Checked by	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	11/02/2009	Date	11/3/2009

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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Page 1 of 2

B&K 2250/2270 Unit #3 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540: 1994 Part 1
and relevant requirements of ISO 9002: 1994
ACCREDITED by NVLAP
(an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.20671

Instrument:	**Acoustical Calibrator**	*Date Calibrated:*	**11/2/2009**	
Model:	**4231**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**2594693**	*Out of tolerance:*		
Class (IEC 60942):	**1**	*See comments:*		
Barometer type:		*Contains non-accredited tests:*	__Yes _X_ No	
Barometer s/n:				

Customer:	**Acoustical Consultants Inc.**	*Address:*	**Suite 107, 9920-63 Ave Edmonton, Alberta CANADA T6E 0G9**
Tel/Fax:	**780-414-6373/ -6376**		

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., 06/06/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
8903A-HP	Audio Analyzer	2514A05691	Jan 2, 2008	Transcat/ NVLAP	Jan 2, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1018 Norsonic	Calibration software	v.44	Validated May 2006	-	
1253-Norsonic	Calibrator	28326	Feb 16, 2009	Scantek, Inc. / NVLAP	Feb 16, 2010
1203-Norsonic	Preamplifier	14051	Jan 2, 2009	Scantek, Inc./ NVLAP	Jan 2, 2010
4180-Bruel&Kjaer	Microphone	2246115	Mar 7, 2008	NPL (UK) / UKAS	Mar 7, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by	Valentin Buzduga	Checked by	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	11/02/2009	Date	11/3/2009

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B&K 2250/2270 Unit #4 Calibration Certificate(s)

OB. NR	LOC.

MANUFACTURER'S CERTIFICATE OF CONFORMANCE

We certify that Brüel & Kjær -2270--- Serial No 2644639 has been tested and passed all production tests, confirming compliance with the manufacturer's published specification at the date of the test.

The final test has been performed using calibrated equipment, traceable to National or International Standards or by ratio measurements.

Brüel & Kjær is certified under ISO 9001:2000 assuring that all calibration data for test equipment are retained on file and are available for inspection upon request.

Nærum 13-aug-2008

Torben Bjørn
Vice President
Operations

Please note that this document is not a calibration certificate, for information on our calibration services please contact your nearest Brüel & Kjær Service Center.

BA 0238 – 15

WORLD HEADQUARTERS: DK-2850 Nærum · Denmark
Telephone: +45 45 80 05 00 · Fax: +45 45 80 14 05 · http://www.bksv.com · e-mail: info@bksv.dk

Brüel & Kjær

Brüel & Kjær

Prepolarized Free-field 1/2" Microphone Type 4189

Calibration Chart

Serial No: 2643219

Open-circuit Sensitivity*, S_0:	-27.0 dB re 1V/Pa
Equivalent to:	44.9 mV/Pa
Uncertainty, 95 % confidence level	0.2 dB
Capacitance:	13.2 pF
Valid At:	
Temperature:	23 °C
Ambient Static Pressure:	101.3 kPa
Relative Humidity:	50 %
Frequency:	251.2 Hz
Polarization Voltage, external:	0 V

Sensitivity Traceable To:
DPLA: Danish Primary Laboratory of Acoustics
NIST: National Institute of Standards and Technology, USA

IEC 61094-4: Type WS 2 F

Environmental Calibration Conditions:
101.1 kPa 23 °C 51 % RH

Procedure: 704215 **Date:** 10. Jun. 2008 **Signature:** S. L

$^*K_0 = -26 - S_0$ Example: $K_0 = -26 - (-26.2) = +0.2$ dB

BC 0224 – 12

B&K 2250/2270 Unit #4 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540: 1994 Part 1
and relevant requirements of ISO 9002: 1994
ACCREDITED by NVLAP
(an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.20672

Instrument:	**Acoustical Calibrator**	*Date Calibrated:*	**11/2/2009**	
Model:	**4231**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X	X
Serial number:	**2642956**	*Out of tolerance:*		
Class (IEC 60942):	**1**	*See comments:*		
Barometer type:		*Contains non-accredited tests:*	__ Yes _X_ No	
Barometer s/n:				

Customer:	**Acoustical Consultants Inc.**	*Address:*	**Suite 107, 9920-63 Ave**
Tel/Fax:	**780-414-6373/ -6376**		**Edmonton, Alberta**
			CANADA T6E 0G9

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., 06/06/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
8903A-HP	Audio Analyzer	2514A05691	Jan 2, 2008	Transcat/ NVLAP	Jan 2, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1018 Norsonic	Calibration software	v.44	Validated May 2006	-	
1253-Norsonic	Calibrator	28326	Feb 16, 2009	Scantek, Inc. / NVLAP	Feb 16, 2010
1203-Norsonic	Preamplifier	14051	Jan 2, 2009	Scantek, Inc./ NVLAP	Jan 2, 2010
4180-Bruel&Kjaer	Microphone	2246115	Mar 7, 2008	NPL (UK) / UKAS	Mar 7, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by	Valentin Buzduga	Checked by	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	11/02/2009	Date	11/3/2009

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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B&K 2250/2270 Unit #5 Calibration Certificate(s)

OB. NR | LOC.

MANUFACTURER'S CERTIFICATE OF CONFORMANCE

We certify that Brüel & Kjær -2250--- Serial No 2661160
has been tested and passed all production tests, confirming compliance with the manufacturer's published specification at the date of the test.

The final test has been performed using calibrated equipment, traceable to National or International Standards or by ratio measurements.

Brüel & Kjær is certified under ISO 9001:2000 assuring that all calibration data for test equipment are retained on file and are available for inspection upon request.

Nærum 27-okt-2008

Torben Bjørn
Vice President
Operations

Please note that this document is not a calibration certificate, for information on our calibration services please contact your nearest Brüel & Kjær Service Center.

BA 0238 – 15

WORLD HEADQUARTERS: DK-2850 Nærum · Denmark
Telephone: +45 45 80 05 00 · Fax: +45 45 80 14 05 · http://www.bksv.com · e-mail: info@bksv.dk

Brüel & Kjær

Bruel & Kjær

Prepolarized Free-field 1/2" Microphone Type 4189

Calibration Chart

Serial No:	**2650729**	
Open-circuit Sensitivity*, S_0:	***-26.8***	dB re 1V/Pa
Equivalent to:	***45.8***	mV/Pa
Uncertainty, 95 % confidence level	0.2	dB
Capacitance:	***12.9***	pF
Valid At:		
Temperature:	23	°C
Ambient Static Pressure:	101.3	kPa
Relative Humidity:	50	%
Frequency:	251.2	Hz
Polarization Voltage, external:	0	V

Sensitivity Traceable To:
DPLA: Danish Primary Laboratory of Acoustics
NIST: National Institute of Standards and Technology, USA

IEC 61094-4: Type WS 2 F

Environmental Calibration Conditions:
103.2 kPa 23 °C 46 % RH

Procedure: 704215 **Date:** 25. Sep. 2008 **Signature:** BLK

$^*K_0 = -26 - S_0$ Example: $K_0 = -26 - (-26.2) = +0.2$ dB

BC 0224 – 12

B&K 2250/2270 Unit #5 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540: 1994 Part 1
and relevant requirements of ISO 9002: 1994
ACCREDITED by NVLAP
(an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.20673

Instrument:	**Acoustical Calibrator**	*Date Calibrated:*	**11/2/2009**	
Model:	**4231**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**2656413**	*Out of tolerance:*		
Class (IEC 60942):	**1**	*See comments:*		
Barometer type:		*Contains non-accredited tests:* __Yes _X_ No		
Barometer s/n:				

Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/ -6376**
Address: **Suite 107, 9920-63 Ave, Edmonton, Alberta, CANADA T6E 0G9**

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., 06/06/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
8903A-HP	Audio Analyzer	2514A05691	Jan 2, 2008	Transcat/ NVLAP	Jan 2, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1018 Norsonic	Calibration software	v.44	Validated May 2006	-	
1253-Norsonic	Calibrator	28326	Feb 16, 2009	Scantek, Inc. / NVLAP	Feb 16, 2010
1203-Norsonic	Preamplifier	14051	Jan 2, 2009	Scantek, Inc./ NVLAP	Jan 2, 2010
4180-Bruel&Kjaer	Microphone	2246115	Mar 7, 2008	NPL (UK) / UKAS	Mar 7, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by	Valentin Buzduga	Checked by	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	11/02/2009	Date	11/3/2009

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B&K 2250/2270 Unit #6 Calibration Certificate(s)

OB. NR

LOC.

MANUFACTURER'S CERTIFICATE OF CONFORMANCE

We certify that Brüel & Kjær -2250--- Serial No 2661161 has been tested and passed all production tests, confirming compliance with the manufacturer's published specification at the date of the test.

The final test has been performed using calibrated equipment, traceable to National or International Standards or by ratio measurements.

Brüel & Kjær is certified under ISO 9001:2000 assuring that all calibration data for test equipment are retained on file and are available for inspection upon request.

Nærum 27-okt-2008

Torben Bjørn
Vice President
Operations

Please note that this document is not a calibration certificate, for information on our calibration services please contact your nearest Brüel & Kjær Service Center.

BA 0238 – 15

WORLD HEADQUARTERS: DK-2850 Nærum · Denmark
Telephone: +45 45 80 05 00 · Fax: +45 45 80 14 05 · http://www.bksv.com · e-mail: info@bksv.dk

Brüel & Kjær

Bruel & Kjær

Prepolarized Free-field 1/2" Microphone Type 4189

Calibration Chart

Serial No: 2650730

Open-circuit Sensitivity*, S_0:	-26.9	dB re 1V/Pa
Equivalent to:	45.2	mV/Pa
Uncertainty, 95 % confidence level	0.2	dB
Capacitance:	12.5	pF
Valid At:		
Temperature:	23	°C
Ambient Static Pressure:	101.3	kPa
Relative Humidity:	50	%
Frequency:	251.2	Hz
Polarization Voltage, external:	0	V

Sensitivity Traceable To:
DPLA: Danish Primary Laboratory of Acoustics
NIST: National Institute of Standards and Technology, USA

IEC 61094-4: Type WS 2 F

Environmental Calibration Conditions:
103.2 kPa 23 °C 46 % RH

Procedure: 704215 **Date:** 25. Sep. 2008 **Signature:** BLK

$^*K_0 = -26 - S_0$ Example: $K_0 = -26 - (-26.2) = +0.2$ dB

BC 0224 – 12

B&K 2250/2270 Unit #6 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540: 1994 Part 1
and relevant requirements of ISO 9002: 1994
ACCREDITED by NVLAP
(an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.20674

Instrument:	**Acoustical Calibrator**	*Date Calibrated:*	**11/2/2009**	
Model:	**4231**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X	X
Serial number:	**2656414**	*Out of tolerance:*		
Class (IEC 60942):	**1**	*See comments:*		
Barometer type:		*Contains non-accredited tests:*	__Yes _X_ No	
Barometer s/n:				

Customer:	**Acoustical Consultants Inc.**	*Address:*	**Suite 107, 9920-63 Ave**
Tel/Fax:	**780-414-6373/ -6376**		**Edmonton, Alberta**
			CANADA T6E 0G9

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., 06/06/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
8903A-HP	Audio Analyzer	2514A05691	Jan 2, 2008	Transcat/ NVLAP	Jan 2, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1018 Norsonic	Calibration software	v.44	Validated May 2006	-	
1253-Norsonic	Calibrator	28326	Feb 16, 2009	Scantek, Inc. / NVLAP	Feb 16, 2010
1203-Norsonic	Preamplifier	14051	Jan 2, 2009	Scantek, Inc./ NVLAP	Jan 2, 2010
4180-Bruel&Kjaer	Microphone	2246115	Mar 7, 2008	NPL (UK) / UKAS	Mar 7, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by	Valentin Buzduga	Checked by	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	11/02/2009	Date	11/3/2009

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B&K 2250/2270 Unit #7 Calibrator Calibration Certificate

MANUFACTURER'S CERTIFICATE OF CONFORMANCE

We certify that Brüel & Kjær **-2250---** Serial No. **2722859**
has been tested and passed all production tests, confirming compliance with the manufacturer's published specification at the date of the test.

The final test has been performed using calibrated equipment, traceable to National or International Standards or by ratio measurements.

Brüel & Kjær is certified under ISO 9001:2008 assuring that all test data is retained on file and is available for inspection upon request.

Nærum 29-jun-2010

Torben Bjørn
Vice President, Operations

Please note that this document is not a calibration certificate.
For information on our calibration services please contact your nearest Brüel & Kjær office.

BA 0238 – 17

HEADQUARTERS: Brüel & Kjær Sound & Vibration Measurement A/S · DK-2850 Nærum · Denmark
Telephone: +45 7741 2000 · Fax: +45 4580 1405 · www.bksv.com · info@bksv.com
Local representatives and service organisations worldwide

Brüel & Kjær
Incorporating LDS and Lochard

Bruel & Kjær

Prepolarized Free-field 1/2" Microphone Type 4189
Calibration Chart

Serial No: **2710791**

Open-circuit Sensitivity*, S_0:	***-26.1***	dB re 1V/Pa
Equivalent to:	***49.8***	mV/Pa
Uncertainty, 95 % confidence level	0.2	dB
Capacitance:	***12.8***	pF
Valid At:		
Temperature:	23	°C
Ambient Static Pressure:	101.3	kPa
Relative Humidity:	50	%
Frequency:	251.2	Hz
Polarization Voltage, external:	0	V

Sensitivity Traceable To:
DPLA: Danish Primary Laboratory of Acoustics
NIST: National Institute of Standards and Technology, USA

IEC 61094-4: Type WS 2 F

Environmental Calibration Conditions:
101.5 kPa 23 °C 52 % RH

Procedure: 704215 **Date:** 29. Jun. 2010 **Signature:** S.L

$^*K_0 = -26 - S_0$ Example: $K_0 = -26 - (-26.2) = +0.2$ dB

acoustical consultants inc

B&K 2260 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1 and relevant requirements of ISO 9002:1994 ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.19216

Instrument:	**Sound Level Meter**	*Date Calibrated:*	**1/16/2009**	
Model:	**2260**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X	X
Serial number:	**1823779**	*Out of tolerance:*		
Tested with:	**Microphone 4189 s/n 2021315** **Preamplifier ZC0026**	*See comments:*		
Type (class):	**1**	*Contains non-accredited tests:* __Yes _X_ No		
		Calibration service: __ Basic _X_ Standard		
Customer:	**Acoustical Consultants, Inc.**	*Address:*	**Suite 107, 9920-63 Avenue** **Edmonton, AB T6E 0G9** **CANADA**	
Tel/Fax:	**780-414-6373/ -6376/** **stevenb@aciacoustical.com**			

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., 06/07/2005
SLM & Dosimeters – Acoustical Tests, Scantek Inc., 06/15/2005

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function Generator	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent Technologies	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Transcat / NVLAP	Nov 7, 2009
PC Program 1019 Norsonic	Calibration software	v.46	Validated Dec 2006	-	-
1253-Norsonic	Calibrator	25726	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.5 °C	102.142 kPa	26.5 %RH

Calibrated by	Valentin Buzduga	**Checked by**	Mariana Buzduga
Signature		Signature	
Date	1/16/2009	Date	1/16/2009

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B&K 2260 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
and relevant requirements of ISO 9002:1994
ACCREDITED by NVLAP (an ILAC and APLAC signatory)

NVLAP®

NVLAP Lab Code: 200625-0

Calibration Certificate No.19217

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2021315**

Date Calibrated: **1/16/2009**

Status:	**Received**	**Sent**
In tolerance:	**X**	**X**
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **Acoustical Consultants, Inc.**
Tel/Fax: **780-414-6373/ -6376/**
stevenb@aciacoustical.com

Address: **Suite 107, 9920-63 Avenue**
Edmonton, AB T6E 0G9
CANADA

Tested in accordance with the following procedures and standards:
Procedure for Calibration of Measurement Microphones, Scantek Inc., 06/15/2005

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	25747	Jan 2, 2009	Scantek, Inc./NVLAP	Jan 2, 2010
DS-360-SRS	Function Generator	61646	Nov 19, 2007	Davis Inotek / A2LA	Nov 19, 2009
34401A-Agilent	Digital Multimeter	MY41022043	Nov 13, 2008	Transcat / NVLAP	Nov 13, 2009
DPI 141-Druck	Pressure Indicator	790/00-04	Nov 21, 2008	Transcat / NVLAP	Nov 21, 2010
HMP233-Vaisala Oyj	Humidity & Temp. Transmitter	V3820001	May 7, 2008	Vaisala / A2LA	Nov 7, 2009
PC Program 1017 Norsonic	Calibration software	v.46	Validated Feb 2006	-	-
1253-Norsonic	Calibrator	28326	Mar 3, 2008	NPL (UK) / UKAS	Mar 3, 2010
1203-Norsonic	Preamplifier	14051	Jan 2, 2009	Scantek, Inc./ NVLAP	Jan 2, 2010
4180-Bruel&Kjaer	Microphone	2246115	Mar 7, 2008	NPL (UK) / UKAS	Mar 7, 2010

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by	Valentin Buzduga	**Checked by**	Mariana Buzduga
Signature	[signature]	Signature	[signature]
Date	1/16/2009	Date	1/16/2009

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Appendix II. THE ASSESSMENT OF ENVIRONMENTAL NOISE (GENERAL)

Sound Pressure Level

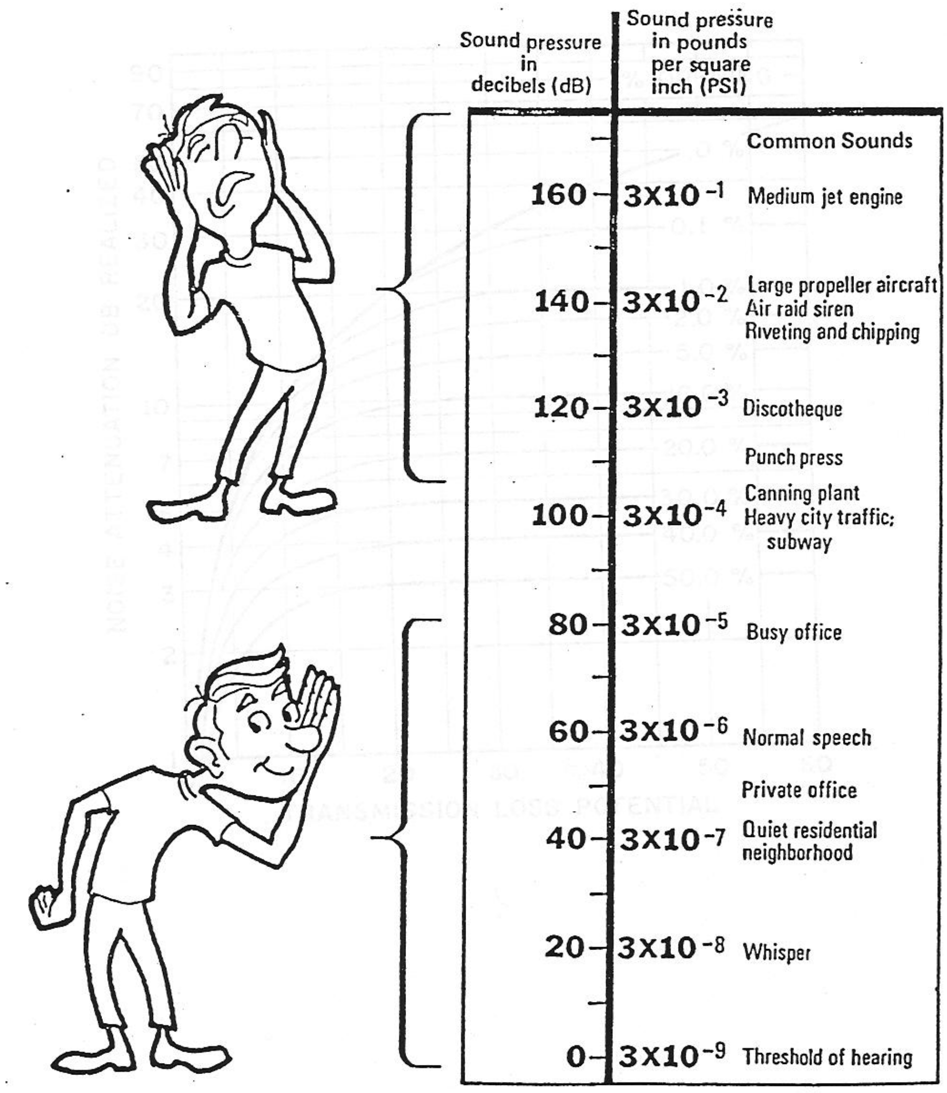
Sound pressure is initially measured in Pascal's (Pa). Humans can hear several orders of magnitude in sound pressure levels, so a more convenient scale is used. This scale is known as the decibel (dB) scale, named after Alexander Graham Bell (telephone guy). It is a base 10 logarithmic scale. When we measure pressure we typically measure the RMS sound pressure.

$$SPL = 10\log_{10}\left[\frac{P_{RMS}^{2}}{P_{ref}^{2}}\right] = 20\log_{10}\left[\frac{P_{RMS}}{P_{ref}}\right]$$

Where: SPL = Sound Pressure Level in dB
P_{RMS} = Root Mean Square measured pressure (Pa)
P_{ref} = Reference sound pressure level ($P_{ref} = 2\text{x}10^{-5}$ Pa = 20 μPa)

This reference sound pressure level is an internationally agreed upon value. It represents the threshold of human hearing for "typical" people based on numerous testing. It is possible to have a threshold which is lower than 20 μPa which will result in negative dB levels. As such, zero dB does not mean there is no sound!

In general, a difference of 1 – 2 dB is the threshold for humans to notice that there has been a change in sound level. A difference of 3 dB (factor of 2 in acoustical energy) is perceptible and a change of 5 dB is strongly perceptible. A change of 10 dB is typically considered a factor of 2. This is quite remarkable when considering that 10 dB is 10-times the acoustical energy!


Sound pressure in decibels (dB)
Sound pressure in pounds per square inch (PSI)
Common Sounds
160 3X10 -1 Medium jet engine
140 3X10 -2 Large propeller aircraft
Air raid siren
Riveting and chipping
120 3X10 -3 Discotheque
Punch press
100 3X10 -4 Canning plant
Heavy city traffic; subway
80 3X10 -5 Busy office
60 3X10 -6 Normal speech
Private office
40 3X10 -7 Quiet residential neighborhood
20 3X10 -8 Whisper
0 3X10 -9 Threshold of hearing

Frequency

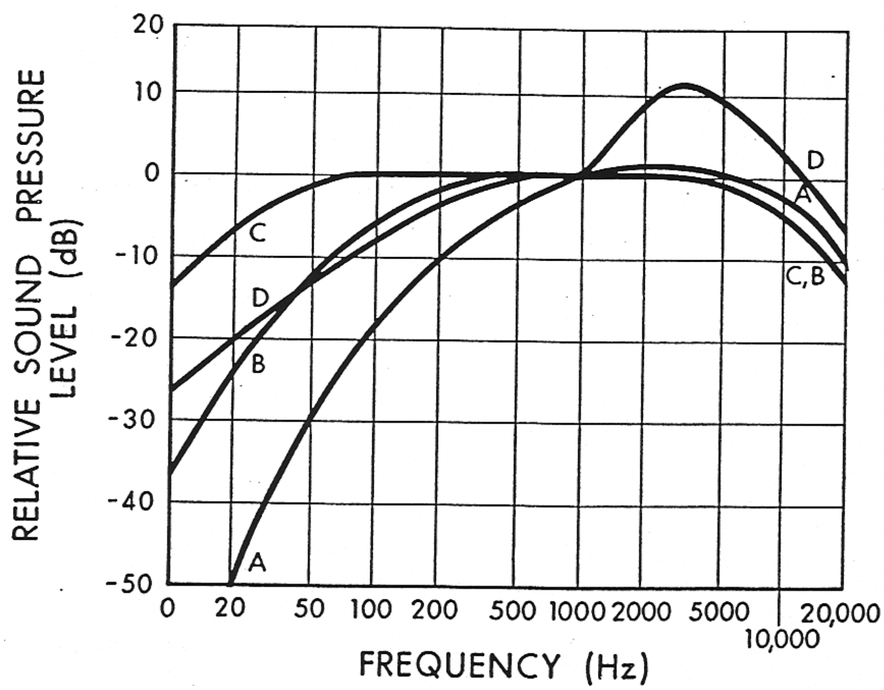
The range of frequencies audible to the human ear ranges from approximately 20 Hz to 20 kHz. Within this range, the human ear does not hear equally at all frequencies. It is not very sensitive to low frequency sounds, is very sensitive to mid frequency sounds and is slightly less sensitive to high frequency sounds. Due to the large frequency range of human hearing, the entire spectrum is often divided into 31 bands, each known as a 1/3 octave band.

The internationally agreed upon center frequencies and upper and lower band limits for the 1/1 (whole octave) and 1/3 octave bands are as follows:

Lower Band Limit	Whole Octave Center Frequency	Upper Band Limit
11	**16**	22
22	**31.5**	44
44	**63**	88
88	**125**	177
177	**250**	355
355	**500**	710
710	**1000**	1420
1420	**2000**	2840
2840	**4000**	5680
5680	**8000**	11360
11360	**16000**	22720

Lower Band Limit	1/3 Octave Center Frequency	Upper Band Limit
14.1	**16**	17.8
17.8	**20**	22.4
22.4	**25**	28.2
28.2	**31.5**	35.5
35.5	**40**	44.7
44.7	**50**	56.2
56.2	**63**	70.8
70.8	**80**	89.1
89.1	**100**	112
112	**125**	141
141	**160**	178
178	**200**	224
224	**250**	282
282	**315**	355
355	**400**	447
447	**500**	562
562	**630**	708
708	**800**	891
891	**1000**	1122
1122	**1250**	1413
1413	**1600**	1778
1778	**2000**	2239
2239	**2500**	2818
2818	**3150**	3548
3548	**4000**	4467
4467	**5000**	5623
5623	**6300**	7079
7079	**8000**	8913
8913	**10000**	11220
11220	**12500**	14130
14130	**16000**	17780
17780	**20000**	22390

Human hearing is most sensitive at approximately 3500 Hz which corresponds to the ¼ wavelength of the ear canal (approximately 2.5 cm). Because of this range of sensitivity to various frequencies, we typically apply various weighting networks to the broadband measured sound to more appropriately account for the way humans hear. By default, the most common weighting network used is the so-called "A-weighting". It can be seen in the figure that the low frequency sounds are reduced significantly with the A-weighting.



Combination of Sounds

When combining multiple sound sources the general equation is:

$$\Sigma SPL_n = 10\log_{10}\left[\sum_{i=1}^{n} 10^{\frac{SPL_i}{10}}\right]$$

Examples:

- Two sources of 50 dB each add together to result in 53 dB.
- Three sources of 50 dB each add together to result in 55 dB.
- Ten sources of 50 dB each add together to result in 60 dB.
- One source of 50 dB added to another source of 40 dB results in 50.4 dB

It can be seen that, if multiple similar sources exist, removing or reducing only one source will have little effect.

Sound Level Measurements

Over the years a number of methods for measuring and describing environmental noise have been developed. The most widely used and accepted is the concept of the Energy Equivalent Sound Level (L_{eq}) which was developed in the US (1970's) to characterize noise levels near US Air-force bases. This is the level of a steady state sound which, for a given period of time, would contain the same energy as the time varying sound. The concept is that the same amount of annoyance occurs from a sound having a high level for a short period of time as from a sound at a lower level for a longer period of time.
The L_{eq} is defined as:

$$L_{eq} = 10\log_{10}\left[\frac{1}{T}\int_0^T 10^{\frac{dB}{10}}\,dT\right] = 10\log_{10}\left[\frac{1}{T}\int_0^T \frac{P^2}{P_{ref}^2}\,dT\right]$$

We must specify the time period over which to measure the sound. i.e. 1-second, 10-seconds, 15-seconds, 1-minute, 1-day, etc**. An L_{eq} is meaningless if there is no time period associated**.

In general there a few very common L_{eq} sample durations which are used in describing environmental noise measurements. These include:

- $L_{eq}24$ - Measured over a 24-hour period
- $L_{eq}Night$ - Measured over the night-time (typically 22:00 – 07:00)
- $L_{eq}Day$ - Measured over the day-time (typically 07:00 – 22:00)
- L_{DN} - Same as $L_{eq}24$ with a 10 dB penalty added to the night-time

Statistical Descriptor

Another method of conveying long term noise levels utilizes statistical descriptors. These are calculated from a cumulative distribution of the sound levels over the entire measurement duration and then determining the sound level at xx % of the time.

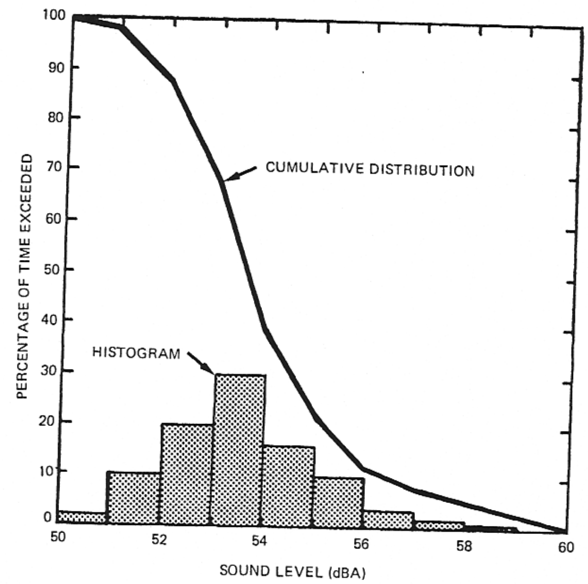


Figure 16.6 Statistically processed community noise showing histogram and cumulative distribution of A weighted sound levels.

Industrial Noise Control, Lewis Bell, Marcel Dekker, Inc. 1994

The most common statistical descriptors are:

L_{min} - minimum sound level measured
L_{01} - sound level that was exceeded only 1% of the time
L_{10} - sound level that was exceeded only 10% of the time.
- Good measure of intermittent or intrusive noise
- Good measure of Traffic Noise

L_{50} - sound level that was exceeded 50% of the time (arithmetic average)
- Good to compare to L_{eq} to determine steadiness of noise

L_{90} - sound level that was exceeded 90% of the time
- Good indicator of typical “ambient” noise levels

L_{99} - sound level that was exceeded 99% of the time
L_{max} - maximum sound level measured

These descriptors can be used to provide a more detailed analysis of the varying noise climate:
- If there is a large difference between the L_{eq} and the L_{50} (L_{eq} can never be any lower than the L_{50}) then it can be surmised that one or more short duration, high level sound(s) occurred during the time period.
- If the gap between the L_{10} and L_{90} is relatively small (less than 15 – 20 dBA) then it can be surmised that the noise climate was relatively steady.

Sound Propagation

In order to understand sound propagation, the nature of the source must first be discussed. In general, there are three types of sources. These are known as ‘point’, ‘line’, and ‘area’. This discussion will concentrate on point and line sources since area sources are much more complex and can usually be approximated by point sources at large distances.

Point Source

As sound radiates from a point source, it dissipates through geometric spreading. The basic relationship between the sound levels at two distances from a point source is:

$$\therefore SPL_1 - SPL_2 = 20\log_{10}\left(\frac{r_2}{r_1}\right)$$

Where: SPL_1 = sound pressure level at location 1, SPL_2 = sound pressure level at location 2
r_1 = distance from source to location 1, r_2 = distance from source to location 2

Thus, the reduction in sound pressure level for a point source radiating in a free field is **6 dB per doubling of distance**. This relationship is independent of reflectivity factors provided they are always present. Note that this only considers geometric spreading and does not take into account atmospheric effects. Point sources still have some physical dimension associated with them, and typically do not radiate sound equally in all directions in all frequencies. The directionality of a source is also highly dependent on frequency. As frequency increases, directionality increases.

Examples (note no atmospheric absorption):

- A point source measuring 50 dB at 100m will be 44 dB at 200m.
- A point source measuring 50 dB at 100m will be 40.5 dB at 300m.
- A point source measuring 50 dB at 100m will be 38 dB at 400m.
- A point source measuring 50 dB at 100m will be 30 dB at 1000m.

Line Source

A line source is similar to a point source in that it dissipates through geometric spreading. The difference is that a line source is equivalent to a long line of many point sources. The basic relationship between the sound levels at two distances from a line source is:

$$SPL_1 - SPL_2 = 10\log_{10}\left(\frac{r_2}{r_1}\right)$$

The difference from the point source is that the ‘20’ term in front of the ‘log’ is now only 10. Thus, the reduction in sound pressure level for a line source radiating in a free field is **3 dB per doubling of distance**.

Examples (note no atmospheric absorption):

- A line source measuring 50 dB at 100m will be 47 dB at 200m.
- A line source measuring 50 dB at 100m will be 45 dB at 300m.
- A line source measuring 50 dB at 100m will be 34 dB at 400m.
- A line source measuring 50 dB at 100m will be 40 dB at 1000m.

Atmospheric Absorption

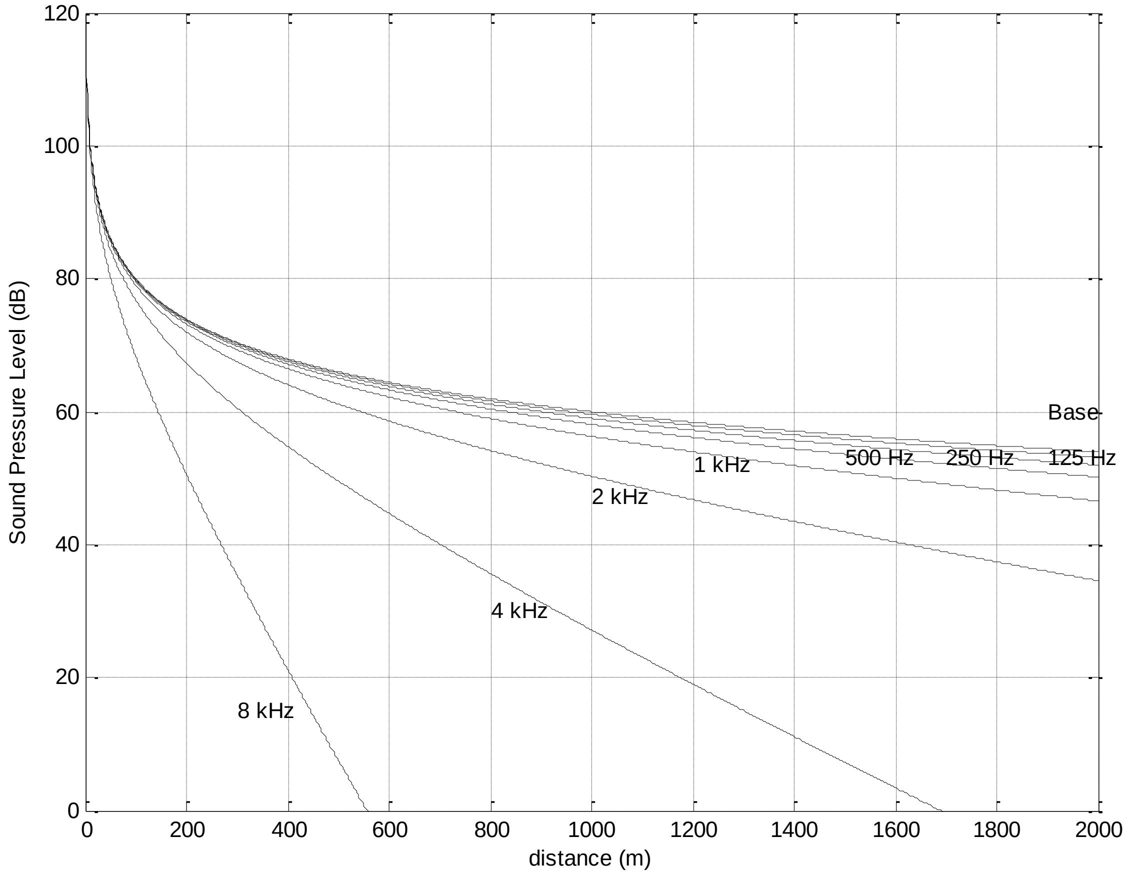
As sound transmits through a medium, there is an attenuation (or dissipation of acoustic energy) which can be attributed to three mechanisms:

1) **Viscous Effects** - Dissipation of acoustic energy due to fluid friction which results in thermodynamically irreversible propagation of sound.
2) **Heat Conduction Effects** - Heat transfer between high and low temperature regions in the wave which result in non-adiabatic propagation of the sound.
3) **Inter Molecular Energy Interchanges** - Molecular energy relaxation effects which result in a time lag between changes in translational kinetic energy and the energy associated with rotation and vibration of the molecules.

The following table illustrates the attenuation coefficient of sound at standard pressure (101.325 kPa) in units of dB/100m.

Temperature ^{o}C	Relative Humidity (%)	Frequency (Hz)					
		125	250	500	1000	2000	4000
30	20	0.06	0.18	0.37	0.64	1.40	4.40
	50	0.03	0.10	0.33	0.75	1.30	2.50
	90	0.02	0.06	0.24	0.70	1.50	2.60
20	20	0.07	0.15	0.27	0.62	1.90	6.70
	50	0.04	0.12	0.28	0.50	1.00	2.80
	90	0.02	0.08	0.26	0.56	0.99	2.10
10	20	0.06	0.11	0.29	0.94	3.20	9.00
	50	0.04	0.11	0.20	0.41	1.20	4.20
	90	0.03	0.10	0.21	0.38	0.81	2.50
0	20	0.05	0.15	0.50	1.60	3.70	5.70
	50	0.04	0.08	0.19	0.60	2.10	6.70
	90	0.03	0.08	0.15	0.36	1.10	4.10

- As frequency increases, absorption increases
- As Relative Humidity increases, absorption decreases
- There is no direct relationship between absorption and temperature
- **The net result of atmospheric absorption is to modify the sound propagation of a point source from 6 dB/doubling-of-distance to approximately 7 – 8 dB/doubling-of-distance (based on anecdotal experience)**



Atmospheric Absorption at 10°C and 70% RH

Meteorological Effects

There are many meteorological factors which can affect how sound propagates over large distances. These various phenomena must be considered when trying to determine the relative impact of a noise source either after installation or during the design stage.

Wind
- Can greatly alter the noise climate away from a source depending on direction
- Sound levels downwind from a source can be increased due to refraction of sound back down towards the surface. This is due to the generally higher velocities as altitude increases.
- Sound levels upwind from a source can be decreased due to a “bending” of the sound away from the earth’s surface.
- Sound level differences of ±10dB are possible depending on severity of wind and distance from source.
- Sound levels crosswind are generally not disturbed by an appreciable amount
- Wind tends to generate its own noise, however, and can provide a high degree of masking relative to a noise source of particular interest.

Temperature
- Temperature effects can be similar to wind effects
- Typically, the temperature is warmer at ground level than it is at higher elevations.
- If there is a very large difference between the ground temperature (very warm) and the air aloft (only a few hundred meters) then the transmitted sound refracts upward due to the changing speed of sound.
- If the air aloft is warmer than the ground temperature (known as an *inversion*) the resulting higher speed of sound aloft tends to refract the transmitted sound back down towards the ground. This essentially works on Snell’s law of reflection and refraction.
- Temperature inversions typically happen early in the morning and are most common over large bodies of water or across river valleys.
- Sound level differences of ±10dB are possible depending on gradient of temperature and distance from source.

Rain
- Rain does not affect sound propagation by an appreciable amount unless it is very heavy
- The larger concern is the noise generated by the rain itself. A heavy rain striking the ground can cause a significant amount of highly broadband noise. The amount of noise generated is difficult to predict.
- Rain can also affect the output of various noise sources such as vehicle traffic.

Summary
- In general, these wind and temperature effects are difficult to predict
- Empirical models (based on measured data) have been generated to attempt to account for these effects.
- Environmental noise measurements must be conducted with these effects in mind. Sometimes it is desired to have completely calm conditions, other times a “worst case” of downwind noise levels are desired.

Topographical Effects

Similar to the various atmospheric effects outlined in the previous section, the effect of various geographical and vegetative factors must also be considered when examining the propagation of noise over large distances.

Topography

- One of the most important factors in sound propagation.
- Can provide a natural barrier between source and receiver (i.e. if berm or hill in between).
- Can provide a natural amplifier between source and receiver (i.e. large valley in between or hard reflective surface in between).
- Must look at location of topographical features relative to source and receiver to determine importance (i.e. small berm 1km away from source and 1km away from receiver will make negligible impact).

Grass

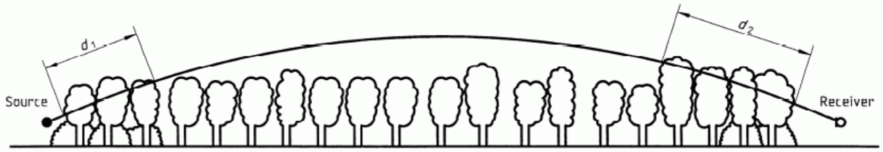
- Can be an effective absorber due to large area covered
- Only effective at low height above ground. Does not affect sound transmitted direct from source to receiver if there is line of sight.
- Typically less absorption than atmospheric absorption when there is line of sight.
- Approximate rule of thumb based on empirical data is:

$$A_g = 18\log_{10}(f) - 31 \qquad (dB/100m)$$

Where: A_g is the absorption amount

Trees

- Provide absorption due to foliage
- Deciduous trees are essentially ineffective in the winter
- Absorption depends heavily on density and height of trees
- No data found on absorption of various kinds of trees
- Large spans of trees are required to obtain even minor amounts of sound reduction
- In many cases, trees can provide an effective visual barrier, even if the noise attenuation is negligible.



NOTE — $d_f = d_1 + d_2$

For calculating d_1 and d_2, the curved path radius may be assumed to be 5 km.

Figure A.1 — Attenuation due to propagation through foliage increases linearly with propagation distance d_f through the foliage

Table A.1 — Attenuation of an octave band of noise due to propagation a distance d_f through dense foliage

Propagation distance d_f	**Nominal midband frequency**							
	Hz							
m	63	125	250	500	1 000	2 000	4 000	8 000
	Attenuation, dB:							
$10 \leq d_f \leq 20$	0	0	1	1	1	1	2	3
	Attenuation, dB/m:							
$20 \leq d_f \leq 200$	0,02	0,03	0,04	0,05	0,06	0,08	0,09	0,12

Tree/Foliage attenuation from ISO 9613-2:1996

Bodies of Water

- Large bodies of water can provide the opposite effect to grass and trees.
- Reflections caused by small incidence angles (grazing) can result in larger sound levels at great distances (increased reflectivity, Q).
- Typically air temperatures are warmer high aloft since air temperatures near water surface tend to be more constant. Result is a high probability of temperature inversion.
- Sound levels can “carry” much further.

Snow

- Covers the ground for approximately 1/2 of the year in northern climates.
- Can act as an absorber or reflector (and varying degrees in between).
- Freshly fallen snow can be quite absorptive.
- Snow which has been sitting for a while and hard packed due to wind can be quite reflective.
- Falling snow can be more absorptive than rain, but does not tend to produce its own noise.
- Snow can cover grass which might have provided some means of absorption.
- Typically sound propagates with less impedance in winter due to hard snow on ground and no foliage on trees/shrubs.

Appendix III. SOUND LEVELS OF FAMILIAR NOISE SOURCES

Used with Permission Obtained from EUB Guide 38: Noise Control Directive User Guide (November 1999)

Source[1]	Sound Level (dBA)
Bedroom of a country home	30
Soft whisper at 1.5 m	30
Quiet office or living room	40
Moderate rainfall	50
Inside average urban home	50
Quiet street	50
Normal conversation at 1 m	60
Noisy office	60
Noisy restaurant	70
Highway traffic at 15 m	75
Loud singing at 1 m	75
Tractor at 15 m	78-95
Busy traffic intersection	80
Electric typewriter	80
Bus or heavy truck at 15 m	88-94
Jackhammer	88-98
Loud shout	90
Freight train at 15 m	95
Modified motorcycle	95
Jet taking off at 600 m	100
Amplified rock music	110
Jet taking off at 60 m	120
Air-raid siren	130

[1] Cottrell, Tom, 1980, *Noise in Alberta*, Table 1, p.8, ECA80 - 16/1B4 (Edmonton: Environment Council of Alberta).

SOUND LEVELS GENERATED BY COMMON APPLIANCES

Used with Permission Obtained from EUB Guide 38: Noise Control Directive User Guide (November 1999)

Source[1]	**Sound level at 3 feet (dBA)**
Freezer	38-45
Refrigerator	34-53
Electric heater	47
Hair clipper	50
Electric toothbrush	48-57
Humidifier	41-54
Clothes dryer	51-65
Air conditioner	50-67
Electric shaver	47-68
Water faucet	62
Hair dryer	58-64
Clothes washer	48-73
Dishwasher	59-71
Electric can opener	60-70
Food mixer	59-75
Electric knife	65-75
Electric knife sharpener	72
Sewing machine	70-74
Vacuum cleaner	65-80
Food blender	65-85
Coffee mill	75-79
Food waste disposer	69-90
Edger and trimmer	81
Home shop tools	64-95
Hedge clippers	85
Electric lawn mower	80-90

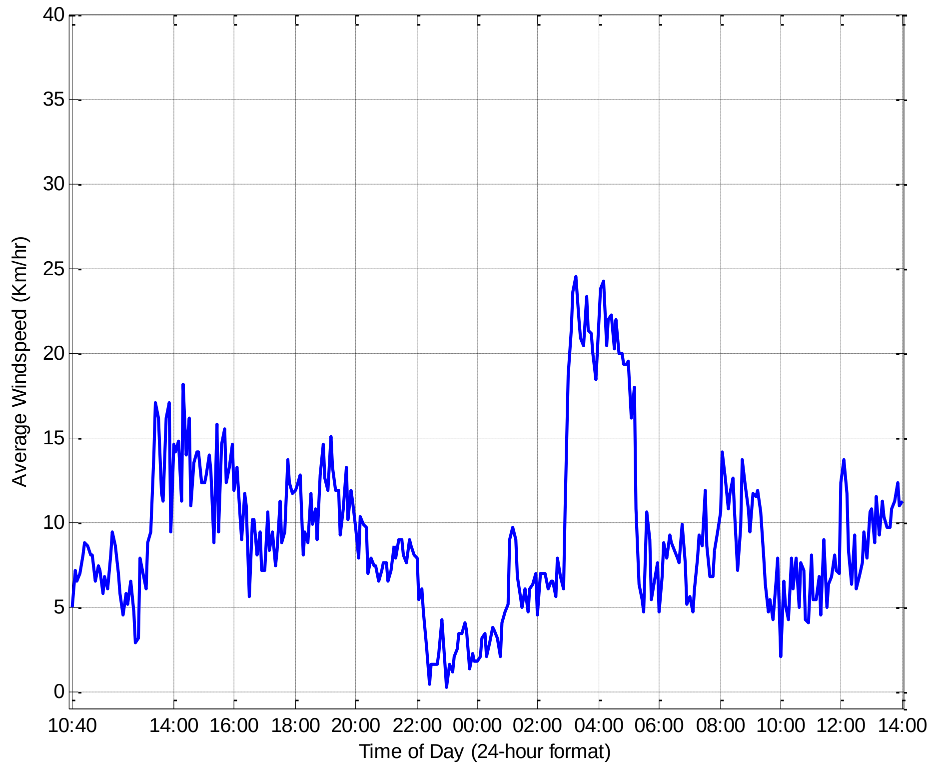
[1] Reif, Z. F., and Vermeulen, P. J., 1979, "Noise from domestic appliances, construction, and industry," Table 1, p.166, in Jones, H. W., ed., *Noise in the Human Environment*, vol. 2, ECA79-SP/1 (Edmonton: Environment Council of Alberta).

Appendix IV. WEATHER DATA

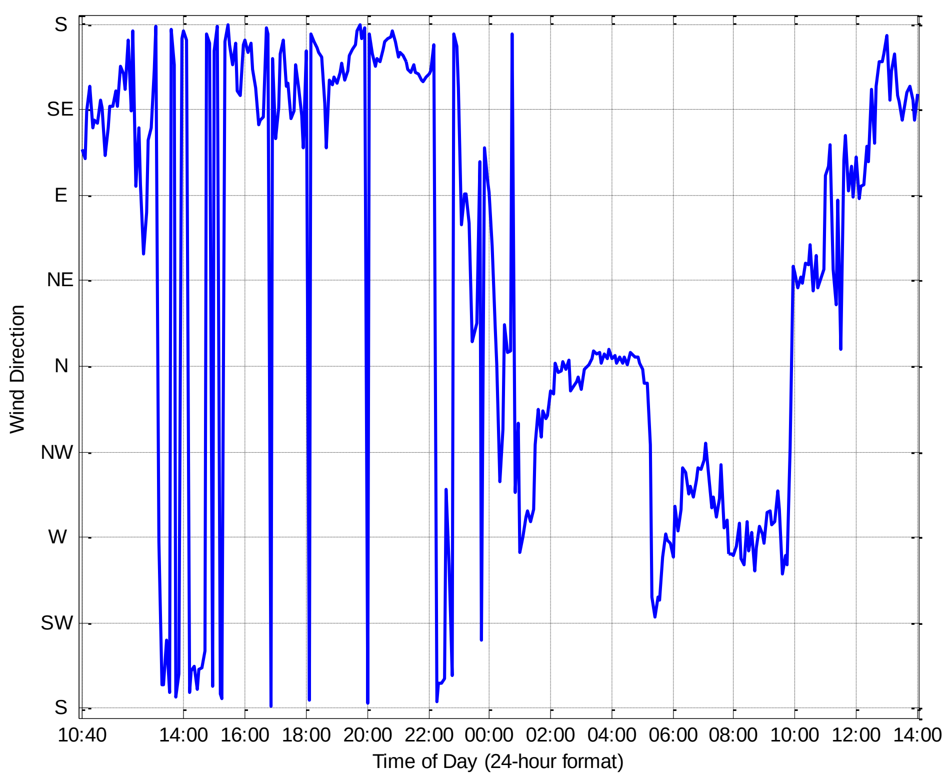
June 23, 2010[1]					
Time	**Temperature (°C)**	**Relative Humidity (%)**	**Wind Direction**	**Wind Speed (km/hr)**	**Weather**
00:00	12.8	88	South-West	9	Mainly Clear
01:00	12.5	88	South-West	11	Clear
02:00	11.8	85	South-West	6	Clear
03:00	10.7	89	North	0	Mainly Clear
04:00	10.4	92	North-West	4	Clear
05:00	9.8	90	North-West	7	Mainly Clear
06:00	12.0	86	North	0	Mainly Clear
07:00	13.4	83	South	7	Mainly Clear
08:00	15.3	75	South	4	Mostly Cloudy
09:00	17.5	64	South	7	Mostly Cloudy
10:00	18.8	58	South-East	11	Mostly Cloudy
11:00	19.6	55	South-East	7	Mostly Cloudy
12:00	20.6	54	East	11	Mostly Cloudy
13:00	20.7	54	South	4	Mostly Cloudy
14:00	21.3	53	East	7	Cloudy
15:00	20.7	54	South-East	17	Rain Showers
16:00	20.8	58	East	11	Mostly Cloudy
17:00	21.8	58	East	22	Mostly Cloudy
18:00	20.9	48	South-East	15	Mostly Cloudy
19:00	16.8	68	South-West	22	Thunderstorms, Heavy Rain Showers
20:00	16.4	58	North-East	13	Thunderstorms, Rain Showers
21:00	15.4	65	North	11	Mostly Cloudy
22:00	13.8	73	North	17	Mostly Cloudy
23:00	12.9	75	North-West	15	Mainly Clear

[1] Data was obtained from Environment Canada at the Calgary International Airport. This was the only monitoring period that weather was taken from Environment Canada as the monitoring locations where in close proximity of the airport.

June 28 - 29, 2010

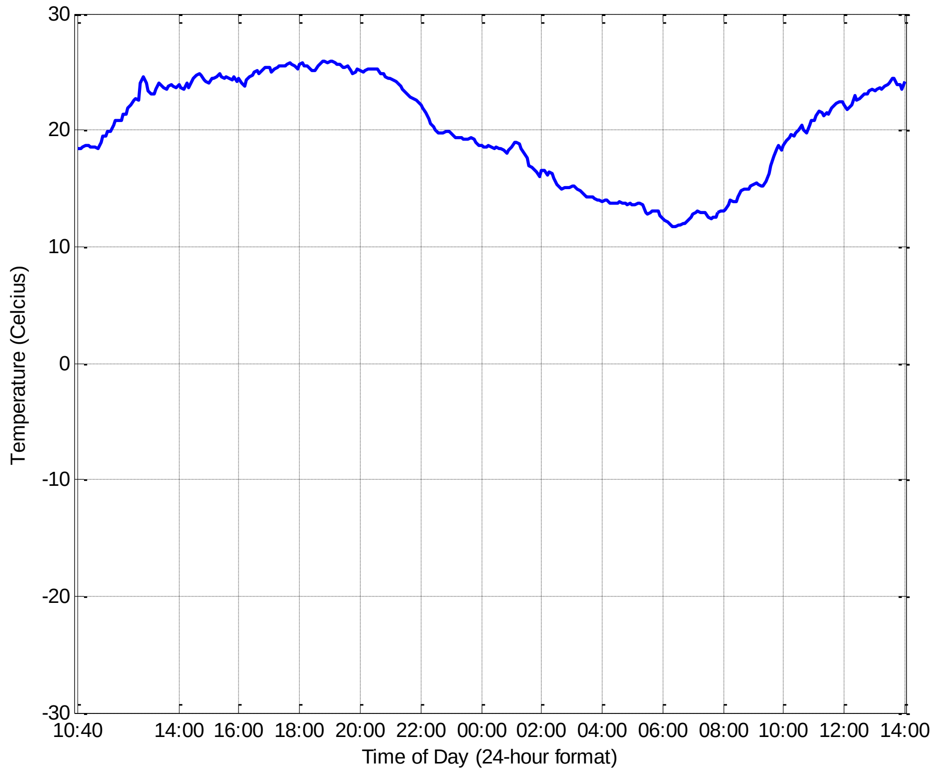


Monitored Wind Speed

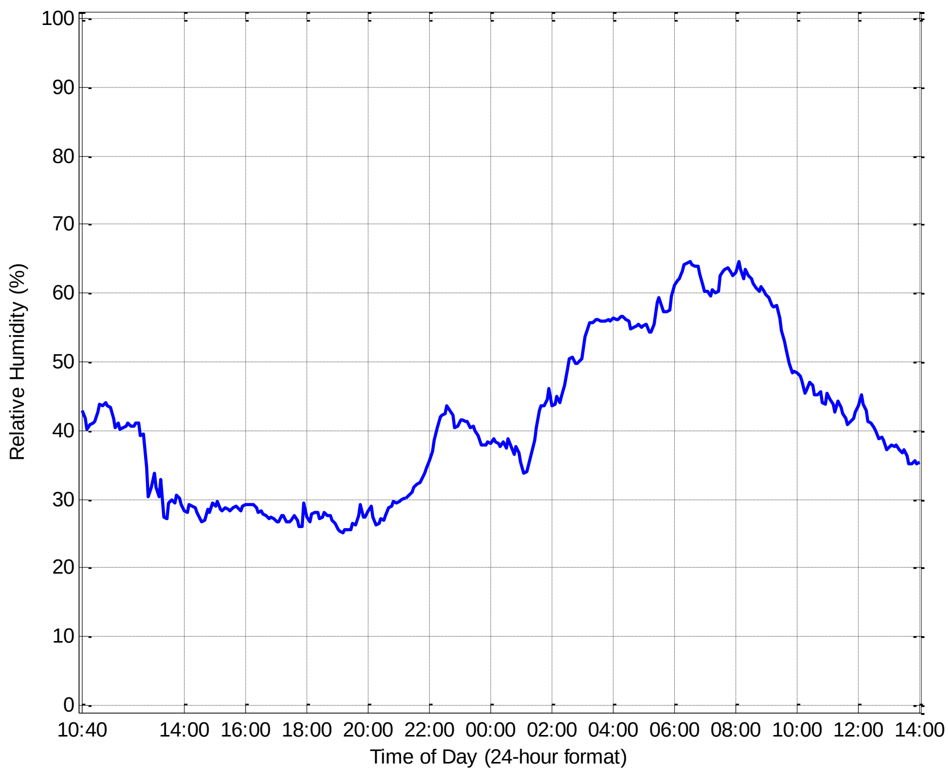


Monitored Wind Direction

aci acoustical consultants inc

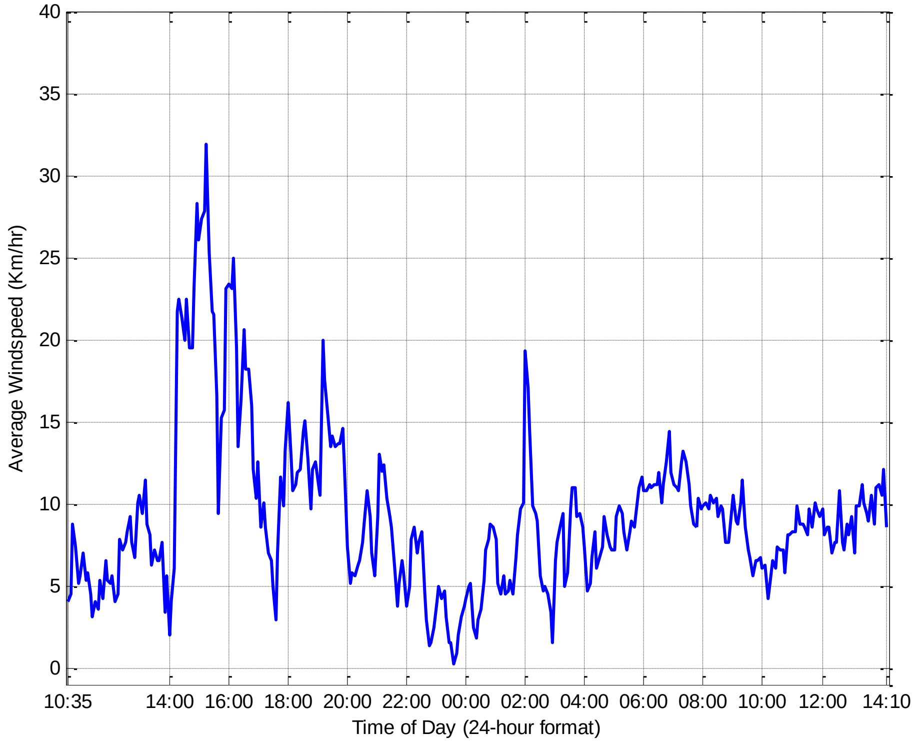


Monitored Temperature

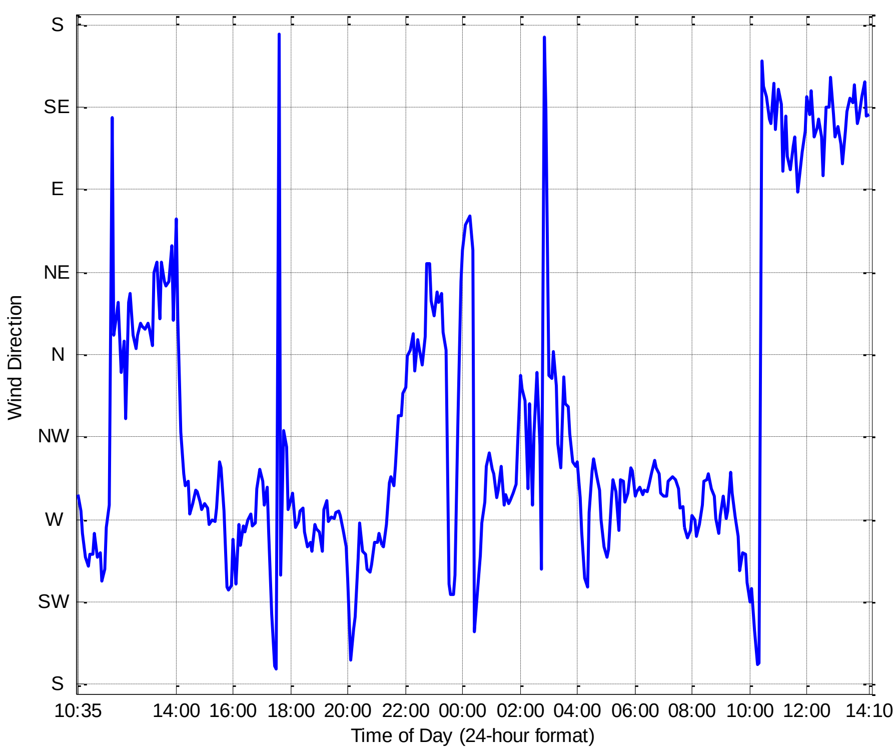


Monitored Relative Humidity

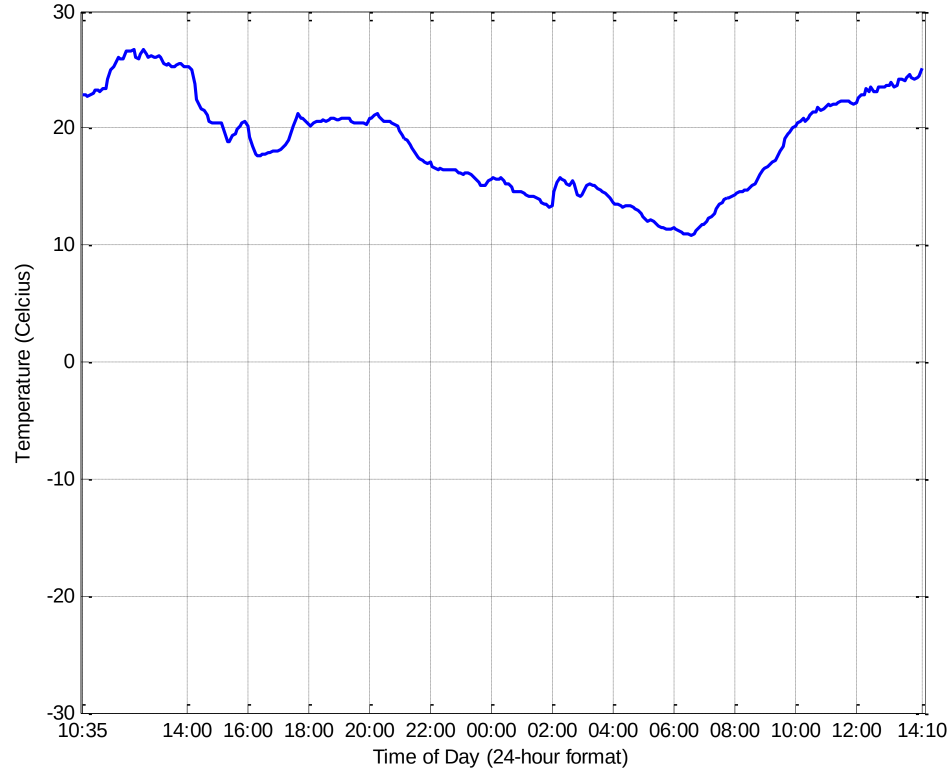
July 29 - 30, 2010



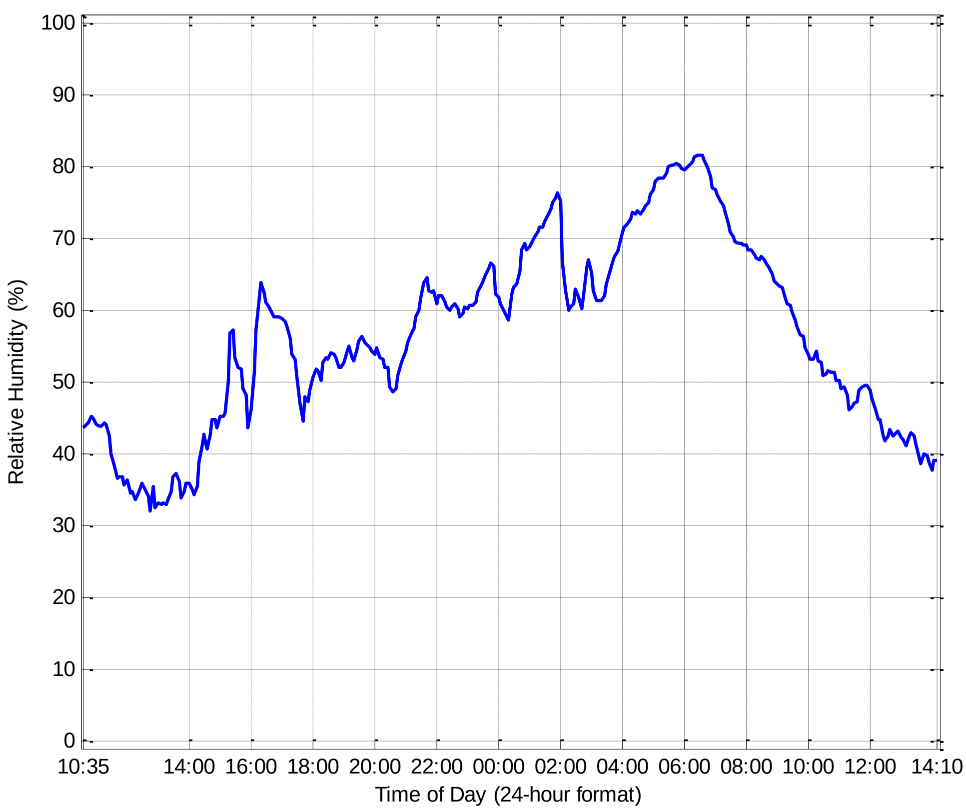
Monitored Wind Speed



Monitored Wind Direction

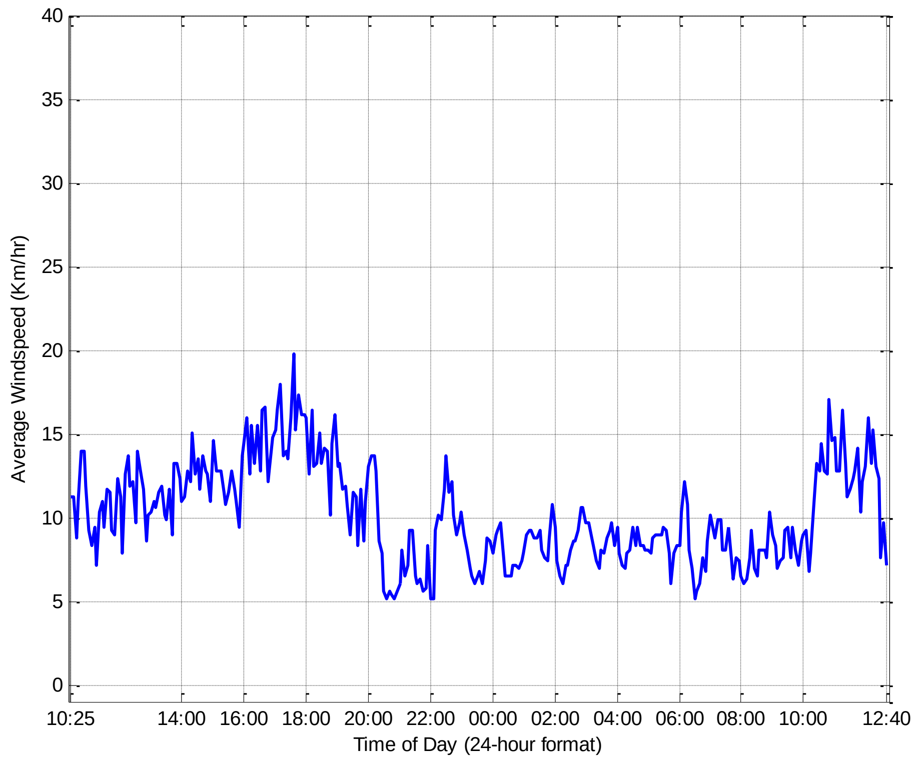


Monitored Temperature

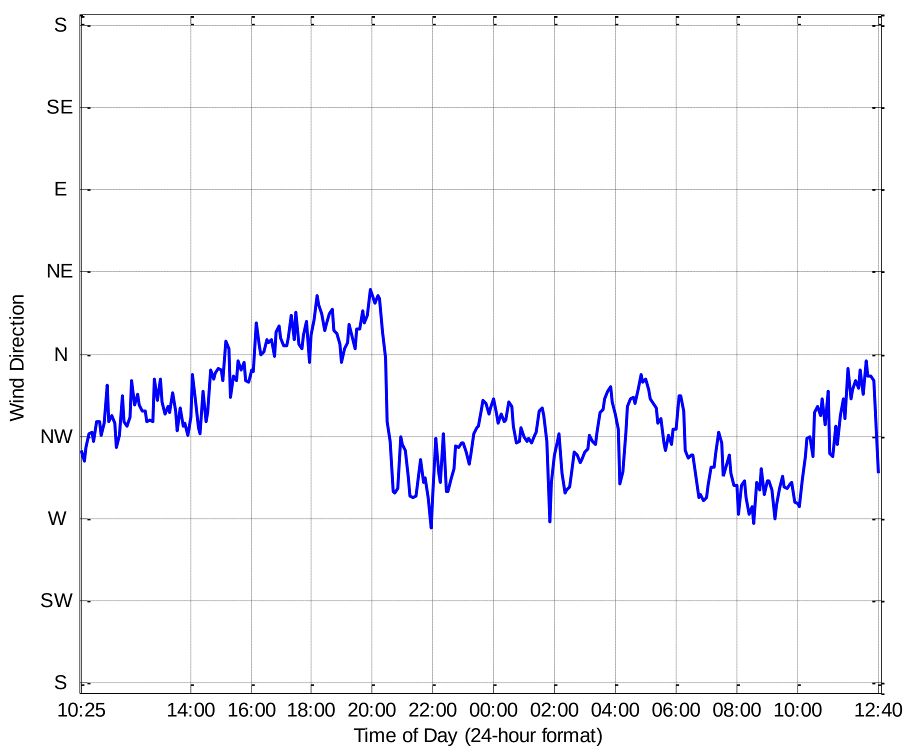


Monitored Relative Humidity

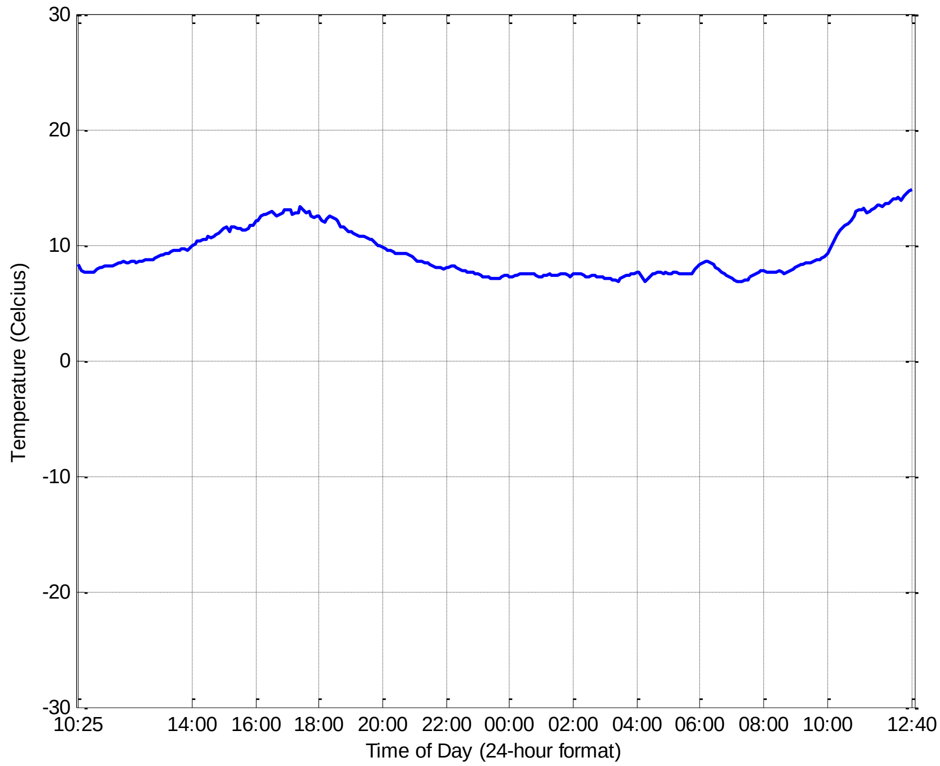
September 9 - 10, 2010



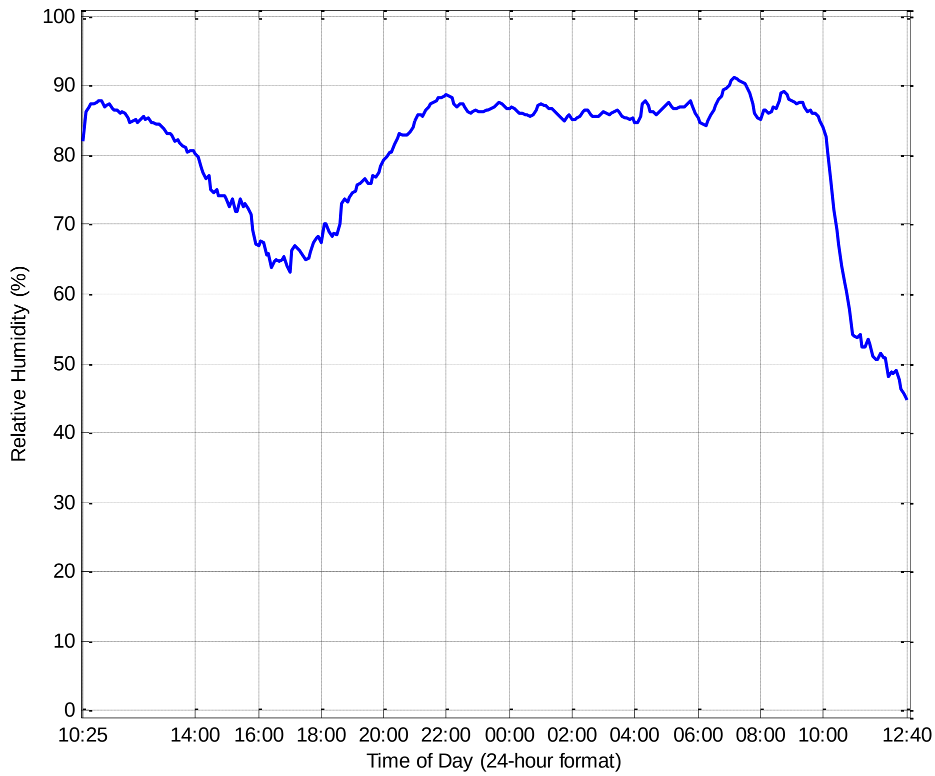
Monitored Wind Speed



Monitored Wind Direction

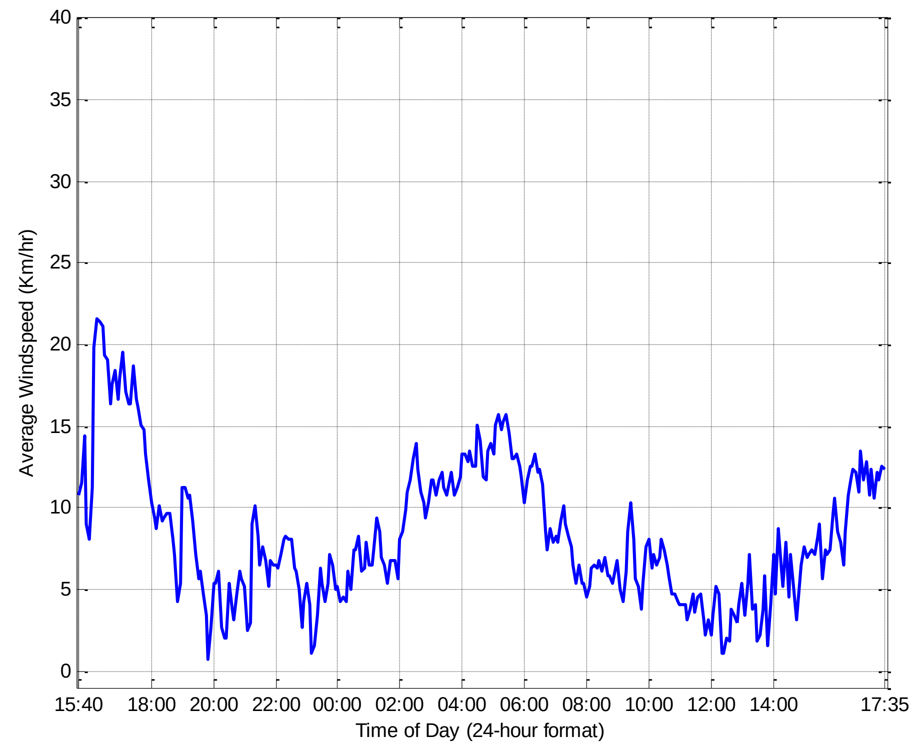


Monitored Temperature

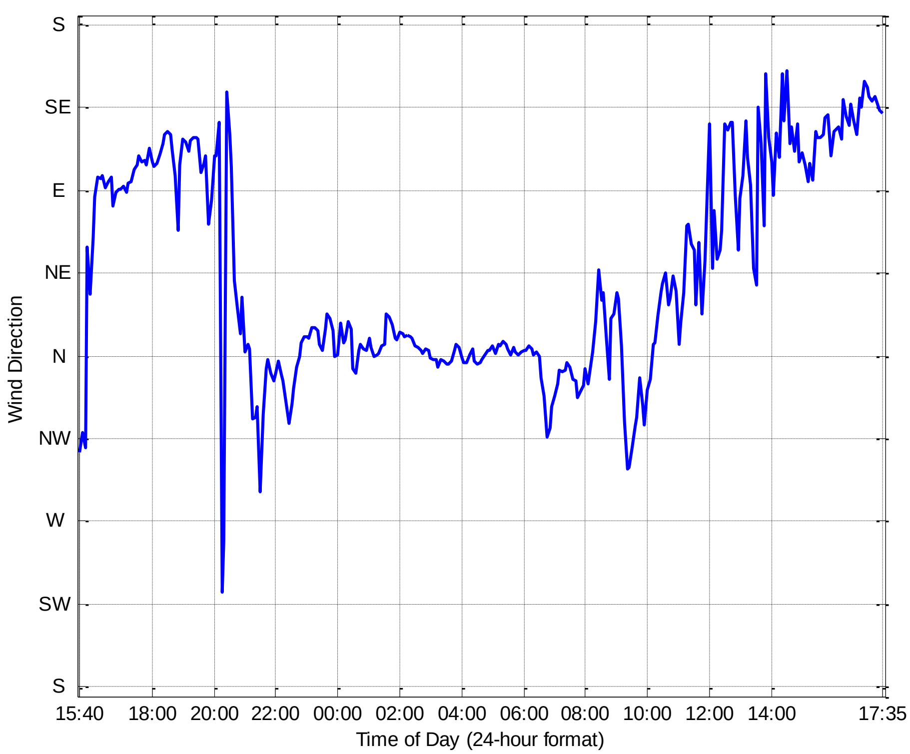


Monitored Relative Humidity

October 21 - 22, 2010



Monitored Wind Speed



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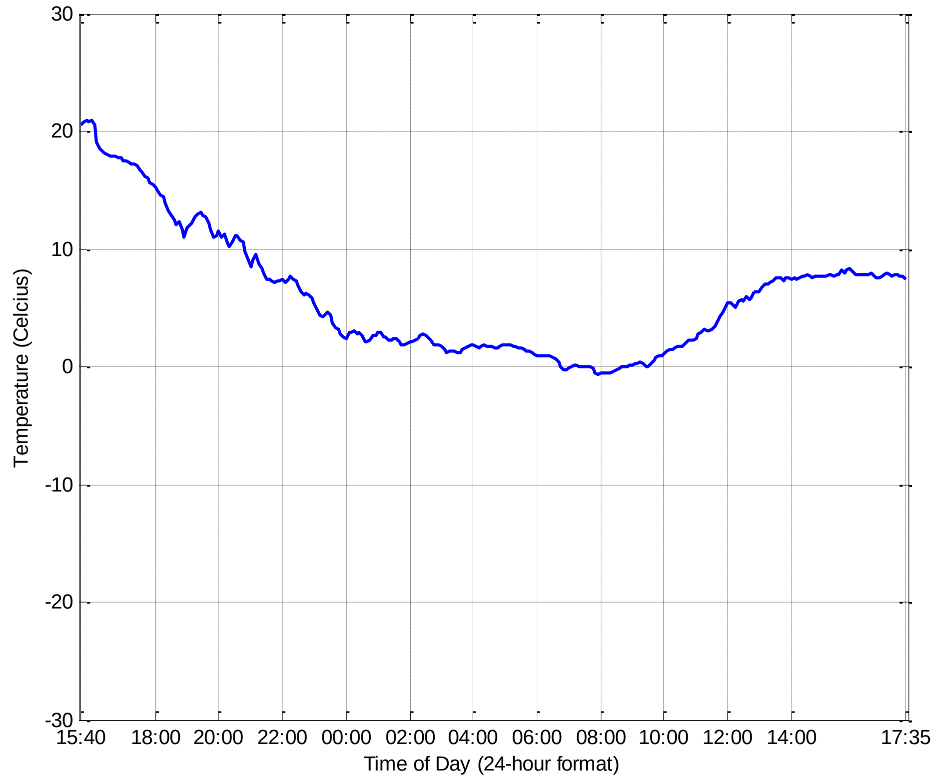
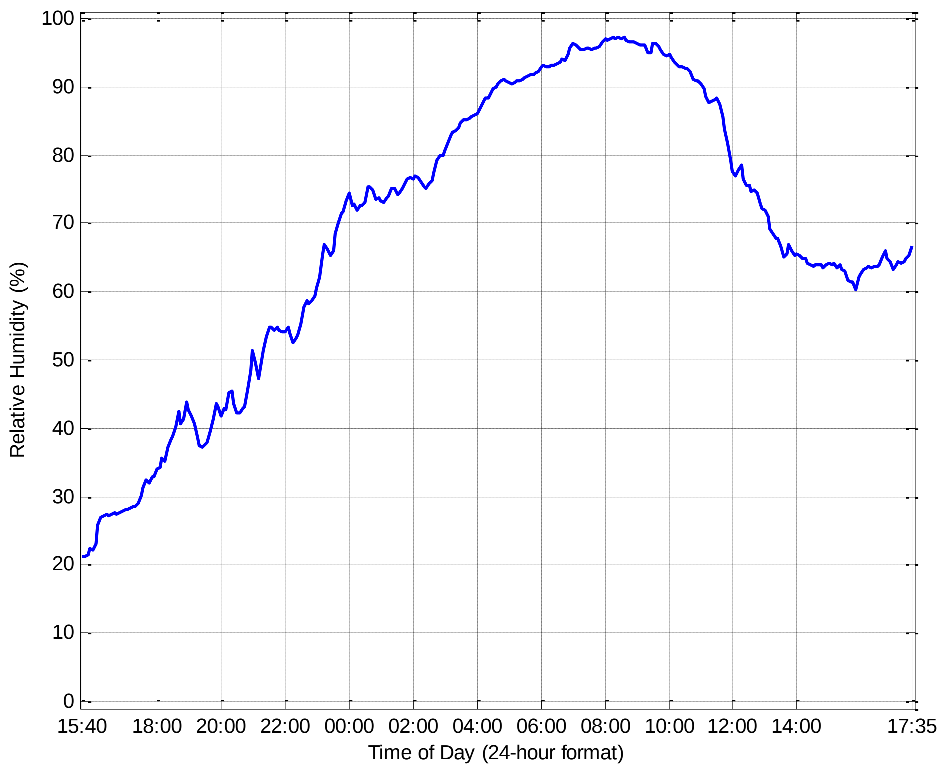


Monitored Temperature



Monitored Relative Humidity