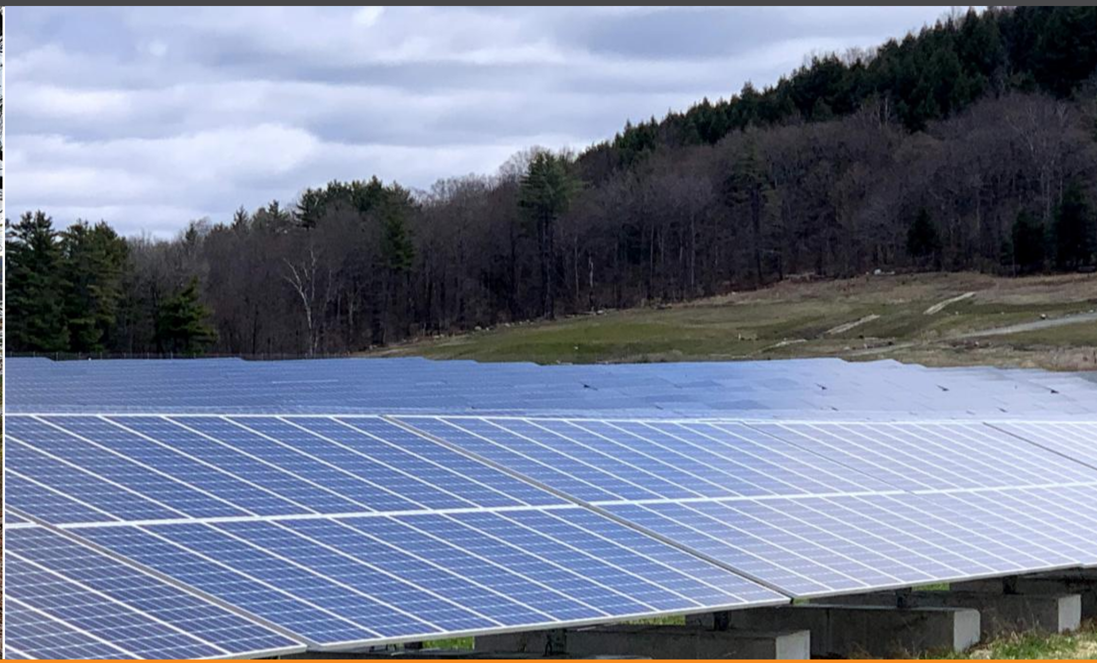
Verdantas

SOUND MODELING – OLD MAIDS LANE SOLAR

October 3, 2025



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1.0 INTRODUCTION

Greenskies Clean Energy, LLC is developing the 4.0 MW AC Old Maids Lane Solar power project ("Project") proposed for Portland, Connecticut. The engineer for the Project has asked RSG to perform sound propagation modeling to assess sound levels relative to State of Connecticut and local sound level limits. The report includes:

- A Project description,
- Description of sound level limits applicable to the project,
- Sound propagation modeling procedures and results, and
- Conclusions.

A primer of acoustical terms used in this report is included in Appendix A.

2.0 PROJECT DESCRIPTION

The Old Maids Lane Solar power project ("Project") is a 4.0 MW AC photovoltaic facility located in the Town of Portland, Connecticut. A map showing the Project in the context of the surrounding area is shown in Figure 1 and a map of the immediate site is shown in Figure 2. The Project site is located on a gravel road approximately 460 meters (1,510 feet) south of Old Maids Lane and approximately 575 meters (1,886 feet) west of Connecticut State Route 17. The Nayaug Elementary school is located directly to the north of the Project site; with its athletic fields bounding the northern parcel of the Project. Residential neighborhoods are situated adjacent to Route 17 and bound the Project on the east in places. Generally the land in the area is forested, with some residential areas.

the Project is proposed to be approximately 17 acres of solar panels with tracking motors ("trackers") mounted to the racks to align the panels to be normal to the sun. Other noise sources include 32 inverters and two transformers, located in two groupings: one to the east and the other in the center of the Project. The inverters are currently planned to be Solectria XGI 1500 125 kW units. Each transformer will be a pad mounted 2,000 kVA unit.

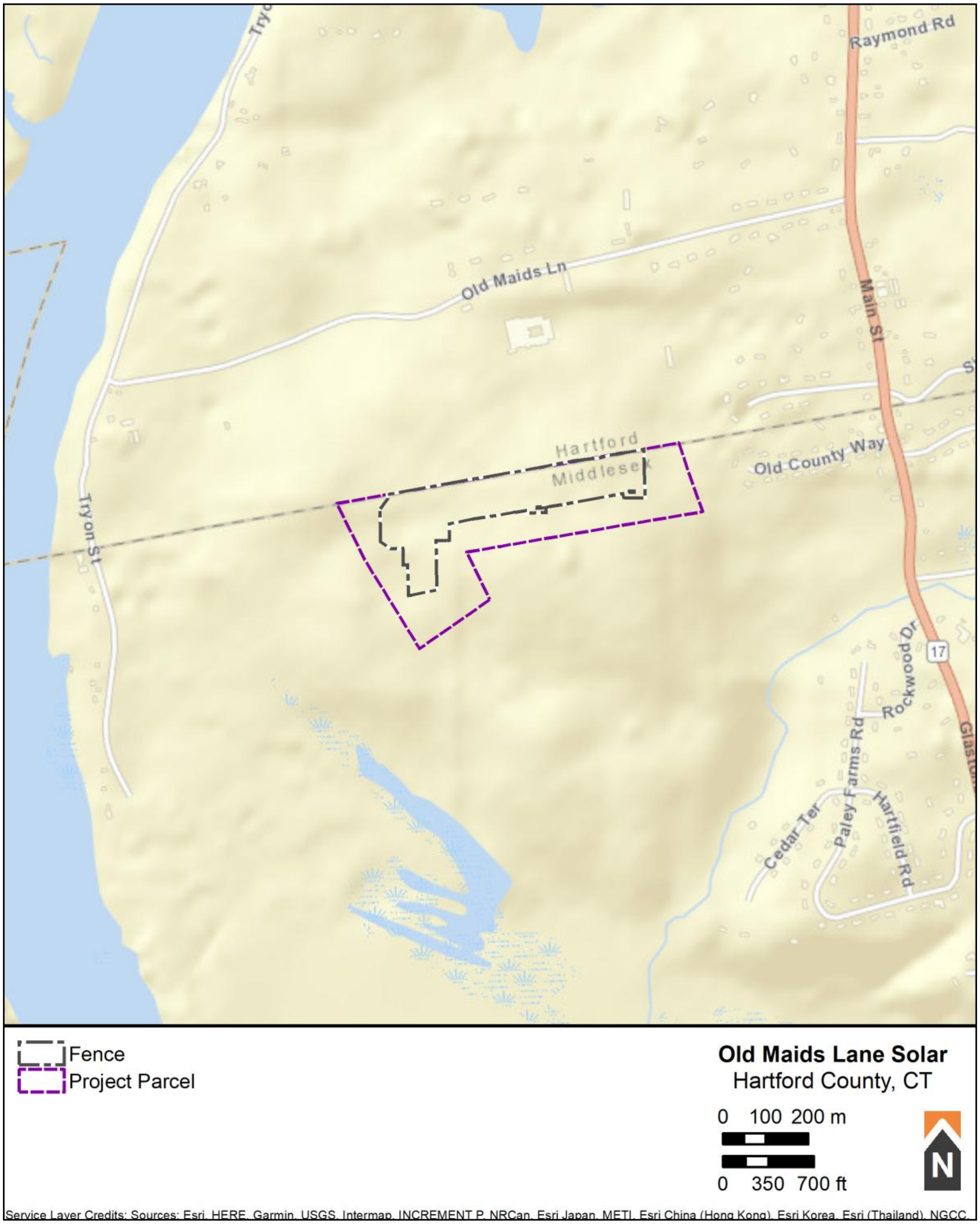

FIGURE 1: PROJECT AREA MAP

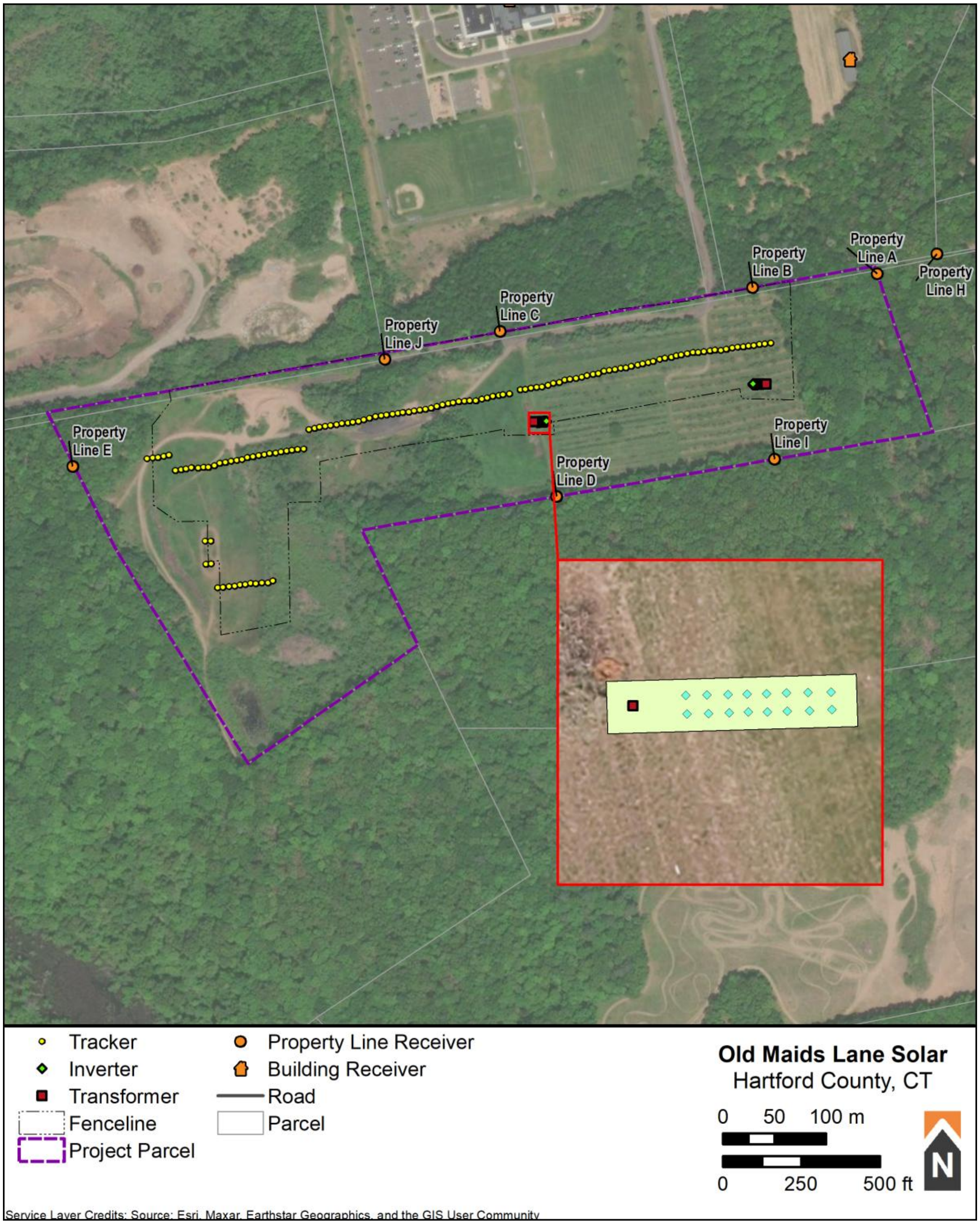

FIGURE 2: PROJECT SITE MAP

3.0 SOUND LEVEL LIMITS

The State of Connecticut noise limits, as well as the limits specified in the Portland, Connecticut Code of Ordinances,[1] are classified by land use. Both the noise emitter and receptors are classified into Noise Zones as described in Section 22a-69-2 of the State of Connecticut Regulations. A Class A Noise Zone is residential or where humans tend to sleep, a Class B Noise Zone is intended for commercial or institutional uses, and a Class C Noise Zone is industrial.

The Project parcel classifies as a Class A Noise Zone per the Town of Portland zoning. Within a Class A Noise Zone, an emitter cannot cause an exceedance of the noise level limits at the adjacent Noise Zones provided in Table 1. Zones surrounding the Project are mostly residential and classified as Class A, with the exception of a zone labeled for “mixed use”, that we have assumed as a Class A Zone. The Town of Glastonbury has a parcel zoned “Reserved Land,” located to the northwest of the Project. This is unused land and would be considered Class B under the State of Connecticut classifications. The largest parcels directly to the south and southwest currently do not have any buildings on them, but under the Portland ordinance, there is no differentiation for unused land and this land is currently zoned Residential. This would still be considered Class A.

TABLE 1: CONNECTICUT CLASS A NOISE ZONE - LIMITS

	Receptor Noise Zone			
	C	B	A/Day	A/Night
Class A Emitter	70 dBA	66 dBA	61 dBA	51 dBA

Daytime is defined as 7:00 am to 10:00 pm and nighttime is defined as 10:00 pm to 7:00 am. There is a tonal penalty based on 1/3 octave band sound levels.

There are no additional limits for the Town of Glastonbury, CT, which borders the Project site to the north.

3.1 PROJECT NOISE DESIGN LIMITS

The noise limits applicable to the Project are 61 dBA during daytime operation at the property line. Nighttime operation is limited to 51 dBA at the property line. A tonal penalty applies to the inverters and transformers.

[1] The limits of Portland, CT are similar to the Connecticut State limits, apart for some terms and parcel classifications.

4.0 SOUND PROPAGATION MODELING

4.1 PROCEDURES

Modeling for the project was in accordance with the standard ISO 9613-2, "Acoustics – Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation." The ISO standard states,

> This part of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level … under meteorological conditions favorable to propagation from sources of known sound emissions. These conditions are for downwind propagation … or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

The model takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological conditions, walls, barriers, berms, and terrain. The acoustical modeling software used here was CadnaA® V4.4, from Datakustik GmbH. CadnaA® is a widely accepted acoustical propagation modeling tool, used by many noise control professionals in the United States and internationally.

ISO 9613-2 also assumes downwind sound propagation between every source and every receiver, consequently, all wind directions, including the prevailing wind directions, are taken into account.

Model input parameters are listed in Appendix B. The ground was modeled as soft (G=1), that is suitable for vegetation growth. The exception is for the equipment (inverter and transformer) pads and roadways, which were modeled as hard ground (G=0).

Sound levels were calculated at 10 property line receivers and over an area of 1.3 square miles with a grid spacing of 10 meters by 10 meters (33 feet by 33 feet). The building heights were placed at 4 meters, while the isoline and property line receivers were modeled at 1.5 meters. Property line receivers were placed at the highest modeled Project sound level along the neighboring parcel boundaries.

Modeled sound sources included 32 Solectria SCG 1500 125 kW inverters, two 2,000 kVA transformers and 127 tracking motors. Data for the inverters was obtained from a manufacturer test. Sound power levels of the transformers were calculated based on sound emissions from the NEMA TR-1 standard and data that RSG has monitored from similar size transformers. Data for the trackers came from manufacturer data from a similar unit.

Sound emissions were prorated to reflect that trackers only operate a small percentage of the time as they track the sun throughout the day. For modeling, they were assumed to operate eight percent of the time. Transformers and inverters are frequently tonal. A five dB penalty was added to both types of sources to reflect this.

During daytime operation, all equipment is modeled to operate. During nighttime, it is assumed that only the transformers will operate.

4.2 RESULTS

Sound propagation modeling results are shown in Figure 3 and Figure 4. Discrete property line receiver results are shown in Appendix C; all results include the 5 dB penalty for tonal sources. Results show sound levels of up to 52 dBA at a property line during the daytime and 26 dBA at night. This meets the combined State of Connecticut and Portland, Connecticut limits.

The nighttime ordinance period may sometimes overlap with the daytime operational condition, but this will be over a confined period (from about 5:30 to 7:00 am) in the late spring and early summer. The trackers and inverters will be operating during this period, the latter operating at a reduced output of not more than 70 percent. Although sound data for this specific inverter is only available at 100 percent output, data from a different inverter type shows that sound levels decrease by 7.5 dB as output decreases from 100 to 70 percent. A different inverter shows an 11 dB decrease from 80 percent to 50 percent output. This means that although modeling shows an overage of up to one dB for this time period, this is unlikely to happen in practice. The locations where this happens are also well away from any residences.

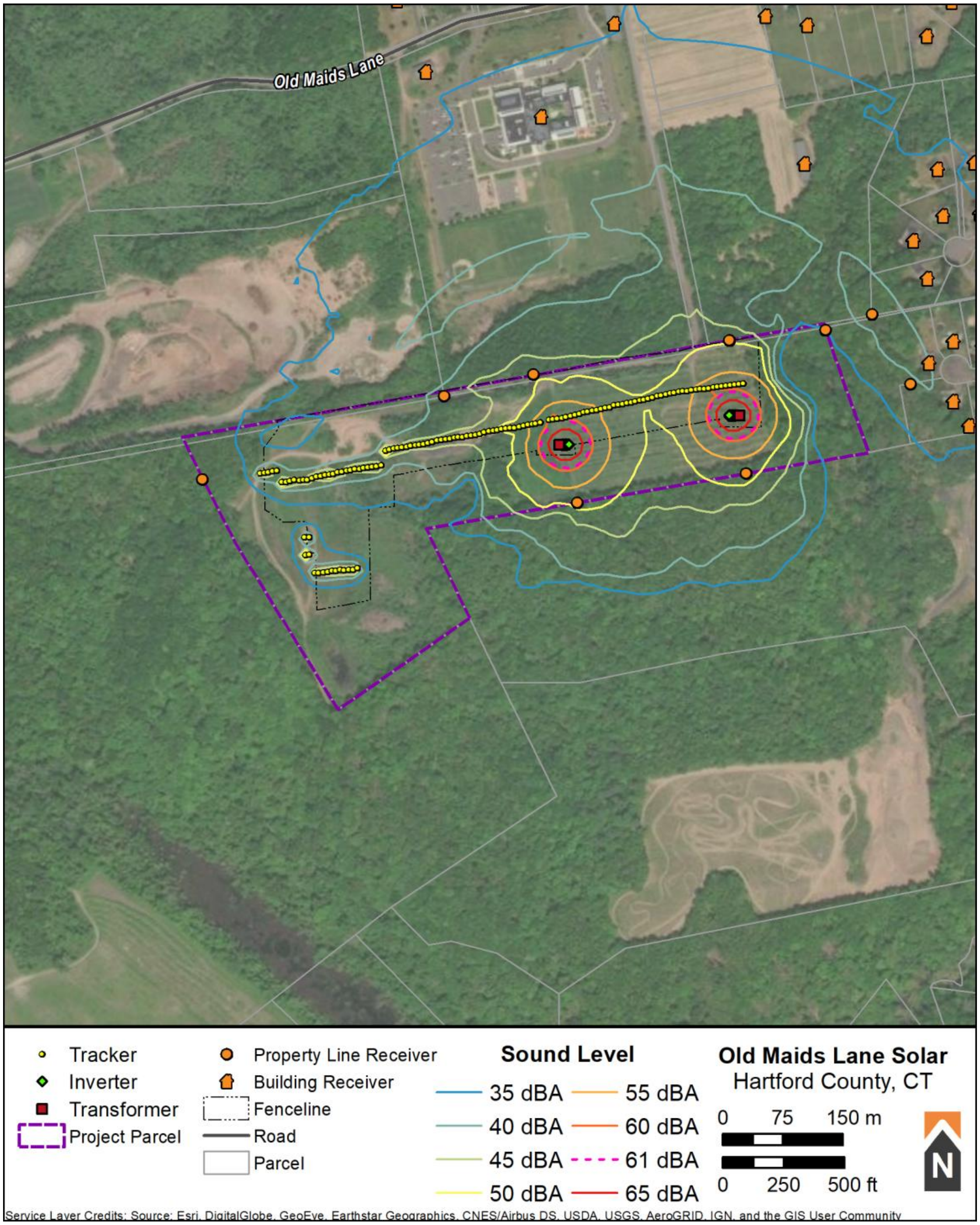

FIGURE 3: SOUND PROPAGATION MODELING RESULTS – DAYTIME OPERATION

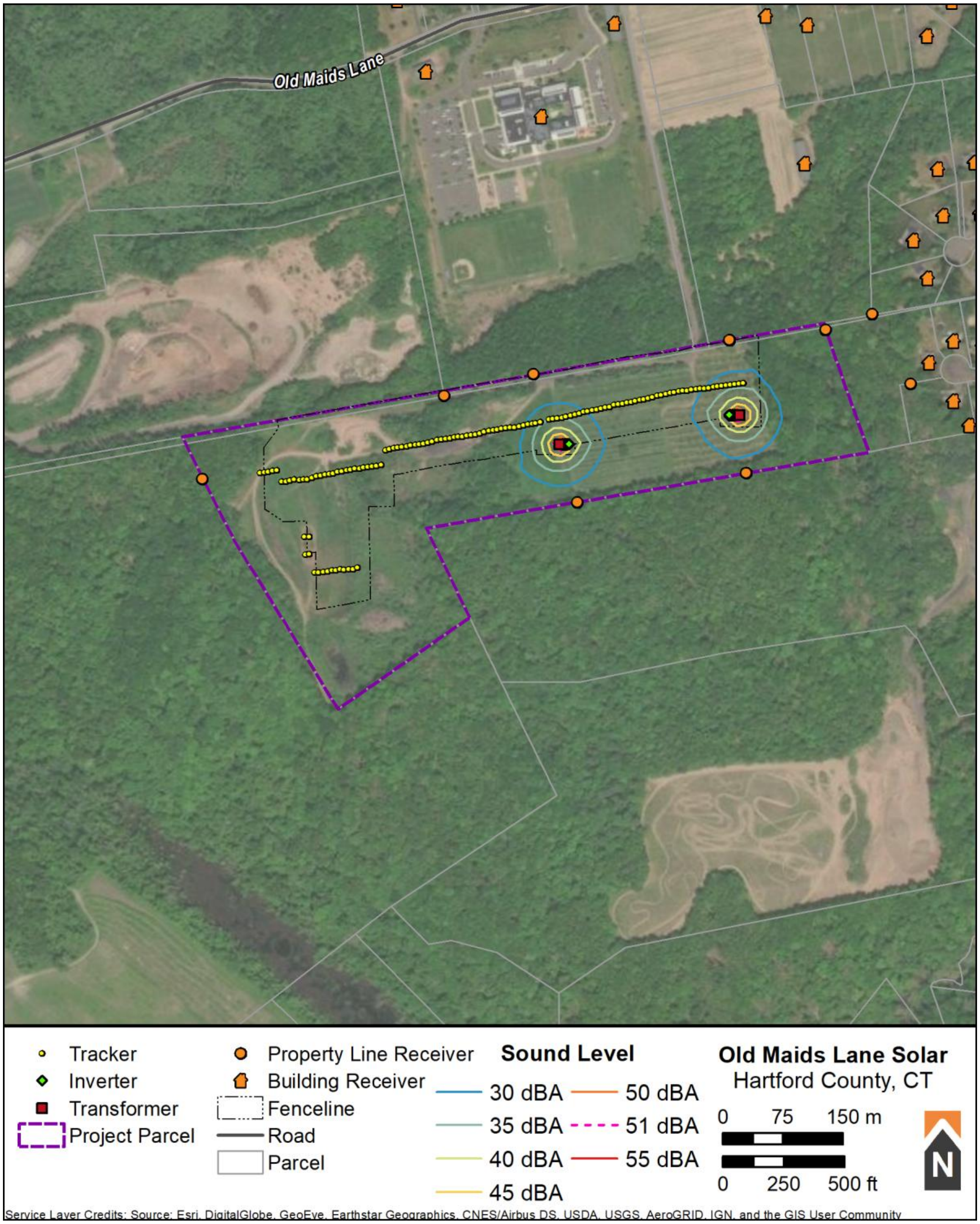

FIGURE 4: SOUND PROPAGATION MODELING RESULTS - NIGHTTIME OPERATION

5.0 CONCLUSIONS

Greenskies Clean Energy, LLC is in the process of developing the 4.0 MW AC Old Maids Lane Solar power project ("Project"), proposed for Portland, Connecticut. Verdantas, the engineering company for the project, asked RSG to assess sound levels of the Project relative to noise limits of the State of Connecticut and Portland, Connecticut. Conclusions are as follows:

- Sound propagation modeling was performed using Datakustik's CadnaA implementation of the ISO 9613-2 sound propagation modeling algorithm. The sound producing sources are the inverters, trackers, and transformers.
- Daytime operation assumes that trackers, inverters, and transformers are operating at full power capacity. Nighttime operation assumes that only the transformers are operating.
- State and town noise regulations require that the Project does not exceed sound levels of 61 dBA during the daytime and 51 dBA at nighttime at any location on a nearby residential property. Modeled property line receivers were placed at the worst-case location along property lines based on the isoline sound levels from the Project. Receivers were also placed at residential locations within a radius of 3,000 meters around the Project.
- The highest sound levels at a nearby property line were 52 dBA during daytime operation and 26 dBA during nighttime operation.

APPENDIX A. ACOUSTICS PRIMER

Expressing Sound in Decibel Levels

The varying air pressure that constitutes sound can be characterized in many different ways. The human ear is the basis for the metrics that are used in acoustics. Normal human hearing is sensitive to sound fluctuations over an enormous range of pressures, from about 20 micropascals (the "threshold of audibility") to about 20 pascals (the "threshold of pain").[3] This factor of one million in sound pressure difference is challenging to convey in engineering units. Instead, sound pressure is converted to sound "levels" in units of "decibels" (dB, named after Alexander Graham Bell). Once a measured sound is converted to dB, it is denoted as a level with the letter "L".

The conversion from sound pressure in pascals to sound level in dB is a four-step process. First, the sound wave's measured amplitude is squared and the mean is taken. Second, a ratio is taken between the mean square sound pressure and the square of the threshold of audibility (20 micropascals). Third, using the logarithm function, the ratio is converted to factors of 10. The final result is multiplied by 10 to give the decibel level. By this decibel scale, sound levels range from 0 dB at the threshold of audibility to 120 dB at the threshold of pain.

Typical sound sources, and their sound pressure levels, are listed on the scale in Figure 5.

Human Response to Sound Levels: Apparent Loudness

For every 20 dB increase in sound level, the sound pressure increases by a *factor* of 10; the sound *level* range from 0 dB to 120 dB covers 6 factors of 10, or one million, in sound *pressure*. However, for an increase of 10 dB in sound *level* as measured by a meter, humans perceive an approximate doubling of apparent loudness: to the human ear, a sound level of 70 dB sounds about "twice as loud" as a sound level of 60 dB. Smaller changes in sound level, less than 3 dB up or down, are generally not perceptible.

[3] The pascal is a measure of pressure in the metric system. In Imperial units, they are themselves very small: one pascal is only 145 millionths of a pound per square inch (psi). The sound pressure at the threshold of audibility is only 3 one-billionths of one psi: at the threshold of pain, it is about 3 one-thousandths of one psi.

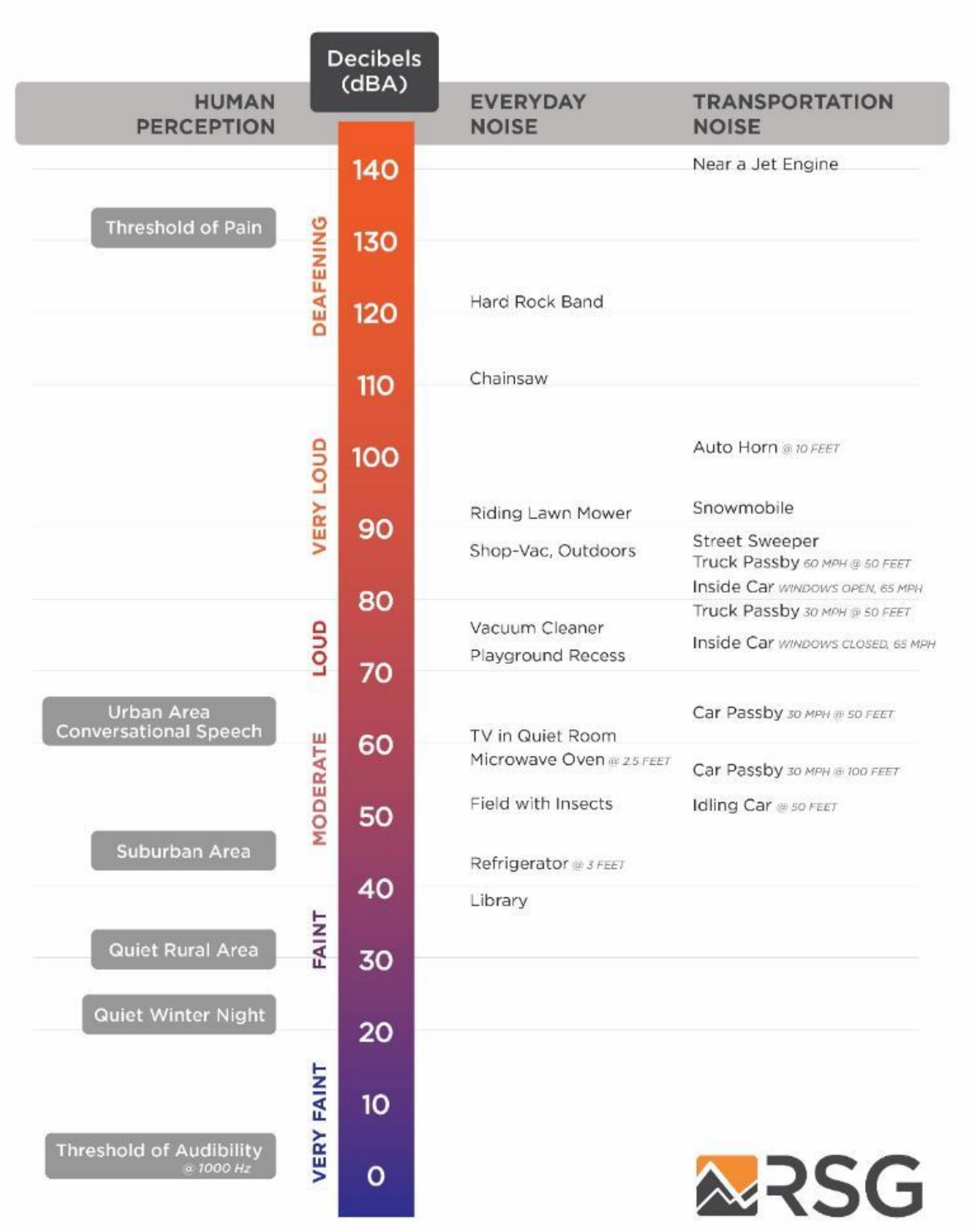

FIGURE 5: A SCALE OF SOUND PRESSURE LEVELS FOR TYPICAL SOUND SOURCES

Frequency Spectrum of Sound

The “frequency” of a sound is the rate at which it fluctuates in time, expressed in Hertz (Hz), or cycles per second. Very few sounds occur at only one frequency: most sound contains energy at many different frequencies, and it can be broken down into different frequency divisions, or bands. These bands are similar to musical pitches, from low tones to high tones. The most common division is the standard octave band. An octave is the range of frequencies whose upper frequency limit is twice its lower frequency limit, exactly like an octave in music. An octave band is identified by its center frequency: each successive band’s center frequency is twice as high (one octave) as the previous band. For example, the 500 Hz octave band includes all sound whose frequencies range between 354 Hz (Hertz, or cycles per second) and 707 Hz. The next band is centered at 1,000 Hz with a range between 707 Hz and 1,414 Hz. The range of human hearing is divided into 10 standard octave bands: 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1,000 Hz, 2,000 Hz, 4,000 Hz, 8,000 Hz, and 16,000 Hz. For analyses that require finer frequency detail, each octave-band can be subdivided. A commonly-used subdivision creates three smaller bands within each octave band, or so-called 1/3-octave bands.

Human Response to Frequency: Weighting of Sound Levels

The human ear is not equally sensitive to sounds of all frequencies. Sounds at some frequencies seem louder than others, despite having the same decibel level as measured by a sound level meter. In particular, human hearing is much more sensitive to medium pitches (from about 500 Hz to about 4,000 Hz) than to very low or very high pitches. For example, a tone measuring 80 dB at 500 Hz (a medium pitch) sounds quite a bit louder than a tone measuring 80 dB at 60 Hz (a very low pitch). The frequency response of normal human hearing ranges from 20 Hz to 20,000 Hz. Below 20 Hz, sound pressure fluctuations are not “heard”, but sometimes can be “felt”. This is known as “infrasound”. Likewise, above 20,000 Hz, sound can no longer be heard by humans; this is known as “ultrasound”. As humans age, they tend to lose the ability to hear higher frequencies first; many adults do not hear very well above about 16,000 Hz. Most natural and man-made sound occurs in the range from about 40 Hz to about 4,000 Hz. Some insects and birdsongs reach to about 8,000 Hz.

To adjust measured sound pressure levels so that they mimic human hearing response, sound level meters apply filters, known as “frequency weightings”, to the signals. There are several defined weighting scales, including “A”, “B”, “C”, “D”, “G”, and “Z”. The most common weighting scale used in environmental noise analysis and regulation is A-weighting. This weighting represents the sensitivity of the human ear to sounds of low to moderate level. It attenuates sounds with frequencies below 1000 Hz and above 4000 Hz; it amplifies very slightly sounds between 1000 Hz and 4000 Hz, where the human ear is particularly sensitive. The C-weighting scale is sometimes used to describe louder sounds. The B- and D- scales are seldom used. All of these frequency weighting scales are normalized to the average human hearing response at

1000 Hz: at this frequency, the filters neither attenuate nor amplify. When a reported sound level has been filtered using a frequency weighting, the letter is appended to “dB”. For example, sound with A-weighting is usually denoted “dBA”. When no filtering is applied, the level is denoted “dB” or “dBZ”. The letter is also appended as a subscript to the level indicator “L”, for example “L_A” for A-weighted levels.

Time Response of Sound Level Meters

Because sound levels can vary greatly from one moment to the next, the time over which sound is measured can influence the value of the levels reported. Often, sound is measured in real time, as it fluctuates. In this case, acousticians apply a so-called “time response” to the sound level meter, and this time response is often part of regulations for measuring sound. If the sound level is varying slowly, over a few seconds, “Slow” time response is applied, with a time constant of one second. If the sound level is varying quickly (for example, if brief events are mixed into the overall sound), “Fast” time response can be applied, with a time constant of one-eighth of a second.[4] The time response setting for a sound level measurement is indicated with the subscript “S” for Slow and “F” for Fast: L_S or L_F. A sound level meter set to Fast time response will indicate higher sound levels than one set to Slow time response when brief events are mixed into the overall sound, because it can respond more quickly.

In some cases, the maximum sound level that can be generated by a source is of concern. Likewise, the minimum sound level occurring during a monitoring period may be required. To measure these, the sound level meter can be set to capture and hold the highest and lowest levels measured during a given monitoring period. This is represented by the subscript “max”, denoted as “L_{max}”. One can define a “max” level with Fast response L_{Fmax} (1/8-second time constant), Slow time response L_{Smax} (1-second time constant), or Continuous Equivalent level over a specified time period $L_{eq,max}$.

Accounting for Changes in Sound Over Time

A sound level meter’s time response settings are useful for continuous monitoring. However, they are less useful in summarizing sound levels over longer periods. To do so, acousticians apply simple statistics to the measured sound levels, resulting in a set of defined types of sound level related to averages over time. An example is shown in Figure 6. The sound level at each instant of time is the grey trace going from left to right. Over the total time it was measured (1 hour in the figure), the sound energy spends certain fractions of time near various levels, ranging from the minimum (about 27 dB in the figure) to the maximum (about 65 dB in the figure). The simplest descriptor is the average sound level, known as the Equivalent Continuous

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[4] There is a third time response defined by standards, the “Impulse” response. This response was defined to enable use of older, analog meters when measuring very brief sounds; it is no longer in common use.

Sound Level. Statistical levels are used to determine for what percentage of time the sound is louder than any given level. These levels are described in the following sections.

Equivalent Continuous Sound Level - L_{eq}

One straightforward, common way of describing sound levels is in terms of the Continuous Equivalent Sound Level, or L_{eq}. The L_{eq} is the average sound pressure level over a defined period of time, such as one hour or one day. L_{eq} is the most commonly used descriptor in noise standards and regulations. L_{eq} is representative of the overall sound to which a person is exposed. Because of the logarithmic calculation of decibels, L_{eq} tends to favor higher sound levels: loud and infrequent sources have a larger impact on the resulting average sound level than quieter but more frequent sounds. For example, in Figure 6, even though the sound levels spends most of the time near about 34 dBA, the L_{eq} is 41 dBA, having been “inflated” by the maximum level of 65 dBA and other occasional spikes over the course of the hour.

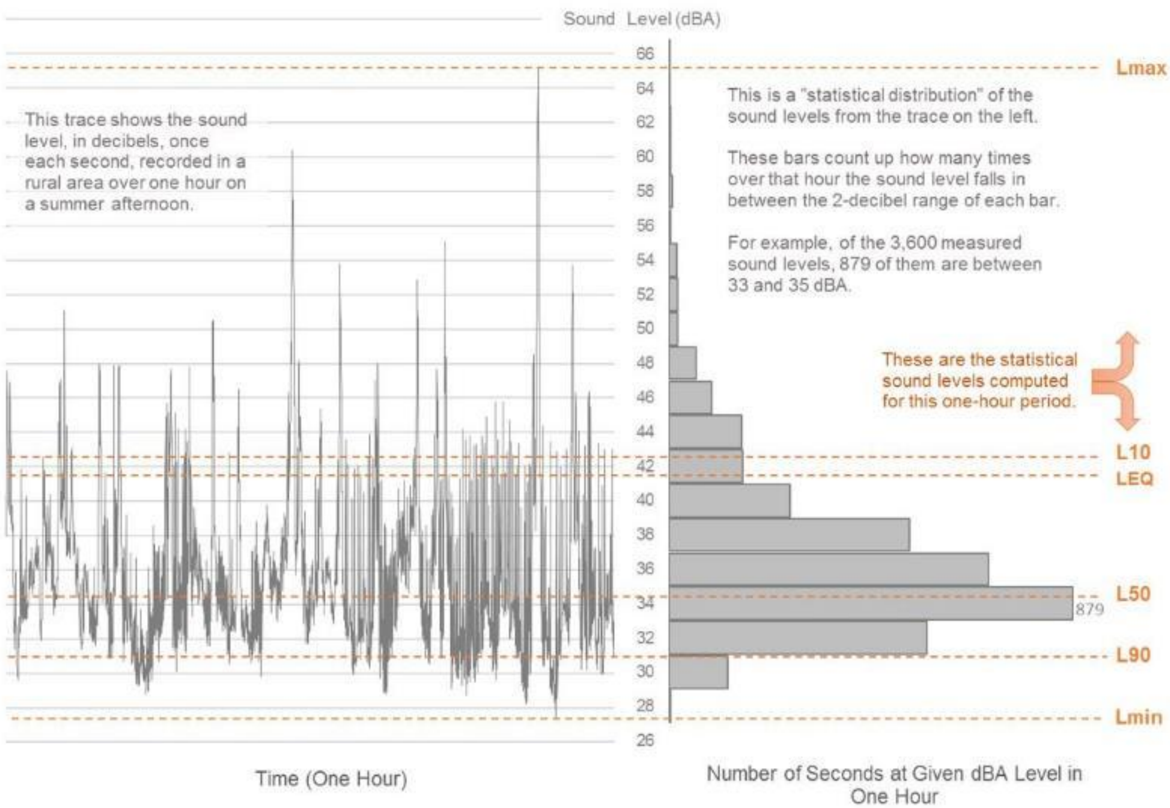

FIGURE 6: EXAMPLE OF DESCRIPTIVE TERMS OF SOUND MEASUREMENT OVER TIME

Percentile Sound Levels – L_n

Percentile sound levels describe the statistical distribution of sound levels over time. "L_N" is the level above which the sound spends "N" percent of the time. For example, L_{90} (sometimes called the "residual base level") is the sound level exceeded 90% of the time: the sound is louder than L_{90} most of the time. L_{10} is the sound level that is exceeded only 10% of the time. L_{50} (the "median level") is exceeded 50% of the time: half of the time the sound is louder than L_{50}, and half the time it is quieter than L_{50}. Note that L_{50} (median) and L_{eq} (mean) are not always the same, for reasons described in the previous section.

L_{90} is the sound that persists for longer periods, and below which the overall sound level seldom falls. It tends to filter out other short-term environmental sounds that aren't part of the source being investigated. L_{10} represents the higher, but less frequent, sound levels. These could include such events as barking dogs, vehicles driving by and aircraft flying overhead, gusts of wind, and work operations. L_{90} represents the background sound that is present when these event sounds are excluded.

Note that if one sound source is very constant and dominates the soundscape in an area, all of the descriptive sound levels mentioned here tend toward the same value. It is when the sound is varying widely from one moment to the next that the statistical descriptors are useful.

APPENDIX B. SOUND SOURCE INFORMATION

TABLE 2: SOUND PROPAGATION MODELING PARAMETERS

Parameter	Setting
Ground Absorption	Spectral for all sources, soft ground (G=1), hard ground (G=0) for equipment pads and roads, G=0.6 for gravel roads
Atmospheric Attenuation	Based on 10 Celsius, 70% relative humidity
Receiver Height	1.5 meters for property line receivers and isoline contours, 4 meters for residences
Search Distance	3,000 meters

TABLE 3: EQUIPMENT SOUND POWER

Sound Source	1/1 Octave Band Center Frequency Sound Power (dBZ)									Sum (dBA)	Sum (dBZ)
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz		
Yaskawa XGI 1500-166/166	80	75	79	73	79	81	76	78	77	85	88
Transformer: 2000kVA	74	79	85	84	74	70	61	53	46	78	88
NexTracker					70					67	70

TABLE 4: SOUND SOURCE INFORMATION

Source ID	Equipment Type	Modeled Sound Power (dBA)	Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
				X (m)	Y (m)	Z (m)
Inverter 01	Inverter	90	1.6	698661	4611897	73
Inverter 02	Inverter	90	1.6	698661	4611899	73
Inverter 03	Inverter	90	1.6	698663	4611897	73
Inverter 04	Inverter	90	1.6	698662	4611899	73
Inverter 05	Inverter	90	1.6	698664	4611898	73
Inverter 06	Inverter	90	1.6	698664	4611899	73
Inverter 07	Inverter	90	1.6	698665	4611898	73
Inverter 08	Inverter	90	1.6	698665	4611899	73
Inverter 09	Inverter	90	1.6	698666	4611898	73
Inverter 10	Inverter	90	1.6	698666	4611899	73
Inverter 11	Inverter	90	1.6	698667	4611898	73
Inverter 12	Inverter	90	1.6	698667	4611899	73
Inverter 13	Inverter	90	1.6	698669	4611898	73
Inverter 14	Inverter	90	1.6	698669	4611899	73

Source ID	Equipment Type	Modeled Sound Power (dBA)	Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
				X (m)	Y (m)	Z (m)
Inverter 15	Inverter	90	1.6	698670	4611898	74
Inverter 16	Inverter	90	1.6	698670	4611899	73
Inverter 17	Inverter	90	1.6	698881	4611935	67
Inverter 18	Inverter	90	1.6	698881	4611934	68
Inverter 19	Inverter	90	1.6	698879	4611935	67
Inverter 20	Inverter	90	1.6	698879	4611934	68
Inverter 21	Inverter	90	1.6	698878	4611935	68
Inverter 22	Inverter	90	1.6	698878	4611934	68
Inverter 23	Inverter	90	1.6	698876	4611935	68
Inverter 24	Inverter	90	1.6	698876	4611934	68
Inverter 25	Inverter	90	1.6	698875	4611935	68
Inverter 26	Inverter	90	1.6	698875	4611934	68
Inverter 27	Inverter	90	1.6	698874	4611935	68
Inverter 28	Inverter	90	1.6	698874	4611934	68
Inverter 29	Inverter	90	1.6	698872	4611935	68
Inverter 30	Inverter	90	1.6	698872	4611934	68
Inverter 31	Inverter	90	1.6	698871	4611934	68
Inverter 32	Inverter	90	1.6	698871	4611935	68
Tracker 001	Tracker	67	1.5	698283	4611862	41
Tracker 002	Tracker	67	1.5	698288	4611863	41
Tracker 003	Tracker	67	1.5	698293	4611863	41
Tracker 004	Tracker	67	1.5	698299	4611865	40
Tracker 005	Tracker	67	1.5	698304	4611866	40
Tracker 006	Tracker	67	1.5	698310	4611851	39
Tracker 007	Tracker	67	1.5	698316	4611851	39
Tracker 008	Tracker	67	1.5	698321	4611852	39
Tracker 009	Tracker	67	1.5	698326	4611854	39
Tracker 010	Tracker	67	1.5	698332	4611853	40
Tracker 011	Tracker	67	1.5	698337	4611854	40
Tracker 012	Tracker	67	1.5	698342	4611854	41
Tracker 013	Tracker	67	1.5	698348	4611856	41
Tracker 014	Tracker	67	1.5	698353	4611858	42
Tracker 015	Tracker	67	1.5	698359	4611859	43
Tracker 016	Tracker	67	1.5	698364	4611860	43
Tracker 017	Tracker	67	1.5	698370	4611861	44
Tracker 018	Tracker	67	1.5	698375	4611862	44

Source ID	Equipment Type	Modeled Sound Power (dBA)	Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
				X (m)	Y (m)	Z (m)
Tracker 019	Tracker	67	1.5	698380	4611864	44
Tracker 020	Tracker	67	1.5	698386	4611864	44
Tracker 021	Tracker	67	1.5	698391	4611865	45
Tracker 022	Tracker	67	1.5	698397	4611866	45
Tracker 023	Tracker	67	1.5	698402	4611867	46
Tracker 024	Tracker	67	1.5	698408	4611868	47
Tracker 025	Tracker	67	1.5	698413	4611869	47
Tracker 026	Tracker	67	1.5	698418	4611870	48
Tracker 027	Tracker	67	1.5	698423	4611870	49
Tracker 028	Tracker	67	1.5	698429	4611871	49
Tracker 029	Tracker	67	1.5	698435	4611872	50
Tracker 030	Tracker	67	1.5	698440	4611891	49
Tracker 031	Tracker	67	1.5	698445	4611892	49
Tracker 032	Tracker	67	1.5	698450	4611893	50
Tracker 033	Tracker	67	1.5	698455	4611894	50
Tracker 034	Tracker	67	1.5	698461	4611894	50
Tracker 035	Tracker	67	1.5	698467	4611895	51
Tracker 036	Tracker	67	1.5	698472	4611897	51
Tracker 037	Tracker	67	1.5	698478	4611897	52
Tracker 038	Tracker	67	1.5	698483	4611898	52
Tracker 039	Tracker	67	1.5	698488	4611898	53
Tracker 040	Tracker	67	1.5	698493	4611900	54
Tracker 041	Tracker	67	1.5	698499	4611902	54
Tracker 042	Tracker	67	1.5	698505	4611903	55
Tracker 043	Tracker	67	1.5	698510	4611904	56
Tracker 044	Tracker	67	1.5	698515	4611905	56
Tracker 045	Tracker	67	1.5	698521	4611906	57
Tracker 046	Tracker	67	1.5	698526	4611906	58
Tracker 047	Tracker	67	1.5	698531	4611907	58
Tracker 048	Tracker	67	1.5	698537	4611907	59
Tracker 049	Tracker	67	1.5	698542	4611909	59
Tracker 050	Tracker	67	1.5	698548	4611909	60
Tracker 051	Tracker	67	1.5	698553	4611910	60
Tracker 052	Tracker	67	1.5	698558	4611912	61
Tracker 053	Tracker	67	1.5	698564	4611913	61
Tracker 054	Tracker	67	1.5	698569	4611915	62

Source ID	Equipment Type	Modeled Sound Power (dBA)	Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
				X (m)	Y (m)	Z (m)
Tracker 055	Tracker	67	1.5	698575	4611916	63
Tracker 056	Tracker	67	1.5	698580	4611917	63
Tracker 057	Tracker	67	1.5	698585	4611918	64
Tracker 058	Tracker	67	1.5	698591	4611918	64
Tracker 059	Tracker	67	1.5	698596	4611919	65
Tracker 060	Tracker	67	1.5	698602	4611919	66
Tracker 061	Tracker	67	1.5	698607	4611920	66
Tracker 062	Tracker	67	1.5	698613	4611921	67
Tracker 063	Tracker	67	1.5	698618	4611923	67
Tracker 064	Tracker	67	1.5	698624	4611924	68
Tracker 065	Tracker	67	1.5	698628	4611925	68
Tracker 066	Tracker	67	1.5	698634	4611925	69
Tracker 067	Tracker	67	1.5	698645	4611929	69
Tracker 068	Tracker	67	1.5	698650	4611930	70
Tracker 069	Tracker	67	1.5	698655	4611931	70
Tracker 070	Tracker	67	1.5	698661	4611931	70
Tracker 071	Tracker	67	1.5	698666	4611932	70
Tracker 072	Tracker	67	1.5	698672	4611934	70
Tracker 073	Tracker	67	1.5	698677	4611936	70
Tracker 074	Tracker	67	1.5	698683	4611936	70
Tracker 075	Tracker	67	1.5	698688	4611939	70
Tracker 076	Tracker	67	1.5	698693	4611940	70
Tracker 077	Tracker	67	1.5	698699	4611940	70
Tracker 078	Tracker	67	1.5	698704	4611941	70
Tracker 079	Tracker	67	1.5	698710	4611943	70
Tracker 080	Tracker	67	1.5	698716	4611944	70
Tracker 081	Tracker	67	1.5	698721	4611945	70
Tracker 082	Tracker	67	1.5	698726	4611947	70
Tracker 083	Tracker	67	1.5	698731	4611948	70
Tracker 084	Tracker	67	1.5	698737	4611949	70
Tracker 085	Tracker	67	1.5	698742	4611950	70
Tracker 086	Tracker	67	1.5	698747	4611951	70
Tracker 087	Tracker	67	1.5	698753	4611952	70
Tracker 088	Tracker	67	1.5	698759	4611953	70
Tracker 089	Tracker	67	1.5	698764	4611954	70
Tracker 090	Tracker	67	1.5	698769	4611956	70

Source ID	Equipment Type	Modeled Sound Power (dBA)	Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
				X (m)	Y (m)	Z (m)
Tracker 091	Tracker	67	1.5	698774	4611957	70
Tracker 092	Tracker	67	1.5	698780	4611959	70
Tracker 093	Tracker	67	1.5	698785	4611960	70
Tracker 094	Tracker	67	1.5	698791	4611961	70
Tracker 095	Tracker	67	1.5	698796	4611962	70
Tracker 096	Tracker	67	1.5	698801	4611963	69
Tracker 097	Tracker	67	1.5	698807	4611964	69
Tracker 098	Tracker	67	1.5	698812	4611965	69
Tracker 099	Tracker	67	1.5	698818	4611965	68
Tracker 100	Tracker	67	1.5	698823	4611966	68
Tracker 101	Tracker	67	1.5	698829	4611967	67
Tracker 102	Tracker	67	1.5	698834	4611968	67
Tracker 103	Tracker	67	1.5	698840	4611967	66
Tracker 104	Tracker	67	1.5	698845	4611969	66
Tracker 105	Tracker	67	1.5	698851	4611970	65
Tracker 106	Tracker	67	1.5	698856	4611971	65
Tracker 107	Tracker	67	1.5	698861	4611971	64
Tracker 108	Tracker	67	1.5	698866	4611972	64
Tracker 109	Tracker	67	1.5	698871	4611972	63
Tracker 110	Tracker	67	1.5	698877	4611973	62
Tracker 111	Tracker	67	1.5	698882	4611974	62
Tracker 112	Tracker	67	1.5	698888	4611975	62
Tracker 113	Tracker	67	1.5	698339	4611782	37
Tracker 114	Tracker	67	1.5	698340	4611760	36
Tracker 115	Tracker	67	1.5	698345	4611760	36
Tracker 116	Tracker	67	1.5	698345	4611782	37
Tracker 117	Tracker	67	1.5	698351	4611737	36
Tracker 118	Tracker	67	1.5	698356	4611738	36
Tracker 119	Tracker	67	1.5	698362	4611738	36
Tracker 120	Tracker	67	1.5	698368	4611739	37
Tracker 121	Tracker	67	1.5	698373	4611740	37
Tracker 122	Tracker	67	1.5	698378	4611740	37
Tracker 123	Tracker	67	1.5	698383	4611741	38
Tracker 124	Tracker	67	1.5	698388	4611741	38
Tracker 125	Tracker	67	1.5	698394	4611742	38
Tracker 126	Tracker	67	1.5	698400	4611742	38

Source ID	Equipment Type	Modeled Sound Power (dBA)	Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
				X (m)	Y (m)	Z (m)
Tracker 127	Tracker	67	1.5	698405	4611744	39
Transformer 2000kVA	Transformer	80	1.7	698658	4611898	73
Transformer 2000kVA	Transformer	80	1.7	698883	4611935	67

APPENDIX C. RECEIVER INFORMATION

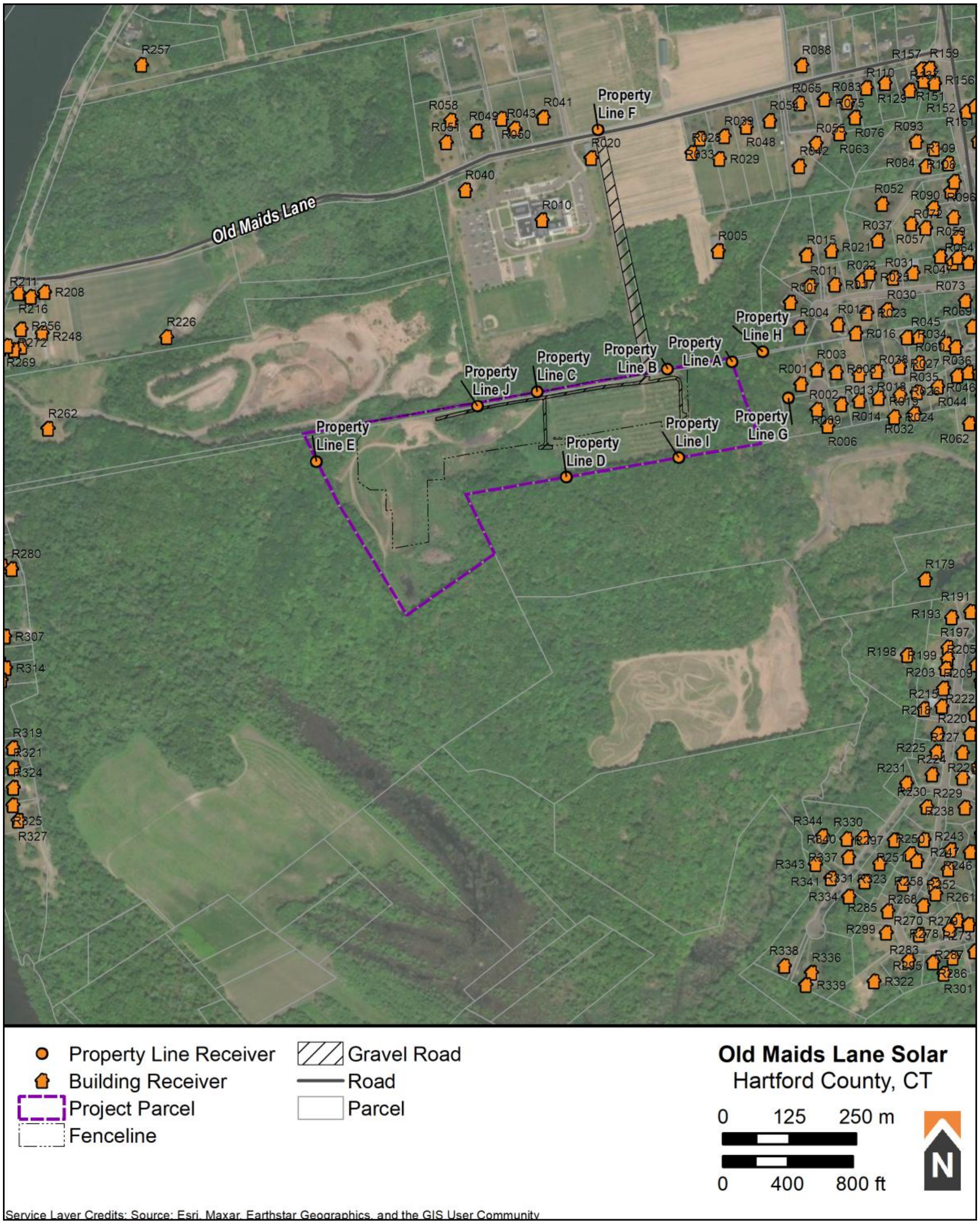

FIGURE 7: RECEIVER LOCATIONS

TABLE 5: DISCRETE RECEIVER RESULTS

Receiver ID	Sound Level (dBA)		Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
	Daytime	Nighttime		X (m)	Y (m)	Z (m)
Property Line A	34	16	1.5	698991	4612042	31
Property Line B	50	24	1.5	698870	4612029	57
Property Line C	49	25	1.5	698625	4611986	63
Property Line D	52	26	1.5	698680	4611825	80
Property Line E	33	9	1.5	698211	4611855	48
Property Line F	35	11	1.5	698739	4612478	54
Property Line G	38	15	1.5	699097	4611974	44
Property Line H	41	17	1.5	699049	4612061	45
Property Line I	52	26	1.5	698892	4611862	78
Property Line J	42	19	1.5	698513	4611959	56
R001	41	18	4	699120	4612001	53
R002	40	17	4	699151	4611952	53
R003	39	16	4	699151	4612028	54
R004	39	16	4	699118	4612106	54
R005	39	16	4	698965	4612250	55
R006	39	16	4	699171	4611922	56
R007	39	15	4	699101	4612153	54
R008	38	15	4	699187	4612022	55
R009	38	15	4	699196	4611962	56
R010	38	14	4	698634	4612308	56
R011	37	14	4	699138	4612184	55
R012	37	14	4	699190	4612112	54
R013	37	15	4	699231	4612018	56
R014	37	14	4	699230	4611969	56
R015	37	14	4	699131	4612242	55
R016	37	14	4	699224	4612095	56
R017	36	13	4	699184	4612187	55
R018	37	14	4	699263	4612024	57
R019	36	13	4	699266	4611974	57
R020	36	12	4	698726	4612425	56
R021	36	13	4	699177	4612251	56
R022	36	13	4	699235	4612195	56

Receiver ID	Sound Level (dBA)		Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
	Daytime	Nighttime		X (m)	Y (m)	Z (m)
R023	36	13	4	699244	4612134	57
R024	36	13	4	699295	4611938	56
R025	35	12	4	699249	4612208	56
R026	35	12	4	699306	4611980	56
R027	35	13	4	699306	4612032	57
R028	35	12	4	698916	4612434	56
R029	35	12	4	698968	4612423	56
R030	35	12	4	699282	4612139	57
R031	34	12	4	699293	4612200	56
R032	35	12	4	699333	4611945	54
R033	34	11	4	698931	4612461	56
R034	35	12	4	699319	4612088	57
R035	35	12	4	699339	4611985	55
R036	34	11	4	699414	4612017	57
R037	34	11	4	699264	4612270	56
R038	35	12	4	699342	4612040	56
R039	34	11	4	698977	4612466	56
R040	35	12	4	698491	4612365	54
R041	34	11	4	698637	4612501	56
R042	34	11	4	699118	4612409	56
R043	34	11	4	698583	4612480	56
R044	34	11	4	699378	4611996	55
R045	34	11	4	699342	4612089	54
R046	34	12	4	699435	4612023	57
R047	34	11	4	699331	4612209	56
R048	34	11	4	699018	4612483	56
R049	34	11	4	698512	4612475	55
R050	33	10	4	698558	4612498	55
R051	33	11	4	698455	4612454	55
R052	33	10	4	699273	4612338	57
R053	33	10	4	699455	4612022	57
R054	33	10	4	699062	4612495	57
R055	33	10	4	699149	4612452	56
R056	33	10	4	699393	4612076	55
R057	33	10	4	699327	4612301	58
R058	33	10	4	698463	4612495	54

Receiver ID	Sound Level (dBA)		Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
	Daytime	Nighttime		X (m)	Y (m)	Z (m)
R059	33	10	4	699355	4612294	59
R060	33	10	4	699411	4612070	56
R061	33	10	4	699382	4612240	57
R062	33	10	4	699437	4611927	55
R063	32	10	4	699193	4612471	55
R064	32	10	4	699405	4612228	57
R065	32	9	4	699118	4612527	56
R066	32	9	4	699415	4612275	58
R067	32	9	4	699369	4612331	58
R069	32	10	4	699442	4612108	56
R070	32	10	4	699460	4611979	57
R071	32	9	4	699415	4612238	57
R072	32	9	4	699407	4612314	58
R073	32	9	4	699429	4612156	53
R075	32	9	4	699165	4612535	56
R076	32	9	4	699222	4612501	54
R077	32	9	4	699435	4612228	57
R078	32	9	4	699463	4612082	57
R079	32	9	4	699476	4611937	55
R083	31	9	4	699207	4612530	56
R084	31	9	4	699355	4612409	58
R085	32	9	4	699494	4611961	56
R088	31	9	4	699122	4612599	56
R090	31	9	4	699402	4612362	59
R091	32	9	4	699496	4611918	54
R093	31	8	4	699337	4612456	58
R094	31	9	4	699474	4612303	58
R095	31	9	4	699502	4612118	56
R096	31	8	4	699409	4612380	58
R098	31	8	4	699497	4612296	57
R108	31	8	4	699371	4612442	58
R109	31	8	4	699397	4612415	58
R110	31	8	4	699243	4612556	56
R119	31	8	4	699466	4612372	58
R123	30	8	4	699479	4612381	59
R125	30	8	4	699502	4612369	57

Receiver ID	Sound Level (dBA)		Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
	Daytime	Nighttime		X (m)	Y (m)	Z (m)
R129	30	8	4	699278	4612565	57
R130	30	8	4	699465	4612401	58
R137	30	7	4	699325	4612552	57
R138	30	8	4	699462	4612421	58
R142	30	7	4	699487	4612413	61
R143	30	7	4	699453	4612457	58
R144	30	7	4	699470	4612445	59
R150	30	7	4	699499	4612426	61
R151	30	7	4	699351	4612570	58
R152	30	7	4	699432	4612512	58
R156	30	7	4	699371	4612565	59
R157	29	7	4	699347	4612592	58
R159	29	7	4	699362	4612593	59
R161	29	7	4	699448	4612522	58
R179	28	8	4	699354	4611634	37
R183	27	6	4	699490	4611593	56
R188	27	6	4	699473	4611554	61
R190	26	6	4	699498	4611548	59
R191	27	7	4	699439	4611573	55
R193	27	7	4	699403	4611562	54
R197	27	6	4	699397	4611506	54
R198	26	6	4	699320	4611491	41
R199	26	6	4	699396	4611484	53
R203	26	6	4	699393	4611466	53
R205	26	6	4	699450	4611474	56
R206	26	5	4	699495	4611461	63
R208	26	4	4	697700	4612173	18
R209	26	6	4	699388	4611429	53
R210	26	5	4	699479	4611454	61
R211	26	4	4	697675	4612164	19
R213	26	6	4	699458	4611442	56
R214	26	5	4	699486	4611443	60
R215	25	6	4	699351	4611390	52
R216	25	4	4	697652	4612171	19
R218	25	5	4	699385	4611395	54
R220	25	5	4	699377	4611344	53

Receiver ID	Sound Level (dBA)		Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
	Daytime	Nighttime		X (m)	Y (m)	Z (m)
R221	25	5	4	699500	4611375	61
R222	25	5	4	699447	4611381	56
R224	24	5	4	699367	4611267	52
R225	25	5	4	699375	4611310	53
R226	25	5	4	697929	4612088	18
R227	25	5	4	699438	4611343	55
R228	25	5	4	699424	4611309	54
R229	24	5	4	699424	4611261	53
R230	24	4	4	699357	4611206	52
R231	23	4	4	699319	4611251	49
R233	24	4	4	699454	4611282	55
R236	24	4	4	699462	4611275	55
R237	22	2	4	697620	4611658	11
R238	24	5	4	699428	4611205	53
R239	24	4	4	699463	4611244	54
R243	23	4	4	699352	4611145	53
R245	23	4	4	699459	4611157	53
R246	23	4	4	699402	4611125	54
R247	23	4	4	699438	4611122	52
R248	23	3	4	697696	4612096	19
R250	22	3	4	699326	4611118	53
R251	22	3	4	699338	4611105	53
R252	23	3	4	699398	4611089	54
R253	23	3	4	699469	4611119	53
R256	23	3	4	697656	4612103	19
R257	23	3	4	697882	4612600	16
R258	22	3	4	699371	4611060	54
R260	23	3	4	699477	4611083	52
R261	22	3	4	699374	4611043	53
R262	23	3	4	697707	4611917	15
R268	22	3	4	699311	4611062	53
R269	23	3	4	697657	4612070	18
R270	22	3	4	699350	4611021	53
R271	23	3	4	697643	4612064	18
R272	23	3	4	697630	4612072	19
R273	22	2	4	699414	4610993	53

Receiver ID	Sound Level (dBA)		Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
	Daytime	Nighttime		X (m)	Y (m)	Z (m)
R274	22	2	4	699490	4611040	52
R275	22	3	4	697614	4612054	18
R278	21	2	4	699400	4610975	53
R279	22	2	4	699436	4610985	53
R280	22	2	4	697638	4611652	11
R281	22	2	4	699476	4610994	52
R283	21	2	4	699342	4610966	53
R285	21	3	4	699284	4611010	52
R286	21	2	4	699406	4610923	52
R287	21	2	4	699446	4610935	51
R293	21	2	4	699481	4610941	52
R295	21	2	4	699369	4610915	52
R296	21	2	4	697613	4611702	11
R297	20	3	4	699296	4611144	42
R299	21	2	4	699281	4610970	52
R300	21	2	4	697606	4611722	12
R301	21	1	4	699389	4610893	49
R304	21	2	4	699323	4610917	52
R307	21	1	4	697625	4611526	11
R308	21	2	4	697592	4611750	10
R309	21	2	4	697584	4611776	11
R313	21	1	4	697614	4611483	11
R314	21	1	4	697627	4611467	12
R315	20	1	4	697619	4611444	12
R316	21	1	4	697562	4611515	8
R317	21	1	4	697562	4611549	8
R319	20	1	4	697641	4611316	11
R321	20	1	4	697641	4611280	12
R322	20	1	4	699258	4610879	49
R323	19	2	4	699268	4611100	38
R324	20	1	4	697641	4611242	12
R325	20	1	4	697641	4611209	11
R327	19	1	4	697651	4611180	11
R330	18	2	4	699237	4611149	36
R331	18	2	4	699240	4611066	35
R334	18	1	4	699210	4611038	31

Receiver ID	Sound Level (dBA)		Relative Height (m)	Coordinates (UTM NAD83 Z18N)		
	Daytime	Nighttime		X (m)	Y (m)	Z (m)
R336	18	0	4	699141	4610894	26
R337	17	1	4	699210	4611111	31
R338	18	0	4	699090	4610908	28
R339	17	0	4	699130	4610871	23
R340	16	1	4	699207	4611146	30
R341	16	0	4	699177	4611072	26
R343	11	0	4	699148	4611098	20
R344	11	0	4	699161	4611151	21