November 4, 2026

Ms. Brie Fortmuller
BlueWave Energy
116 Huntingdon Avenue, Suite 601
Boston, MA 02116

SUBJECT: Acoustic Analysis - Proposed Solar Facility (revision 3)
Ridge Road, Worthington, MA

Dear Ms. Fortmuller,

Cavanaugh Tocci Associates has evaluated the environmental sound impact associated with the proposed 2 MWAC solar installation located at 190 Ridge Road in Worthington, Massachusetts. The objectives of this evaluation were:

- To define acoustic design goals based on applicable noise regulations, and the results of a baseline sound survey.
- To estimate and evaluate the acoustic impact of the proposed project in the surrounding community.
- To provide sound control concepts as needed to mitigate acoustic impacts.

Results of the evaluation are summarized herein. Appendix A provides a glossary of acoustic terminology used in this report.

Baseline Sound Survey

Sound is a feature of all environments. Sound is only objectionable when it is inconsistent with its environment; by being either too loud or by being distinctive in character (i.e. tonally or temporally varying). The goal of acoustic design is to render facility noise consistent with the level and character of other sounds in the environment. To this end, the following environmental noise analysis evaluates sound produced by the proposed Project in light of existing environmental sound levels.

In order to document typical background sound levels in the project area, we performed continuous sound monitoring at the Project site for a weeklong period (March 11 through March 17, 2026). Figure 1 is an aerial photograph indicating the Project area and the location of the sound monitors SM-1 and SM-2. The results of the survey allow both quantitative and qualitative analyses of the acoustic environment surrounding the Project.

Figures 2 and 3 present the results of the continuous sound monitoring. Due to weather events during the monitoring period, we calculated background sound levels by averaging the sound level during periods of relatively low wind speed and precipitation rate. The calculated levels were 30 dBA during daytime hours (7 AM – 7 PM, when inverters are likely to be active), and 25 dBA during the remaining hours.

Applicable Environmental Noise Regulations

Massachusetts Department of Environmental Protection (MADEP)

Commonwealth of Massachusetts requirements under 310 CMR Section 7.10 qualitatively prohibit noise under some circumstances. Interpretation is provided in the Massachusetts Department of Environmental Quality Engineering's Policy 90-001[1] dated February 1, 1990; and in the Department of Environmental Protection (DEP) Form BWP AQ Sound. The Massachusetts policy limits new noise intrusions to 10 dBA over the existing ambient (L_{90}) sound level. Tonal sound, defined as any octave band level which exceeds the levels in adjacent octave bands by 3 dB or more, is also not allowed. These DEP noise guidelines are applicable both at the property lines and at the nearest inhabited buildings.

The DEP noise policy enumerated above is strictly applied to protect residences, other sensitive receptors (e.g. schools, hospitals), and land that could be developed for acoustically sensitive use. However, a new noise source that would be located in an area that is not likely to be developed for residential use in the future, or in a commercial or industrial area with no sensitive receptors may not be required to mitigate noise impacts on those areas, even if projected to cause noise levels at the facility's property line to exceed existing background sound levels by more than 10 dBA.

Town of Worthington Zoning By-law

The Zoning By-law of the Town of Worthington[2] specifically regulates large-scale ground-mounted solar photovoltaic installations (LSCMSPI) in section 8.5. Safety and Environmental Standards are presented in 8.5.6. Standard D states "The sound levels under normal operating conditions, measured at the boundary of the lot on which the installation is sited, shall not be more than 10 decibels greater than would otherwise exist in the absence of such a facility." The standard does not provide a metric for establishing existing sound levels. We conservatively use L_{90} in our evaluation, consistent with the above MADEP policy.

Project Acoustic Design Goals

To fully comply with the MADEP noise policy and the Town of Worthington Zoning By-law, sound from the project may not exceed the lowest measured background sound level L_{A90} by 10 dBA, as measured at nearby residential properties or facility property boundaries. In addition, a pure-tone condition may not exist at these locations. Table 1 provides a summary of measured sound levels and resulting project sound level limits.

Table 1
Measured Sound Levels and Limits (dBA)

Sound Monitor	Nominally Lowest L_{A90} (day/night)	MADEP Limit (day/night)
SM-1	30 / 25	40 / 35
SM-2	30 / 25	40 / 35

[1] https://www.mass.gov/doc/massdep-noise-policy/download

[2] https://worthington-ma.us/wp-content/uploads/2024/08/Worthington-ZBL-5-4-24.pdf

Project Sound Analysis

Project-related sound impacts that are associated with facility equipment have been calculated using CadnaA environmental sound modeling software (Version 2026 MR1 DataKustic GmbH). The CadnaA sound modeling software uses algorithms and procedures described in International Standard ISO 9613-2:1996 "Acoustics- Attenuation of sound during propagation outdoors – Part 2: General method of calculation". This standard and its associated methodology are the most universally accepted approach for environmental sound modeling of industrial and transit sound sources. The methodology described in this standard provides estimates of A-weighted sound levels for meteorological conditions that are favorable for the propagation of sound (downwind with a wind speed of 1-5 meters/sec). This methodology is also valid for sound propagation under well-developed moderate ground-based temperature profile inversions, which commonly occur on clear calm nights.

Our analysis includes the following equipment:

- Fourteen Solectria XGI-1500 125 kW inverters, with field measurement data provided by Acentech (daytime operation only).
- Two WEG 2.5 MVA transformers, with sound data provided by the manufacturer.
- Two e-STORAGE SolBank-3 BESS modules, with sound data provided by the manufacturer.
- Ninety FlexRack tracking drives, with sound data provided by the manufacturer.

Equipment layouts have not yet been determined, but all inverters, transformers, and BESS units will be located on the three equipment pads, while tracking drives will be located throughout the photovoltaic array.

Figure 4 presents the results of the acoustic modeling for the proposed Project. Table 2 provides a summary of our estimates of Project A-weighted sound levels at relevant receptors. Daytime sound levels exceed MADEP limits at one of the modeled receivers. For compliance with the applicable regulations, sound mitigation measures are warranted.

TABLE 2
Estimate of Project Sound Levels at Surrounding Properties (dBA)

Location	Description	Facility Sound Level (day/night)	MADEP Limit (day/night)
R1	**Landowner Residence**	37 / 28	**40 / 35**
R2	**Residence North**	33 / 25	**40 / 35**
PL2-W	**R2 West Property Line**	31 / 25	**40 / 35**
PL2-S	**R2 South Property Line**	33 / 27	**40 / 35**
R3	**Residence East**	***41*** / 30	**40 / 35**
R4	**Residence Southeast**	29 / 25	**40 / 35**
C1	**Commercial (clubhouse)**	25 / 20	-

Noise Control

Full compliance with the applicable noise regulations will require mitigation. We recommend implementing sound barriers as shown in Figure 5. The barriers on the east side of the central and south inverter banks, with height 2 feet above the top of the inverter units.

Inverter bank configuration has not yet been determined, but the barrier segments should be located on the sides of the inverter bank indicated, and positioned as close to inverters as allowed by equipment clearance requirements. We will provide updated barrier configuration when equipment pad layout is determined.

Modeling results are presented in Table 3 and Figure 6. Facility sound levels are compliant with MADEP limits at all modeled locations. In addition, sound levels are compliant with the Worthington Zoning By-Law at all facility property boundaries.

TABLE 3
Estimate of Project Sound Levels at Surrounding Properties (dBA)
With Noise Controls

Location	Description	Facility Sound Level (day/night)	MADEP Limit (day/night)
R1	**Landowner Residence**	37 / 28	**40 / 35**
R2	**Residence North**	33 / 25	**40 / 35**
PL2-W	**R2 West Property Line**	31 / 25	**40 / 35**
PL2-S	**R2 South Property Line**	33 / 27	**40 / 35**
R3	**Residence East**	39 / 30	**40 / 35**
R4	**Residence Southeast**	29 / 25	**40 / 35**
C1	**Commercial (clubhouse)**	25 / 20	-

Conclusion

Based on our review of the data presented in Table 3, it is our professional opinion that sound produced by the proposed solar facility on Ridge Road in Worthington, Massachusetts will comply with the most stringent requirements of the state and local noise regulations with implementation of barriers as recommended. Furthermore, with implementation of these measures, sound emitted by the project would not produce a noticeable impact on the acoustic environment and would not have an unreasonable adverse effect at any surrounding properties.

Sincerely,
CAVANAUGH TOCCI



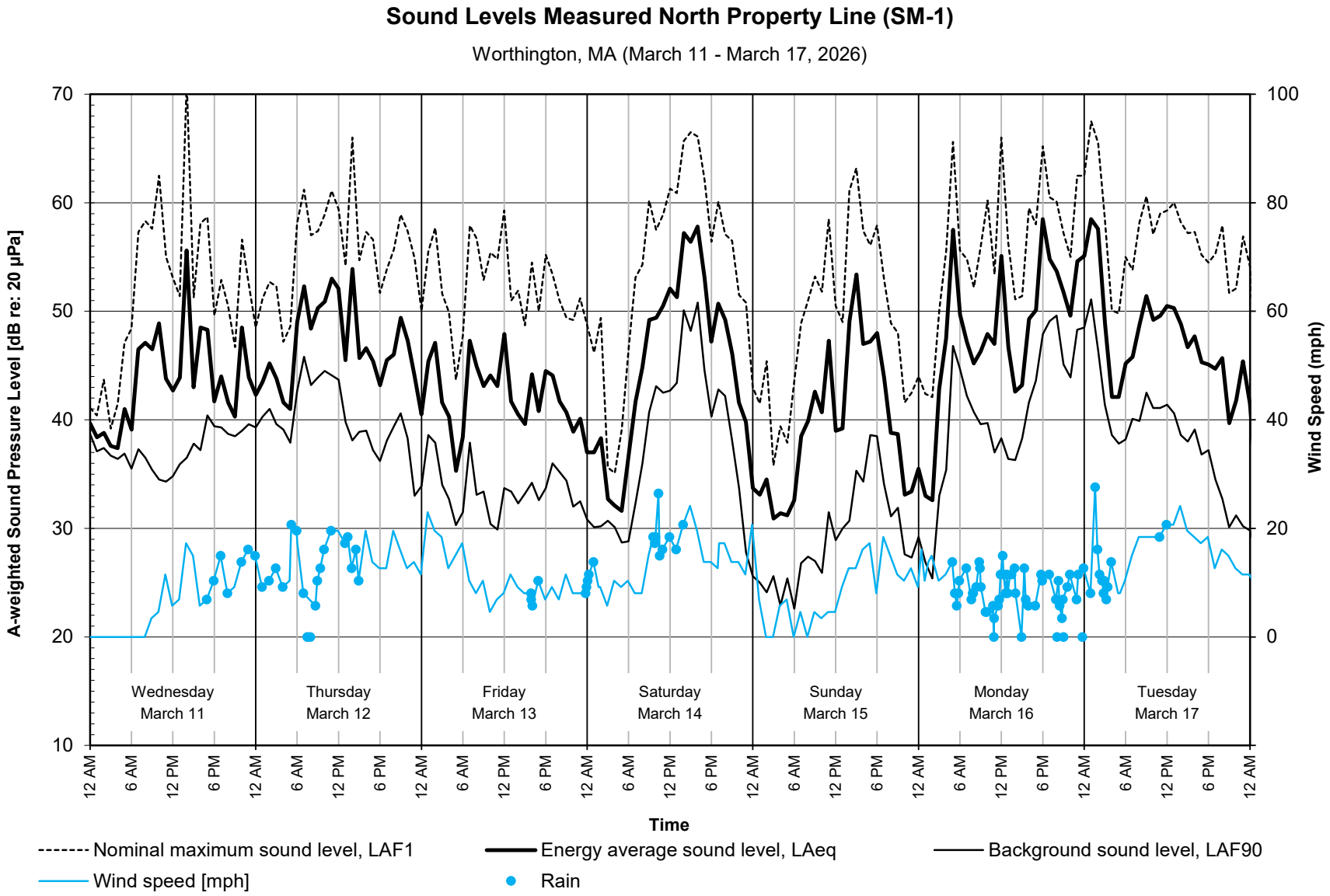
Bradley M. Dunkin, *Associate Principal Consultant*
25050/BlueWave Solar Ridge Road Worthington MA Sound Study (revision 3).docx

FIGURES



Aerial Photograph of Project Area Indicating Location of Sound Monitors

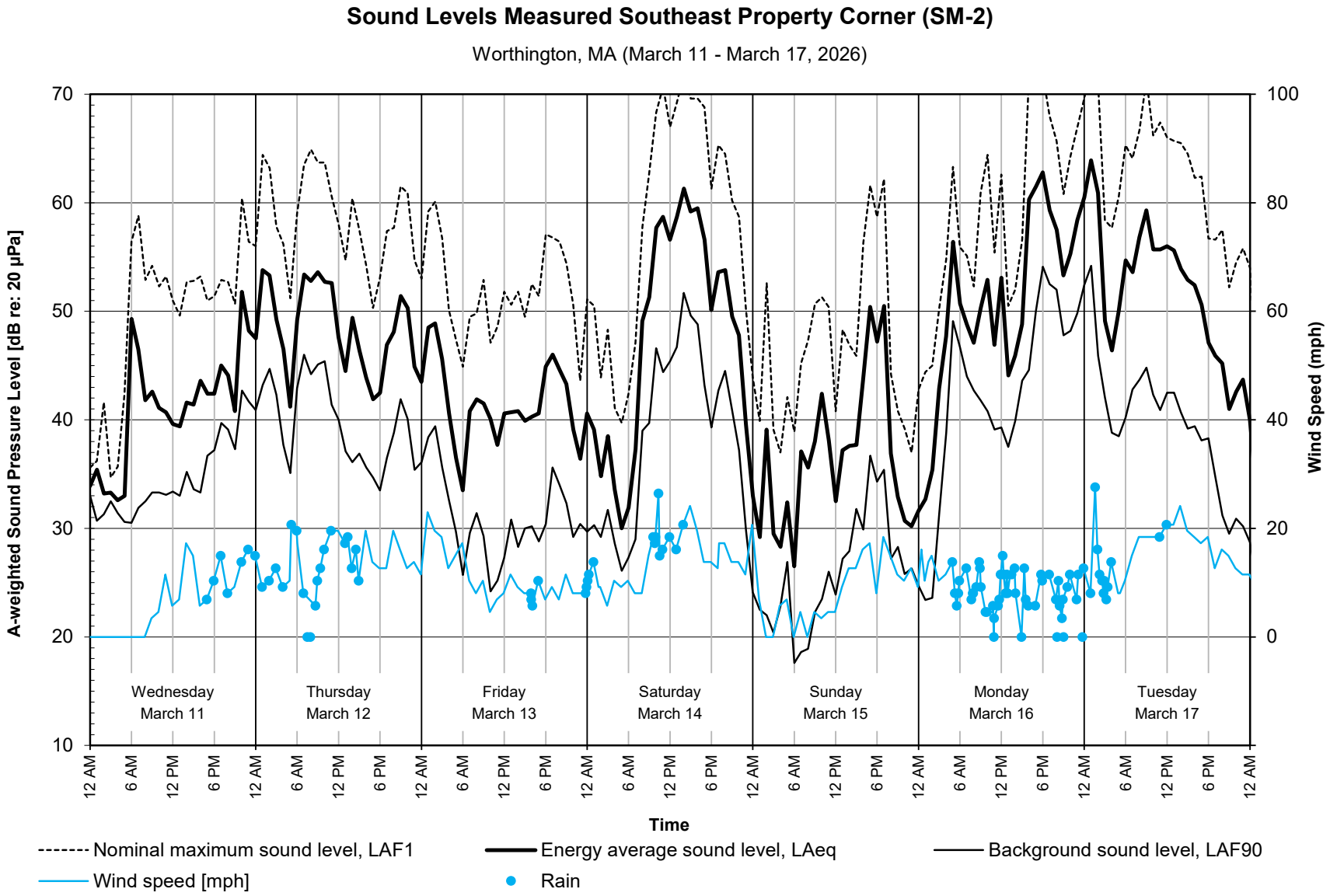
Figure 1



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Figure 2

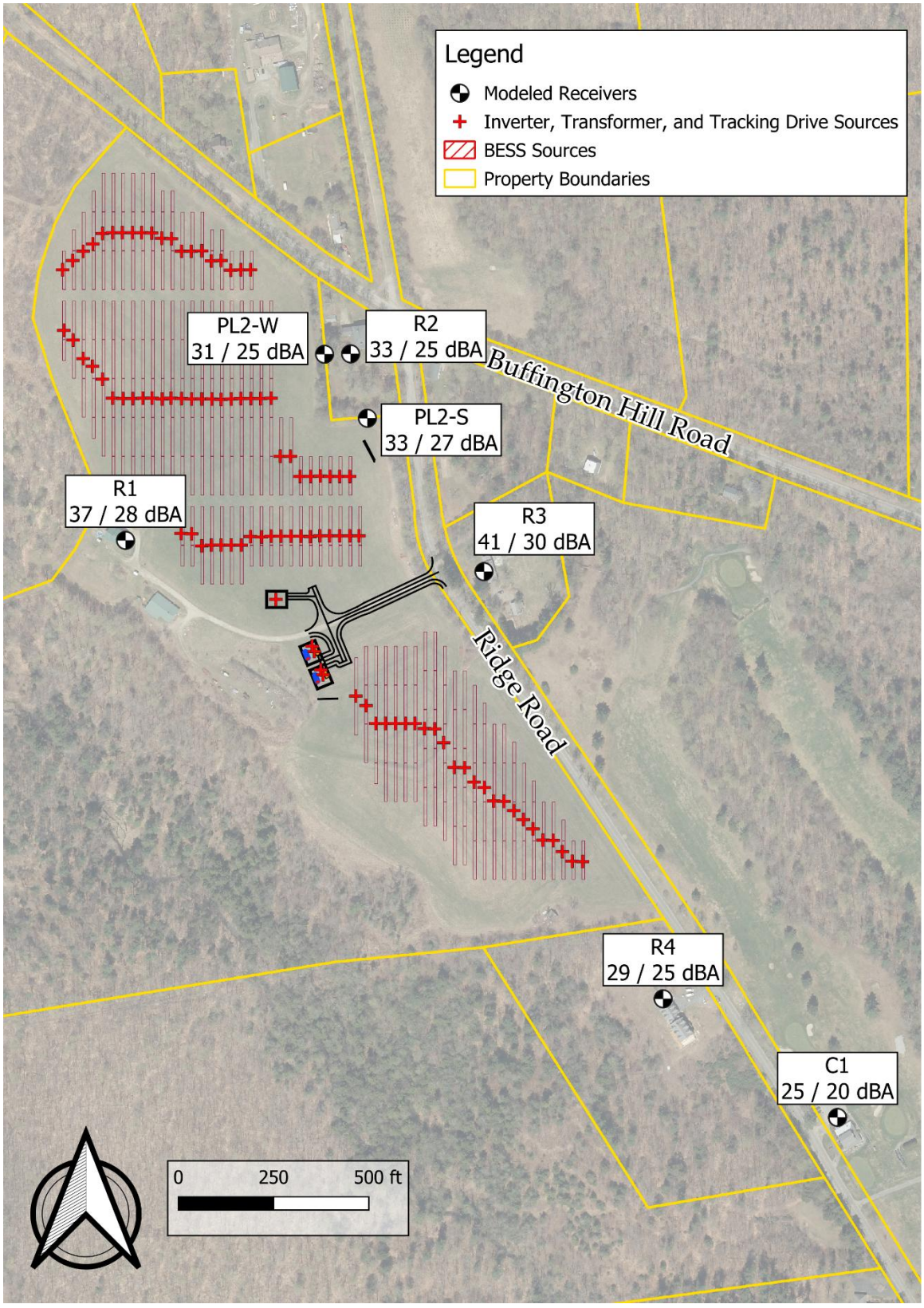
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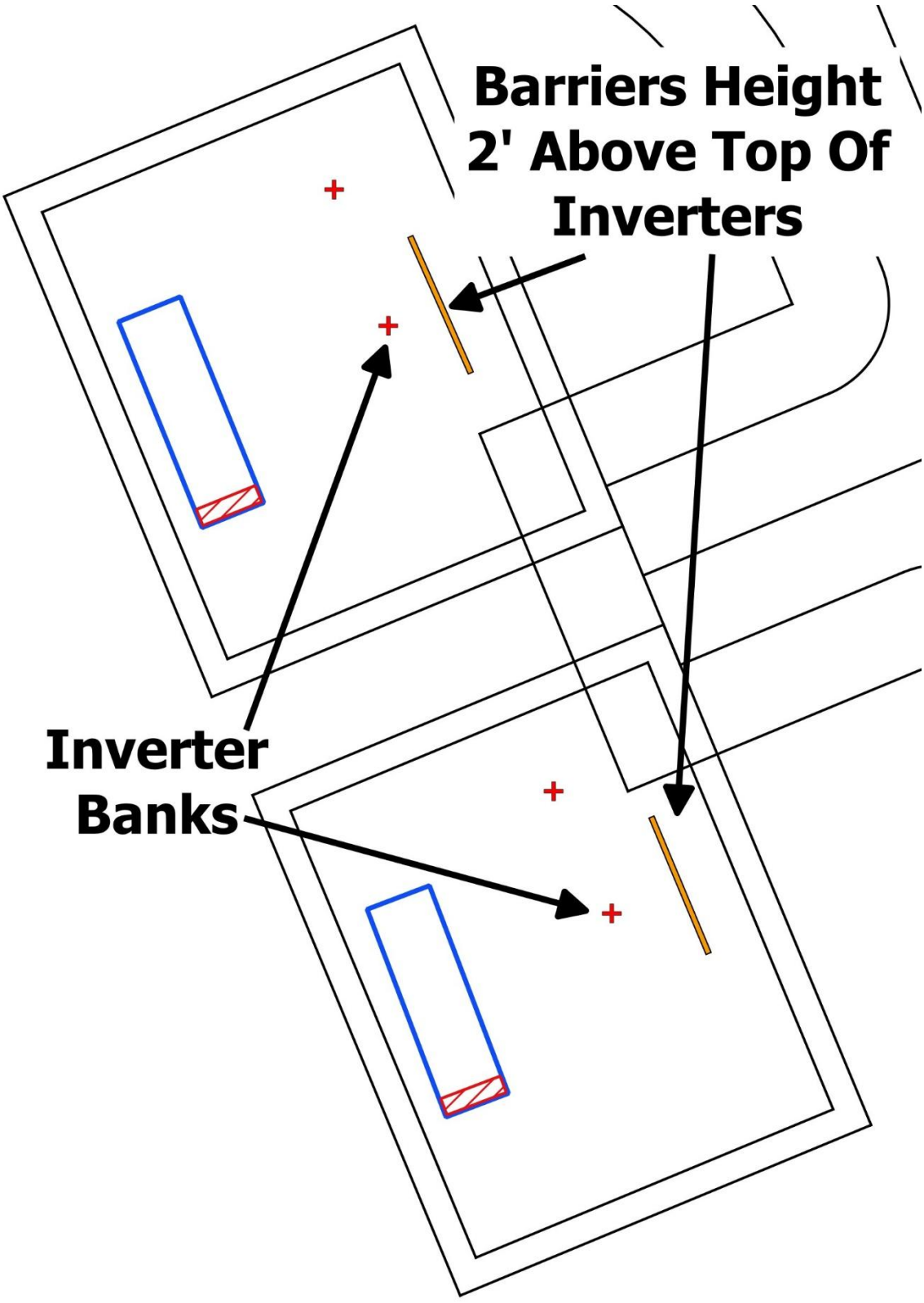
Figure 3

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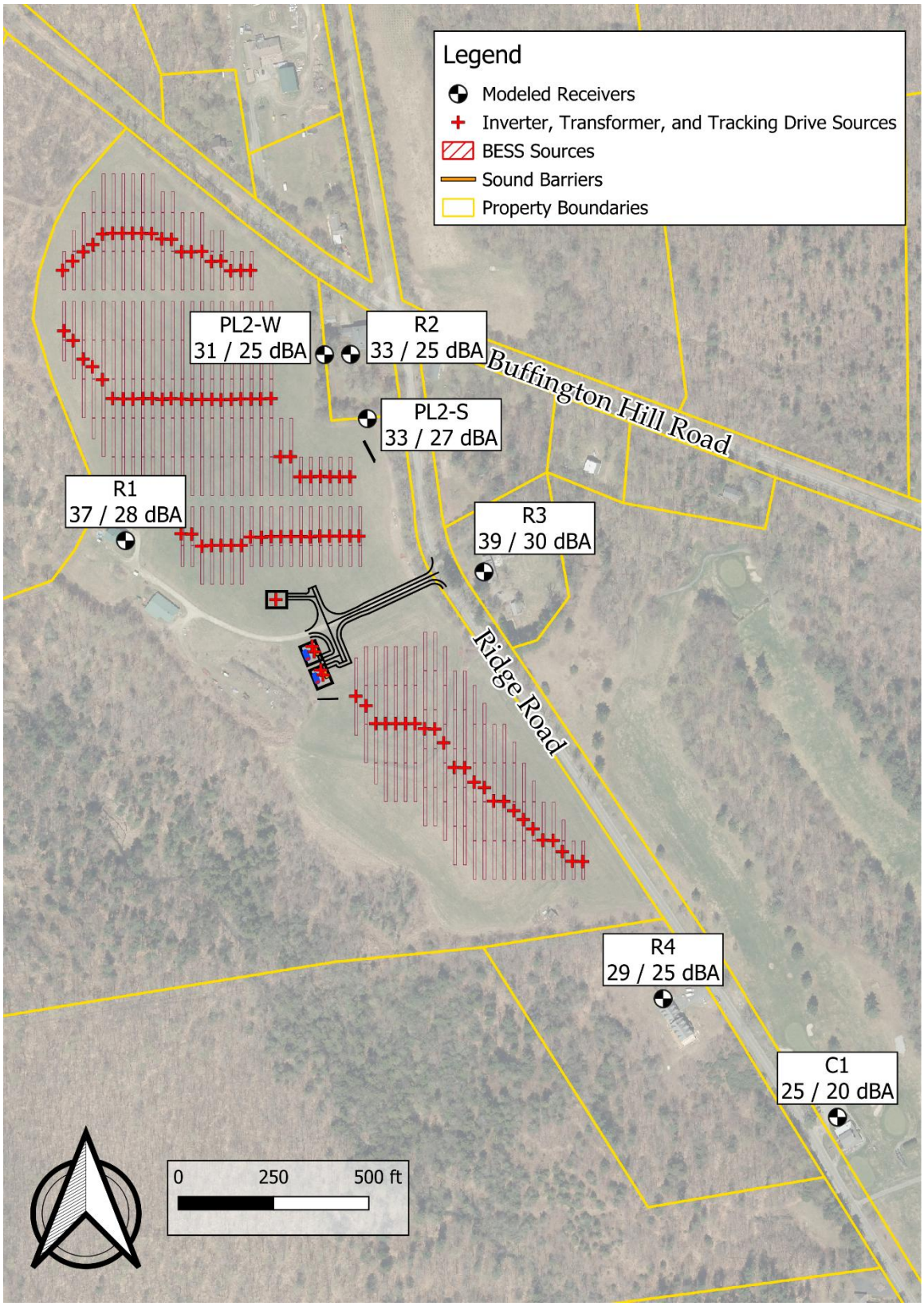
Estimated Sound Levels (day/night) Produced by the Project at Nearest Properties

Figure 4



Recommended Sound Barrier Design

Figure 5



Estimated Sound Levels (day/night) Produced by the Project at Nearest Properties With Sound Barriers

Figure 6

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Appendix A

Sound Measurement Terminology

SOUND MEASUREMENT TERMINOLOGY

In order to quantify the amplitude, frequency, and temporal characteristics of sound, various acoustical descriptors are used. The following is an introduction to acoustic terminology that is used in this report.

Sound Level

Sound levels are typically quantified using a logarithmic decibel (dB) scale. The use of a logarithmic scale helps to compress the wide range of human sensitivity to sound amplitude into a scale that ranges from approximately 0 to 180 dB. Note however, that the use of the logarithmic scale prevents simple arithmetic operations when combining the cumulative impact of sources. For example, two sources of equal sound level operated simultaneously results in a combined sound level that is only 3 dB higher than if only one source was operated alone. An important feature of the human perception of continuous sound is that an increase or decrease in sound pressure level by 3 dB or less is barely perceptible, and an increase or decrease by 10 dB is perceived as a doubling or halving of noise level.

A-weighting

Generally, the sensitivity of human hearing is restricted to the frequency range of 20 Hz to 20,000 Hz. However, the human ear is most sensitive to sound in the 500 Hz to 5,000 Hz frequency range. Above and below this range, the ear becomes progressively less sensitive. To account for this feature of human hearing, sound level meters incorporate filtering of acoustic signals that corresponds to the varying sensitivity of the human ear to sound at different frequencies. This filtering is called A-weighting. Sound level measurements that are obtained using this filtering are referred to as A-weighted sound levels and are signified by the identifier, dBA. A-weighted sound levels are widely used for evaluating human exposure to environmental sounds. To help place A-weighted sound levels in perspective, Figure A-1 contains a scale showing typical sound levels for common interior and environmental sound sources.

Spectral Characteristics – Octave and 1/3 Octave Band Sound Levels

To characterize a sound, it is often necessary to evaluate the frequency distribution of the sound energy. As mentioned before, the frequencies of most interest where human exposure is concerned range between 20 Hz and 20,000 Hz. This frequency range is commonly divided into octave bands, where an octave band is a range of frequencies. Each octave band is referred to by its center frequency and has a bandwidth of one octave (a doubling of frequency). To cover the full range of human hearing, it is necessary to measure sound in 10 separate octave bands. Typically, the lowest frequency band measured has a center frequency of 31.5 Hz. The next frequency band has a center frequency of 63 Hz. This geometric series continues to the highest frequency band that has a center frequency of 16,000 Hz. A set of octave band sound levels to describe a particular sound is called an octave band spectrum. Covering the full range of hearing, an octave band spectrum would have 10 values, one for each band. Under certain

circumstances, more frequency resolution in acoustical data is needed to identify the presence of tonal sounds. A 1/3 octave band spectrum uses filters that divide each octave band into 3 separate frequency bands. Note that octave band and 1/3 octave band sound levels are not usually A-weighted, with their units being dB.

Environmental Noise Descriptors

Sound levels in the environment are continuously fluctuating and it is difficult to quantify these time-varying levels with single number descriptors. Statistical approaches, which use *percentile sound levels* and *equivalent sound levels*, are often used to quantify the temporal characteristics of environmental sound.

Percentile sound levels (L_n) are the A-weighted sound levels that are exceeded for specific percentages of time within a noise measurement interval. For example if a measurement interval is one hour long, the 50th percentile sound level (L_{50}) is the A-weighted sound level that is exceeded for 30 minutes of that interval.

- L_{90} is the sound level in dBA exceeded 90 percent of the time during the measurement period. The 90th percentile sound level represents the nominally lowest level reached during the monitoring interval and is typically influenced by sound of relatively low level, but nearly constant duration, such as distant traffic or continuously operating industrial equipment. The L_{90} is often used in standards to quantify the existing background or residual sound level.

- L_{50} is the median sound level: the sound level in dBA exceeded 50 percent of the time during the measurement period.

- L_{10} is the sound level exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. The L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder noises like those from passing motor vehicles or aircraft.

By using percentile sound levels, it is possible to characterize the sound environment in terms of the steady-state background sound (L_{90}) and occasional transient sound (L_{10}).

The equivalent sound level (L_{eq}) is the energy average of the A weighted sound level for the measurement interval. Sounds of low level and long duration, as well as sounds of high level and short duration influence this sound level descriptor.

Noise levels at night generally produce greater annoyance than do the same levels which occur during the day. It is generally agreed that a given level of environmental noise during the day would appear to be 10 dBA louder at night – at least in terms of potential for causing community concern. The day night average sound level (Ldn) is a 24 hour average A-weighted sound level where a 10 dB “penalty” is applied to sound occurring between the hours of

10:00 p.m. and 7:00 a.m. The 10 dB penalty accounts for the heightened sensitivity of a community to noise occurring at night.

When a steady continuous sound is measured, the L_{10}, L_{50}, L_{90} and L_{eq} are all equal. For a constant sound level, such as from a power plant operating continuously for a 24-hour period, the L_{dn} is approximately 6 dBA higher than the directly measured sound level.

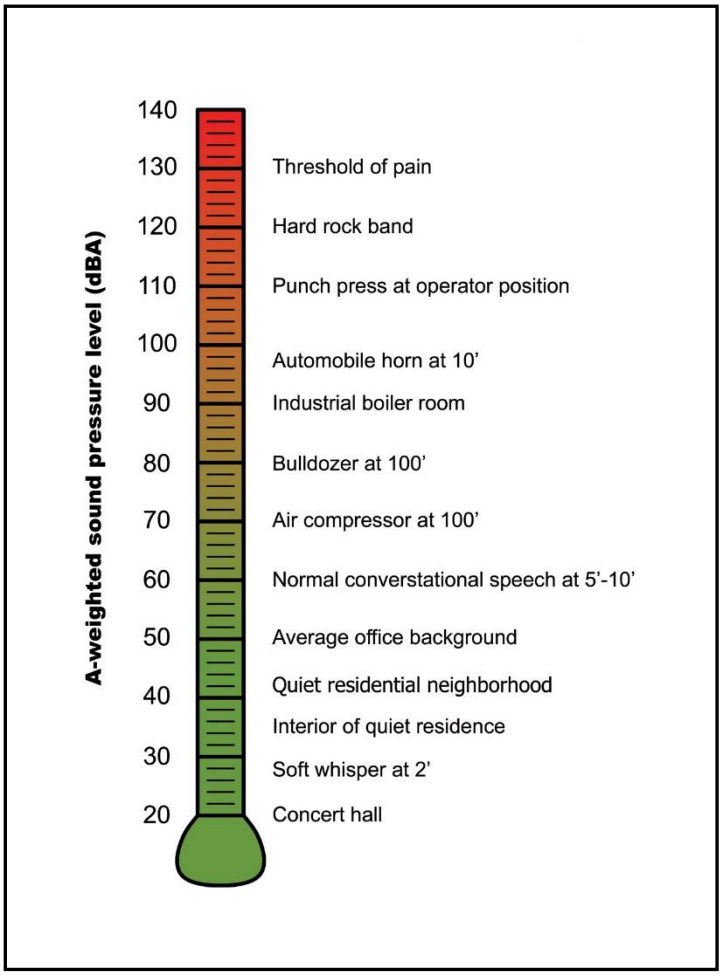


Figure A-1
Typical Sound Levels for Common Interior and Environmental Sources