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September 19, 2024

<u>*Via Electronic Mail and Overnight Delivery*</u>
Melanie Bachman
Executive Director / Staff Attorney
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: Petition No. 1607 - Hanwha Q Cells America Inc. petition for a declaratory ruling, pursuant to Connecticut General Statutes § 4-176 and § 16-50k, for the proposed construction, maintenance and operation of a 4.896-megawatt AC battery energy storage facility located at Parcel No. 95-F10-247-5 and 95-F10-247-5A, 163 State Pier Road, New London, Connecticut and associated interconnection

Dear Ms. Bachman:

I am writing on behalf of my client Hanwha Q Cells America, Inc. ("Petitioner") in connection with the above-captioned Petition.

The Connecticut Siting Council ("Council") granted Petitioner's Motion for Extension of Time to provide responses to the Council's Interrogatories to Petitioner - Set 2 ("Interrogatory Nos. 67-74") on June 7, 2024, establishing a June 28, 2024 timeline for response.

Petitioner provided responses to Interrogatory Nos. 67-74 as well as a supplement memorandum on June 27, 2024. In its supplement memorandum, Petitioner stated that a new acoustical modeling analysis taking into account the new MP2XL equipment would be submitted as soon as it was completed.

The new acoustical modeling analysis is now completed and is enclosed herein.

The original and fifteen copies of the acoustical modeling analysis are being sent via overnight delivery to the Council's office.

I hereby certify that a copy of the foregoing was sent via electronic mail to the service list for Petition No. 1607 on September 19, 2024.

Please do not hesitate to contact me with any questions or concerns regarding this request.

Sincerely,

Mark J. Cook, Esq.

Enc.

SOUND LEVEL ANALYSIS REPORT

State Pier Road Battery Storage Project
New London, Connecticut

Prepared for:

Qcells North America
300 Frank W Burr Blvd. #52
Teaneck, New Jersey 07666

Prepared by:

Epsilon Associates, Inc.
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Maynard, MA 01754

September 19, 2024

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1.0 EXECUTIVE SUMMARY

The State Pier Road Battery Storage Project (the Project) is a proposed battery energy storage system (BESS) with a capacity of approximately 5 megawatts (MW) in New London, Connecticut. The Project is being developed by Qcells North America (Qcells). Epsilon Associates Inc. (Epsilon) has been retained by Qcells to conduct a sound level analysis for this Project.

The sound level analysis consisted of sound level modeling of operational sound from the proposed facility. Computer modeling was used to predict worst-case future L_{eq} sound levels from the Project. The Project will include 5 Tesla Megapack 2 XL energy storage containers and two transformers (rated 2 MVA and 3 MVA).

The highest predicted exterior Project only L_{eq} sound level at a residential modeling location is 50 dBA. Modeling indicates that the Project will meet the sound level limits set forth by the State of Connecticut.

2.0 INTRODUCTION

The proposed Project will consist of 5 Tesla Megapack 2 XL energy storage containers and two transformers (rated 2 MVA and 3 MVA). The Project has a capacity of approximately 5 MW and will be located in New London, Connecticut. This report presents the findings of a sound level modeling analysis to predict sound levels from the Project and comparison to the relevant sections of the Connecticut Department of Energy & Environmental Protection Control of Noise regulations. The Project components were modeled in CadnaA using sound data provided by Qcells. The Project layout and surrounding area are shown in Figure 2-1.

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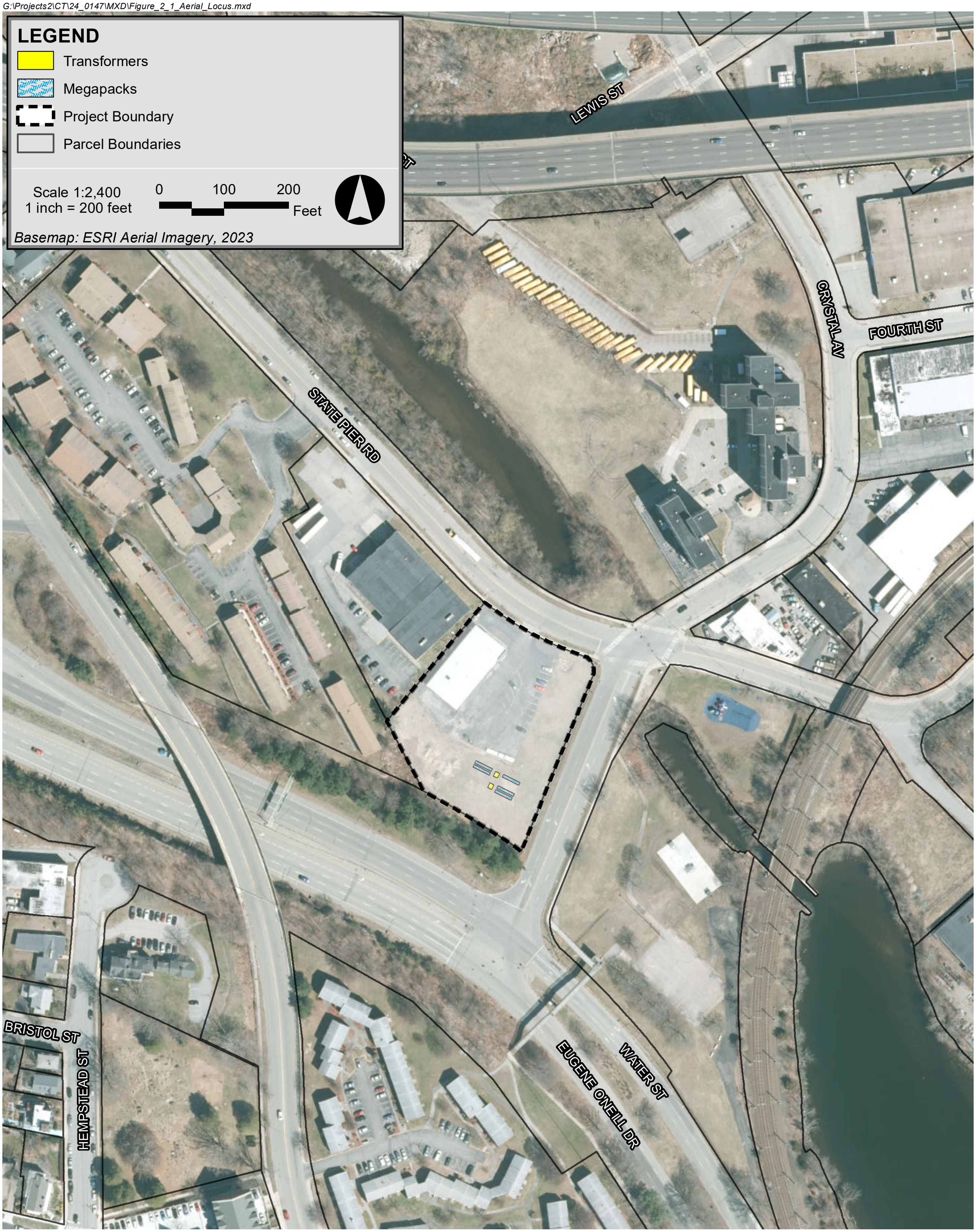

State Pier Road Battery Storage Project **New London, Connecticut**

Epsilon ASSOCIATES INC.

Figure 2-1
Aerial Locus

3.0 SOUND TERMINOLOGY

There are several ways in which sound levels are measured and quantified. All of them use the logarithmic decibel (dB) scale. The following information defines the sound level terminology used in this analysis.

The decibel scale is logarithmic to accommodate the wide range of sound intensities found in the environment. A property of the decibel scale is that the sound pressure levels of two or more separate sounds are not directly additive. For example, if a sound of 50 dB is added to another sound of 50 dB, the total is only a 3-decibel increase (53 dB), which is equal to doubling in sound energy, but not equal to a doubling in decibel quantity (100 dB). Thus, every 3-dB change in sound level represents a doubling or halving of sound energy. The human ear does not perceive changes in the sound pressure level as equal changes in loudness. Scientific research demonstrates that the following general relationships hold between sound level and human perception for two sound levels with the same or very similar frequency characteristics[1]:

- 3 dB increase or decrease results in a change in sound that is just perceptible to the average person,
- 5 dB increase or decrease is described as a clearly noticeable change in sound level, and
- 10 dB increase or decrease is described as twice or half as loud.

Another mathematical property of decibels is that if one source of sound is at least 10 dB louder than another source, then the total sound level is simply the sound level of the higher-level source. For example, a sound source at 60 dB plus another sound source at 47 dB is equal to 60 dB.

A sound level meter (SLM) that is used to measure sound is a standardized instrument.[2] It contains "weighting networks" (e.g., A-, C-, Z-weightings) to adjust the frequency response of the instrument. Frequencies, reported in Hertz (Hz), are detailed characterizations of sounds, often addressed in musical terms as "pitch" or "tone". The most commonly used weighting network is the A-weighting because it most closely approximates how the human ear responds to sound at various frequencies. The A-weighting network is the accepted scale used for community sound level measurements; therefore, sounds are frequently reported as detected with a sound level meter using this weighting. A-weighted sound levels emphasize middle frequency sounds (i.e., middle pitched – around 1,000 Hz) and de-emphasize low and high frequency sounds. These sound levels are reported in decibels designated as "dBA". The C-weighting network has a nearly flat response for frequencies between 63 Hz and 4,000 Hz and is noted as dBC. Z-

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1 Bies, David, and Colin Hansen. 2009. *Engineering Noise Control: Theory and Practice*, 4th Edition. New York: Taylor and Francis.

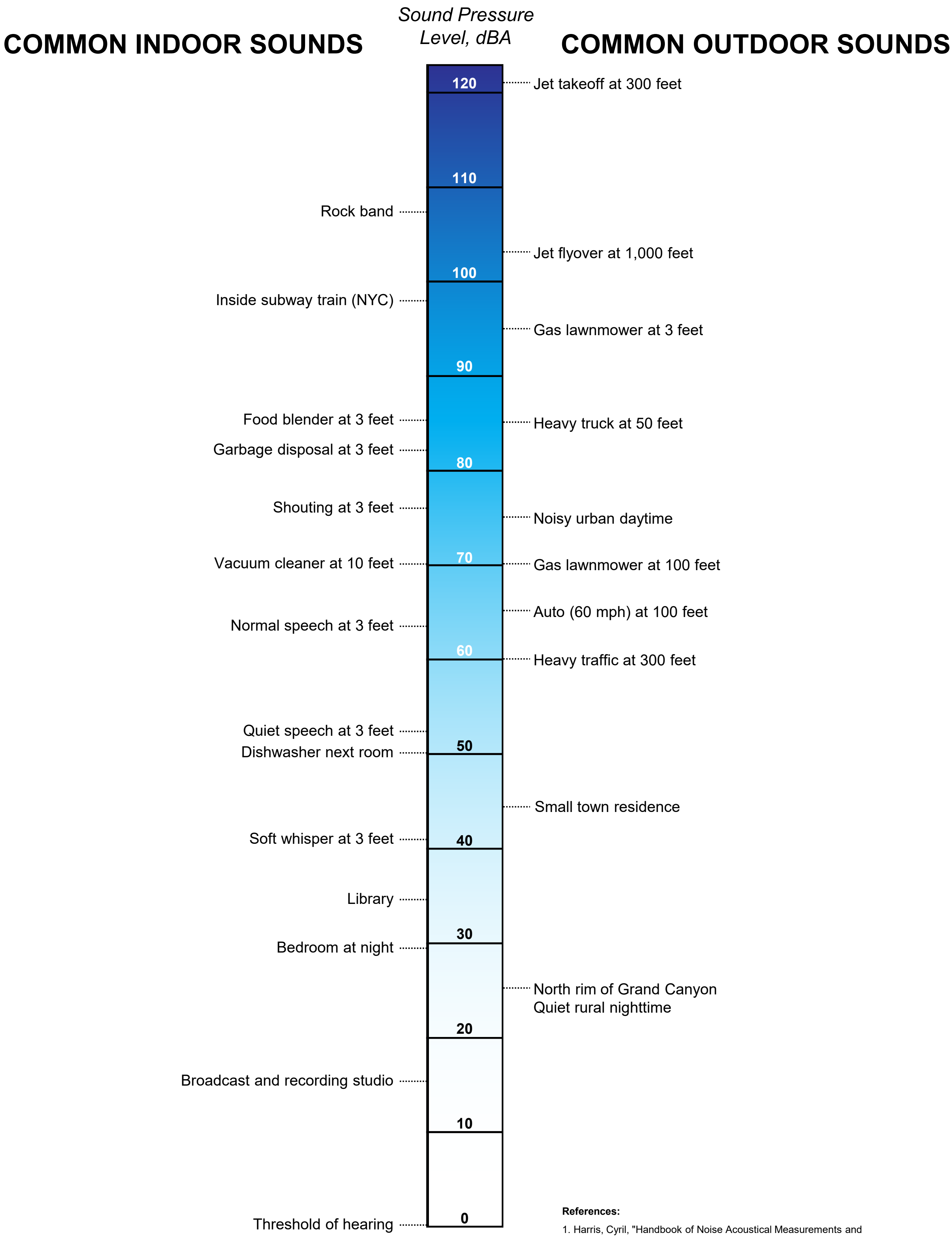
2 *American National Standard Electroacoustics – Sound Level Meters – Part 1: Specifications,* ANSI S1.4-2014 (R2019), published by the Standards Secretariat of the Acoustical Society of America, Melville, NY.

weighted sound levels are measured sound levels without any weighting curve and are otherwise referred to as "unweighted". Sound pressure levels for some common indoor and outdoor environments are shown in Figure 3-1.

Because the sounds in our environment vary with time, they cannot simply be described with a single number. Two methods are used for describing variable sounds. These are exceedance levels and the equivalent level, both of which are derived from some number of moment-to-moment sound level measurements. Exceedance levels are values from the cumulative amplitude distribution of all of the sound levels observed during a measurement period. Exceedance levels are designated L_n, where n can have a value between 0 and 100 in terms of percentage. Two sound level metrics that are commonly reported in community sound studies are described below.

- L_{90} is the sound level exceeded 90 percent of the time during the measurement period. The L_{90} is close to the lowest sound level observed. It is essentially the same as the residual sound level, which is the sound level observed when there are no obvious nearby intermittent sound sources.

- L_{eq}, the equivalent level, is the level of a hypothetical steady sound that would have the same energy (*i.e.,* the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level is designated L_{eq} and is typically A-weighted. The equivalent level represents the time average of the fluctuating sound pressure, but because sound is represented on a logarithmic scale and the averaging is done with linear mean square sound pressure values, the L_{eq} is mostly determined by loud sounds if there are fluctuating sound levels.



References:

1. Harris, Cyril, "Handbook of Noise Acoustical Measurements and Noise Control", p 1-10., 1998
2. "Controlling Noise", USAF, AFMC, AFDTC, Elgin AFB, Fact Sheet, August 1996
3. California Dept. of Trans., "Technical Noise Supplement", Oct, 1998

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Figure 3-1

Common Indoor and Outdoor Sound Levels

4.0 NOISE REGULATIONS

4.1 Federal Regulations

There are no federal noise regulations applicable to this Project.

4.2 State Regulations

The Project is located on land zoned for general business use within the Town of New London and is required to comply with the State of Connecticut noise control regulation issued by the Connecticut Department of Energy & Environmental Protection.

4.2.1 Noise Zone Standards (§22a-69-3.5)

The sound level limits in the regulation vary by land classification that is based on land use. There are three land use classes that generally fall into the categories of industrial, commercial, and residential and the land classification of both the emitter and the receptor must be considered. The proposed land use will be for utility purposes which falls under Class C. The sound level limits for Class C emitters are shown in Table 4-1.

Table 4-1 Connecticut Noise Limits for Class C Emitters

Emitter's Zone: Class C (Industrial)	
Receptor's Zone	**Maximum Level (dBA)**
Class C (Industrial)	70
Class B (Commercial)	66
Class A (Residential) / Day	61
Class A (Residential) / Night	51

Since the project may be operational during the night, the most restrictive residential nighttime limit of 51 dBA was applied for evaluating Project sound levels at the adjacent residential property lines. The commercial and industrial limits were applied at the non-residential property lines based on land use. This is discussed further in Section 5.3.

4.2.2 Prominent Discreet Tones (§22a-69-3.3)

The Connecticut regulation also limits sources from emitting prominent discrete tones (PDTs). PDTs are defined in the regulation using one-third octave band sound levels (§22a-69-1.2(r)). If continuous sound levels measured at a receptor contains a PDT, the sound levels in Table 4-1 are to be reduced by 5 dBA. Sound pressure levels due to the project equipment will therefore be evaluated for PDTs in addition to the broadband limits shown in Table 4-1.

4.3 Local Regulations

The City of New London Zoning Regulations contains sound limits for each zoning district. Section 613.B.1(i) of the regulation imposes a maximum noise limit to be generated or received by any zoning district. These limits are applicable regardless of land use and are shown in Table 4-2.

Table 4-2 Maximum Sound Levels by New London Zoning District

Zoning District[3]	WC-I, LI-O	C-1, C-2, CBD, WD, NB	R-1, R-3, WD	R-2, R-4, INST
Maximum Sound Level:	70 dBA	66 dBA	Day[1] 61 dBA	Night[2] 51 dBA

Notes:

1. Day = 7 a.m. to 10 p.m., on Sunday 9 a.m. to 10 p.m.
2. Night = 10 p.m. to 7 a.m., on Saturday 10 p.m. to 9 a.m.
3. Zoning District Codes:

   WC-I: Waterfront commercial/industrial
   LI-O: Light industrial office
   C-1: General Business
   C-2: Limited commercial district
   CBD: Central business district
   WD: Waterfront development
   NB: Neighborhood business
   R-1: Single family residential
   R-3: Multi-family residential
   R-2: Two family residential
   R-4: Multi-family / office
   INST: Institutional

5.0 MODELED SOUND LEVELS

5.1 Sound Sources and Noise Controls

The primary sources of sound from the Project will be 5 Tesla Megapack 2 XL battery storage containers operating at 40% fan duty cycle, one 3 MVA transformer, and one 2 MVA transformer. Sound pressure and sound power level data for the Megapacks were provided by Qcells, and the transformer sound power level was calculated by Epsilon based on the power rating. The equipment is summarized in Table 5-1. The Megapack sound data are confidential and are therefore not reported here. The Project layout is shown in Figure 5-1.

Table 5-1 Modeled Sound Levels per Sound Source

Sound Source	Number of Units Modeled	Sound Power Level, dBA L_{eq}
Tesla Megapack 2 XL, 40% Fan Duty Cycle, 2025	5	CONFIDENTIAL
3 MVA Transformer	1	76
2 MVA Transformer	1	74

5.2 Modeling Methodology

The sound levels associated with the proposed energy storage system were predicted using the CadnaA sound level calculation software developed by DataKustik GmbH. This software uses the ISO 9613-2 international standard for sound propagation.[3] The software accounts for topography, ground attenuation, multiple building reflections (if applicable), drop-off with distance, and atmospheric absorption. The CadnaA software allows for octave band calculation of sound from multiple sources as well as computation of diffraction.

Inputs and significant parameters employed in the model are described below.

- *Project Layout:* The analysis is for the Project layout dated August 5th, 2024. The proposed Project layout is shown in Figure 5-1.
- *Terrain Elevation:* Elevation contours for the modeling domain were imported into CadnaA which allowed for consideration of terrain shielding where appropriate. The terrain height contour elevations for the modeling domain were generated from elevation information derived from the National Elevation Dataset (NED) developed by the U.S. Geological Survey.
- *Source Sound Levels:* Sound levels used in the modeling are discussed in Section 5.1.

[3] *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation,* International Standard ISO 9613-2:1996 (International Organization for Standardization, Geneva, Switzerland, 1996).

- *Ground Attenuation:* Consistent with the aforementioned international standard, the model allows inputs between 0 (hard ground) and 1 (porous ground). Spectral ground absorption was calculated using a G-factor of 0.5 for the modeling domain which is representative of mixed ground cover. Nearby paved areas are set to 0.
- *Modeling Grid:* A modeling grid with 5-meter spacing was calculated for the entire region surrounding the Project. The grid was modeled at a height of 1.5 meters above ground level to be consistent with the modeling locations. The resulting sound level contour lines are shown in Figure 5-2.

Several modeling assumptions inherent in the ISO 9613-2 calculation methodology, or selected as conditional inputs by Epsilon, were implemented in the CadnaA model to ensure conservative results (i.e., higher sound levels), and are described below:

- All modeled sources were assumed to be operating simultaneously and the Megapacks were modeled operating at 40% fan duty cycle corresponding to the greatest expected operational sound level impacts.
- Per ISO 9613-2, the model assumed favorable conditions for sound propagation, corresponding to a moderate, well-developed ground-based temperature inversion, as might occur on a calm, clear night or equivalently downwind propagation.
- Meteorological conditions assumed in the model (T=10°C/RH=70%) were selected to minimize atmospheric attenuation in the 500 Hz and 1 kHz octave bands where the human ear is most sensitive.
- No additional attenuation due to tree shielding, air turbulence, or wind shadow effects was considered in the model.

5.3 Sound Modeling Locations

The modeled receptors PL1 and PL3 are located at the residential parcels adjacent to the Project. Therefore, Class A Nighttime Residential limits under §22.-69-3.5 from the Connecticut State Regulations have been applied at these locations. Receptor PL2 is located on a parcel containing a warehouse, which falls under Class C. Receptors PL4 and PL6 are located on the property lines of a neighboring park and PL5 and PL7 are located on property containing commercial businesses. Both commercial businesses and parks are regulated as a Class B noise zone under §22.-69-2.4 of the Connecticut State Regulations. The modeled sound levels are evaluated against the state limits in Section 6.1.

The City of New London zoning limits are based on zoning rather than land use and therefore differ slightly from the state regulatory limits. The city limits are evaluated separately in Section 6.2.

Epsilon selected modeling locations based on local zoning maps and aerial imagery. The receptors were placed at the locations with the greatest impacts at each property line adjacent to the Project. Receptors were placed one foot within the receiving property as specified in the state and local regulations. Receptors were modeled as discrete points at a height of 4.9 ft (1.5 m) above ground level which is the approximate ear height of a typical standing adult. The modeling locations are shown in Figure 5-1.

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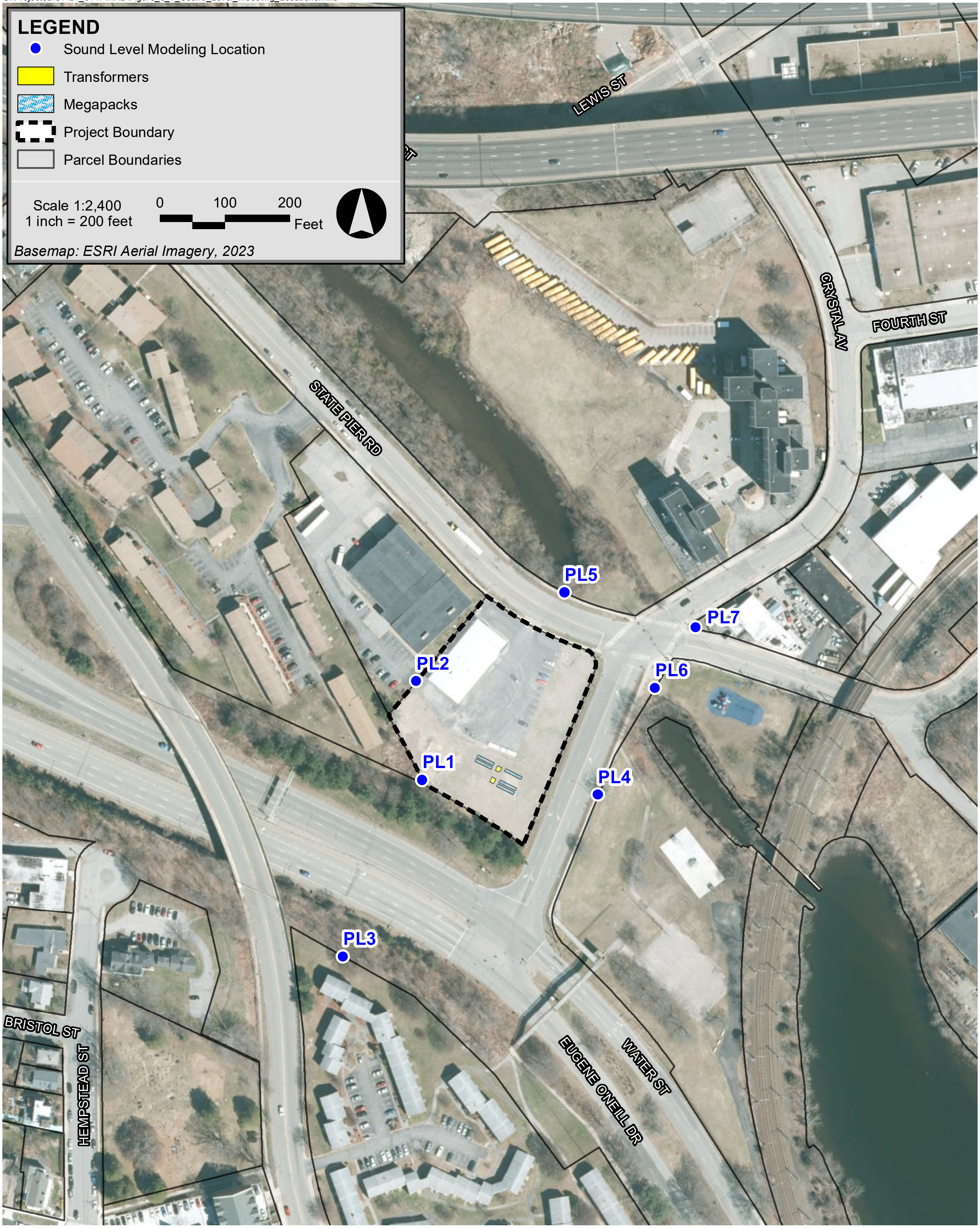

State Pier Road Battery Storage Project **New London, Connecticut**

Epsilon ASSOCIATES INC.

Figure 5-1

Sound Level Modeling Locations

5.4 Sound Level Modeling Results

The modeled sound levels at each modeling receptor are shown in Table 5-2. All modeled sound levels are A-weighted equivalent sound levels (L_{eq}, dBA). The predicted sound levels at the modeling locations range from 40 to 50 dBA. The sound levels presented in this report are project-only and do not include any contribution from existing sound sources in the area.

Table 5-2 Sound Level Modeling Results

Modeling Receptor	Land Use Description	Modeled Sound Pressure Level, L_{eq}, dBA
PL1	Residential	50
PL2	Warehouse	46
PL3	Residential	40
PL4	Park	47
PL5	Commercial Business	42
PL6	Park	43
PL7	Commercial Business	41

In addition to the discrete modeling points, sound level isopleths generated from the modeling grid are shown in Figure 5-2.

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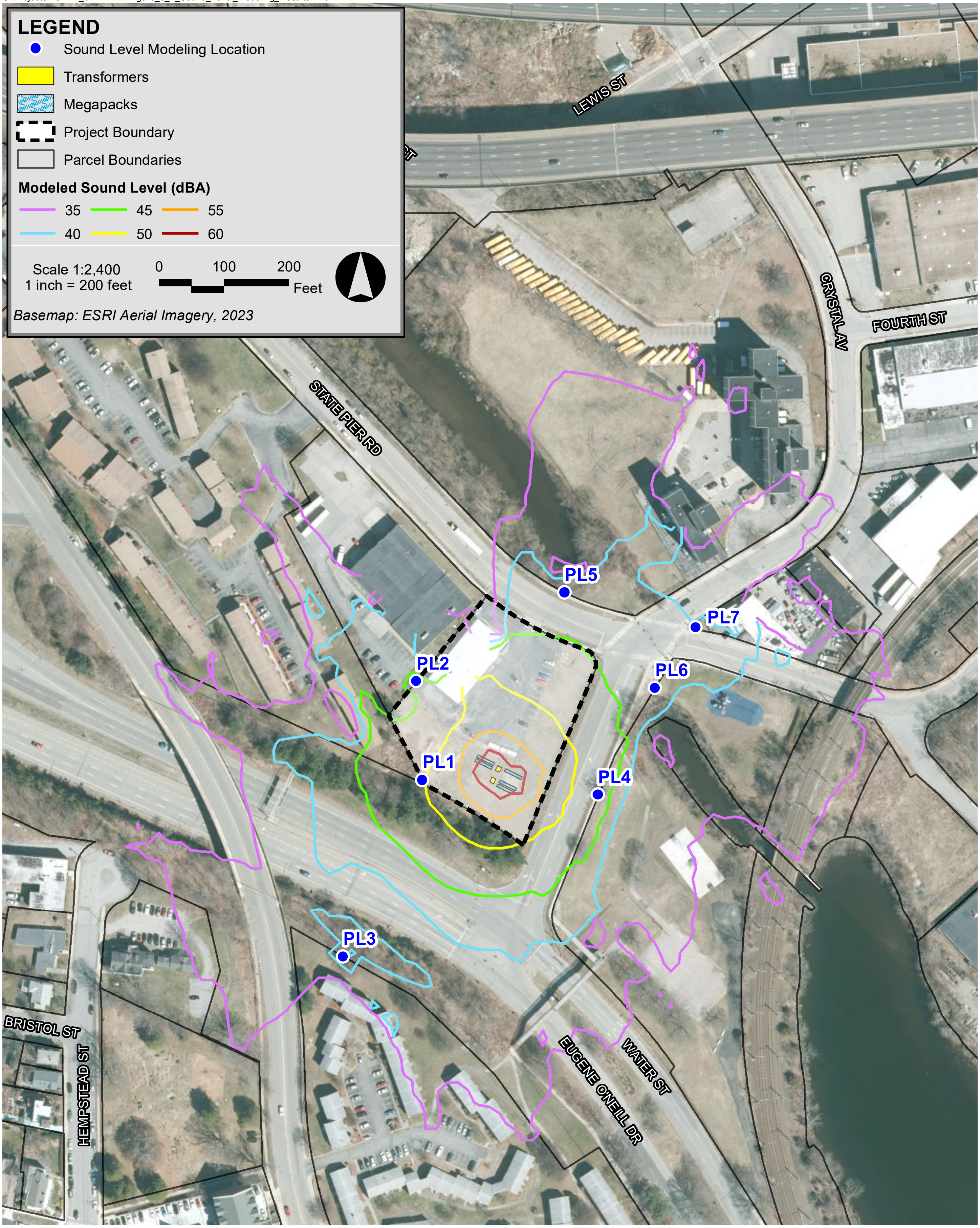

State Pier Road Battery Storage Project **New London, Connecticut**

Epsilon ASSOCIATES INC.

Figure 5-2

Sound Level Modeling Results

6.0 EVALUATION

6.1 State of Connecticut Regulations

6.1.1 Broadband Sound Level Limit Evaluation

Sound level modeling results are shown evaluated against the State of Connecticut broadband sound level limits in Table 6-1. The state limits are based on land use rather than zoning. As shown in Table 6-1 and Figure 5-2, the modeled sound levels meet the state regulatory limits at all locations.

Table 6-1 State of Connecticut Broadband Sound Level Evaluation

Modeling Receptor	Land Use Description	Modeled Sound Pressure Level, L_{eq}, dBA	§22a-69-3.5 Receptor Class[1]	§22a-69-3.5 Sound Level Limit, dBA[1]
PL1	Residential	50	A-Night	51
PL2	Warehouse	46	C	70
PL3	Residential	40	A-Night	51
PL4	Park	47	A-Day	61
PL5	Commercial Business	42	B	66
PL6	Park	43		
PL7	Commercial Business	41		

Notes:

1. Regulatory limits are for Class C emitters

6.1.2 Prominent Discrete Tone Evaluation

The Connecticut regulation also considers PDTs as excessive noise under certain conditions. One third octave band sound pressure levels due to the Project equipment were modeled using data from the equipment manufacturer and calculated by Epsilon. According to the regulation, a tone is considered excessive when a broadband sound level that is 5 dBA below the applicable broadband standard is exceeded when a tone is present. Third-octave band sound pressure levels at all modeling receptors were evaluated for PDTs.

The PDT evaluation data are shown in Table 6-2. The regulation states that a tone is present if the sound pressure level in a one-third octave band exceeds the arithmetic average of the two adjacent one-third octave band by an amount greater than in Sec. 222a-69-1.2 of the regulation. For reference, these thresholds are shown in the last row of Table 6-2. As shown in the table, there are no PDTs present, therefore, the Project meets the Connecticut regulatory standards with respect to noise.

Table 6-2 Prominent Discrete Tone Evaluation

Rec.ID	L_{eq} Sound Pressure Levels (dB) by 1/3 Octave Band Center Frequency (Hz)																			
	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
PL1	48	44	42	45	49	41	41	40	42	38	40	40	38	37	37	35	34	31	25	20	15
PL2	43	38	35	40	44	35	35	34	37	34	37	37	36	34	34	32	31	27	21	15	8
PL3	38	34	32	36	41	32	32	31	33	29	31	30	29	27	26	24	22	17	9	1	0
PL4	45	39	37	42	46	37	37	36	39	36	38	38	36	35	34	32	31	28	22	16	10
PL5	40	36	35	38	42	34	33	32	35	31	33	32	31	29	28	26	24	20	12	5	0
PL6	39	34	32	37	40	32	32	31	34	31	34	34	32	31	30	28	26	22	14	7	0
PL7	38	33	32	35	40	31	31	30	32	30	32	32	30	29	28	25	23	18	10	1	0
Connecticut DEP Prominent Discrete Tone Threshold (dB)																					
	16	14	12	11	9	8	7	6	6	5	4	4	4	3	3	3	3	4	4	5	6

6.2 City of New London Zoning Regulation

Sound level modeling results are shown evaluated against the City of New London zoning sound level limits in Table 6-3. The sound level limits are based on the zoning district and are undefined for the park space where PL4 and PL6 are located. As the table shows, the modeled sound levels are below the City of New London zoning regulation sound level limits at all locations.

Table 6-3 City of New London Zoning Limit Evaluation

Receptor	City of New London Zoning Districts	Modeled Sound Pressure Level, dBA Leq	City of New London Noise Limit, dBA
PL1	C-1: General Business	50	66
PL2	C-1: General Business	46	66
PL3	R-4: Multi-Family/Office	40	51
PL4	OS: Open Space	47	NA
PL5	C-1: General Business	42	66
PL6	OS: Open Space	43	NA
PL7	C-1: General Business	41	66

7.0 CONCLUSION

A comprehensive sound level assessment was conducted for the proposed New London Battery Storage Project in New London, Connecticut. The Project consists of 5 Tesla Megapack 2 XL energy storage containers and two transformers (rated 2 MVA and 3 MVA) and has a capacity of approximately 5 MW.

Sound level modeling was conducted for the proposed project layout to assess the sound levels at the nearby property lines. The highest predicted Project only L_{eq} sound level at a residential modeling location is 50 dBA. Modeling results indicate that the Project will meet the sound level limits set forth in both the Connecticut state regulations and the City of New London Zoning Noise Performance Standard.