

March 7, 2023

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Re: Sound Modeling Study  
**QTS - PJC1 Project**  
 East Windsor, New Jersey

## TECHNICAL MEMORANDUM

### 1. INTRODUCTION

This memorandum provides the results of our review of applicable noise ordinances for the project, and computer-based noise models for the QTS – PJC1 project in East Windsor, New Jersey.

### 2. SOUND LEVEL CRITERIA

#### 2.1 State of New Jersey

The project site is located within the boundaries of East Windsor, New Jersey. New Jersey’s Noise Control Act was enacted in 1971. The New Jersey Department of Environmental Protection promulgated noise regulations in 1974, which apply to stationary commercial and industrial sources. The applicable noise limits can be found in Chapter 7:29 of the New Jersey Administrative Code (N.J.A.C 7:29). No industrial or commercial service shall emit sound such that exceeds the limits shown in **Table 1**, when measured at any residential property.

**Table 1: New Jersey Continuous Sound Limits at Residential Property Line**

Time Period	A-Weighted Limit	31.5 Hz (dB)	63 Hz (dB)	125 Hz (dB)	250 Hz (dB)	500 Hz (dB)	1k Hz (dB)	2k Hz (dB)	4k Hz (dB)	8k Hz (dB)
7:00 A.M. to 10:00 P.M. (Daytime)	65 dBA	96	82	74	67	63	60	57	55	53
10:00 P.M. to 7:00 A.M. (Nighttime)	50 dBA	86	71	61	53	48	45	42	40	38

No industrial or commercial service shall emit sound such that it exceeds the limits shown in **Table 2**, when measured at any commercial property.

**Table 2: New Jersey Continuous Sound Limits at Commercial Property Line**

Time Period	A-Weighted Limit	31.5 Hz (dB)	63 Hz (dB)	125 Hz (dB)	250 Hz (dB)	500 Hz (dB)	1k Hz (dB)	2k Hz (dB)	4k Hz (dB)	8k Hz (dB)
Anytime	65 dBA	96	82	74	67	63	60	57	55	53

Octave band limits are rather rare, as only a few states include them in their noise ordinances (i.e. Illinois, New Jersey).

## 2.2 Backup Generator Exemption

The New Jersey DEP also developed separate guidelines<sup>1</sup> to assist with the investigation of noise violations. Section III (Guidance Policies and Procedures), G (Emergency Generator Use at an Industrial, Commercial or Community Services Property, states:

“The use of an emergency generator at an Industrial, Commercial or Community Service Property is explicitly exempt from the provisions of the State Code during an electrical outage.

Weekly or periodic testing of emergency generators must comply with the State established sound level standards. In addition, the use of generators during the course of an emergency is exempt from the State’s sound level standards in accordance with N.J.A.C. 7:29-1.4(4). The term "Emergency" is defined at N.J.A.C. 7:29-1.1 and means an “unexpected occurrence or situation resulting from natural or unnatural causes which endangers or has the potential to endanger the health, safety or resources of citizens or a municipality (emphasis added), and as such, necessitates prompt action and response on the part of emergency services personnel.”

If the use of the emergency generator is consistent with the definition of the term “Emergency” as found above, the sound level would be exempt from regulation under the State Code.

As will be discussed later in this memo, it was assumed that weekly or periodic testing of generators would occur during Daytime hours (7 a.m. to 10 p.m.), when the 65-dBA limit would apply, with the associated octave-band limits.

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<sup>1</sup> Guidelines for the Investigation of Noise Complaints Pursuant to the State of New Jersey Noise Control Regulation (N.J.A.C. 7:29) and the Model Noise Control Ordinance; February 4, 2022

## 2.4 Town of East Windsor Noise Restrictions

The only quantitative noise limits in the Township of East Windsor Municipal Cade are in Chapter 22, “Technical Standards for the Construction of Improvements.” However, the limits apply to construction activities (road paving, etc.) and would not apply to noise emission from the operational facility:

“It is the intent of the township council that these technical standards serve as township standards for the design, construction and operation of public and private improvements, when requirements for the same are not otherwise set forth by the New Jersey Department of Community Affairs pursuant to the Uniform Construction Code Act (L 1975 C. 217).”

“All construction shall be performed in accordance with requirements set forth herein, and the Standard Specifications for Road and Bridge Construction of the New Jersey Department of Transportation, current edition, and any amendments thereto, three copies of which are available for inspection in the office of the township engineer.” (§ 22-1.7 Compliance With Standards Required)

The maximum permitted level is 55 dBA at a residence and 65 dBA at a commercial property. This study does not address construction related sound emission. These limits are provided for informational purposes only.

The steady state operation of the facility will be designed so as to be lower than the 55-dBA East Windsor construction limits.

## 2.5 Facility Layout and Equipment

The QTS PJC1 facility is an existing data center undergoing updates to add emergency generators, chillers, and UPS systems to the north and east sides of the facility.

Project equipment includes generator sets (“gensets”) on the north side of the building on a raised, concrete platform, and air-cooled chillers (“chillers”) installed on the east side of the building. An existing cooling tower is located on the east side of the building, surrounded by a screen wall consisting of non-acoustical louvers. Rooftop chillers are located along the east edge of the building. Those were not operating during the ambient survey and are not considered in the model. Rooftop generator exhausts are located near the southeast corner of the building but were not operating during the ambient survey and are not considered in the model.

A 22-foot-tall, eight-inch precast concrete wall will be located to the north and east sides of the proposed gensets, UPS systems, and chillers. A total of 14 non-acoustical louver openings will be spaced equally along the length of the concrete wall and will also have two standard roll-up doors for maintenance purposes – one on the west corner and one on the east corner.

All project gensets are exclusively used to provide electricity to the building in the event of a power outage and are therefore exempted from the noise ordinance as defined in **Section 2.2**. However, during periodic testing (presumably during daytime hours as previously discussed), the gensets would need to comply with the Daytime limits at residences and other commercial lot lines. In both cases, the limit is 65 dBA with associated octave-band limits (see **Table 2**).

### 3. COMPUTER-BASED NOISE MODEL

#### 3.1 Software

A three-dimensional computer noise model was constructed to analyze the noise contributions expected from the proposed applicable equipment. The model was developed using CadnaA 2023, build 195.5312, a commercial noise modeling package developed by DataKustik GmbH. The software takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, reflections from surfaces, and other sound propagation properties. The software is based on published engineering standards. The ISO 9613-2<sup>2</sup> standard was used for air absorption and other noise propagation calculations.

#### 3.2 Sound Level Data and Assumptions

Sound power levels representative of the Phase 4 equipment in the computer noise model are shown below in **Table 3**, and treatment acoustical performances are shown in **Table** . Various assumptions for the computer model are listed below:

- Genset enclosure was specified as 85 dBA at 7-meters, the ventilation for that enclosure was assumed to be 85 dBA at 1-meter;
- The genset exhaust was specified to have a “critical grade” silencer; the exhaust was modeled as 85 dBA at 1-meter (90-degree directivity);
- No engine exhaust sound level data were provided; it was assumed to be similar to a previous SLR project;
- No information was specified for the genset radiator; it was assumed to be 85 dBA at 1-meter;
- No information was provided for the air-cooled computer room air conditioner fans, so it was assumed that each fan will emit 85 dBA at 1-meter;
- All four condensers on the north side of the each of the new UPS units were assumed to be operating;
- New chillers in the mechanical yard were assumed to emit a total of 75 dBA at 30-feet, which was obtained from a previous Corgan project;
- Existing rooftop chillers did not appear to be operating during the ambient sound survey, and were therefore not considered in the model;
- The existing cooling tower on the east side of the building was modeled as per the calibration measurements collected during the ambient sound survey;
- Rooftop generator exhausts did not appear to be emitting any noise during the ambient sound survey and were therefore not included in the model.
- All modeling included the mechanical yard screen wall, consisting of 22-foot-tall, 8-inch precast concrete with 14 non-acoustical louvers (20-feet-wide by 15-feet-tall) and two equipment roll-up doors (assumed to be standard STC 21 roll-up doors, 12-feet-wide by 15-feet-tall). Sound transmission through the non-acoustical louvers was predicted by calculating the sound pressure level on the inside of the solid barrier and modeling as a vertical area source with a standard, non-acoustical louver transmission loss applied on the exterior of the screen wall;
- All roads and pavement in the calculation area were modeled with a ground absorption coefficient of 0.1 to represent hard, reflective ground;
  - All other ground was modeled with a coefficient of 0.7 to represent mixed ground.

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<sup>2</sup> ISO 9613-2, “International Standards Organization, Acoustics – Attenuation of sound during propagation outdoors,” 1996.

**Table 3: Equipment Sound Power Levels**

Noise Source	Sound Power Level at Octave Band (dBA)									Total (dBA)
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Generator Exhaust, Unsilenced	114	135	134	132	131	131	127	119	82	<b>135</b>
Generator Ventilation Opening	84	84	86	88	91	90	88	84	83	<b>95</b>
Generator Radiator Fan	97	97	98	96	91	89	83	77	71	<b>94</b>
Air-Cooled Chillers Standard Enclosure, Per Fan	87	87	90	89	88	86	85	75	68	<b>91</b>
Existing Cooling Tower	94	94	93	85	83	78	77	76	67	<b>90</b>
Generator Sets 85dB@7m Enclosure	127	101	87	93	81	70	60	57	57	<b>90</b>
UPS Condenser Fan	96	96	91	87	86	82	78	75	74	<b>88</b>

**Table 4: Acoustic Treatment Performance**

Noise Source	Dynamic Insertion Loss (DIL) or Transmission Loss (TL)									
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Generator Critical Grade Exhaust Silencer, DIL	20	30	39	43	42	41	40	41	41	
Basic Non-Acoustical Louver, TL	-	-	-	1	1	2	3	3	5	
Standard STC-21 Equipment Roll-Up Door, TL	2	7	12	17	18	19	22	30	35	

### 3.3 Model Predicted Sound Level Results

Predicted noise levels from the computer noise model are given in at the three nearest residential properties and two closest commercial properties where applicable noise ordinance(s) apply. The commercial properties assessed included the Solar Advanced facility to the north, and the ForDoz Pharma Corp property to the east. Assessed residential properties included the nearest residence to the southwest (Wilmore Dr.), southeast (Oakmont Ct.), and northeast (The Orchards).

Two operating conditions were assessed - normal operation and generator testing. Normal operation will consist of the new UPS systems, new chillers, and existing cooling tower, while generator testing will consist of everything in the normal operation plus the number of allowable daytime generator tests to remain below the daytime State of New Jersey limit of 65 dBA. These locations are shown in **Figure 1**, attached. The results for the normal operating condition are shown in **Figure 2**. The generators were not included in the results as they are exempted from the noise ordinance limitations.

**Table 5: Model Calculated Sound Levels (dBA) for Normal Operating Condition**

Noise Receptor	NJ Limit, dBA	Normal Operating Condition	Compliant w/ Limit? Yes / No
		L <sub>eq</sub> , dBA	
Commercial Property – North	65 <sup>1</sup>	53	Yes
Commercial Property – East	65 <sup>1</sup>	52	Yes
Residential Property – Northeast	50 <sup>2</sup>	49	Yes
Residential Property – Southwest	50 <sup>2</sup>	38	Yes
Residential Property - Southeast	50 <sup>2</sup>	43	Yes

<sup>1</sup> 65 dBA commercial property boundary limit from State of New Jersey ordinance is applicable.

<sup>2</sup> 50 dBA nighttime limit from State of New Jersey ordinance is applicable.

Since the State of New Jersey ordinance also has limits in specific octave bands, calculated octave band results for the normal operating condition are shown in **Table 6**.

**Table 6: Octave Band Calculated Results for Normal Operating Condition**

Noise Receptor	Octave Band Center Frequency									Compliant w/ Limit Yes / No
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
<b>NJ Anytime Limit at Commercial Parcel, dB <sup>1</sup></b>	<b>96</b>	<b>82</b>	<b>74</b>	<b>67</b>	<b>63</b>	<b>60</b>	<b>57</b>	<b>55</b>	<b>53</b>	-
Commercial Property – North	59	59	53	48	49	49	46	32	17	Yes
Commercial Property – East	56	55	53	48	48	48	45	31	13	Yes
<b>NJ Nighttime Limit at Residence, dB <sup>1</sup></b>	<b>86</b>	<b>71</b>	<b>61</b>	<b>53</b>	<b>48</b>	<b>45</b>	<b>42</b>	<b>40</b>	<b>38</b>	-
Residential Property – Northeast	53	52	48	45	45	44	42	27	2	Yes
Residential Property – Southwest	47	46	36	31	31	35	31	12	-	Yes
Residential Property - Southeast	50	48	43	38	39	40	37	20	-	Yes

<sup>1</sup> Octave band limit as per State of New Jersey ordinance

**During the normal operating condition, calculated sound level at all commercial and residential receptors are compliant with the applicable noise ordinances.**

Daytime routine testing of the generators would be subject to the New Jersey state ordinance of 65 dBA at commercial and residential properties. **Table** shows the calculated results while testing one generator.

**Table 7: Model Calculated Sound Levels (dBA) for Generator On Condition**

Noise Receptor	Noise Ordinance Limit, dBA	Generator On Condition	Compliant w/ Limit? Yes / No
		L <sub>eq</sub> , dBA	
Commercial Property – North	65	61	Yes
Commercial Property – East		55	Yes
Residential Property – Northeast		54	Yes
Residential Property – Southwest		43	Yes
Residential Property - Southeast		46	Yes

Model results indicate that two generators can be tested simultaneously and remain below a 65-dBA overall limit. Testing a third generator at the same time results in non-compliance with a daytime noise ordinance of 65 dBA. However, **the most stringent interpretation of the New Jersey noise code requires that generator operation also meet the associated octave-band limits.**

Calculated octave band results for operation of one generator are shown in **Table 8**.

**Table 8: Octave Band Calculated Results for One Generator On Condition**

Noise Receptor	Octave Band Center Frequency									Compliant w/ Limit Yes / No
	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
<b>NJ Anytime Limit at Commercial Parcel OR Daytime Limit at Residence, dB<sup>1</sup></b>	<b>96</b>	<b>82</b>	<b>74</b>	<b>67</b>	<b>63</b>	<b>60</b>	<b>57</b>	<b>55</b>	<b>53</b>	-
Commercial Property – North	81	80	63	66	56	51	47	34	21	Yes
Commercial Property – East	74	73	57	58	51	49	45	32	15	Yes
Residential Property – Northeast	73	72	55	59	50	45	43	28	5	Yes
Residential Property – Southwest	66	65	43	46	37	36	31	13	-	Yes
Residential Property - Southeast	67	66	46	47	42	40	37	20	-	Yes

<sup>1</sup> Octave band limit as per State of New Jersey noise ordinance

The results in **Table 8** indicate compliance with applicable noise ordinance limitations at nearby commercial and residential properties with one (1) generator in operation. Model results indicate that operating two (2) generators simultaneously would slightly exceed the limits in two octave bands: 63-Hz and 250-Hz.

Site map with noise ordinance compliance locations identified can be found as **Figure 1**. Sound level contour maps can be found as **Figures 2 – 3** and are representative of the model predicted sound levels for the normal operating condition and one (1) generator testing condition, respectively.

#### 4. CONCLUSION

Based on the modeled results, the as-designed QTS data center expansion will comply with applicable noise ordinance limitations with the following conditions:

1. Limit routine maintenance operation of generators to no more than one (1) unit in operation at a time.

This concludes the sound study technical memorandum. Please feel free to contact us should you have any questions.

Sincerely,

**SLR INTERNATIONAL CORPORATION**



Cole Pavlina, P.E.  
Senior Engineer

SG/DB/cwp  
SLR Sound Modeling Tech Memo - QTS - PJC1 Project v1.docx

Attachments:  
Figures 1 – 3