

McDowell County Game Land Proposed Shooting Range Sound Study

Prepared For:
North Carolina Wildlife Resources Commission
Division of Engineering and Land Management



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Prepared by:
FREESE AND NICHOLS, INC.
717 Green Valley Road, Suite 200
Greensboro, North Carolina 27408
336-790-6744

NCW17557

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1.00 PROJECT BACKGROUND

This document is to serve as a sound study report for the proposed shooting range located in McDowell County, North Carolina. The primary purpose for this sound study is to collect data in the vicinity of the proposed shooting range location in order to understand the levels of sound emanating from the proposed shooting range site that may be heard by nearby residents, if the shooting range was to be constructed. This sound study also evaluated the effectiveness of sound containment devices, or sound dampening tubes, supplied by North Carolina Wildlife Resource Commission. The purpose of this document is to summarize the sound study and the findings of this study.

2.00 SHOOTING SESSIONS

The sound study was conducted on November 28th, 2017 on a clear day, free from cloud cover or precipitation. Temperatures were cool, approximately 55°F with an average humidity of 54% and moderate to variable winds of approximately 9-10 mph from the south. To conduct the sound study, representatives from the North Carolina Wildlife Resources Commission (NCWRC) and Freese and Nichols Inc. (FNI) agreed to conduct a shooting session at the proposed shooting range site in McDowell County (35°37'57.10"N 82°0'9.69"W). The shooting session was conducted in a manner similar to a typical practice shooting session which could be expected at a shooting range of this type (small arms pistol and rifle).

The NCWRC and FNI staff assigned to perform the shooting for this study, used three different types of firearms. These firearms are as follows:

1. **Pistol Glock (.357 Sig)**
2. **Rifle Remington Bolt Action (.243 Win)**
3. **Pistol (9 mm) (only used for pistol volley at the end of the session)**

The sound study consisted of one shooting session which lasted for a duration of approximately half an hour (11:56 am – 12:24 pm). The session consisted of firearm discharge at the shooting range site in the following order: Pistol – No Tube, Pistol – In Tube, Rifle – No Tube, Rifle – In Tube, and Pistol Volley. For the execution of the sound study, a total of 10 shots were fired during each of the four sequences mentioned above, followed by a pistol firing volley at the end. The scenario for the shooting sessions were conducted as follows:

- The staff discharged a total of 10 rounds of ammo for each sequence of pistol and rifle during the shooting session. Pistol – No Tube was the first firearm to be discharged by the staff, followed by Pistol – In Tube. Next, Rifle – No Tube was discharged by the staff, followed by Rifle – In Tube. The last sequence completed by staff was the Pistol Volley.

- a. There were two sequences of pistol firing, in which the first set was “Pistol- No Tube” where a pistol was discharged without the use of any sound dampening device. The second sequence, “Pistol – In Tube”, involved the use of a sound dampening tube provided by the NCWRC. There were 10 rounds of ammunition without the sound dampening tube and 10 rounds discharged using the sound dampening tube.
- b. There were two sequences of rifle firing, in which the first set was “Rifle- No Tube” where a rifle was discharged without the use of any sound dampening device. The second sequence, “Rifle – In Tube”, involved the use of a sound dampening tube provided by the NCWRC. There were 10 rounds of ammunition without the sound dampening tube and 10 rounds discharged using the sound dampening tube.
- c. The staff discharged a volley of shots, “Pistol Volley”, using both the 9mm pistol and the .357 sig pistol. This sequence was performed to simulate the rapid fire and cumulative sound of several shooters firing at one time. Qualitative observations of this sequence were noted to compare to the auditory impression of individual shots in the previous sequences.

3.00 SOUND MONITORING

For monitoring the sound levels, four (4) 3M SoundPro SE/DL-2 sound meters were used to record sound levels before, during, and after the shooting sessions described above. These sound level meters are capable of recording sound levels up to 129.5 decibels (dB). All four sound level meters were set to the “impulse” response setting and “A” weighting, as it most closely approximates the human ear response to sound. The sound level meters were calibrated prior to recording of the sound levels at the four monitoring sites identified below. A windscreen was installed on the tip of the microphone of each sound level meter to reduce sound disturbances caused by physical contact and wind turbulence.

The sound level meters were operated by FNI and NCWRC staff. The NCWRC staff were informed of their duties in regards to recording shot times. Three test sites were selected based on their proximity to residences and to provide a variety of distances and vegetative cover from the shooting range. Each of the three test sites were given a site nomenclature of A, B, and C as shown on **Table 1**. In addition, the shooting range and test site locations are depicted in **Figure 1** included in the appendix.

Table 1 – Test Site Location Summary

| Location | Latitude | Longitude | Distance from Range (miles) |
|---------------------|---------------|---------------|-----------------------------|
| Shooting Range Site | 35°37'54.43"N | 82°0'38.57"W | 0 |
| Test Site A | 35°38'8.22"N | 82° 0'18.09"W | 0.4 |
| Test Site B | 35°37'54.57"N | 82° 0'1.85"W | 0.5 |
| Test Site C | 35°37'40.84"N | 82° 0'0.64"W | 0.6 |

Each operator set up the sound level meter on a tripod and placed the meter so that it would be in a relatively open area free of reflective surfaces. Each operator had a two-way radio for communication with the shooting range in order to receive instructions as to when to start and stop recording sound levels, and to communicate any issues during the test. For the period of time during which each sound meter was recording sound, the operator kept a log of noises heard, including ambient noises (e.g. bird chirps, wind, vehicles driving by, planes overhead) and the sound of any gunshots. The time at which each noise was heard was recorded so that it could later be analyzed with the time record of the shots fired from the shooting range. The operator also noted any qualitative information about the noises heard (e.g. "shots were loud", "shots were faint and distant", "shots barely audible").

4.00 SOUND DATA

Sound meters were set to record continuous sound levels for the duration of the shooting session. During each of these times the following sound level readings were logged by each sound level meter:

- Lpeak- highest impulse sound pressure level in decibels (Note: sound level meters were set on impulse mode) obtained during the preset 1-second recording interval for the sound level meter (Note: sound was assessed for each 35-microsecond interval during each 1-second recording interval to determine the peak);
- Lavg - average sound pressure level in decibels for each recording interval of 1 second; and
- Lmax - root mean square (rms) of maximum sound pressure levels in decibels during each recording interval of 1 second. The Lmax is usually less than the Lpeak.

Sound levels were recorded before, during and after the shooting session. The approximate times for each type of firearm for the shooting session were as follows (**Table 2**):

Table 2: Shooting Session (Shooting Range Site):

| Shooting Sequence | Time |
|--------------------------|--------------------------------------|
| 1. Pistol – No Tube | 11:56:10 am – 11:58:18 am (Pause) |
| 2. Pistol – In Tube | 11:59:51 am – 12:03:08 pm (Pause) |
| 3. Rifle – No Tube | 12:08:42 pm – 12:11:55 pm (Pause) |
| 4. Rifle – In Tube | 12:13:33 pm – 12:16:49 pm (Pause) |
| 5. Pistol Volley | 12:23:48 pm – 12:24:20 pm |

The Lpeak sound level data are typically more representative of the sound impulse levels from firearms used at a shooting range. Typically, the Lmax and Lavg sound levels are less than the Lpeak. Thus, the analysis of the sound impulse levels focused on Lpeak. The Lpeak sound level data are presented for review in a graphical form with a tabular summary of the data in the attached Appendix.

5.00 RESULTS OF SOUND STUDY AND INTERPRETATION OF DATA

At Test Site A, sounds such as heavy traffic including cars and semi-trucks, vehicles running over rumble strips, as well as environmental noise (wind and leaves) in the vicinity contributed to the recorded sound levels. The meter operator could identify the sound of gun shots but described them as being “faint” or “audible but not prominent”. The meter operator was unable to make note of all ten shots fired for any particular shooting session due to ambient noise or lack of noise emanating from the site. The operator noted that one shot was able to be heard from pistol fire while the NCWRC tube was in use.

At Test Site B, sounds such as a slight breeze, rustling leaves, and constant traffic noise contributed to the recorded sounds levels. The meter operator described the rounds of fire they were able to detect as ranging from “very faint” to “distinct”. The meter operator was able to make note of all 10 shots fired for each shooting session. The operator noted the shots were clear and audible but not loud and often faint.

At Test Site C, sounds such as a constant highway traffic noise and water rushing from the outfall

of the nearby dam outlet contributed to the recorded sounds levels. The meter operator described the rounds of fire they were able to detect as ranging from “muffled” to “faint but distinct”. The operator noted throughout each shooting sequence that any shots that could be heard were drowned out by the vehicle and semi-truck traffic from the nearby highway.

Overall the maximum Lpeak sound levels during the shooting session came primarily from ambient noises (i.e. semi-trucks and cars passing) with shots only faintly or barely audible during most shooting sequences, if they were heard at all by the observer. The proximity of the Interstate highway to the test locations created a fairly constant background noise of semi-trucks and other vehicles passing by, especially as trucks would consistently swerve onto the rumble strips along the edge of the highway creating additional ambient noise. Only during the rifle shooting sequence without sound dampening measures were some shots described as “prominent” or “distinctive” by the observer and distinct peaks are discernible above ambient levels on the sound data graphs (see Appendix).

The results of the data analysis and observer notes for the shooting range is summarized in **Table 4**. **Table 5** details the maximum Lpeak values measured at both Test Site A and Test Site B. The table shows the maximum, minimum, and average Lpeak values recorded from ambient noises and firearm noises for each firearm type. **If a distinct peak could not be discerned from the data for a particular shot during the test, it is labeled as “indiscernible above ambient”, meaning the shot was either inaudible as to be indistinguishable from ambient noise, or that ambient noise was at that moment louder than the shot.** Ambient noise levels tend to have a broader base when graphed due to sound being elevated for several seconds, indicating the max level came from an ambient source. **Table 6** gives reference Lpeak values for shots and ambient noises that could be discerned in the Lpeak data.

6.00 CONCLUSIONS

Test Site A

Quantitative

- During the shooting session, no evidence of disturbing sound levels (i.e. sound levels above 90 dB) from ambient sounds were evident during the sound study.
- **No evidence of disturbing sound levels (i.e. sound levels above 90 dB) from firearms were evident at Test Site A.**

Qualitative

- FNI and NCWRC staff had difficulty identifying all ten shots from each shooting sequence and described many shots as faint, muffled, or audible but not prominent.

Test Site B

Quantitative

- During the shooting session, no evidence of disturbing sound levels (i.e. sound levels above 90 dB) from ambient sounds were evident during the sound study.
- **No evidence of disturbing sound levels (i.e. sound levels above 90 dB) from firearms were evident at Test Site B.**

Qualitative

- The observer noted that shots that were heard were often audible but faint. Some “distinctive” shots were heard during the rifle sequence outside of the sound tubes.

Test Site C

Quantitative

- During the shooting session, no evidence of disturbing sound levels (i.e. sound levels above 90 dB) from ambient sounds were evident during the sound study.
- **No evidence of disturbing sound levels (i.e. sound levels above 90 dB) from firearms were evident at Test Site B.**

Qualitative

- Observer noted that any shots that were heard were no louder than that of the noise emanating from the highway. The shots were audible but often muffled or faint.

In summary, none of the sound levels emanating from the shooting of the weapons at the shooting range site produced sound levels above what is considered disturbing (i.e.90 dB).

It is important to note that the above sound study was conducted without mitigation measures that would be included in the design of the shooting range and therefore provides a comparative analysis of a scenario in which shooting tubes are utilized and one in which they are not.

7.00 RECOMMENDATIONS

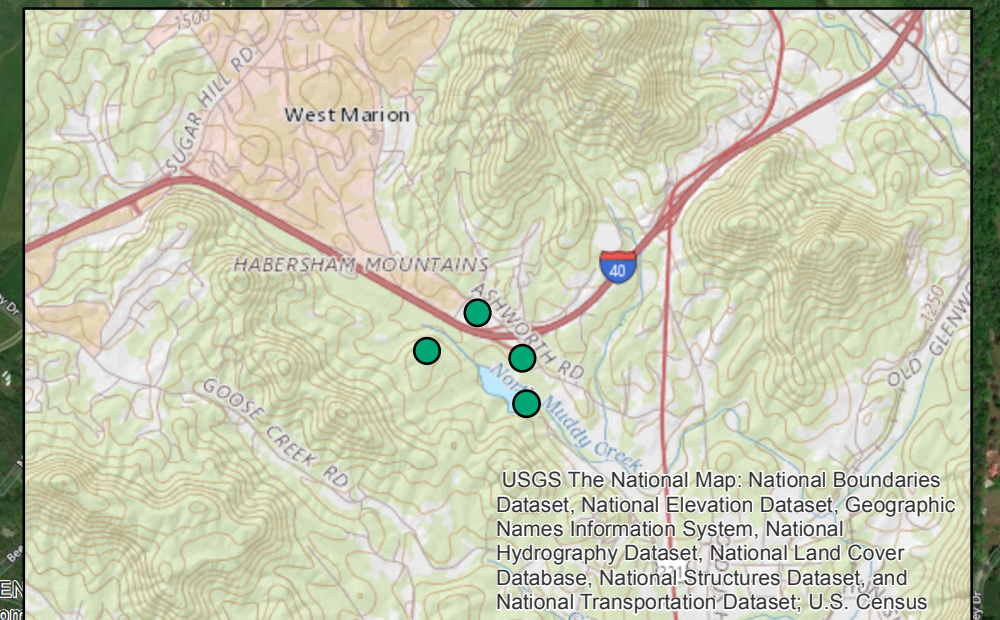
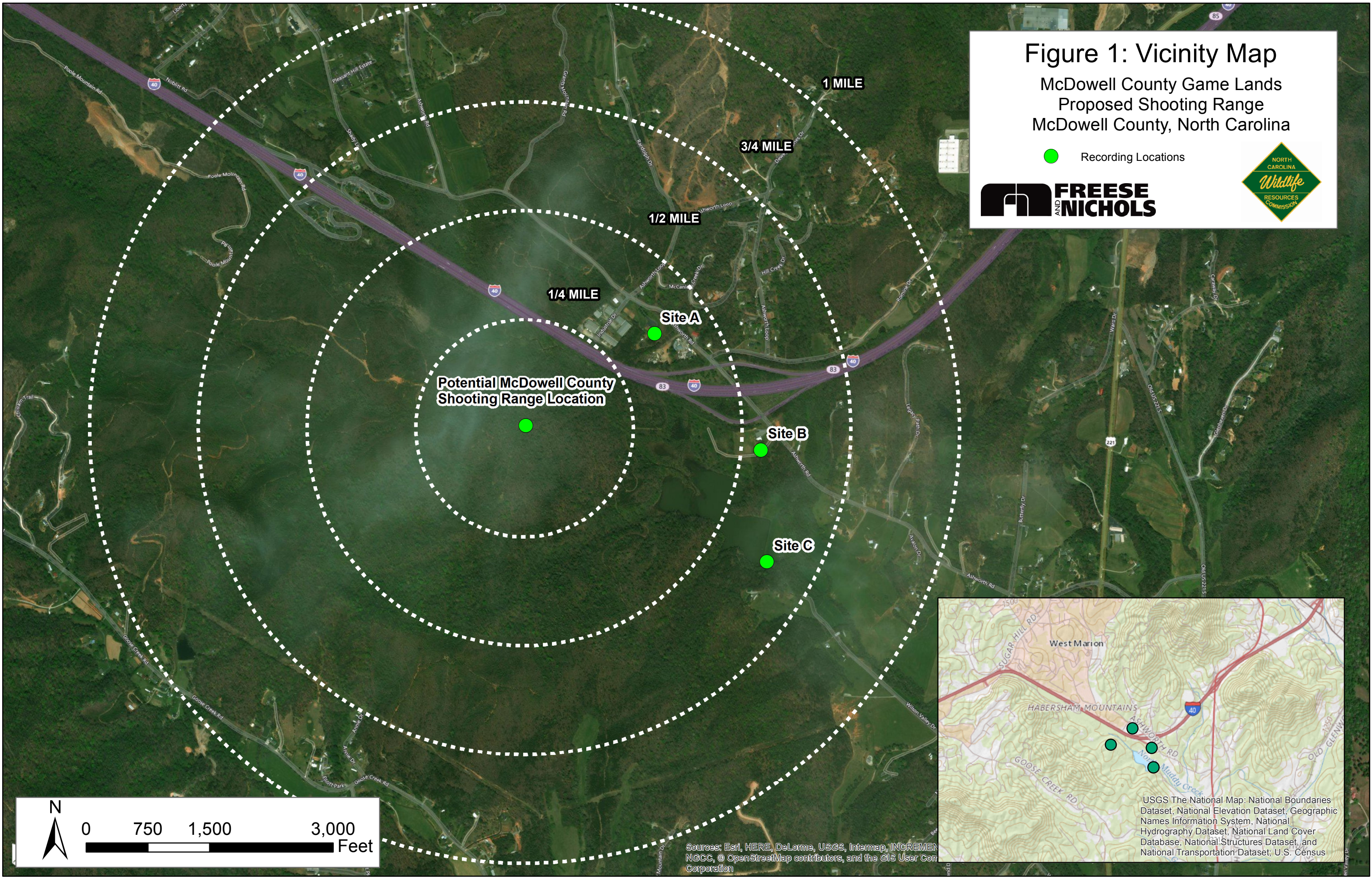
Given the results of the sound study, recommendations for the proposed shooting range would suggest that the facility maintain a well vegetated buffer along the property line and between any residential areas to maintain the good results observed during the analysis. Ambient conditions in the area are substantial and muffle the noise from the firearms well.

8.00 APPENDIX – TABLES AND FIGURES

Figure 1: Vicinity Map

McDowell County Game Lands
Proposed Shooting Range
McDowell County, North Carolina

● Recording Locations



USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census



0 750 1,500 3,000 Feet

Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENTAL, NGCC, © OpenStreetMap contributors, and the GIS User Community

Table 3: Recorded Shot Times at Shooting Range Adjusted for Test Sites

| Pistol - No Tube | | Time of Shot Adjusted for Distance | | |
|------------------|--------|------------------------------------|-------------|-------------|
| Time | Lpeak* | Test Site A | Test Site B | Test Site C |
| 11:56:20 AM | 129.5 | 11:56:22 PM | 11:56:23 PM | 11:56:23 PM |
| 11:56:31 AM | 129.5 | 11:56:33 PM | 11:56:34 PM | 11:56:34 PM |
| 11:56:43 AM | 129.5 | 11:56:45 PM | 11:56:46 PM | 11:56:46 PM |
| 11:56:56 AM | 129.5 | 11:56:58 PM | 11:56:59 PM | 11:56:59 PM |
| 11:57:11 AM | 129.5 | 11:57:13 PM | 11:57:14 PM | 11:57:14 PM |
| 11:57:27 AM | 129.5 | 11:57:29 PM | 11:57:30 PM | 11:57:30 PM |
| 11:57:41 AM | 129.5 | 11:57:43 PM | 11:57:44 PM | 11:57:44 PM |
| 11:57:55 AM | 129.5 | 11:57:57 PM | 11:57:58 PM | 11:57:58 PM |
| 11:58:11 AM | 129.5 | 11:58:13 PM | 11:58:14 PM | 11:58:14 PM |
| 11:58:26 AM | 129.5 | 11:58:28 PM | 11:58:29 PM | 11:58:29 PM |

| Pistol - In Tube | | Time of Shot Adjusted for Distance | | |
|------------------|--------|------------------------------------|-------------|-------------|
| Time | Lpeak* | Test Site A | Test Site B | Test Site C |
| 12:00:00 PM | 129.5 | 12:00:02 AM | 12:00:03 AM | 12:00:03 AM |
| 12:00:13 PM | 129.5 | 12:00:15 AM | 12:00:16 AM | 12:00:16 AM |
| 12:00:27 PM | 129.5 | 12:00:29 AM | 12:00:30 AM | 12:00:30 AM |
| 12:00:42 PM | 129.5 | 12:00:44 AM | 12:00:45 AM | 12:00:45 AM |
| 12:00:57 PM | 129.5 | 12:00:59 AM | 12:01:00 AM | 12:01:00 AM |
| 12:01:14 PM | 129.5 | 12:01:16 AM | 12:01:17 AM | 12:01:17 AM |
| 12:01:30 PM | 129.5 | 12:01:32 AM | 12:01:33 AM | 12:01:33 AM |
| 12:01:47 PM | 129.5 | 12:01:49 AM | 12:01:50 AM | 12:01:50 AM |
| 12:02:01 PM | 129.5 | 12:02:03 AM | 12:02:04 AM | 12:02:04 AM |
| 12:02:17 PM | 129.5 | 12:02:19 AM | 12:02:20 AM | 12:02:20 AM |

| Rifle - No Tube | | Time of Shot Adjusted for Distance | | |
|-----------------|--------|------------------------------------|-------------|-------------|
| Time | Lpeak* | Test Site A | Test Site B | Test Site C |
| 12:08:51 PM | 129.5 | 12:08:53 AM | 12:08:54 AM | 12:08:54 AM |
| 12:09:14 PM | 129.5 | 12:09:16 AM | 12:09:17 AM | 12:09:17 AM |
| 12:09:35 PM | 129.5 | 12:09:37 AM | 12:09:38 AM | 12:09:38 AM |
| 12:09:56 PM | 129.5 | 12:09:58 AM | 12:09:59 AM | 12:09:59 AM |
| 12:10:17 PM | 129.5 | 12:10:19 AM | 12:10:20 AM | 12:10:20 AM |
| 12:10:37 PM | 129.5 | 12:10:39 AM | 12:10:40 AM | 12:10:40 AM |
| 12:10:57 PM | 129.5 | 12:10:59 AM | 12:11:00 AM | 12:11:00 AM |
| 12:11:15 PM | 129.5 | 12:11:17 AM | 12:11:18 AM | 12:11:18 AM |
| 12:11:40 PM | 129.5 | 12:11:42 AM | 12:11:43 AM | 12:11:43 AM |
| 12:12:04 PM | 129.5 | 12:12:06 AM | 12:12:07 AM | 12:12:07 AM |

| Rifle - In Tube | | Time of Shot Adjusted for Distance | | |
|-----------------|--------|------------------------------------|-------------|-------------|
| Time | Lpeak* | Test Site A | Test Site B | Test Site C |
| 12:13:40 PM | 129.5 | 12:13:42 AM | 12:13:43 AM | 12:13:43 AM |
| 12:14:04 PM | 129.5 | 12:14:06 AM | 12:14:07 AM | 12:14:07 AM |
| 12:14:25 PM | 129.5 | 12:14:27 AM | 12:14:28 AM | 12:14:28 AM |
| 12:14:47 PM | 129.5 | 12:14:49 AM | 12:14:50 AM | 12:14:50 AM |
| 12:15:09 PM | 129.5 | 12:15:11 AM | 12:15:12 AM | 12:15:12 AM |
| 12:15:31 PM | 129.5 | 12:15:33 AM | 12:15:34 AM | 12:15:34 AM |
| 12:15:54 PM | 129.5 | 12:15:56 AM | 12:15:57 AM | 12:15:57 AM |
| 12:16:19 PM | 129.5 | 12:16:21 AM | 12:16:22 AM | 12:16:22 AM |
| 12:16:37 PM | 129.5 | 12:16:39 AM | 12:16:40 AM | 12:16:40 AM |
| 12:16:58 PM | 129.5 | 12:17:00 AM | 12:17:01 AM | 12:17:01 AM |

| Pistol Volley | | Time of Shot Adjusted for Distance | | |
|---------------|--------|------------------------------------|-------------|-------------|
| Time | Lpeak* | Test Site A | Test Site B | Test Site C |
| 12:08:51 PM | 129.5 | 12:08:51 PM | 12:08:51 PM | 12:08:54 AM |
| 12:09:14 PM | 129.5 | 12:09:14 PM | 12:09:14 PM | 12:09:17 AM |
| 12:09:35 PM | 129.5 | 12:09:35 PM | 12:09:35 PM | 12:09:38 AM |
| 12:09:56 PM | 129.5 | 12:09:56 PM | 12:09:56 PM | 12:09:59 AM |
| 12:10:17 PM | 129.5 | 12:10:17 PM | 12:10:17 PM | 12:10:20 AM |
| 12:10:37 PM | 129.5 | 12:10:37 PM | 12:10:37 PM | 12:10:40 AM |
| 12:10:57 PM | 129.5 | 12:10:57 PM | 12:10:57 PM | 12:11:00 AM |
| 12:11:15 PM | 129.5 | 12:11:15 PM | 12:11:15 PM | 12:11:18 AM |
| 12:11:40 PM | 129.5 | 12:11:40 PM | 12:11:40 PM | 12:11:43 AM |
| 12:12:04 PM | 129.5 | 12:12:04 PM | 12:12:04 PM | 12:12:07 AM |

| Test Site A Time Difference | |
|-----------------------------|----------------|
| Distance from Range (ft) | Time Delay (s) |
| 1923 | 1.71 |

| Test Site B Time Difference | |
|-----------------------------|----------------|
| Distance from Range (ft) | Time Delay (s) |
| 2865 | 2.54 |

| Test Site C Time Difference | |
|-----------------------------|----------------|
| Distance from Range (ft) | Time Delay (s) |
| 3364 | 2.99 |

*Measured at the shooting range. In this study the sound from all shots at the shooting range exceeded the maximum recording limit of the sound meter (129.5 dbA)

Table 4: Summary of Lpeak Values Recorded During Shooting Session at Test Site Locations During McDowell County Game Lands Sound Study

| Test Site A | | | | | | | |
|------------------------|------------------|-----------------------------------------|-----------------------------------------|------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Shooting Session 1 | Weapon Type | Description | Max. | Min. | Avg. | Notes | Nuisance ² |
| | Pistol - No Tube | Lpeak from Ambient (dB) | 69.7 | 59.8 | 64.2 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles account for the maximum noise levels. No shot was discernible in the recorded sound data. | No |
| | | Lpeak from Pistol (dB) | Indiscernible from ambient ¹ | | | | No |
| | Pistol - In Tube | Lpeak from Ambient (dB) | 77.3 | 57.3 | 65.1 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles account for the maximum noise levels. No shot was discernible in the recorded sound data. | No |
| | | Lpeak from Pistol (dB) | Indiscernible from ambient ¹ | | | | No |
| | Rifle - No Tube | Lpeak from Ambient (dB) | 73.4 | 56.6 | 63.7 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles account for the maximum noise levels. | No |
| | | Lpeak from Rifle (dB) | 70.1 | 67.7 | 69.1 | | No |
| | Rifle - In Tube | Lpeak from Ambient (dB) | 71.7 | 54.3 | 63.0 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles account for the maximum noise levels. No shot was discernible in the recorded sound data. | No |
| | | Lpeak from Rifle (dB) | Indiscernible from ambient ¹ | | | | No |
| | Pistol Volley | Lpeak from Ambient (dB) | 72.4 | 58.4 | 67.2 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles account for the maximum noise levels. No shot was discernible in the recorded sound data. | No |
| Lpeak from Volley (dB) | | Indiscernible from ambient ¹ | | | No | | |
| Test Site B | | | | | | | |
| Shooting Session 1 | Weapon Type | Description | Max. | Min. | Avg. | Notes | Nuisance ² |
| | Pistol - No Tube | Lpeak from Ambient (dB) | 59.9 | 50.5 | 54.1 | Continuous general highway noise was present at the recording location. | No |
| | | Lpeak from Pistol (dB) | 60.5 | 57.8 | 59.1 | | No |
| | Pistol - In Tube | Lpeak from Ambient (dB) | 68.6 | 50.2 | 62.6 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles account for the maximum noise levels. | No |
| | | Lpeak from Pistol (dB) | 58.5 | 58.1 | 58.3 | | No |
| | Rifle - No Tube | Lpeak from Ambient (dB) | 61.7 | 46.7 | 54.3 | Continuous general highway noise was present at the recording location. | No |
| | | Lpeak from Rifle (dB) | 71 | 61.7 | 64.9 | | No |
| | Rifle - In Tube | Lpeak from Ambient (dB) | 67.5 | 47.8 | 54.6 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles account for the maximum noise levels. | No |
| | | Lpeak from Rifle (dB) | 63.3 | 60.1 | 61.7 | | No |
| | Pistol Volley | Lpeak from Ambient (dB) | 65.9 | 49.5 | 58.3 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles account for the maximum noise levels. | No |
| Lpeak from Volley (dB) | | Indiscernible from ambient ¹ | | | No | | |
| Test Site C | | | | | | | |
| Shooting Session 1 | Weapon Type | Description | Max. | Min. | Avg. | Notes | Nuisance ² |
| | Pistol - No Tube | Lpeak from Ambient (dB) | 62.5 | 59.0 | 60.1 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles, in addition to sound emanating from the outfall from the pond adjacent to the test site. account for the maximum noise levels. No shot was discernible in the recorded sound data. | No |
| | | Lpeak from Pistol (dB) | Indiscernible from ambient ¹ | | | | No |
| | Pistol - In Tube | Lpeak from Ambient (dB) | 61.6 | 58.9 | 60.1 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles, in addition to sound emanating from the outfall from the pond adjacent to the test site. account for the maximum noise levels. No shot was discernible in the recorded sound data. | No |
| | | Lpeak from Pistol (dB) | Indiscernible from ambient ¹ | | | | No |
| | Rifle - No Tube | Lpeak from Ambient (dB) | 61.7 | 58.7 | 60.0 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles, in addition to sound emanating from the outfall from the pond adjacent to the test site. account for the maximum noise levels. | No |
| | | Lpeak from Rifle (dB) | 67.1 | 61.7 | 63.2 | | No |
| | Rifle - In Tube | Lpeak from Ambient (dB) | 62.0 | 58.6 | 60.0 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles, in addition to sound emanating from the outfall from the pond adjacent to the test site. account for the maximum noise levels. No shot was discernible in the recorded sound data. | No |
| | | Lpeak from Rifle (dB) | Indiscernible from ambient ¹ | | | | No |
| | Pistol Volley | Lpeak from Ambient (dB) | 64.2 | 59.6 | 61.4 | Continuous general highway noise was present at the recording location. Semi-trucks and other highway vehicles, in addition to sound emanating from the outfall from the pond adjacent to the test site. account for the maximum noise levels. No shot was discernible in the recorded sound data. | No |
| Lpeak from Volley (dB) | | Indiscernible from ambient ¹ | | | No | | |

Note: Lpeak values for weapons noise determined from observation of distinct peaks in data that correlate with noted time at which weapon was discharged at firing line and/or heard and noted by observer at sound meter location.

¹ The noise meter collects data on the loudest sound for a given instant and the shot is either within the limits of the ambient noise and does not stand out or is not the loudest sound recorded at that instant. This is often the case when observers indicate that they can barely shots or that they only hear some of the shots. Noise levels from the shot are therefore well within the range of the ambient noise and well below nuisance levels.

² Nuisance level is sound levels above the disturbing sound level value of 90 dB.

Table 5: Maximum Sound Levels During Recording

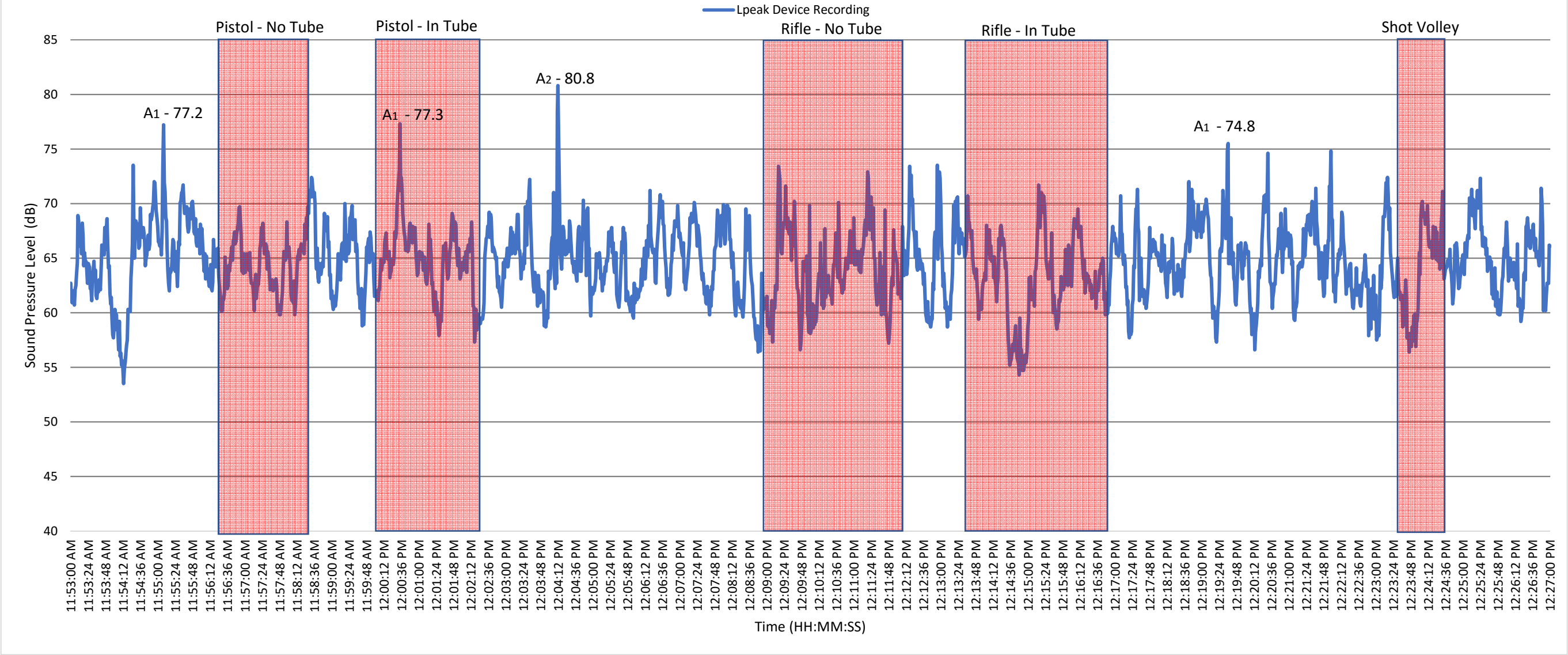
| | Sound Meter Location | | |
|---------------------------------------------------------------------|----------------------|---------------|---------------|
| | Test Site A | Test Site B | Test Site C |
| Maximum Lpeak for Period of Record (dB) | 80.8 | 76 | 78.3 |
| Maximum Lpeak for Pistols (dB) | Indiscernible | 60.5 | Indiscernible |
| Maximum Lpeak for Rifles (dB) | 70.1 | 71 | 67.1 |
| Maximum Lpeak for Volley (dB) | Indiscernible | Indiscernible | Indiscernible |
| Maximum Lpeak for Period of Record excluding shooting sequences(dB) | 80.8 | 76 | 78.3 |

Table 6: Ambient Noise Reference Summary Table

| Site Location | Lpeak (dB) | Nuisance ¹ | Ambient Noise Description |
|---------------|------------|-----------------------|----------------------------|
| Test Site A | 77.3 | No | Traffic Noise |
| | 80.8 | No | Semi-Truck on Rumble Strip |
| | 74.8 | No | Traffic Noise |
| | 77.2 | No | Traffic Noise |
| Test Site B | 70.4 | No | Traffic Noise |
| | 71 | No | Traffic Noise |
| | 72.7 | No | Traffic Noise |
| | 73.1 | No | Traffic Noise |
| Test Site C | 71.9 | No | Traffic Noise |
| | 73.5 | No | Semi-Truck Passing |
| | 78.3 | No | Traffic Noise |
| | 75.5 | No | Traffic Noise |

¹ Nuisance level is sound levels above the disturbing sound level value of 90 dBA.

Figure 2 - Continuous Sound Data Recording from Shooting Session
McDowell County Shooting Range Sound Study - Test Site A

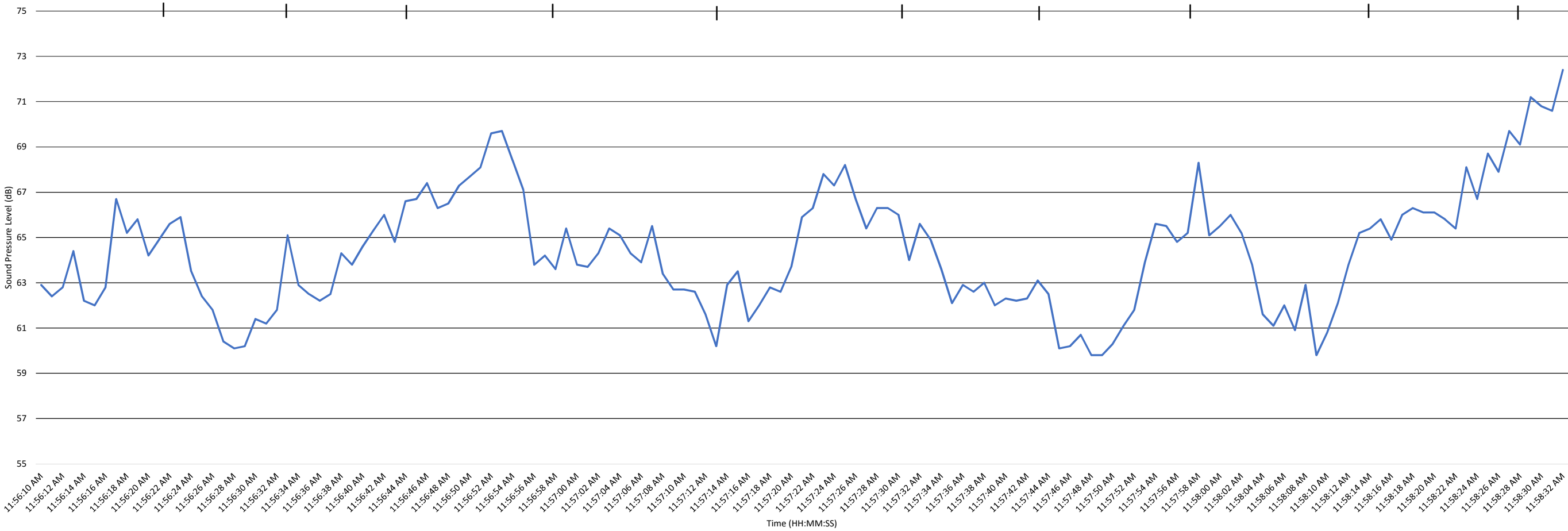


| Legend | | |
|--------|--------------------------------------|----------|
| Symbol | Description | Time |
| S | Shot | - |
| X | Indeterminate Noise | 11:55:08 |
| A1 | Traffic Noise | - |
| A2 | Semi-Truck Running Over Rumble Strip | 12:04:12 |

The above figure depicts the compiled data recorded at Test Site A with the regions highlighted in red where shot sequences took place.

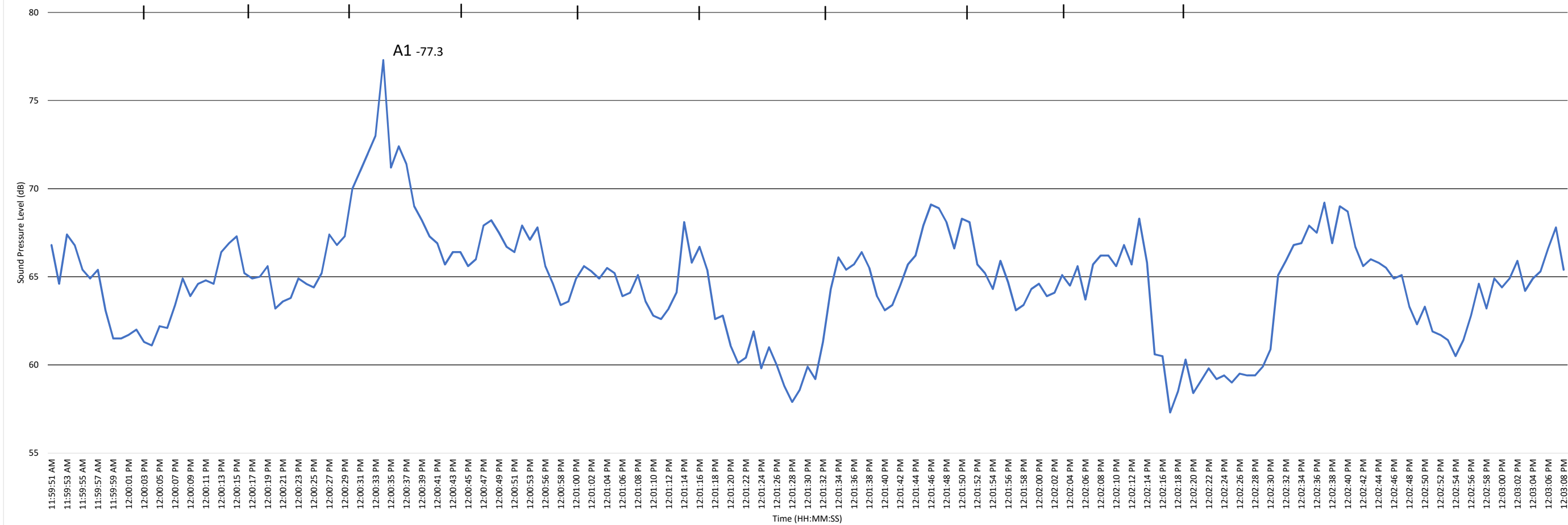
Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 3 - Data Analysis Graph
Recorded Lpeak Values at **Test Site A**
Pistol Fire Without Shooting Tube
McDowell County Game Lands



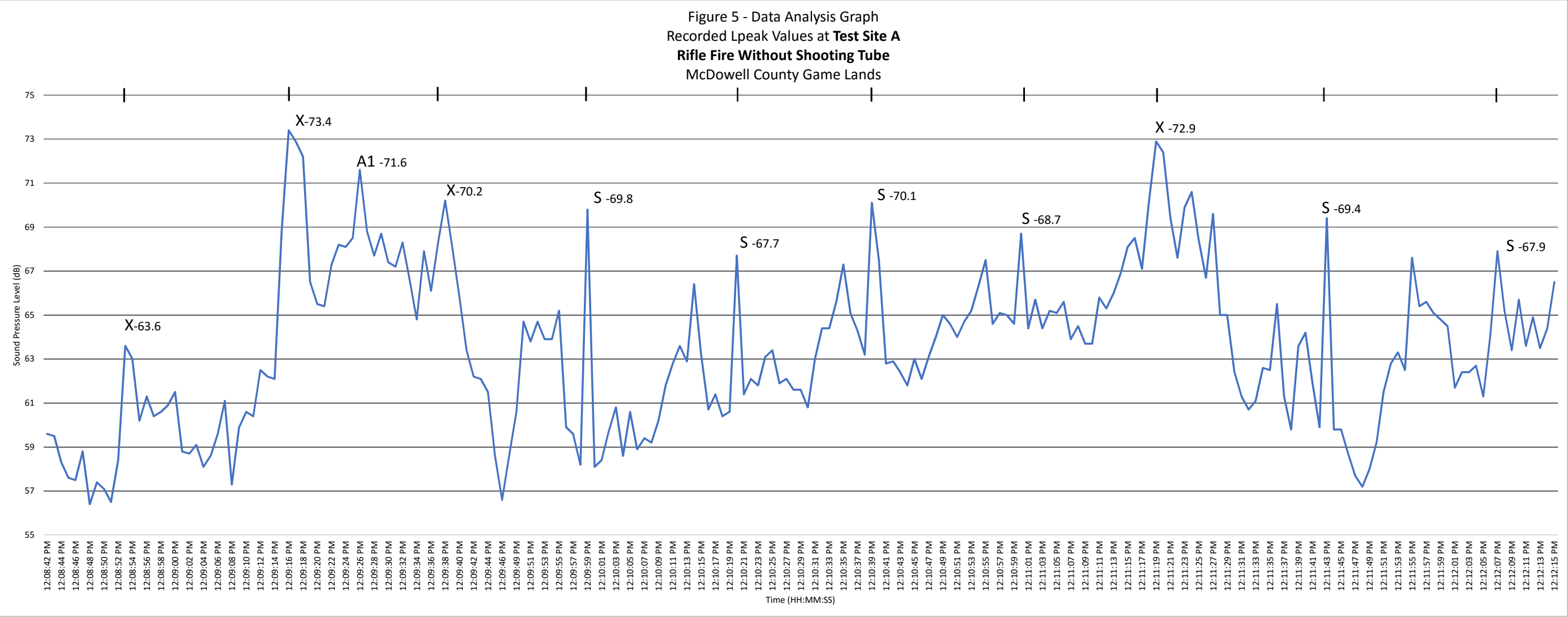
Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 4 - Data Analysis Graph
Recorded Lpeak Values at **Test Site A**
Pistol Fire in Shooting Tube
McDowell County Game Lands



| Legend | | |
|--------|---------------|----------|
| Symbol | Description | Time |
| A1 | Traffic Noise | 12:00:34 |

Tick mark placed at time of shot fired at range, adjusted for distance to site

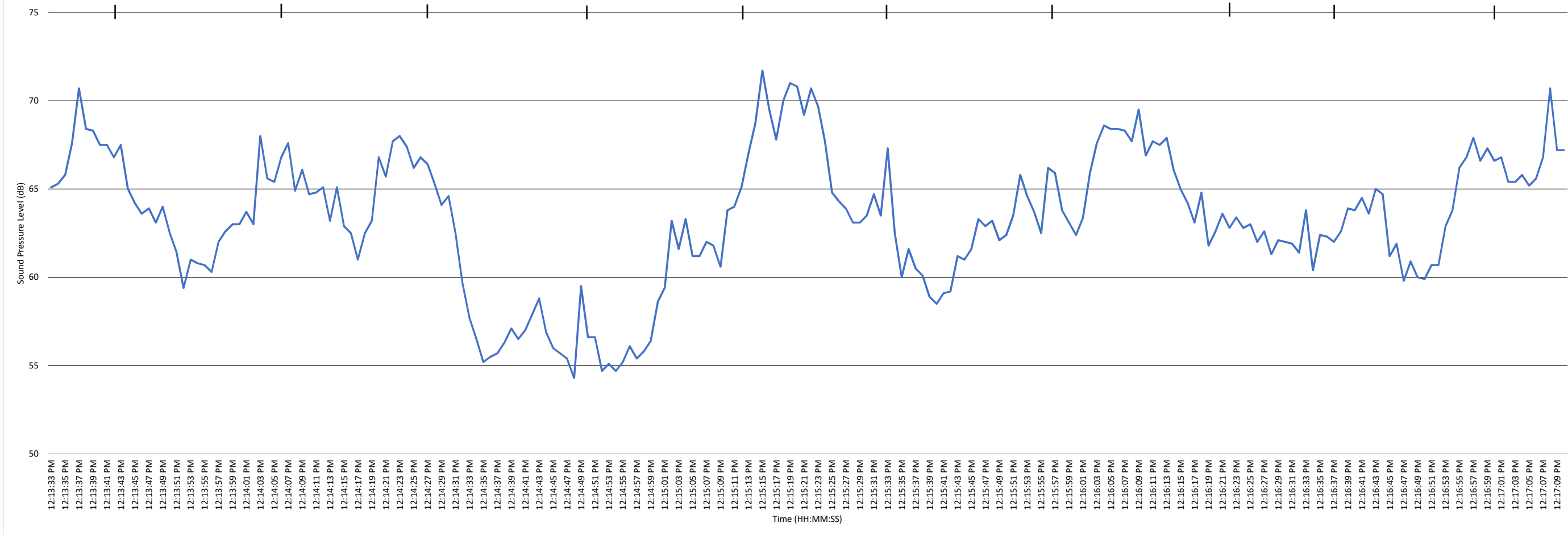


| Legend | | |
|--------|--------------------------------------|------|
| Symbol | Description | Time |
| S | Discernible Shot | - |
| A1 | Semi-Truck Running Over Rumble Strip | - |
| X | Indeterminate Noise | -- |

Tick mark placed at time of shot fired at range, adjusted for distance to site

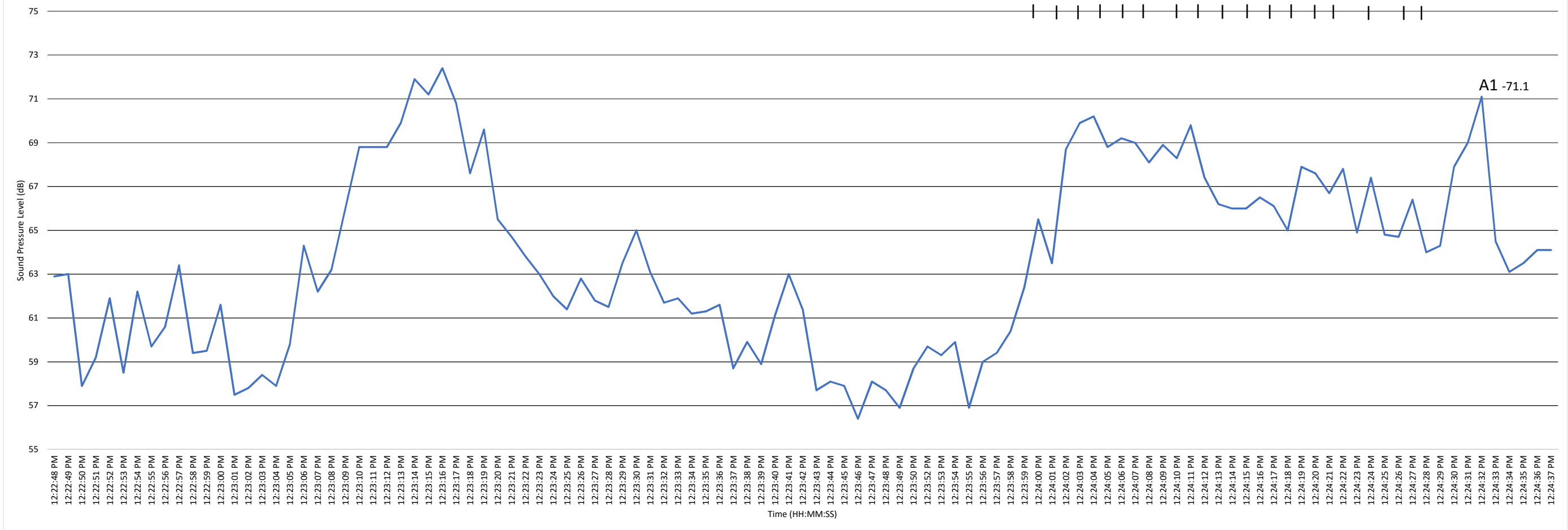
Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 6 - Data Analysis Graph
Recorded Lpeak Values at **Test Site A**
Rifle Fire in Shooting Tube
McDowell County Game Lands



Tick mark placed at time of shot fired at range, adjusted for distance to site

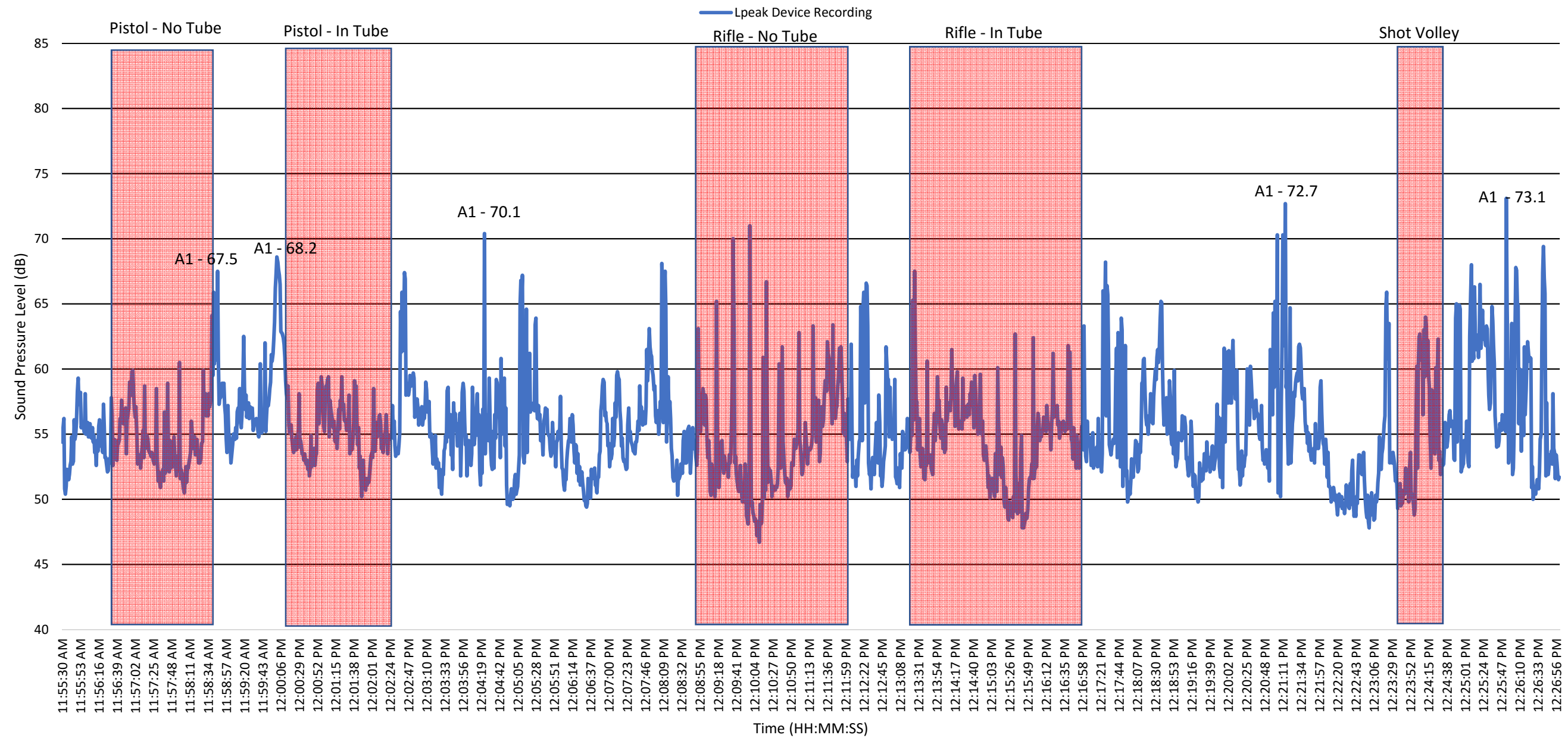
Figure 7 - Data Analysis Graph
Recorded Lpeak Values at **Test Site A**
Pistol Volley
McDowell County Game Lands



| Legend | | |
|--------|--------------------------------------|------|
| Symbol | Description | Time |
| A1 | Semi-Truck Running Over Rumble Strip | -- |

Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 8 - Continuous Sound Data Recording from Shooting Session
McDowell County Shooting Range Sound Study - Test Site B



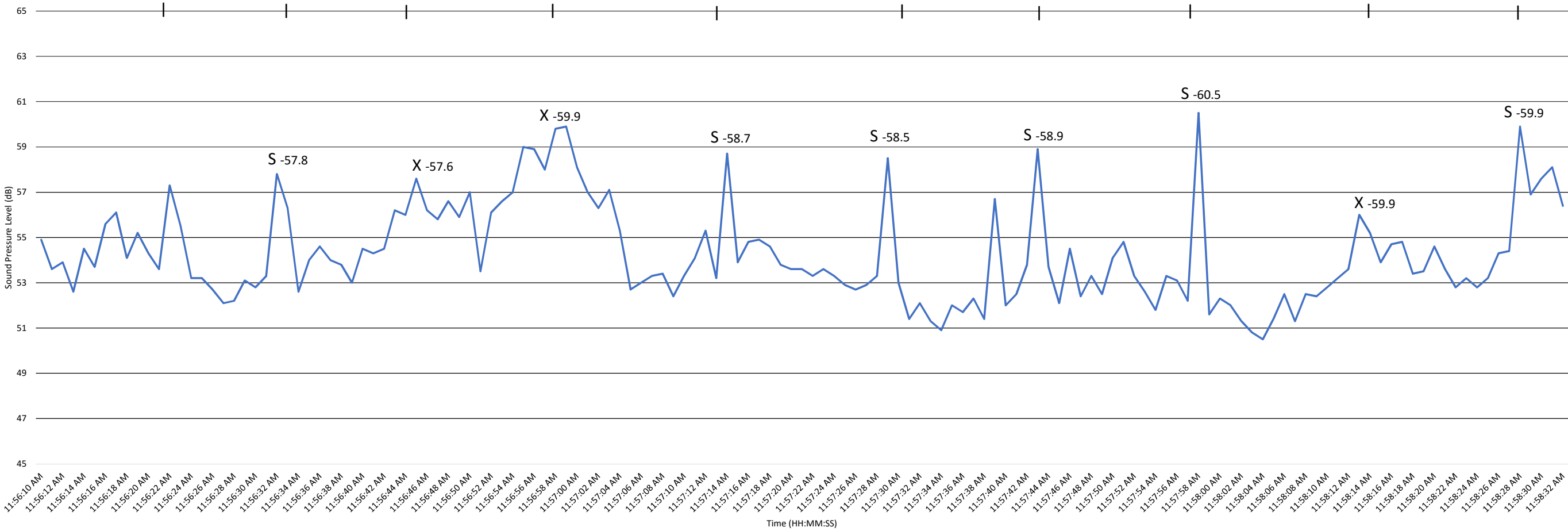
| Legend | | |
|--------|---------------------|------|
| Symbol | Description | Time |
| S | Shot | - |
| X | Indeterminate Noise | - |
| A1 | Traffic Noise | - |

During recording period, constant background noise included rustling leaves, traffic noise from adjacent highway, and slight breeze.

The above figure depicts the compiled data at Test Site B with the regions highlighted in red where shot intervals took place.

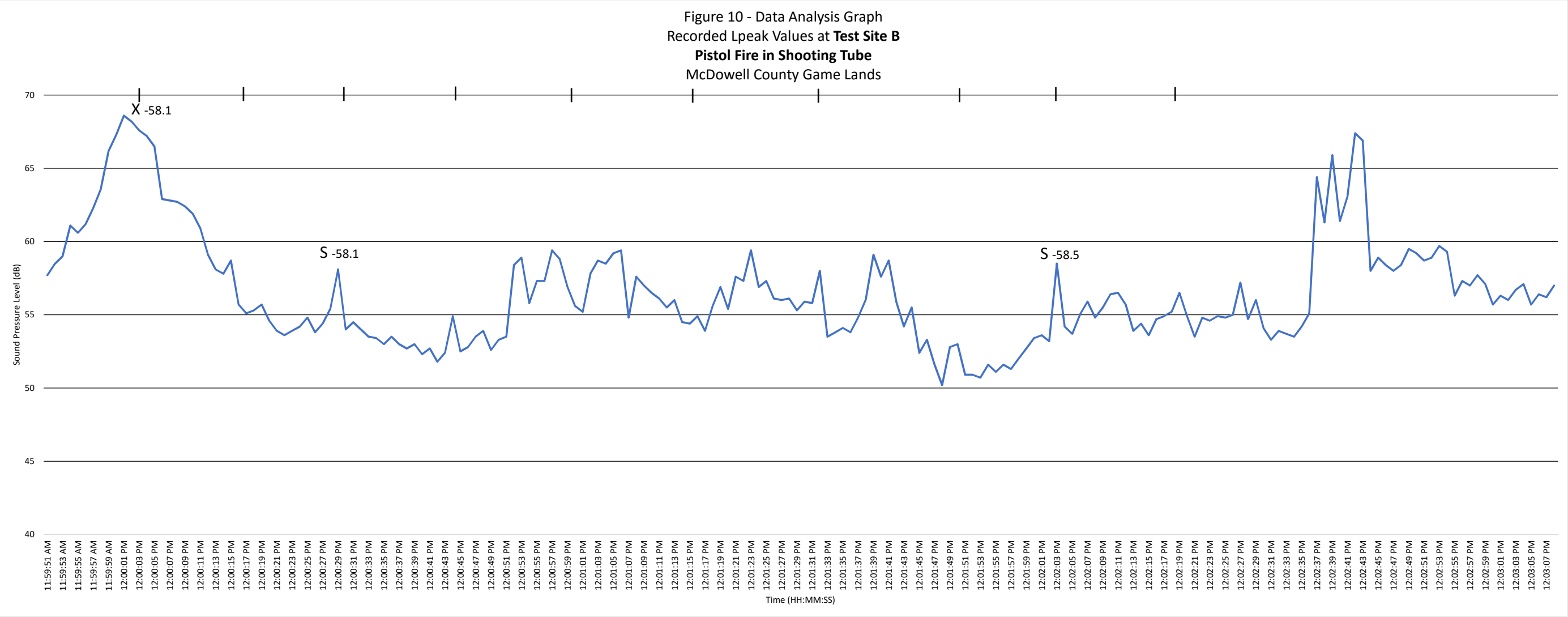
Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 9 - Data Analysis Graph
Recorded Lpeak Values at **Test Site B**
Pistol Fire Without Shooting Tube
McDowell County Game Lands



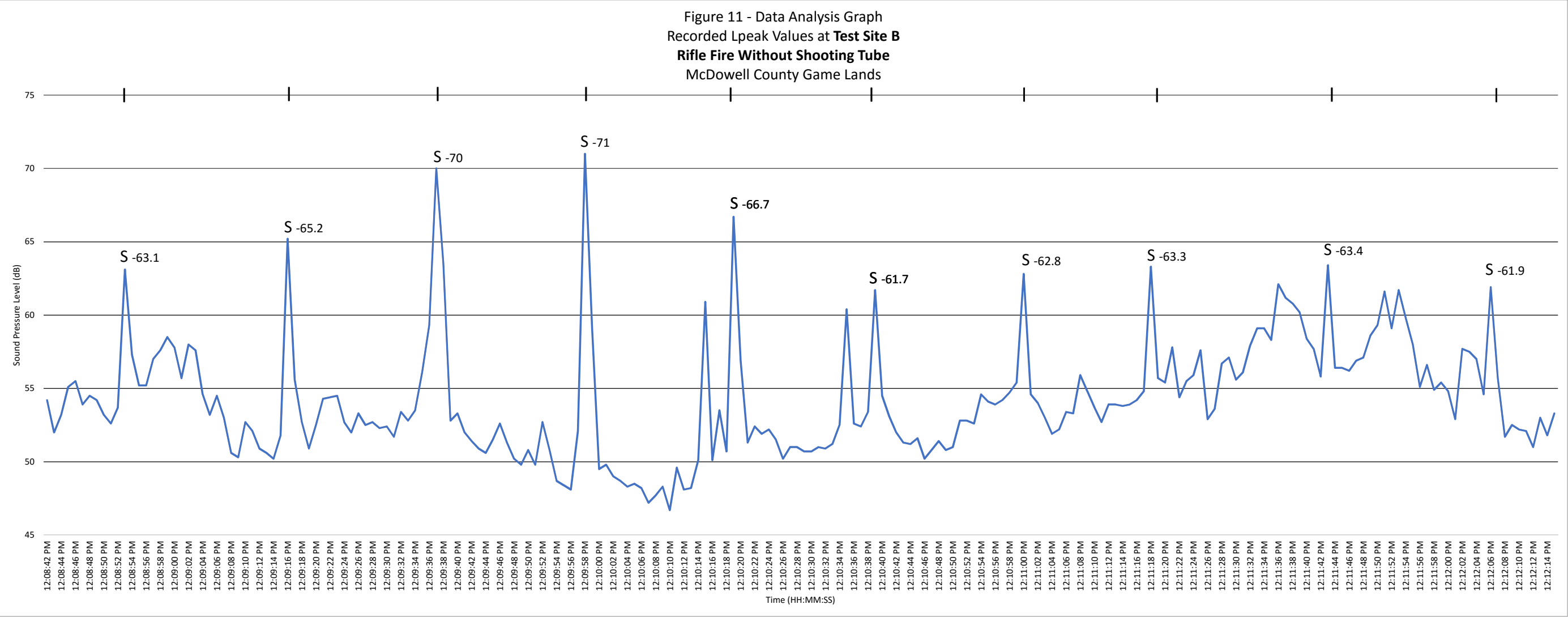
| Legend | | |
|--------|-------------------|------|
| Symbol | Description | Time |
| S | Discernible Shot | - |
| X | Inderminate Noise | - |

Tick mark placed at time of shot fired at range, adjusted for distance to site



| Legend | | |
|--------|-------------------|------|
| Symbol | Description | Time |
| S | Discernible Shot | - |
| X | Inderminate Noise | - |

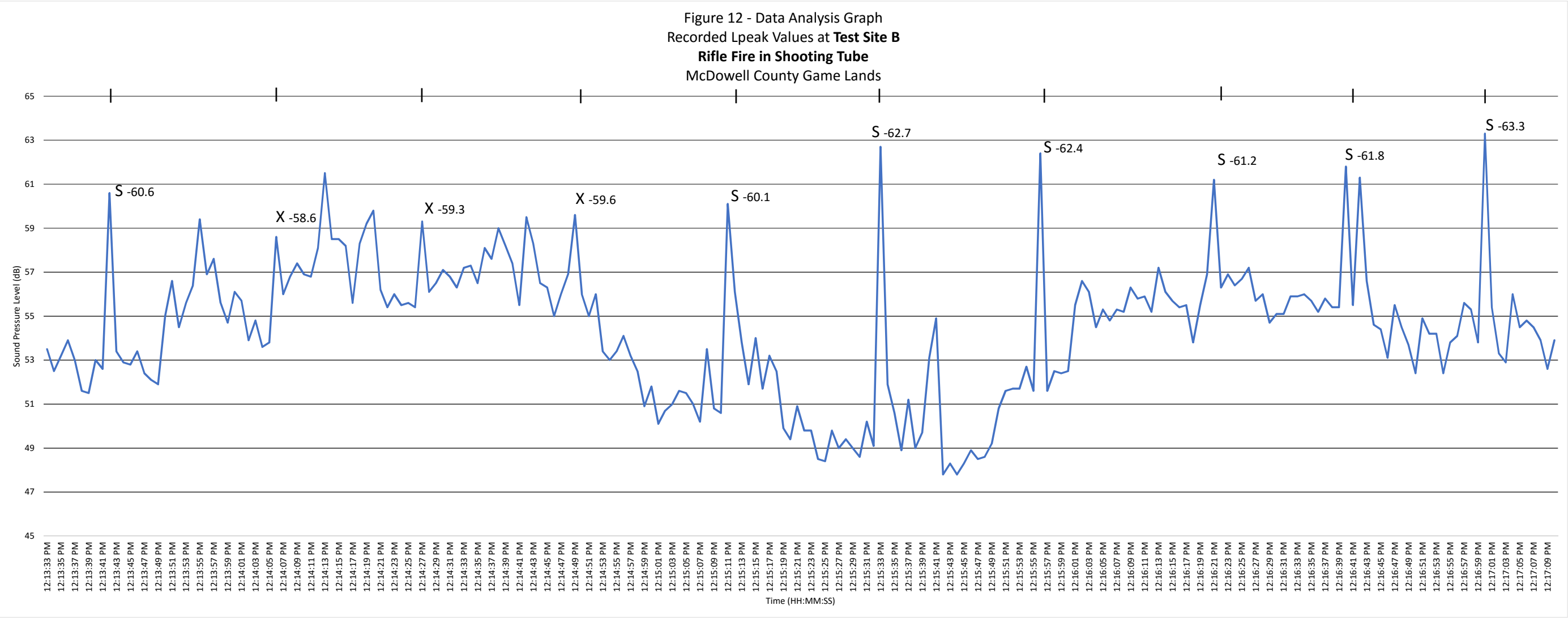
Tick mark placed at time of shot fired at range, adjusted for distance to site



| Legend | | |
|--------|------------------|------|
| Symbol | Description | Time |
| S | Discernible Shot | - |

Tick mark placed at time of shot fired at range, adjusted for distance to site

Tick mark placed at time of shot fired at range, adjusted for distance to site



| Legend | | |
|--------|-------------------|------|
| Symbol | Description | Time |
| S | Discernible Shot | - |
| X | Inderminate Noise | - |

Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 13 - Data Analysis Graph
Recorded Lpeak Values at **Test Site B**
Pistol Volley
McDowell County Game Lands

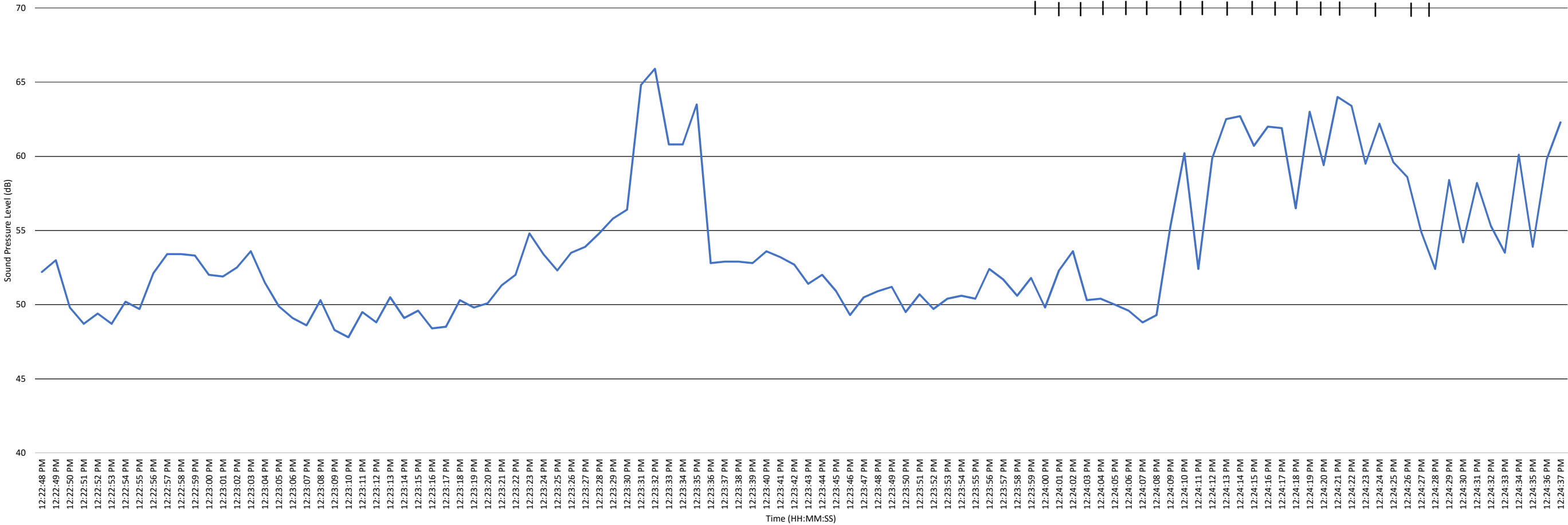
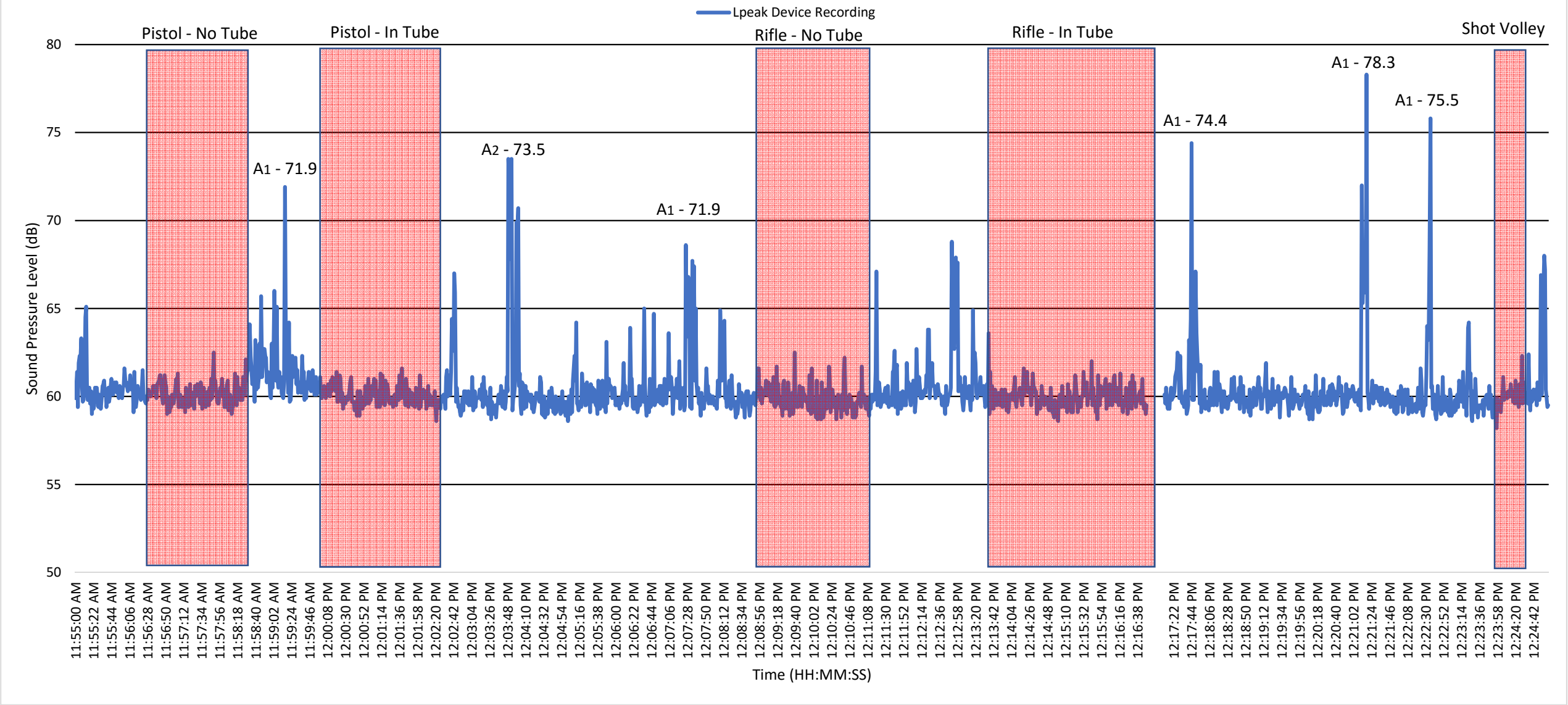


Figure 14 - Continuous Sound Data Recording from Shooting Session
McDowell County Shooting Range Sound Study - Test Site C

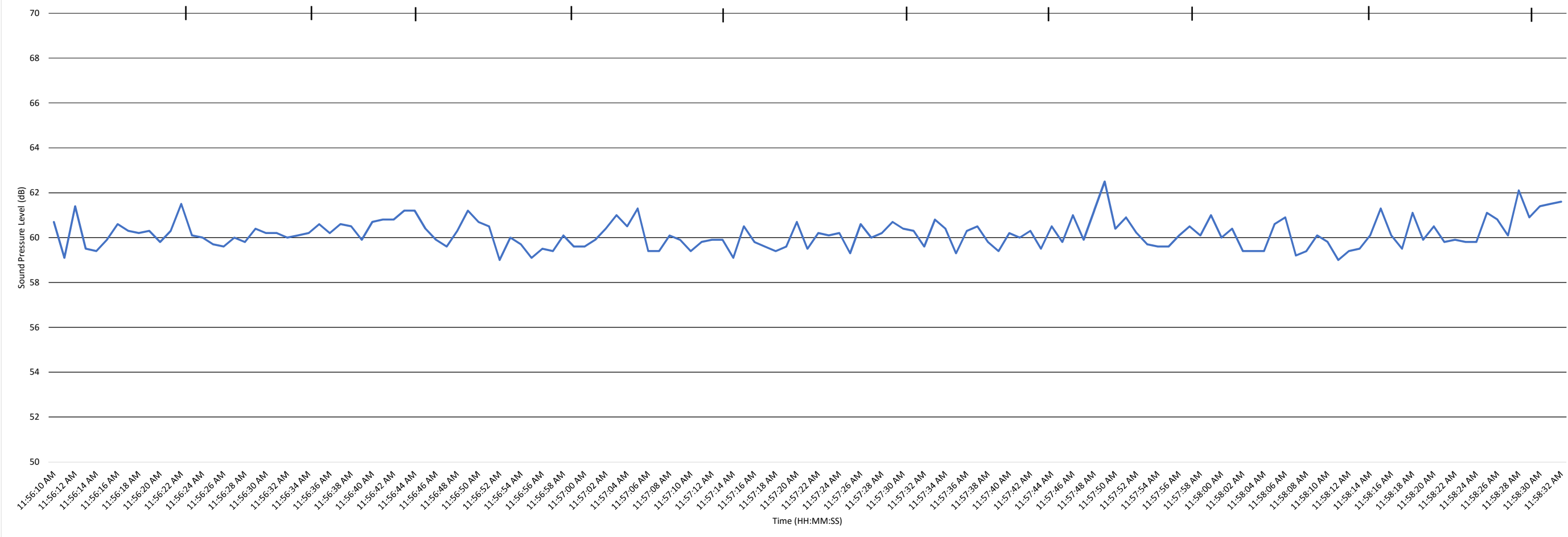


| Legend | | |
|--------|---------------------|----------|
| Symbol | Description | Time |
| S | Shot | - |
| X | Indeterminate Noise | - |
| A1 | Highway Noise | - |
| A2 | Semi-Truck Passing | 12:03:53 |

The above figure depicts the compiled data at Test Site B with the regions highlighted in red where shot intervals took place.

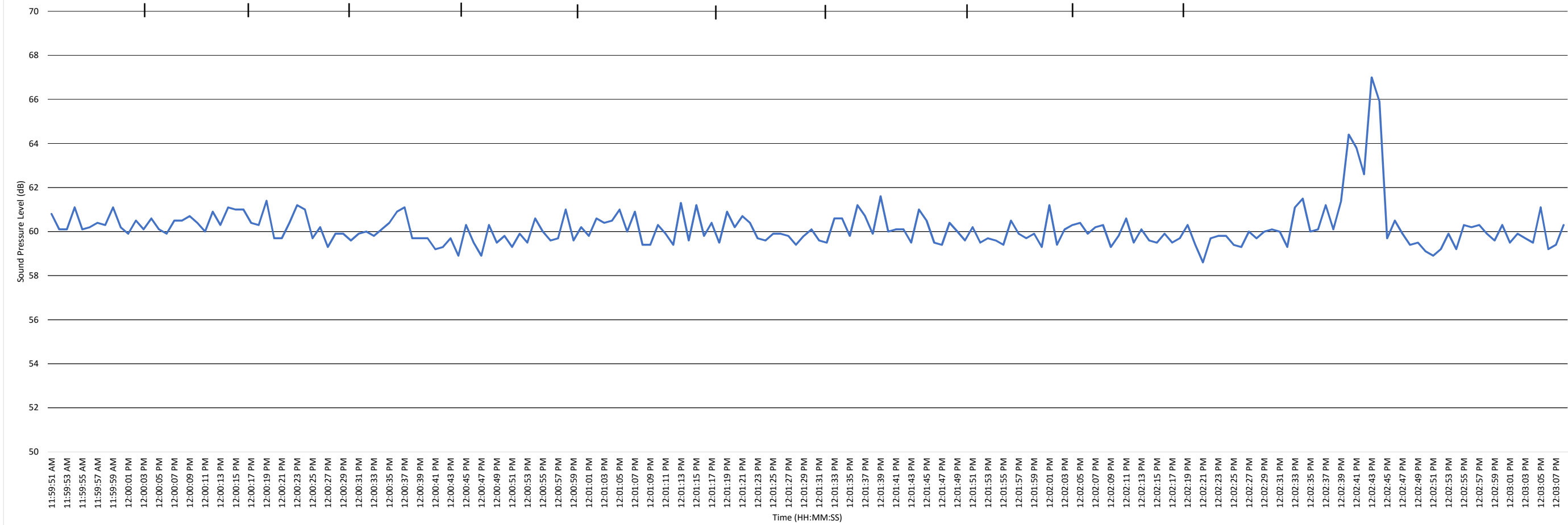
Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 15 - Data Analysis Graph
Recorded Lpeak Values at **Test Site C**
Pistol Fire Without Shooting Tube
McDowell County Game Lands

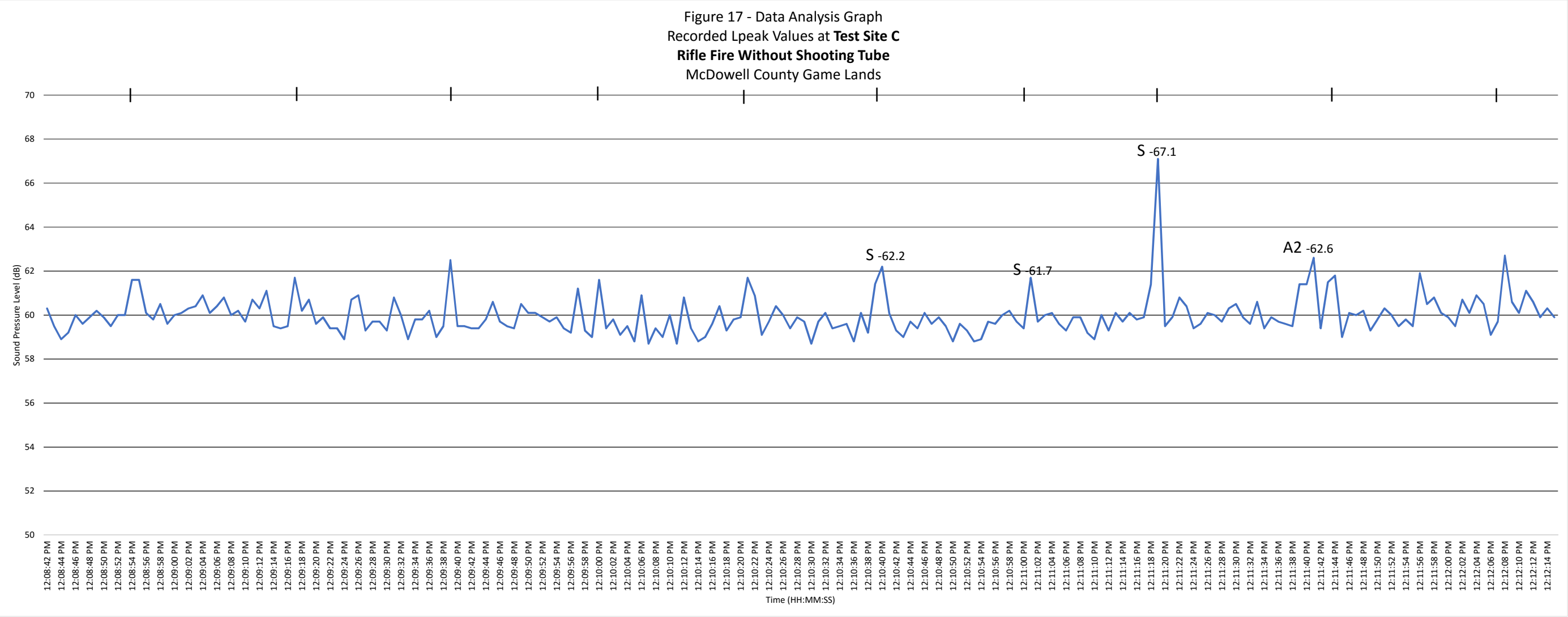


Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 16 - Data Analysis Graph
Recorded Lpeak Values at Test Site C
Pistol Fire in Shooting Tube
McDowell County Game Lands



Tick mark placed at time of shot fired at range, adjusted for distance to site

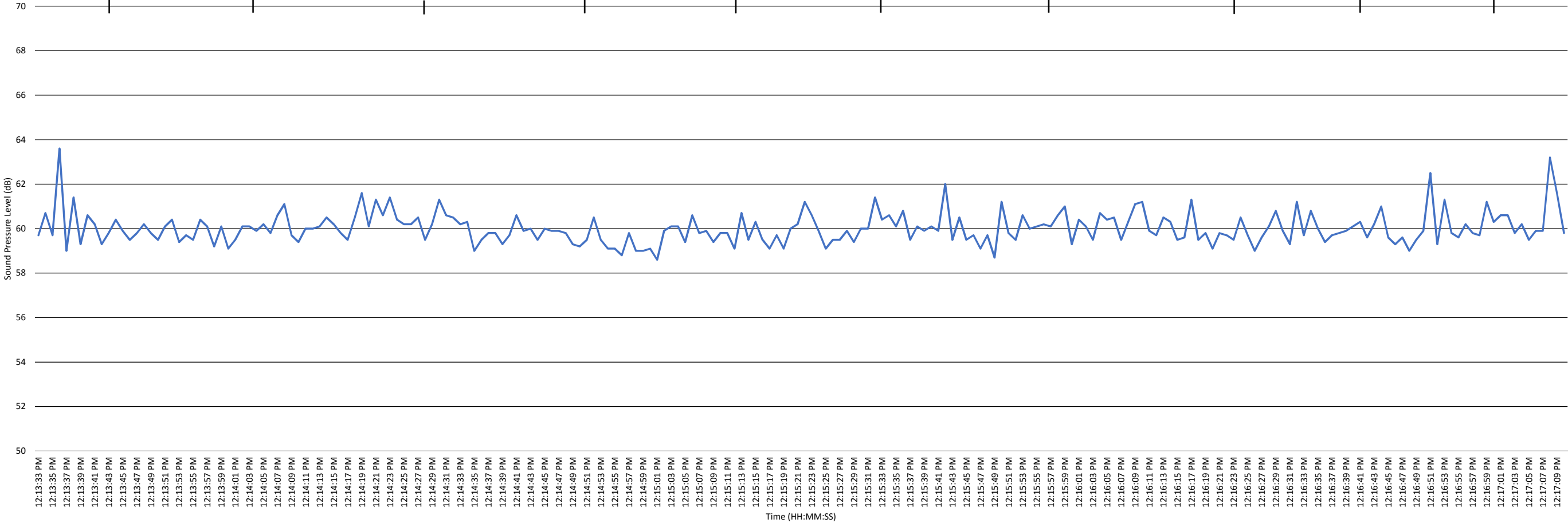


| Legend | | |
|--------|--------------------|----------|
| Symbol | Description | Time |
| S | Discernible Shot | - |
| A2 | Semi-Truck Passing | 12:11:41 |

Tick mark placed at time of shot fired at range, adjusted for distance to site

Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 18 - Data Analysis Graph
Recorded Lpeak Values at **Test Site C**
Rifle Fire in Shooting Tube
McDowell County Game Lands



Tick mark placed at time of shot fired at range, adjusted for distance to site

Figure 19 - Data Analysis Graph
Recorded Lpeak Values at **Test Site C**
Pistol Volley
McDowell County Game Lands

